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BULGARIAN ACADEMY OF SCIENCES

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE EFFECTS OF THE CRISIS ON CONVERGENCE BETWEEN THE EASTERN PARTNERSHIP AND EU-15 STATES[3]

This paper aims to investigate the effects of the 2008/2009 financial crisis on the convergence process of the Eastern Partnership (EaP) countries towards the core countries of the European Union (EU-15). To do so, we econometrically test the relationship between the per capita GDP growth rate and selected macroeconomic variables in the period 2004–2018 and three sub-periods: the pre-crisis, the crisis, and the post-crisis period. We hypothesize that the financial crisis had a negative impact on the absolute and conditional convergence process in the analyzed group of countries. The convergence rates are estimated using ordinary least squares (OLS) semi-log regression based on cross-sectional data. The empirical results show that the EaP countries converge towards the EU-15 Member States and that the convergence rates range between 1.6% and 4.3%. Negative effects of the financial crisis on the convergence process are confirmed only for absolute convergence. The two groups of countries form separate clusters, which indicates a considerable heterogeneity of growth. According to the results of this research, the EaP countries should focus on opening their economies to more trade, increase macroeconomic stability and decrease corruption, because improvement in these areas should lead to a faster convergence process.
Keywords: β-convergence; Eastern Partnership; European Union; Financial crisis; Economic growth
JEL: F15; O47; O52

1. Introduction

This paper presents an analysis of the absolute and conditional convergence process of the Eastern Partnership (EaP) countries: Armenia, Azerbaijan, Belarus, Georgia, Moldova, and Ukraine towards the EU-15 Member States; Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.[4] The analyzed period is 2004-2018 with three sub-periods: the pre-

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[4] The United Kingdom is included in the analysis because the analyzed period is 2004-2018.

crisis sub-period 2004-2008, the crisis sub-period 2009-2013, and the post-crisis sub-period 2014-2018.

The EaP countries were part of the Union of Soviet Socialist Republics (USSR) and their economies were characterized by a centrally planned system. After the fall of the Berlin Wall in 1989, the countries gained their independence and started the transition process to the market economy, which has not finished. The countries are following the path of the Central and Eastern European (CEE) countries that joined the European Union (EU) in 2004[5], 2007[6], and 2013[7]. The transition of these countries ended once they became EU Member States. Another group of transition countries that has official relations with the European Union are the Western Balkans. These countries have a more formal relation with the EU as they signed the Stabilization and Association Agreements (SAA) and they are candidates or potential candidates for EU membership.

The EaP, which was launched in 2009, is not an association process, but a specific Eastern dimension of the European Neighbourhood Policy (ENP), which aims to reinforce the political association and economic integration of the six countries **(**European External Action Service, 2019b). The EU signed association agreements with Georgia, Moldova, and Ukraine. The agreements include the Deep and Comprehensive Free Trade Area (DCFTA), which offers the countries the free movement of goods, services and capital. The three countries have visa-free regimes with the EU. The EU has become the main trade partner for the DCFTA countries and it is also the main trade partner for Azerbaijan. Armenia and Belarus mostly trade with the Russian Federation. The EaP countries benefited from an overall of €2.8 billion of EU funds (European External Action Service 2016). In January 2019, it was announced that the European Commission, together with the World Bank had developed a new Indicative trans-European Transport Network (TEN-T) Investment Action Plan, which identifies almost 100 priority projects in the countries. These projects amount to an investment of almost €13 billion up to 2030 (European External Action Service, 2019a). In order to help the enlargement and assist the neighbourhood partners in limiting the economic consequences of the Covid-19 pandemic, the European Commission adopted a proposal for a €3 billion macro-financial assistance (MFA). Ukraine will receive €1.2 billion of the MFA funds, Georgia €150 million and Moldova €100 million (European Commission, 2020). With the financial support, the poorer countries catch up faster with the richer countries, i.e. they converge.

In the past two decades, the economic literature has mostly focused on the convergence process of the new Member States of the European Union towards the old Member States. Most studies have found that the CEE countries converge towards the EU-15 Member States (Kulhánek (2014), Matkowski et al. (2016), Grela et al. (2017), Alcidi et al. (2018), Stanišić et al. (2018), Alcidi (2019), Cieślik and Wciślik (2020)). However, the convergence process in the EU is not a homogeneous one (Cavenaile and Dubois (2010), Grzelak and Kujaczinska (2013), Benczes and Szent-Ivanyi (2015)) and it is slower at the regional level, as compared

[5] Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.
[6] Bulgaria and Romania.
[7] Croatia.

to the national level (Mikulić et al. (2013), Głodowska (2015)). Recently, the effects of the 2008/2009 financial crisis have also been investigated (Stoica et al. (2019), Marelli et al. (2019), Rapacki and Prochniak (2019), Bisciari et al. (2020)) and the results confirmed that the EU Member States did not converge or the process was slower during the crisis.

Even though the convergence process of candidates and potential candidates for EU membership has not been sufficiently investigated, some authors have included the Western Balkan and EaP countries in their analyses (Colak (2015), Benešová et al. (2017), Pipień and Roszkowska (2018), Siljak and Nagy (2018; 2019)). They confirm convergence among the analyzed countries.

The main objective of this paper is to present the analysis of the absolute (unconditional) and conditional convergence process of the EaPcountries towards the EU-15 group. Other objectives include: analyzing whether the 2008/2009 crisis had a negative effect on the convergence process and determining which policies the EaP countries should pursue in order to catch up with the EU-15 countries faster.

Two research hypotheses are tested. The first hypothesis is that the 2008/2009 crisis had a negative impact on the absolute convergence process of the EaP countries towards the old Member States of the European Union (EU-15). The second research hypothesis is that the 2008/2009 crisis had a negative impact on the conditional convergence process in the analyzed group. The sub-hypotheses are as follows: the EaP countries converge as a club and the selected macroeconomic variables are determinants of per capita growth in at least one analyzed period.

The paper is organized as follows: Section 2 analyzes the macroeconomic and political structures of the EaP countries. In Section 3, the methodology and data are presented. Section 4 discusses the empirical findings on absolute and conditional β-convergence. Section 5 concludes the paper.

2. Macroeconomic and Political Structures of the Eastern Partnership Countries

The EaP countries are former socialist countries that have been going through the transition process from a centrally planned to a market economy for the past three decades. In socialism, all decisions were made by the central government: what to produce, the quantity of production, which companies sell the products, in which markets, and at what prices. Some of the characteristics of the socialist system were the state ownership of the economy, restricted trade and investment, production according to five-year plans, low-quality products, artificially determined prices, almost non-existent unemployment, and a lack of institutions. In the early 1990s, with the dissolution of the Soviet Union, Yugoslavia, and Czechoslovakia, more than twenty countries gained their independence. All of them went through a transition recession, which was characterized by hyperinflation, due to the fact that the prices had not been determined according to the law of supply and demand. Additionally, unemployment was in double digits, as the previously state-owned companies no longer existed, and there was no market to sell their products in. The unemployment rates have stabilized in the region; the highest is in Armenia, at 17.5%, and the lowest is in Moldova, at

3%. However, the inadequately educated workforce and the poor work ethic are among the most problematic factors for doing business in the region (World Economic Forum, 2020).

Most former socialist countries decided to join the EU. Therefore, they had to fulfil the Copenhagen criteria (1993), as part of their accession process. One of the criteria is that a country has to be „a functioning market economy with the capacity to cope with competition and market forces" (European Commission, 2021). The existence of a functioning market economy requires that all prices, as well as trade, should be liberalized and that an enforceable legal system, including property rights, is in place (European Commission, 2019, p. 71). Also, the countries should be competitive and attract foreign investors, which will help them produce better-quality products and gain access to foreign markets.

Table 1

Macroeconomic indicators of the Eastern Partnership countries

Indicator	Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Real GDP growth (%)	Armenia	2.2	1.8	-0.4	0.3	1.7	2.3	2.0	2.6	2.0	7.6
	Azerbaijan	5.0	0.1	2.2	5.8	2.8	1.1	-3.1	0.2	7.5	2.2
	Belarus	7.7	5.5	1.7	1.0	1.7	-3.8	-2.5	2.5	3.0	1.2
	Georgia	6.3	7.4	6.4	3.6	4.4	3.0	2.9	4.8	4.9	5.1
	Moldova	7.1	5.8	-0.6	9.0	5.0	-0.3	4.4	4.7	4.3	3.5
	Ukraine	3.8	5.5	0.2	-0.03	-6.6	-9.8	2.2	2.5	3.4	3.2
Inflation rate (%)	Armenia	8.2	7.7	2.6	5.8	3.0	3.7	-1.4	1.0	2.5	1.4
	Azerbaijan	5.7	7.9	1.1	2.4	1.4	4.0	12.4	12.9	1.9	2.6
	Belarus	7.7	53.2	59.2	18.3	18.1	13.5	11.8	6.0	4.9	5.6
	Georgia	7.1	8.5	-0.9	-0.5	3.1	4.0	2.1	6.0	2.6	4.9
	Moldova	7.4	7.7	4.6	4.6	5.1	9.6	6.4	6.6	3.1	4.9
	Ukraine	9.4	8.0	0.6	-0.3	12.1	48.7	13.9	14.4	11.0	7.9
Unemployment rate (%)	Armenia	19.0	18.4	17.3	16.2	17.5	18.3	17.6	17.8	17.2	17.5
	Azerbaijan	5.6	5.4	5.2	5.0	4.9	5.0	5.0	5.0	5.2	4.9
	Belarus	6.1	6.1	6.0	5.9	5.9	5.9	5.8	5.7	5.7	4.8
	Georgia	17.4	17.3	17.2	16.9	14.6	14.1	14.0	13.9	12.7	11.6
	Moldova	7.4	6.7	5.6	5.1	3.9	5.0	4.2	4.1	3.0	3.0
	Ukraine	8.1	7.9	7.5	7.2	9.3	9.1	9.5	9.7	9.0	8.5
General government debt (% of GDP)	Armenia	33.8	35.7	35.6	36.3	39.4	44.1	51.9	53.7	51.3	-
	Azerbaijan	5.0	5.0	5.8	6.2	8.5	18.0	20.6	22.5	18.8	-
	Belarus	36.8	58.2	36.9	36.9	38.8	53.0	53.5	53.2	47.8	42.0
	Georgia	42.4	36.5	34.8	34.7	35.6	41.4	44.4	45.1	44.9	47.9
	Moldova	25.5	24.2	25.9	24.9	30.3	37.8	35.6	31.8	29.7	25.1
	Ukraine	40.6	36.9	37.5	40.5	70.3	79.5	81.2	71.6	60.2	50.3
Budget deficit/surplus (% of GDP)	Armenia	-5.0	-2.8	-1.5	-1.5	-1.9	-4.8	-5.5	-4.8	-1.6	-0.5
	Azerbaijan	-0.9	0.6	-0.2	0.6	-0.5	-0.5	-0.4	-1.5	-0.3	8.1
	Belarus	-1.7	2.7	0.6	0.1	1.0	1.4	1.5	3.0	4.0	2.5
	Georgia	-4.5	-0.9	-0.6	-1.1	-2.0	-1.1	-1.4	-0.9	-0.8	-1.9
	Moldova	-2.1	-2.0	-1.7	-1.4	-1.5	-1.9	-1.6	-0.6	-0.8	-1.4
	Ukraine	-6.3	-2.2	-3.7	-4.1	-4.5	-0.8	-1.9	-1.2	-1.9	-2.2

Source: World Bank, European Commission, and World Economic Outlook databases.

Macroeconomic stability and successful integration are mutually dependent on each other: stability may be a prerequisite to integration, on the one hand, and an indicator of its success, on the other hand (Palankai, 2010, p 16). Table 1 shows the most important macroeconomic

indicators, GDP growth rate, inflation rate, unemployment rate, general government debt, and budget deficit or surplus, and their development in the past 10 years in the EaP countries.

As part of the transition, less developed economies, such as the EaP countries should reach high GDP growth rates. In the period 2010-2019, the countries experienced various periods of recession (Belarus in 2015 and 2016 and Ukraine in the period 2013-2015). However, their economies started to grow again and in 2019, only Moldova's GDP growth rate (1.2%) was lower than the EU-15 average (1.9%). Armenia is the country with the highest growth rate (7.6%), followed by Georgia (5.1%).

After the collapse of socialism and the dissolution of the USSR, the newly created countries faced hyperinflation, which started to stabilize in the late 1990s or early 2000s. According to the European Bank for Reconstruction and Development (EBRD) transition indicator, except for Belarus, the EaP countries have achieved comprehensive or complete price liberalization. The EaP countries have had inflation rates higher than the EU average in the past decade. Belarus experienced hyperinflation in 2011 and 2012, while Ukraine's inflation rate in 2014 was 48.7%, due to the war with Russia. While the inflation rates in the region have a tendency to fluctuate, only Armenia and Azerbaijan had an inflation rate below 3% in 2019.

One of the characteristics of the EaP region is low general government debt rates and budget deficits. The countries did not inherit high debt from the previous system and they have maintained it below 60% of GDP (as required by the Maastricht criteria, which each country has to fulfil prior to joining Europe's Economic and Monetary Union). The only exception is Ukraine, but the country's debt increased due to the war with Russia and reached its peak in 2016, at 81.2%. However, it decreased to 50.3% in 2019. The lowest debt rate is in Azerbaijan, at 18.8%. In 2018, none of the countries had a budget deficit above 3% of the GDP (another Maastricht criterion). Belarus recorded a surplus of 4% of the GDP, while the highest deficit was in Ukraine (1.9%). Considering the economic background of the EaP countries, they have made progress and achieved a certain degree of macroeconomic stability. However, the corruption, inefficient institutions, uneducated labour force and political instability in the region hamper economic growth.

Due to a lack of institutional framework in the previous system, where all decisions were made by the central government, former socialist countries have fought against corruption, with varying degrees of success. The EaP countries are transition economies and economic transition is a process of institutional change and a process of building new institutions, as required by a capitalist economy (Redek and Sušjan, 2005: 995). A strong institutional change, which is required by the Copenhagen criteria, has had a positive effect on the economic performance of CEE countries (Aralica et al., 2019). However, history also has an effect on the quality of institutions and corruption; thus, the Soviet successor states have more corruption today because socialism lasted over 20 years longer than in CEE countries (Uberti, 2018). According to the Global Competitiveness report (2020), the least competitive country in the EaP region is Ukraine (positioned 85th out of 141 countries) and the most competitive is Azerbaijan (58th out of 141). The most competitive country in the EU is the Netherlands (4th out of 141) and the least competitive is Croatia (63rd out of 141). Ukraine has the lowest quality of institutions (104th position) and the protection of property rights (109th position), while Azerbaijan has the most protected property rights (44th position) and developed infrastructure (38th position). The highest quality of institutions is in Georgia (43rd position).

According to the Political Stability Index, Belarus is the most stable country in the region (positioned 80th out of 195 countries) and it is the only EaP country with a positive index value. Moldova's position is the second-best (130th), while Ukraine is the least politically stable country in Europe (178th position in the world).

One of the biggest challenges for the EU relations with the EaP countries is their history with and dependency on Russia, especially because Russia is one of the region's main trade partners. The countries' attitude towards the EU depends on the ruling party, i.e., whether the leading party is pro-Russia or pro-EU oriented. The EaP countries want stronger relations with the EU for a number of reasons. First, the EU provides substantial financial aid. Second, it is the main trade partner for all countries, except for Armenia and Belarus. Finally, the countries can have a visa-free regime, which facilitates travelling to and studying in the EU. Ukraine, Moldova, and Georgia signed association agreements in 2016 and 2017, but these countries are less concerned about their relations with Russia, as they were at war with Russia for a period of time since the early 2000s.

The situation with Armenia, Azerbaijan, and Belarus is more complicated. Belarus and Azerbaijan do not want to join the EU, as Belarus has very tight relations with Russia, and Azerbaijan seeks to have an independent foreign policy (Boucart, 2020b). Both countries have authoritarian regimes and their democracy indices are very low: 2.48 in Belarus and 2.75 in Azerbaijan (the index values in other countries of the region range between 5.42 in Georgia to 5.9 in Ukraine). However, one of the Copenhagen criteria for accession to the EU is „the stability of institutions guaranteeing democracy" (European Commission, 2021). Belarus' participation in the EaP is limited and the country does not take part in the Euronest Parliamentary Assembly for political reasons (European Parliament, 2021). The EU has decided to turn a blind eye to the political situation in Azerbaijan, as the country is rich in natural resources (natural gas and oil) and good relations could decrease the EU's dependence on Russia's natural resources (Boucart, 2020b).

Armenia is in a different position, as the country is in the middle between the EU and Russia. Armenia and the EU signed the Comprehensive and Enhanced Partnership Agreement (CEPA) in 2017, which entered into force in 2018 (European Commission, 2021). In 2013, the country was negotiating an association agreement with the EU, but it withdrew and joined the Eurasian Economic Union, which consists of most former Soviet republics. Armenia is in a difficult geopolitical position, as its immediate neighbours, Turkey and Azerbaijan, have closed their borders with the country. In 2020, Armenia and Azerbaijan were at war in the Nagorno-Karabagh region. Armenia is trying to find a balance between the EU and Russia, as it is military and energetically dependent on Russia (Boucart, 2020a) and the EU is its main trade partner and a significant contributor of foreign aid.

The EaP countries have to put a lot of effort into transforming their economies and achieving similar structural development levels as the EU Member States. Even though the EU has initiated some formal relations, a lack of the EU's commitment to deepen those relations can push the EaP countries towards Russia. Inconsistent policies towards Western Balkan states, where the start of the accession process was delayed (cf. the case of Albania and North Macedonia) can leave the countries discouraged. The EaP economies are not ready to start the accession negotiation. The countries should stay outside the EU as long as it takes for

them to gradually transform, to become competitive functioning market economies, which will be able to cope with the challenges of being EU Member States, without pressure from the EU.

3. Methodology and Data

The methodology for convergence analysis was developed by Barro and Sala-i-Martin (1992), who defined convergence as a tendency of poor economies to grow faster than rich economies, in per capita terms. Based on the Solow neoclassical growth model (1956), the authors tested if there was convergence in the US in the period 1840-1988 and several sub-periods. The results showed that the states converged at the rate of 2% per year, regardless of the time period. The rate of 2% is considered as a benchmark for convergence analysis. The economic literature distinguishes two types of economic convergence: sigma (δ) and beta (β) convergence. Sigma convergence measures the dispersion among the per capita GDP in the analyzed group of countries. Beta convergence occurs when there is a negative relationship between the per capita GDP growth rate and per capita GDP at the beginning of the analyzed period. There are two types of β-convergence: absolute (unconditional) and conditional β-convergence.

Absolute convergence occurs when countries of the analyzed group have similar structures in the initial period and they converge towards the same steady-state. The convergence (or β) coefficient represents the speed of convergence in the course of one year. The coefficient is obtained by estimating a simple regression model. The dependent variable in the analysis is the average per capita GDP growth rate for the analyzed period and the independent variable is the initial per capita GDP, computed in natural logarithm (Equation 1).

$$\Upsilon_{i.0,T} = \alpha_i + \beta \log(Y_{i,0}) + \varepsilon_i \quad (1)$$

Where β is the convergence coefficient; $\Upsilon_{i.0,T}$ is the average annual growth rate of per capita GDP for country *i*; $Y_{i,0}$ is per capita GDP at PPP for country *i* at the beginning of the analyzed period 0; α_i is a constant; ε_i is the stochastic error of the equation; and T is the end of the time interval.

Convergence exists only if there is a negative relationship between the variables. Therefore, the β-coefficient must be negative. If the coefficient is positive, it indicates divergence, i.e. rich countries tend to grow faster than poor countries.

If countries start with different structures, they will converge towards a different steady state. The β-coefficient is obtained by estimating a multiple regression model, which represents an absolute convergence model augmented with various macroeconomic variables. In this research, we estimate a conditional convergence model with two economic variables: economic openness and the inflation rate, and an institutional variable, the Government Integrity Index, which is a proxy for corruption (Equation 2).

$$\Upsilon_{i.0,T} = \alpha_i + \beta_1 \log(Y_{i,0}) + \beta_2 EO_{i.0,T} + \beta_3 Inf_{i.0.T} + \beta_4 GI_{i.0.T} + \varepsilon_i \quad (2)$$

Where EO is the economic openness rate; Inf is the inflation rate; and GI is the Government Integrity index.

Theoretically, it is expected that economic openness and government integrity will have a positive impact on per capita growth, while the inflation rate is expected to have a negative impact.

The classical approach to convergence analysis presented by Sala-i-Martin (1996) is followed in this research. We estimate the convergence models using ordinary least square (OLS) regression based on cross-sectional data. Cross-sectional data is used because it is free of the distortions caused by business cycles as well as various demand-side and random supply-side shocks, both internal and external, which deviate the economy from a path towards a steady state (Vojinović et al. 2009: 127). The literature on economic convergence and transition is followed (Carmeci and Mauro (2002), Yin et al. (2003), Vojinović et al. (2009), Szeles and Marinescu (2010), Dobrinsky and Havlik (2014), Rapacki and Prochniak (2019), Stoica et al. (2019), Popovic et al. (2020)) and the selected macroeconomic variables are generally used in the convergence analysis.

Eight models are estimated in this research; four absolute (Models 1-4) and four conditional convergence models (Models 5-8). The analyzed period is 2004-2018, with three sub-periods: the pre-crisis sub-period 2004-2008, the crisis sub-period 2009-2013, and the post-crisis sub-period 2014-2018. The sub-periods are included in the analysis to test the effects of the 2008/2009 crisis on the convergence process in the analyzed countries. In order to investigate relevant model diagnostics, two tests are conducted with all estimated models; the Breusch-Pagan test, which tests the null hypothesis that the variance of residuals is constant, and the Ramsey RESET test, which tests the null hypothesis that a model has no omitted variables. We test for multicollinearity in the conditional convergence models using the variance inflation factor (VIF).

The analysis is based on annual data. Table 2 presents the descriptive statistics of the variables used in the estimation of convergence models in the period 2004-2018. The data set includes twenty-one countries.

Table 2

Descriptive statistics

Variable	Description	Mean	Standard deviation	Minimum	Maximum
Per capita GDP growth	Annual percentage growth rate of GDP per capita based on constant local currency	2.09	2.18	-0.66	7.33
Log (initial per capita GDP)	Natural logarithm of per capita GDP at the beginning of the analyzed period	9.85	0.90	8.07	11.07
Economic openness	A sum of exports and imports divided by GDP	105.41	64.77	53.92	345.42
Inflation rate	Measured by the Harmonized Index of Consumer Prices	3.84	4.40	0.97	17.62
Government integrity		0.62	0.25	0.25	0.93

Source: Authors' calculations based on World Bank, World Economic Outlook, and Heritage Foundation data.

The World Bank, World Economic Outlook, and Heritage Foundation data sets are the main source of data for this research. Data for the per capita GDP growth rate, per capita GDP (in PPP) in 2004, 2009, and 2014, and economic openness are obtained from the World Bank (WB) database. Data for the inflation rate are derived from the World Economic Outlook (WEO) database and data for the Government Integrity Index from the Heritage Foundation database.

4. Results and Discussion

This paper analyzes the convergence process of EaP countries towards the EU-15 Member States in the period 2004-2018. In order to test the research hypotheses that the 2008/2009 crisis had a negative impact on the absolute and conditional convergence process in the group, three sub-periods are included in the analysis: the pre-crisis sub-period, the crisis sub-period, and the post-crisis sub-period. Eight convergence models are estimates: four absolute convergence models (Models 1-4) and four conditional convergence models (Models 5-8).

a. Absolute β-Convergence

Beta convergence implies that poor economies in the analyzed group will grow faster than rich economies. If the countries have similar structures, they will converge towards the same steady state, and the convergence will be absolute. Table 3 presents the regression results for absolute convergence in the analyzed periods.

The empirical analysis shows that the EaP countries converge towards the EU-15 Member States in every analyzed period, except the post-crisis period. The β-coefficient for the period 2004-2018 is negative, -1.93, and highly significant at the *p*-value=0.0000, which indicates that the countries converge towards the same steady state at the rate of 1.9% per year. The rate is slightly lower than the reference value from the Barro and Sala-i-Martin (1992) findings. The convergence rate in the pre-crisis period is the highest, 4.3% and it decreases to 1.6% during the crisis period. In the post-crisis period, the rate is negative, but not statistically significant, because the EaP countries achieved lower growth rates than the EU-15 member states. Their per capita GDP was only 22.7% of the EU-15 average between 2014 and 2018. The EaP countries went through a transition recession after the dissolution of the Soviet Union, which resulted in a fall of per capita GDP. The biggest fall was recorded in Georgia. The country's per capita GDP in 1994 was only 30% of the 1990 level. Other countries' per capita GDPs ranged between 44% of the 1990 level in Azerbaijan to 74% in Belarus. Per capita GDPs in the EaP countries reached the 1990 level in the late 1990s (Belarus) and early 2000s (other countries).

Based on the regression results, it can be concluded that the convergence process was slower during the 2008/2009 crisis, i.e. the crisis had a negative effect on convergence, and that the EaP countries did not start to catch up with the EU-15 average in the post-crisis sub-period. Therefore, there is no sufficient evidence to reject the first research hypothesis.

Table 3

Absolute convergence of the EaP countries towards the EU-15 Member States

	Model 1 2004-2018	Model 2 2004-2008	Model 2' 2004-2008	Model 3 2009-2013	Model 4 2014-2018
	β (t)	β (t)	β (t)	β (t)	β (t)
Log of initial per capita GDP	-1.93*** (-5.74)	-4.29*** (-5.47)	-4.29*** (-3.76)	-1.58*** (-2.95)	-0.07 (-0.10)
Number of observations	21	21	21	21	21
Number of panel observations	315	105	105	105	105
F statistics (1, 19)	33.00	29.96	14.17	8.72	0.01
Prob>F	(0.0000)	(0.0000)	(0.0013)	(0.0082)	(0.9207)
R^2	0.6346	0.6120	0.6120	0.3145	0.0005

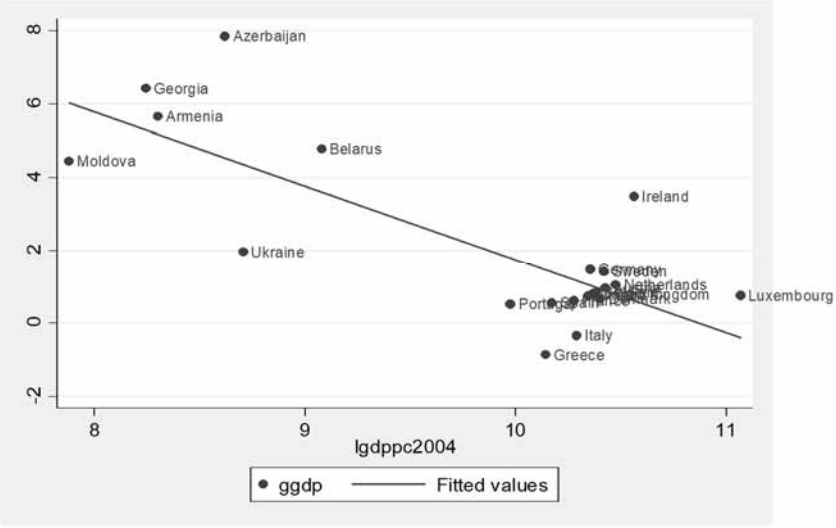
*Significance codes: ***p<0.01, **p<0.05, p*<0.1*
Source: Authors' calculations based on World Bank data.

The problem of heteroscedasticity is present in Model 2. When regression with a heteroscedasticity robust standard error (Model 2') is estimated, the issue of heteroscedasticity is corrected and the results remain unchanged.

Figure 1 plots the per capita GDP in 2004 (X-axis) with the average per capita GDP growth rate in the period 2004-2018 (Y-axis). The Figure supports the convergence hypothesis in the analyzed group as the line of fitted values shows a negative relationship between the variables, i.e., it has a downward slope.

Figure 1

Absolute convergence of the Eastern Partnership countries towards the EU-15 Member States



Source: Authors' calculations based on World Bank data.

Figure 1 shows that there are two clusters; the EaP countries and the EU-15 Member States. While the EU-15 group is mostly homogeneous, the EaP countries are heterogeneous. The EaP countries are positioned in the upper left corner in the Figure, indicating that these countries have the lowest initial per capita GDP, but they achieved the highest per capita growth rates. The average growth rate in the group is 5.2%. Azerbaijan is the country with the highest rate, 7.8%, while Ukraine has the lowest rate, 2%. However, it has to be taken into consideration that the Ukrainian economy has been affected by the war with the Russian Federation that started in 2014. The average growth rate in the EU-15 group is 0.9%, ranging from -0.9% in Greece to 3.5% in Ireland. The average per capita GDP of the EaP countries increased from 16.1% of the EU-15 average in 2004 to 23.9% in 2018.

b. Conditional β-Convergence

If countries do not have similar structures, they will converge towards a different steady state and the convergence will be conditional. We estimate four conditional convergence models (Models 5-8) and test whether economic openness, the inflation rate, and government integrity have an impact on per capita GDP growth. The empirical findings can serve as a recommendation for countries when they are deciding which policies they should pursue in order to increase per capita GDP growth rates. Table 4 presents the regression results for conditional convergence models.

Table 4

Conditional convergence in the analyzed group of countries

	Model 5 2004-2018	Model 5' 2004-2018	Model 6 2004-2008	Model 6' 2004-2008	Model 7 2009-2013	Model 8 2014-2018	Model 8' 2014-2018
	β (t)	β (t)	β (t)	β (t)	β (t)	β (t)	β (t)
Log of initial per capita GDP	-2.72*** (-4.31)	-2.72*** (-5.00)	-3.21 (-1.58)	-3.21 (-1.43)	-2.83*** (-3.32)	-2.47** (-2.30)	-2.47*** (-7.48)
Economic openness (%)	0.01* (1.99)	0.01** (2.44)	0.01 (0.63)	0.01 (0.97)	0.001 (1.11)	0.01* (1.99)	0.01 (1.31)
Inflation rate (annual %)	-0.01 (-0.07)	-0.01 (-0.06)	0.23 (0.59)	0.23 (0.48)	0.13* (1.92)	-0.26** (-2.19)	-0.26*** (-3.95)
Government Integrity Index	2.44 (1.05)	2.44 (1.44)	-1.11 (-0.17)	-1.11 (-0.27)	5.27* (1.92)	3.44* (1.03)	3.44** (2.40)
Number of observations	21	21	21	21	21	21	21
Number of panel observations	315	315	105	105	105	105	105
F statistics (4, 16)	10.70	8.77	7.45	3.66	4.44	2.33	22.77
Prob>F	(0.0002)	(0.0006)	(0.0014)	(0.0266)	(0.0132)	(0.1003)	(0.0000)
R^2	0.7280	0.7280	0.6505	0.6505	0.5263	0.3680	0.3680

*Significance codes: ***p<0.01, **p<0.05, p*<0.1*
Source: Authors' calculations based on World Bank, World Economic Outlook, and Heritage Foundation data.

The regression results for conditional convergence show that the EaP countries converge towards the EU-15 Member States in every analyzed period, except the pre-crisis sub-period. The β-coefficient for the period 2004-2008 is negative, but not statistically significant. The

countries converge at the highest rate between 2009 and 2013. Since the countries do not converge in the pre-crisis period, it cannot be concluded that the 2008/2009 crisis had a negative effect on the conditional convergence process. The EaP countries went into shorter periods of recession in the post-crisis period, therefore they recovered slower, which reflected in a lower conditional convergence rate.

The conditional convergence rates are higher than the absolute rates in the analyzed group, confirming that the countries have different structures and that improvements in trade and macroeconomic stability, and decreased corruption would help the EaP countries catch up faster with the core of the EU.

Heteroscedasticity is not only detected in the model for the crisis period. When regressions with heteroscedasticity robust standard errors are estimated (Models 5', 6' and 8'), the conditional convergence rates do not change. The change occurs in the determinants of per capita growth.

The regression results show that economic openness has a positive effect on convergence in the entire analyzed period. The positive effects of economic openness are also found by Rapacki and Prochniak (2009), Stoica et al. (2019), and Popovic et al. (2020). The EaP countries are open economies. Their average economic openness rate has decreased from 103.6% in the pre-crisis sub-period to 96.8% in the post-crisis sub-period. The average rate in the EU-15 increased from 100.9% to 117.9% between the periods. Georgia, Moldova, and Ukraine signed the Deep and Comprehensive Free Trade Agreement (DCFTA) with the EU in 2014 and trade between the two groups has increased. Total trade between the EU and Ukraine has increased by 45% in the period 2014-2019, by 39% between the EU and Moldova, and by 5% between the EU and Georgia. The EU is the main trade partner for the DCFTA countries and Azerbaijan, and the second main trade partner for Armenia and Belarus. Moldova is also a member of the Central European Free Trade Agreement, together with the Western Balkan countries, but intra-CEFTA trade is not pronounced, as the country is not a main trade partner for any of the CEFTA members.

Theoretically, inflation should have a negative effect on per capita growth, which is confirmed by Vojinović et al. (2009) and Siljak and Nagy (2019). This research has shown that the inflation rate has a negative effect on per capita growth in the post-crisis sub-period and a positive effect during the crisis period. Stable, low inflation is always good for the economy and its positive effects on economic growth are confirmed by Hasanov (2010) and Kryeziu and Durguti (2019). The average inflation rate decreased from 10.6% in the pre-crisis sub-period to 8.2% in the post-crisis sub-period. The highest rate is detected in Ukraine, which is as expected considering that the country has been at war with Russia since 2014. The average inflation rate decreased from 2.4% to 0.8% in the EU-15.

The Government Integrity Index is a statistically significant variable in the crisis and post-crisis period, and, as expected, it has a positive impact on per capita growth. The results confirm the finding of other studies (Marelli and Signorelli (2010), Masuch et al. (2016), Žuk and Savelin (2018)). The Index values range between 0 and 100 and a higher score indicates that a country is less corrupt. In the EaP countries, the average value of the Index increased from 26 in the period 2004-2008 to 35 in the period 2014-2018, and it decreased in the EU-15 countries, from 77 to 72. The most corrupt countries in the EaP region were Ukraine and

Azerbaijan (the value of the Index was 25), and the least corrupt was Georgia (38). Among the EU-15 Member States, the lowest value of the Index was in Greece (41) and the highest was in Denmark and Finland (93).

The empirical results show that the 2008/2009 crisis did not have a negative effect on the conditional convergence process in the analyzed group of countries. The countries do not converge only in the pre-crisis sub-period. Based on the results, we reject the second research hypothesis.

5. Conclusion

This paper investigates the convergence process of the Eastern Partnership (EaP) countries towards the old Member States of the European Union (EU-15). The analyzed period is 2004-2018 with three sub-periods: the pre-crisis sub-period 2004-2008, the crisis sub-period 2009-2013, and the post-crisis sub-period 2014-2018. Two types of β-convergence are analyzed: absolute and conditional convergence.

The empirical results suggest that the EaP countries converge in absolute terms towards the EU-15 Member States in every analyzed period, except the post-crisis period. The β-coefficient for the crisis period is lower than for the pre-crisis period, indicating a slower convergence process between 2009 and 2013. The countries do not converge in the post-crisis period, as their average per capita growth rate is lower than the rate of the EU-15 countries. Based on the results, we can conclude that the 2008/2009 crisis had a negative effect on the absolute convergence process, and we do not have sufficient evidence to reject the first research hypothesis.

The regression results for conditional convergence show that the countries converge in the periods 2004-2018, 2009-2013, and 2014-2018. The β-coefficient for the period 2004-2008 is negative, but it is not statistically significant. Therefore, it can be concluded that the crisis did not have a negative effect on the conditional convergence process in the analyzed group of countries and the second research hypothesis is rejected.

All selected macroeconomic variables are determinants of per capita growth in at least one analyzed period. Economic openness and the Government Integrity Index have a positive impact on per capita growth, which is as expected, while the inflation rate has both positive and negative impacts.

According to the empirical results of this study, the countries should open their economies to more trade, inflation should be stabilized, and the level of corruption should decrease. Improvements in these areas could lead to higher per capita growth rates and the EaP countries could catch up with the EU-15 group faster.

Even though the countries have achieved a certain degree of macroeconomic stability, they are not mature enough to start accession negotiations with the EU. A high degree of political instability, corruption, inefficient institutions, low competitiveness, and uneducated labour force are the factors that have hampered economic growth and will remain major issues during the transition process. In order to become full member states, the EaP countries will

have to achieve development levels similar to the EU average. However, the decision made by EU Member States is not always based on integration maturity, but on geopolitical concepts. This process should be gradual and the countries should focus on becoming functioning market economies, with help from the EU. The EaP countries should not initiate any deeper relations with the EU, as in this case they can decide on their own pace of the transition process, without external pressure.

References

Alcidi, C. (2019). Economic Integration and Income Convergence in the EU. – Intereconomics, 54(1), pp. 5-11.

Alcidi, C., Núñez Ferrer, J., Di Salvo, M., Pilati, M., Musmeci, R. (2018). Income Convergence in the EU: A tale of two speeds, CEPS Commentary. 9 January 2018 (Available at http://aei.pitt.edu/93160/).

Aralica, Z., Svilokos, T., Bacic, K. (2018). Institutions and Firms' Performance in Transition Countries: The Case of Selected CESEE Countries. – South East European Journal of Economics and Business, 13(1), pp. 68-80.

Barro, R. J., Sala-I-Martin, X. (1992). Convergence. – Journal of Political Economy, 100(2), pp. 223-251.

Benczes, I., Szent-Ivanyi, B. (2015). The European economy in 2014: Fragile recovery and convergence. – J. Common Mkt. Stud., 53, pp. 162-180.

Benešová, I., Dlubalová, Z., Rumánková, L., Laputkova, A. (2017). Economic convergence of the post-Soviet countries. Paper presented at the 20th International Scientific Conference "Enterprise and Competitive Environment", Brno, March 9-10, 2017.

Bisciari, P., Essers, D., Vincent, E. (2020). Does the EU convergence machine still work?. – National Bank of Belgium, NBB Economic Review, June 2020.

Boucart, T. (2020a). Armenia: Stuck in the Middle?. – The New Federalist, (online). Available at: https://www.taurillon.org/armenia-stuck-in-the-middle?lang=fr, (Accessed: 10 January 2021)

Boucart, T. (2020b). Belarus and Azerbaijan: Two Dictatorships in Touch with the EU. The New Federalist, (online). Available at: https://www.taurillon.org/belarus-and-azerbaijan-two-dictatorships-in-touch-with-the-eu?lang=fr (Accessed: 10 January 2021).

Carmeci, G., Mauro, L. (2002). The Convergence of the Italian Regions and Unemployment: Theory and Evidence. – Journal of Regional Science, 42(3), pp. 509-532.

Cavenaile, L., Dubois, D. (2011). An empirical analysis of income convergence in the European Union. – Applied Economics Letters, 18(17), pp. 1705-1708.

Cieślik, A., Wciślik, D. R. (2020). Convergence among the CEE-8 Economies and their Catch-up towards the EU-15. – Structural Change and Economic Dynamics, 55, pp. 39-48.

Colak, O. (2015). Convergence Revisited: Case of EU and Eastern Europe. – Regional Science Inquiry, 7(1), pp. 69-81.

Dobrinsky, R., Havlik, P. (2014). Economic convergence and structural change: The role of transition and EU accession. Wiener Institut für Internationale Wirtschaftsvergleiched (Available at https://www.econstor.eu/handle/10419/204167).

European Bank for Reconstruction and Development. (2020). Transition Indicators. (Available at https://www.ebrd.com/economic-research-and-data/transition-qualities-asses.html).

European Commission. (2019). Commission Opinion on Bosnia and Herzegovina's application for membership of the European Union – Analytical report. 29 May, Brussels (Available at https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/20190529-bosnia-and-herzegovina-analytical-report.pdf).

European Commission. (2020). Coronavirus: Eight macro-financial assistance programmes agree to support enlargement and neighbourhood partners. (Available at https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1457).

European Commission. (2021). Accession Criteria. (Available at https://ec.europa.eu/neighbourhood-enlargement/policy/glossary/terms/accession-criteria_en).

European External Action Service. (2016). Eastern Partnership. 19 October, Brussels (Available at http://eueuropaeeas.fpfis.slb.ec.europa.eu:8084/headquarters/headquartershomepage/419/eastern-partnership_en).

European External Action Service. (2019a). Eastern Partnership: TEN-T Investment Action Plan of €13 billion for better connectivity with the EU and stronger growth in the region. (Available at https://eeas.europa.eu/headquarters/headquarters-homepage/56558/eastern-partnership-ten-t-investment-action-plan-%E2%82%AC13-billion-better-connectivity-eu-and_en).

European External Action Service. (2019b). Myths about the Eastern Partnership – Factsheet. (Available at https://eeas.europa.eu/headquarters/headquarters-homepage/35712/myths-about-eastern-partnership-factsheet_en).

European Parliament. (2021). Understanding the Euronest Parliamentary Assembly. (Available at https://www.europarl.europa.eu/euronest/en/home/introduction.html).

Global Economy. (2021). Political Stability Index (Available at https://www.theglobaleconomy.com/rankings/wb_political_stability/).

Głodowska, A. (2015). Beta and Sigma Convergence within the European Union Countries and Regions. Proceedings of the 6th GCRM, pp. 233-245.

Grela, M., Majchrowska, A., Michałek, T., Mućk, J., Stążka-Gawrysiak, A., Tchorek, G., Wagner, M. (2017). Is Central and Eastern Europe converging towards the EU-15?. Narodowy Bank Polski, Education and Publishing Department (Available at https://www.nbp.pl/publikacje/materialy_i_studia/264_en.pdf).

Grzelak, A., Kujaczyńska, M. (2013). Real convergence of the European Union member states –evaluation attempt. – Management, 17(1), pp. 393-404.

Hasanov, F. (2010). Relationship between Inflation and Economic Growth in Azerbaijani Economy: Is there any Threshold Effect?. – Asian Journal of Business and Management Sciences, 1(1), pp. 1-11.

Heritage Foundation. (2020). Index of Economic Freedom' (Available at https://www.heritage.org/index/explore).

International Monetary Fund. (2020). World Economic Outlook Database. (Available at www.imf.org).

Kryeziu, N., Durguti, E. A. (2019). The Impact of Inflation on Economic Growth. – International Journal of Finance & Banking Studies, 8(1), pp. 1-09.

Kulhánek, L. **(**2014). Debt crisis and convergence in the European Union. – In: International Conference on European Integration, Ostrava: VŠB-TU, Ostrava: Faculty of Economics, p. 401-409 (Available at https://www.researchgate.net/profile/Lumir_Kulhanek/publication/262376206_Debt_Crisis_and_Convergence_in_the_European_Union/links/54dbf4ae0cf28d3de65e148e.pdf).

Marelli, E., Signorelli, M. (2010). Institutional, nominal and real convergence in Europe. – Banks & bank systems, 5(2), pp. 140-155.

Marelli, E. P., Parisi, M. L., Signorelli, M. (2019). Economic convergence in the EU and Eurozone. – Journal of Economic Studies, 46(7), pp. 1332-1344.

Masuch, K., Moshammer, E., Pierluigi, B. (2017). Institutions, public debt and growth in Europe. – Public sector economics, 41(2), pp. 159-205.

Matkowski, Z., Próchniak, M., Rapacki, R. (2016). Real income convergence between Central Eastern and Western Europe: Past, present, and prospects. Copenhagen: 33rd CIRET (Centre for International Research on Economic Tendency Surveys) Conference on Economic Tendency Surveys and Economic Policy (Available at https://www.econstor.eu/handle/10419/146992).

Mikulić, D., Lovrinčević, Ž., Nagyszombaty, A. G. (2013). Regional convergence in the European Union, new member states and Croatia. – South East European Journal of Economics and Business, 8(1), pp. 9-21.

Palánkai, T. (2010). Evaluation of the EU membership of the new member states. – Köz-gazdaság, 5(3), pp. 9-23.

Pipień, M., Roszkowska, S. (2019). The heterogeneity of convergence in transition countries. – Post-Communist Economies, 31(1), pp. 75-105.

Popovic, G., Eric, O., Stanic, S. (2020). Trade Openness, Institutions and Economic Growth of the Western Balkans Countries. – Montenegrin Journal of Economics, 16(3), pp. 173-184.

Rapacki, R., Próchniak, M. (2009). Real beta and sigma convergence in 27 transition countries, 1990-2005. – Post-Communist Economies, 21(3), pp. 307-326.

Rapacki, R., Prochniak, M. (2019). EU membership and economic growth: Empirical evidence for the CEE countries. – The European journal of comparative economics, 16(1), pp. 3-40.

Redek, T., Sušjan, A. (2005). The impact of institutions on economic growth: The case of transition economies. – Journal of Economic Issues, 39(4), pp. 995-1027.

Sala-i-Martin, X. (1996). The classical approach to convergence analysis. – The economic journal 106(437), pp. 1019-1036.

Siljak, D., Nagy, S. G. (2018). Economic convergence of the Eastern Partnership countries towards the EU-13. – Eastern Journal of European Studies, 9(2), pp. 169-185.

Siljak, D., Nagy, S. G. (2019). Do Transition Countries Converge towards the European Union?. – Baltic Journal of European Studies, 9(1), pp. 115-139.

Solow, R. M. (1956). A contribution to the theory of economic growth. – The quarterly journal of economics, 70(1), pp. 65-94.

Stanišić, N., Makojević, N., Ćurčić, T. T. (2018). The EU Enlargement and Income Convergence: Central and Eastern European Countries vs Western Balkan Countries. – Entrepreneurial Business and Economics Review, 6(3), pp. 29-41.

Stoica, O., Roman, A., Diaconaşu, D. E. (2019). Real Convergence and European Integration with Focus on the New Member States. – Scientific Annals of Economics and Business, 66(SI2), pp. 215-228.

Szeles, M. R., Marinescu, N. (2010). Real convergence in the CEECs, euro area accession and the role of Romania. – The European Journal of Comparative Economics, 7(1), pp. 181-202.

Uberti, L. J. (2018). Corruption in transition economies: Socialist, Ottoman or structural?. – Economic Systems, 42(4), pp. 533-555.

Vojinović, B., Acharya, S., Próchniak, M. (2009). Convergence analysis among the ten European transition economies. – Hitotsubashi Journal of Economics, 50(2), pp. 123-141.

Yin, L., Zestos, G. K., Michelis, L. (2003). Economic convergence in the European Union. – Journal of Economic Integration, 18(1), pp. 188-213.

World Bank. (2020). World Development Indicators Database (Available at www.databank.worldbank.org).

World Economic Forum. (2020). The Global Competitiveness Report (Available at: https://www.weforum.org/reports/the-global-competitiveness-report-2020).

Żuk, P., Savelin, L. (2018). Real convergence in central, eastern and South-Eastern Europe. – ECB occasional paper, N 212, European Central Bank (ECB), Frankfurt a. M.

https://www.theglobaleconomy.com/rankings/wb_political_stability/

https://www.europarl.europa.eu/euronest/en/home/introduction.html

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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CAPTURED ENERGY MARKET OPERATION AND LIBERALISATION EFFORTS[2]

The article examines several developments in the energy sector in Bulgaria through the prism of the "capture" theory ("interest groups" theory), and regulatory capture in particular. It argues that captured state interventions or the lack thereof lead to inefficiencies in the utilities and to socially inferior results, especially in a highly concentrated market, intensive public ownership and questionable NRA independence context. They are liable to hinder effective market liberalisation and green transition efforts.
Keywords: regulation; capture; liberalization; energy
JEL: L51; L94; L95

Introduction

Why do governments intervene in the economy? Traditionally, public service sectors, like the energy sector, are considered to present rather strong market failures compared with other sectors. Utilities involve considerable infrastructure investments and entail significant social, political, security and environmental concerns, that is why during the last century, they were mainly provided by vertically integrated State-owned undertakings. Certain challenges related to the productive and planning capacities of the governments made the doctrine question whether the costs of State intervention may not exceed the costs of the market failure to be fixed. Moreover, it crystallised that natural monopoly characteristics are not typical for the whole vertical production chain, and that parts of the service may be open to competition through unbundling techniques.

Following developments in the telecommunications sector, the EU started liberalisation of the energy sector. This transformation covered both the electricity and the gas sectors. Although it was possible to open/subject some parts of the vertically integrated sections (like generation and supply) to competition, some activities (like transmission and distribution) continued to present monopoly characteristics or dominant market position despite the liberalisation efforts. Introducing effective competition in the energy sector proved to be a challenging task and required the development of significant new legislation through

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consecutive regulatory packages. Furthermore, technical and market evolution revealed shortages that needed to be corrected by further regulatory efforts. As a result, this deregulation/liberalisation led to re-regulation. The regulation became extremely complex. Decarbonisation, green economy and sustainability goals and instruments, as well as general competition policy concerns needed to be balanced against, integrated and coordinated with energy policy goals, and with technical and regional particularities. Today, this is still the case, especially in the context of the ambitious long-term carbon neutrality objective of the European Union under the European Green Deal.

This reaffirms the importance of answering the question: what stays behind regulatory activities and State intervention, especially in Bulgaria, where the transmission, and major parts of the generation and supply assets are held by the State conglomerate Bulgarian Energy Holding. It should also be reminded that as a member of the EU, the country is under an obligation to comply with the policy and regulations of the European Union[3].

A number of economic theories have been developed to answer the question of State intervention. The "public interest" theory (the theory of the benevolent regulator) and the "capture" theory (the "interest groups" theory of regulation) take a central part in the work of the doctrine. The following sections will focus on the "capture" theory, on some of the main contributions of the doctrine, its impact and the regulatory "answer" in the energy sector. Then, certain examples of the *de facto* operation of the Bulgarian energy market will be presented in the light of some of the capture theory premises in an attempt to illustrate captured market operation and liberalisation efforts.

I. Regulatory Capture and Energy Market Regulation

The capture theory challenges the arguments of the "public interest "theory. A number of contributions aimed to define, measure the impact and develop techniques for capture-proof regulations in the energy sector. The independence of the regulatory authorities is the key instrument the European Union has embraced in its legislation to cope with capture.

1. The Public Interest Theory vs. Regulatory Capture Theory

The "public interest" theory takes a central role, especially in the field of regulation of natural monopolies. According to its premises, government intervention in an industry is directed at correcting market imperfections for the purpose of social welfare maximisation. It is intended to enhance allocative as well as productive efficiency, securing the financial viability of the

[3] Article 4 of the Treaty on the Functioning of the EU provides that energy is among the areas where the EU and Member States exercise shared competence. Art. 194 TFEU provides that in the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment EU policy on energy shall aim, to ensure the functioning of the energy market, ensure security of energy supply in the Union, to promote energy efficiency and energy saving and the development of new and renewable forms of energy; and to promote the interconnection of energy networks.

undertakings. At the same time, it should protect consumers and companies in competitive sections of industry against the abuses of monopoly power (be it private or public) in the sectors dominated by one firm.

The "interest groups" theory argues that regulations are routinely and predictably "captured" and manipulated to serve the interests of those who are supposed to be subject to them, or the bureaucrats and legislators who write or control them (Etzioni, 2009). Captured regulations thus serve the interest of these interest groups not the public interest. The main task of the capture theory is to explore the role of interest groups in public policy formation, be it commercial interests, trade unions, non–industry groups like the public or the government/politicians.

Different authors propose different definitions of regulatory capture. For example, Ernesto Dal Bo (Dal Bó, 2006) gives a broad and a narrow definition of regulatory capture. In the broad sense, he describes regulatory capture as the process through which special interests affect State intervention in any of its forms, which can include areas as diverse as the setting of taxes, the choice of foreign or monetary policy, or the legislation affecting Research and Development. According to the narrow interpretation, regulatory capture is the process through which regulated monopolies end up manipulating the State agencies that are supposed to control them.

Another definition of (state) capture suggests it is a combination of different forms of corruption which have a single objective: to secure wholesale (by default) and long-term privileges to captors by exploiting the power of governments for private benefit (Center for the Study of Democracy, 2021).

Although capture is determined by the local economic and regulatory context, as well as by historical and even cultural factors, captors are reported to target specific sectors and the energy sector (electricity and gas) is among them (Center for the Study of Democracy, 2021).

2. Theory Origins and Main Contributions

Most authors like Posner (Posner, 1974), Lafont and Tirole (Laffont & Tirole, 1991), trace its origins back to Marx's view that large businesses control institutions and to early 20th-century political scientists like Arthur Bentley (Bentley, 1908) and David Truman (Truman, 1951) who argued that all political activity is groups, pursuing their interests against the interests of others. Others go back to Montesquieu or Alexis de Tocqueville. However, the major contributions to this theory we owe to authors like Stigler (Stigler, 1971), Olson (Olson, 1971), Posner, Pelzman (Peltzman, 1976), Lafont, Tirole (Laffont & Tirole, 1991), Shleifer, Vishny (Shleifer & Vishny, 1993), Dal Bo and Rossi (Dal Bo & Rossi, 2007).

Stigler's work is considered a breakthrough in the field[4]. According to Stigler (Stigler, 1971), regulation is acquired by the industry and designed and operated mainly for its benefit. He also notes that small industries may capture the regulatory process as well. Stigler's model is illustrated by examples from the regulation of trucks in the United States. While Stigler

[4] Although it has been subject to critics.

focuses on the industry as the only active part in the capture and does not consider other interest groups, his capture theory has been later further developed by other Chicago School economists. These later contributions differ from Stigler's approach, since they take into consideration that other pressure groups besides the industry may enter into competition for favours as well (Boehm, 2007). These may include – politicians, trade unions, other agencies, foreign governments, consumers, banks, donors along with the regulated firms (Etzioni, 2009).

Posner indicates problems with both the traditional public interest theory and Stigler's approach (Posner, 1974). Regarding the latter, he criticises the lack of clear implications as to the profile of groups benefited by regulation. Stigler emphasises that industries with concentrated ownership would more easily overcome the hurdles facing collective action. However, large groups could attract favourable regulation by vote-seeking politicians. Posner also reminds, that protective regulation can take a variety of forms.

Following Lafont and Tirole (Laffont & Tirole, 1991), the main means of interest groups to influence government decision making (captures) are:

- Monetary bribes;
- Hoped-for future employment for commissions and agency staff with regulated firms or with public interest law firms – Revolving doors;
- Personal relationships;
- Industry, which caters to the agency's concern for tranquillity by refraining from criticising the agency's management publicly;
- Industry operates indirect transfers through a few key elected officials who have influence over the agency. These include monetary contributions to political campaigns, corporate votes and lobbying of the "grassroots" (employees, shareholders, suppliers, citizens of communities where plans are located).

They develop an agency model which offers a precise framework to understand how asymmetric information can be the main source for regulatory discretion. It examines the possibility for regulated firms and regulators to collude in order to extract and divide rents from the regulator's principal. It depicts the regulation of a natural monopoly, where a national regulatory authority regulates the firm's rate of return and price.

Shleifer and Vishny's work (Shleifer & Vishny, 1993) considers another aspect of capture – the tollbooth theory – where regulation is pursued for the benefit of politicians and bureaucrats. They find that the reason behind the existence of many regulations is to give officials the power to issue licences or deny them and to collect bribes or campaign contributions in return for providing the permits.

Measuring regulatory capture is not an easy task. According to Dal Bo and Rossi (Dal Bo & Rossi, 2007), the use of a nationwide measure of corruption can be correlated to regulatory capture and serve that purpose. Countries, where regulators are more easily captured, should have more inefficient utilities. They study a panel of 80 electricity distribution firms in 13

Latin American countries for the period 1994-2001. They conclude that firms are more inefficient in countries displaying higher corruption.

A recent study (Center for the Study of Democracy, 2021) presents the results from the application of an innovative analytical tool, the State Capture Assessment Diagnostics (SCAD) on a sectoral level, which provides policy-relevant findings about state capture, characterising it as a systemic failure of public governance.

Another interesting study of regulatory capture in the energy sector (Van Koten & Ortmann, 2007) explores the question of whether vertically integrated utilities were able to manipulate the legislative and regulatory process in favour of the weaker form of unbundling, and whether these manipulations were a function of the integrity of legislative and regulatory practices. The authors argue that the fact that weaker forms of unbundling are allowed at all, suggests that the pertinent political, legislative, and regulatory processes might have been unduly (and possibly illegally) influenced. Such influence is considered more effective in countries where the policy and the regulatory processes are more susceptible to manipulation. Countries with less corruption (higher levels of the Corruption Perception Index[5] score) have more complete unbundling regimes.

Djankov et al. (Djankov, et al., 2002) present an econometric study on the regulation of entry of start-up firms in 85 countries. They argue that more extensive regulation should be associated with socially inferior outcomes, particularly corruption, while the quality of the private or public goods is not better because of regulation. Furthermore, democratic governments are regulating less entry of start-up firms than governments known for being inefficient. They consider these results as providing evidence against public interest theories of regulation and in favour of the public choice view.

3. Captured Regulations Impact

Capture can be very costly to society. Some authors argue that the damage done by corruption to the technical efficiency of regulated utilities is similar in magnitude to operating an environment characterised by poor law and order, *and it is orders of magnitude larger than the damage, done by macroeconomic instability* (Dal Bó, 2006).

Capture allows special interest groups to shape regulations ex-ante or ex-post. They can exert their influence either directly on regulators or indirectly, capturing the authorities who hold power over regulatory agencies. It opens the door for interest groups to weaken regulations that are already in place, to weaken enforcement of the existing regulations, to repeal existing regulations, to manipulate or switch regulators or even to set prices and rates that increase profitability (Etzioni, 2009). It can also lead to the opposite – keeping tariffs and rates below the normal price, thus seriously harming regulated industries. So capture has the effect to either redistribute rents or to change efficiency. Some examples demonstrating this impact from the Bulgarian energy sector will be discussed in the second part of the article.

[5] CPI shows how corrupt a country's public sector is perceived to be by the experts and business executives.

The key question is not whether regulation is necessary but rather how to make regulation stronger or "capture-proof". It is also important to note that capture can be related to either lobbying or to corruption practices. While lobbying is not prohibited by law, corruption is illegal. Therefore, there are different types of anti-capture measures to be considered. While lobbying practices need to be regulated, fighting corruption requires anti-corruption strategies.

However, the primary purpose of this article is not to propose such measures or to examine this problem in detail. It aims to illustrate some interventions in the Bulgarian energy sector that arguably constitute examples of the influence of different interested parties and to quantify them. The next section presents one of the main "arms" against capture, which is used in the energy sector legislation and policy instruments.

4. Energy Regulatory Bodies Independence – A Tool for Capture Proof Regulation?

The energy sector transformation efforts in the European Union have been ongoing for almost three decades. The introduction and establishment of institutions/bodies both at a national and supranational level, including national energy regulatory authorities and EU level oversight is an essential element of the liberalisation process of the electricity market. Their existence is based on the need to regulate energy networks (as natural monopolies) and, in particular, to ensure non-discriminatory access to the energy networks. Consecutive legislative instruments formulated requirements intended to ensure national regulatory authorities (NRA) powers, independence, resources, transparency and accountability, and to diminish the fragmentation of the regulatory oversight at the European Union.

The independence of regulators preserves stability and continuity in the setting of rules, avoids political interference in business decisions and regulatory risks, and maintains high standards of expertise and professionalism (Capros, 2003). Independence is a cornerstone of the functioning and position of NRAs since they are entitled to ensure a balance between commercial interests, policy objectives and social welfare considerations. It is considered that one of the very reasons why regulators were created in the first place was to ensure that decisions about the energy market would be shielded from commercial and political interests, thereby addressing the conflict of interests that can arise where the government has a stake in energy or network companies (Directorate-General for Energy (European Commission) , 2019).

Regulators must be independent both from the industry they regulate and from the government (CEER, 2016), as the State has, at least potentially, economic or political interests, particularly with the incumbent companies. In the case of countries, like Bulgaria, where State-owned public monopolies had prevailed, the liberalisation further necessitates a clear separation of the State as a regulator, and the State as the owner of public utilities, either through privatisation or through the establishment of (not only *de jure* but also *de facto)* independent regulators or both. In addition, with the energy sector accounting for a considerable part of most countries' economies, there are real risks that private and/or public entities seek to interfere with the regulatory decision-making (Capros, 2003).

II. Regulatory Capture and the Case of the Bulgarian Energy Sector

The electricity sectors of the Republic of Bulgaria and Malta are the last to remain not fully liberalised in the European Union[6]. Liberalisation is perceived as the possibility for customers to choose their supplier at a retail level, and the freedom for utilities to choose their partners at a wholesale level.

It can be argued that regulatory capture is one of the main drivers for the policy action and legislative developments in several aspects. Although energy sector legislation in the EU stipulates that NRAs must be impartial and independent from both commercial and political influence, a number of examples of government intervention in the work of the Bulgarian energy regulators can be pointed out. Furthermore, examples of government intervention distorting competition at the EU level through export bans will be examined. The price regulation techniques of the Bulgarian Energy and Water Regulatory Commission and their devastating implications on the activities of a regulated company will be discussed. Last but not least, several developments in the sector with significant implications for the regulated business will be pointed, which were either results of questionable competence and expertise, or blunt examples of the influence of interest groups.

1. Government intervention during the cold spell in 2017

By Order of Jan. 11, 2017, the Minister of Energy imposed on the company certified as independent transmission operator (ITO) an "additional public service obligation" entailing an export ban. The measure consisted of the termination of access to the electricity transmission network of users exporting electricity generated in the country for the period from Jan. 13, 2017, until the reserves necessary for the operation of Bulgaria's electricity system have been restored. This intervention resulted in a suspension of the cross-border capacity allocation for exports through Feb. 9, 2017.

Platts' report for the European Commission (Platts report for the European Commission, DG Energy, 2017) concluded that this was a non-market measure and that *it was not necessary through the entire period*. They consider the measure particularly distortive in the days when the average dispatching of Bulgarian plants was below 5200 MW. In those days, the spread between Bulgaria and Greece (or Hungary, a benchmark in the region) was unusually wide, given prior winters' observations, suggesting the Bulgarian system was artificially oversupplied. They argue that as a consequence, Bulgarian plants lost the opportunity to sell power to neighbouring countries given there was enough generation capacity and the price spread was wider than historical levels. According to Platts, the estimated daily loss amounted to €1 million, leading to a total loss for generators around €27 million.

Clearly, the measure was counterproductive for the power producers in Bulgaria, and it was a non-market measure, which interfered with the interests of the utilities. The measure was

[6] https://ec.europa.eu/energy/content/electricity-market-liberalization_en.

also harmful to the ITO, as it incurred losses from the non-allocated cross border capacity and from the transmission fees, that it would have otherwise realised.

However, the ban led to "preserving" low prices for the Bulgarian non-residential customers. One could argue that the fact for a political/government representative to instruct non-proportionate measures that could not be objectively justified, constitutes an example of regulatory capture. As we have seen, regulatory capture may be driven by a desire of politicians to secure political support for their administrations and the government. In this case, the interests of large industrial consumers in the country were protected at the expense of the utilities and the system operator. Furthermore, it also undoubtedly affected EU energy market liquidity and prices.

2. Government Intervention in the Price Determination of Regulated Industries

Another intervention in the normal course of work of the industry presents the characteristics of the capture exercised over the regulatory process. On Sept. 1, 2020, the Minister of energy ordered the regulated supplier of natural gas – Bulgargaz to withdraw its price application, thus hindering the NRA from exercising its powers to set the regulated price for the company[7]. The Minister's concern was that the gas supplier requested a price increase of about 20.3 percent. The regulatory process was interrupted and the price regulation procedure was delayed and restarted only when the Minister of energy gave a permission. Here again, following a concern of political order – securing consumers' support for the government as the main reason behind this intervention. At the time of the intervention, large protests were taking place in the country, and a significant price increase would have resulted in losing political support for the government. It should be mentioned that in 2013 electricity prices increase led to massive anti-government protests and to the fall of the government[8].

3. Government and NRA Inaction towards NEK's Tariff Deficit

Regulatory capture interferes with consumer welfare, business interests and adequate policy formation. According to the narrow definition of regulatory capture proposed at the beginning of the article, capture is the process through which regulated monopolies end up manipulating the State agencies that are supposed to control them to their benefit. But capture also has the potential to lead to detrimental consequences for the financial health of regulated undertakings, especially where price setting is involved.

As outlined in Part I, the independence of regulators is a key prerequisite for capture-free decision making. It is said to preserve stability and continuity in the setting of rules, avoid

[7] https://www.mediapool.bg/zelena-svetlina-za-po-skap-s-20-gaz-za-septemvri-news311916.html.

[8] https://www.reuters.com/article/us-bulgaria-protests-electricity/tens-of-thousands-join-electricity-protests-across-bulgaria-idUSBRE91G0C520130217.

political interference in business decisions and regulatory risks, and maintain high standards of expertise and professionalism.

In 2014 a paper prepared for the European Commission defined electricity tariff deficit as *a deficit or debt built up in the electricity sector, often in the regulated segments of transmission or distribution system operators, but in some cases also in the competitive segments, e.g. in incumbent utilities. A deficit is accumulated due to the fact that the regulated tariffs, which should cover the system's operating costs, including e.g. subsidies to renewables, are either set too low or not allowed to increase at a pace that cover rising production or service costs. As these deficits accumulate due to government regulation of tariff or price levels, they have been recognised as contingent liabilities of the State in a few Member States. However, in some other Member States, they appear as losses on the financial statements of energy companies* (Directorate-General for Economic and Financial Affairs (European Commission), 2014).

Natsionalna Elektricheska Kompania EAD (NEK) is a public supplier on the Bulgarian electricity market. As such, the company is subject to tariff setting, as the market in the country has only been partially liberalised and residential customers still buy electricity under regulated tariffs. For many years the company has been under an obligation to purchase renewable energy and to secure the support for combined heat and power producers under mandatory buy-out obligations. These support measures were intended to be passed on to the final energy consumers and for NEK to recover the costs of these obligations.

In 2014 the NRA[9] recognised a tariff deficit for NEK's regulated activities in 2012-2013, amounting to approximately 1,5 billion BGN. It established a five-year compensation plan for the company. However, the 2014 Decision has not been implemented since the company received only partial compensation for the first year of the plan. During the following regulatory periods, the tariff deficit accumulation continued.

In its price-setting application in 2019, NEK claimed that the tariff deficit recognised by the NRA in its 2014 decision and the respective sums should be recovered and additionally the deficit accumulated through 2014-2018 should be recognised and recovered by the NRA. However, the NRA price-setting decision from 2019 refused to accept the company claims, stating that the exact amounts of the tariff deficit and the compensatory mechanism needed to be further clarified. The same happened in 2020[10] and 2021[11] when in its decisions the regulatory body again postponed tariff deficit compensation for NEK.

The public supplier has been facing bankruptcy and its sole owner, the state company Bulgarian Energy Holding secured financing (loans) to its subsidiary NEK. Clearly, no private company/investor would be in the position to incur such losses and to continue operation for such a long period of time.

It can be argued the activities of the NRA are not an example of capture-free price-setting technique. Electricity prices have been a highly sensitive issue and price increases have led

[9] Decision Ц-12/30.06.2014 of the State Water and Energy Regulatory Commission of Bulgaria.
[10] At the time NEK pretended for tariff deficit amounting at nearly 2,5 billion BGN.
[11] Decision Ц-27/01.07.21 of the State Water and Energy Regulatory Commission of Bulgaria.

to turmoil and government resignations in 2013[12]. Keeping the electricity bills low is an instrument for the government to secure political support, but such courtesy to the political parties in power has been detrimental to NEK, as evidenced by its financial losses over the past 10 years. If the State refuses to recognise NEK's tariff deficit as a contingent liability, sooner or later, the deficit would eventually be transferred to the consumers through a significant increase in the electricity bills.

4. Government Inaction towards Strategic Assets in Carbon Neutrality Objectives Context

As mentioned earlier, the European Union has set a climate neutrality objective for 2050. EU institutions have recognised the need to put in place an enabling framework to reach this goal. The green transition is closely related to coal phase-out and all political documents and the legislative framework in place have set the rules and financial framework, including a Just Transition Fund intended for high carbon intensity regions with a significant level of employment in the industry. Bulgaria is one of the countries where solid fossil fuels represent a significant part of the national electricity generation mix and where strategic planning and measures are needed.

The EU energy regulations provided for a transitional period and instruments regarding coal-phase out such as Capacity mechanisms. Unfortunately, Bulgaria has not to this day presented a strategy for the future of the Maritsa-East region and the thousands of employed people in the industry. It was also not able to present in a timely manner a capacity mechanism for the transitional period.

A number of thermal power plants (TPPs) and the biggest coal mine in the country[13] are located in the region. The lack of action by political representatives provoked by fear of losing political support for the government has the potential to lead to catastrophic consequences for the State-owned TPP in the region, which is exposed to carbon emissions payments and is no longer competitive on the electricity market. Only short-term measures have been implemented over the past two years, where the Minister of Energy uses a rather controversial technique of imposing "additional public obligations" in order to prolong for a year the life of the State-owned TPP. The public obligations consist of defining a quota for the regulated market, where the public supplier NEK is under a mandatory obligation to buy the power produced by the undertaking at a non-competitive price. This, in turn, is passed on to the final consumer through an increase of prices in the electricity bills and taxes. Not only this situation is detrimental for the companies, for the employed in the region, but it is also harmful to the consumers.

[12] https://www.nytimes.com/2013/02/21/world/europe/bulgarian-government-is-reported-set-to-resign.html.
[13] The largest TPP and the coal mine are both subsidiaries of Bulgarian Energy Holding.

5. (In)dependence of the NRA

The revolving doors problem is one of the main obstacles to the independence of the decisions of the regulator. The hope for future employment or the appointment of officials in the regulatory agencies, who are closely related to industry representatives, is notorious in Bulgaria. Interestingly, according to the Bulgarian Energy Act the NRA is politically independent of the executive power, without any mention of independence from commercial or other interests[14].

Another important factor for the decision-making processes is the nomination and appointment procedures for Board members of the NRA. Questionably the requirements for the nomination of board members were significantly lowered in 2020, when an amendment of the Energy Act introduced a requirement for only 5 years of professional experience[15], including the Chair of the NRA. Given the significance and complexity of the tasks performed by the NRA, it can be noted that this is a rather strange turn in the regulation. The commissioners – members of the NRA – are directly appointed and dismissed by the parliament following nominations from the different political parties in the country and a public procedure[16]. Here again, we could expect that each of the candidates would be rather bound to following the instructions of the nominating party, than following independent decision-making practices. The appointment and dismissal process, combined with a rather short term, suggests that nominees work at the agency is limited in time and directly dependent on political will in the government. That is why there is a risk for the integrity, independence, stability and continuity in the work of the regulator in the energy sector in Bulgaria. Given that the appointment process is highly dependent on the constellation of political forces in parliament, one could argue that few professionals and experts in the field would agree to be nominated for such positions given the short horizon and potential influences on their activity.

It should be noted, however, that regarding any life-cycle effect, related to the capture, researchers (Dnes & Seaton, 1999) neither find evidence that regulatory agencies become more captured as time passes, nor that a lack of experience makes them most vulnerable to capture. Therefore, it is not certain whether term lengths should be adjusted to reduce regulatory capture.

Added to this, there is another problem, identified by the doctrine – agencies do not dispose of sufficient finances to be able to attract competent experts in their administrations. The wages in the NRA are considerably lower than in the industry.

In 2019 a study, commissioned by the European Commission, to assess the *de jure* and *de facto* independence of the national regulatory authorities in the field of energy and their effectiveness in performing key tasks in 12 Member States, including Bulgaria (Directorate-General for Energy (European Commission) , 2019), confirms some of the assumptions made

[14] Article 10 of the Energy Act.
[15] Article 12 of the Energy Act.
[16] Article 12a of the Energy Act.

above. According to the field research performed by the report team – the *"de facto aspects"* for the independence of the NRA are as follows:

- Most survey participants consider that the NRA is not independent of the political decision-makers. 50% of the 12 Bulgarian survey respondents think that the NRA is to no extent independent from government influence.
- The appointment and dismissal systems are flawed. The majority of the stakeholders in Bulgaria held the view that parliamentary involvement was more likely to result in board members who are dependent on and accountable to political parties.
- Even though some operators are state-owned, the NRA is not perceived as favouring these players by any of the stakeholders consulted.
- 71% of the Bulgarian survey respondents mentioned, that the approval of the budget has been used as a means to jeopardise NRA's ability to carry out its duties and exercise its powers in an efficient and effective manner.
- Governmental involvement in fixing salaries is considered to be an obstacle or potential obstacle in attracting adequate staff.
- The majority of survey respondents consider that the number of staff, working at the NRA, is inadequate to appropriately fulfil its tasks. Only 8% think that the staff and management of the NRA are neutral and competent; while 50% think it is not neutral and competent (and 33% only somewhat neutral and competent).

Conclusion

The evidence provided above suggests that the market operation and liberalisation efforts on the energy market in Bulgaria are also susceptible to regulatory capture, as defined by the doctrine. Although the main policy and legal framework are adopted at EU level[17], at national level, the actions and inactions which were examined show that regulatory activities are exploited by captors. This view is also supported by the stakeholders regarding the national regulatory authorities' independence in the survey.

The ownership structure on the Bulgarian market, together with a strong market concentration, contribute significantly to this vulnerability of State interventions to capture. The actions and inactions of public authorities, allegedly attributable to capture, lead to significant consequences for the financial health of utilities, which in turn impacts their performance and efficiency. They are also capable of compromising effective participation in programs and financial instruments related to the green transition of the country with regard to the binding commitments under the European Union's climate neutrality policies and regulations.

[17] European policy and regulatory instruments formation and capture have not been discussed in this article. Nevertheless, regulatory developments and policy formation are not capture-proof at both national and supranational level.

In the absence of specialised policies and regulations addressing capture in a systematic manner, significant efforts need to be made to fighting the negative aspects of this phenomenon, especially on the social welfare and business environment.

Some proven measures are, for example, implementing actual (as opposed to formal) guarantees for NRA independence and enforcing transparency and public involvement in decision making. Further levers could be strategic, timely planning and policy formation, improving the professional and administrative capacity of key public institutions, as well as effective anti-corruption strategies and lobbying activities regulation.

References

Bentley, A. F. (1908). The Process of Government: A Study of Social Pressures. Chicago: University of Chicago Press.

Boehm, F. (2007). Regulatory capture Revisited - Lessons from Economics of Corruption. - Internet Centre for Corruption Research (ICGG) Working Paper.

Capros. (2003). Independence of energy regulators: new challenges. Rome: World Forum on Energy Regulation.

CEER. (2016). Safeguarding the independence of regulators - Insights from Europe's energy.

Center for the Study of Democracy. (2021). State Capture Assessment on Sectoral Level. Sofia: CSD.

Center for the Study of Democracy. (2021). State Capture Deconstructed. Sofia: CSD.

Dal Bó, E. (2006). Regulatory Capture: a Review. - Oxford Review of Economic Policy, 22(2), pp. 203-225.

Dal Bo, E., Rossi, M. A. (2007). Corruption and inefficiency: Theory and evidence from electric utilities. - Journal of Public Economics, 91(5-6), pp. 939-962.

Directorate-General for Economic and Financial Affairs (European Commission). (2014). Electricity Tariff Deficit: Temporary or Permanent problem in the EU?.

Directorate-General for Energy (European Commission). (2019). Assessing the independence and effectiveness of national regulatory authorities in the field of energy.

Djankov, S., La Porta, R., Lopez de Silanes, F., Shleifer, A. (2002). The Regulation of Entry. - Quarterly Journal of Economics, 117(1), pp. 1-37.

Dnes, A., Seaton, J. S. (1999). The regulation of electricity: results from an event study. - Applied Economics, 31(5), pp. 609-618.

Etzioni, A. (2009). The Capture Theory of Regulations - Revisited. Society, Vol. 46, pp. 319-323.

European Commission, Directorate General for Energy, Spark, Trinomics, University of Groningen. (2019). Assessing the independence and effectiveness of national regulatory authorities in the field of energy. EU publications.

Laffont, Tirole. (1991). The Politics of Government Decision-Making: A Theory of Regulatory Capture. - The Quarterly Journal of Economics, 106(4), pp. 1089-1127.

Olson, M. (1971). The Logic of Collective Action: Public Goods and the Theory of Groups. Second Printing with a New Preface and Appendix. London: Harvard University Press.

Peltzman, S. (1976). Toward a More General Theory of Regulation. - The Journal of Law & Economics, 19(2), pp. 211-240.

Platts report for the European Commission, DG Energ. (2017). EU Electricity Markets in January and February 2017.

Posner, R. (1974). Theories of Economic Regulation. - The Bell Journal of Economics and Management Science, 5(2), pp. 335-358.

Shleifer, A., Vishny, R. (1993). Corruption. - The Quarterly Journal of Economics, 108(3), pp. 599-617.

Stigler, G. (1971). The Theory of Economic Regulation. - The Bell Journal of Economics and Management Science, 2(1), pp. 3-21.

Truman, D. B. (1951). The Governmental Process: Political Interests and Public Opinion. New York: Alfred A. Knopf, Inc..

Van Koten, S., Ortmann, A. (2007). The Unbundling Regime for Electricity Utilities in the EU: A Case of Legislative and Regulatory Capture?. - CERGE-EI Working Papers.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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STOCK PRICE DYNAMICS SURROUNDING COMPANY-SPECIFIC SHOCKS[2]

In this study, I analyze the correlation between stock returns before and after major price shocks. I hypothesize that if a large price move for a given stock takes place after a short period when the stock's price moves in the same direction, then it may indicate that the fundamentals of the company-specific shock are more completely incorporated in the stock price, significantly increasing the probability of subsequent post-event price reversal. In order to test the study's hypothesis, I employ the price data for all the stocks that made up the S&P 500 Index during the period from 1993 to 2019, and define significant price moves according to a number of alternative proxies referring to both raw and abnormal stock returns. I find that both large price increases and decreases are followed by significant one to three month price reversals (drifts) if they are preceded by the same- (opposite-) sign short-term cumulative abnormal returns. The effect remains significant after accounting for additional relevant company-specific (size, Market Model beta, historical volatility) and event-specific (stock's return and trading volume on the event day) factors.
Keywords: Behavioral Finance; Large Price Changes; Overreaction; Stock Price Reversals
JEL: G11; G14; G19

1. Introduction

Stock prices are widely considered to reflect all the information that may be relevant for the respective stocks, both on the market-wide and the respective company's level. The question that preoccupies a large number of both financial researchers and stock market practitioners is whether the stock prices immediately incorporate all the relevant information and if there are some possibilities for gaining systematic and consistent profits based on some pre-determined and continuously repeating price patterns.

One of the issues attracting a lot of interest in this respect refers to large short-term stock price changes following various company-specific shocks.

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Extensive previous literature analyzes stock price predictability following large price changes. Several authors report subsequent reversals, and thus, conclude that the initial price moves may actually represent some kind of overreaction to the underlying shocks (e.g., Zarowin, 1989; Conrad et al., 1994; Avramov et al., 2006). A few other studies either suggest that there are no reversals after large price changes (e.g., Cox, Peterson, 1994; Lasfer et al., 2003; Mazouz et al., 2009), or establish that the reversals are non-significant or insufficient for generating profitable arbitrage opportunities (e.g., Atkins, Dyl, 1990; Park, 1995; Bremer et al., 1997). An additional strand of literature focuses on the relation between public information and major stock price changes (e.g., Pritamani, Singal, 2001; Chan, 2003; Tetlock, 2010; Savor, 2012). The overall conclusion that may be drawn based on this group of studies is that large price changes tend to be followed by price drifts if they are accompanied by public information releases, suggesting that investors generally underreact to news about price fundamentals, and by price reversals if they are not accompanied by any public news, indicating that investors may overreact to other shocks that move stock prices, such as shifts in investor sentiment or liquidity shocks.

The main goal of the present study is to analyze stock price dynamics *surrounding* large price moves. Specifically, I analyze the correlation between stock returns before and after major price shocks. I suggest that if a large price move for a given stock takes place after a short period when the stock's price moves in the same direction, then it may indicate that the fundamentals of the company-specific shock are more completely incorporated in the stock price, significantly increasing the probability of subsequent post-event price reversal.

I construct a large sample of large daily stock price moves for all S&P 500 index constituents over the period from 1993 to 2019. Consistently with the overall conclusion arising from the previous literature, for the total sample of price moves, I document either non-significant or marginally significant reversals following both positive and negative price moves. On the other hand, after classifying the sample of large stock price moves according to the magnitude of short-term stock returns preceding the price moves, I get corroborative evidence for the study's hypothesis. I establish that after large stock price increases preceded by relatively high (highest sample quintile or decile) 5- or 10-day cumulative abnormal returns (CARs), there are significantly negative average CARs over all post-event periods (one, two and three months), whose magnitude slightly increases as the post-event window is expanded. On the other hand, stocks whose 5- or 10-day CARs before large stock price increases are relatively low, experience significantly positive average post-event CARs. Symmetrically, I report that after large stock price decreases preceded by relatively low 5- or 10-day CARs, there are significantly positive average CARs over all the post-event periods, whose magnitude slightly increases as the post-event window is expanded. On the other hand, stocks whose 5- or 10-day CARs before large stock price increases are in the highest quintile or decile, exhibit significantly negative average post-event CARs. These findings may imply that if a large stock price move is preceded by the same-sign short-term stock returns, then there may be a more complete reaction, or even overreaction, to the underlying company-specific shock, so that during the subsequent period, the respective stock's price may be more likely to experience a reversal. The documented effect of short-term stock returns preceding large price moves on post-move stock price dynamics remains significant after accounting for additional company-specific (size, Market-Model beta, historical volatility) and event-specific (stock's return and trading volume on the event day) factors.

The rest of the paper is organized as follows. Section 2 discusses the previous literature focusing on stock returns after large price moves. Section 3 presents and explains the study's research hypothesis. Section 4 includes the sample description and the research design. Section 5 describes the empirical tests and reports the results. Section 6 provides some concluding remarks and a brief discussion.

2. Literature Review: Stock Returns Following Large Price Changes

Stock price dynamics following significant price changes are in the focus of a vast strand of financial literature. Numerous studies document systematic price reversals after large price moves, and subsequently suggest that the latter may contain some element of overreaction[3]. Renshaw (1984) and Bremer and Sweeney (1991) employ the 10-percent threshold for defining significant stock price declines and detect that the latter are followed by significantly positive market-adjusted returns. Howe (1986) concentrates on the most extreme events, namely weekly stock price increases and decreases of 50% or more, and reports significant price reversals that are not driven by seasonality and do not depend on the analyzed period. Brown et al. (1988) employ extremely negative one-period returns for building their working sample and study the subsequent monthly stock returns. They control for the directional effect, the magnitude effect and the intensity effect and find evidence consistent with overreaction. Zarowin (1989) also uses monthly data and employs a portfolio approach similar to DeBondt and Thaler (1985, 1987). His results point out at the existence of short-term stock market overreaction. Conrad et al. (1994) demonstrate that stock trading volumes are negatively correlated with the magnitude of price reversals for small stocks. On the other hand, Cooper (1999) argues that stock trading volumes are positively correlated with price reversals for larger stocks. Sturm (2003) documents that negative price shocks are in general followed by positive post-shock excess returns, but this relationship may be different, when the shocks are classified by several characteristics that may refer to investor confidence. Moreover, he states that larger price shocks are followed by smaller price reversals, potentially suggesting that investors may connect the former to stable causes. Avramov et al. (2006) detect that stock illiquidity is positively correlated with volume-induced price reversals.

Another group of studies do not support the existence of significant reversals following large price moves. Atkins and Dyl (1990) make an effort to construct profitable investment strategies over the first few days after extreme price declines, but do not manage to confront the Efficient Market Hypothesis. They find that if bid-ask spreads are taken into consideration, then excess returns resulting from reversals are not sufficient for generating profits. Lehmann (1990) does report the existence of short-term price reversals after negative weekly events, but concludes that the former hardly cover the transaction costs. Cox and Peterson (1994) suggest that price reversals following large price declines may be partially explained by bid-ask bounce and market liquidity. They document that the reversals tend to

[3] This inference is based on the conclusions arising from the studies that closely connect the concepts of overreaction and price reversals (e.g., DeBondt, Thaler, 1985; Lo, MacKinlay, 1990; Jegadeesh, Titman, 1993; Daniel et al., 1998; Hong, Stein, 1999).

disappear with time (4-20 days following the event), and therefore reject the overreaction hypothesis. Using the mid-point of bid-ask prices, Park (1995) continues this line of research and argues that price reversals following large price moves are partially driven by the bid-ask bounce, and that the latter practically neutralizes the profit potential embedded in the. In the same spirit, Hamelink (1999) and Fehle and Zdorovtsov (2003) detect significant post-extreme return reversals but concludes that the overreaction hypothesis cannot be supported if the bid-ask spread is taken into consideration. Even more flatly, Ratner and Leal (1998) find no evidence of any price reversals based on the trading data from emerging markets of Latin America and Asia. Bremer et al. (1997) employ Japanese stock market data and establish the existence of a reversal pattern, which is significant, but not sufficient for earning arbitrage profits. They (Lasfer et al., 2003) expand the area of analysis to both developed and emerging markets and infer that, in general, the evidence of price reversals is mixed and cannot be efficiently employed for making abnormal profits. Mazouz et al. (2009) use three alternative approaches for calculating abnormal post-event (large price move) returns. They not only fail to document the existence of price reversals, but even bring some evidence of price drifts following large price increases.

More recent studies in the field mostly concentrate on the effect of public information on stock price dynamics around large price changes. Pritamani and Singal (2001) analyze a sample of large stock price changes combined with daily news stories for the same stocks and report that large price changes accompanied by public announcements or volume increases are followed by price drifts, while large price changes that are not accompanied by any public news produce non-significant post-event abnormal returns. Chan (2003) considers news headlines for a sample of stocks that have experienced large price moves. Consistently with some of the previous literature demonstrating underreaction to news about fundamentals (e.g., Ikenberry, Ramnath, 2002; Michaely, Womack, 1999; Vega, 2006), he detects price momentum after events driven by news. On the other hand, he finds significant reversals after events, especially large price declines, taking place without any detectable public news. Chan (2003) also establishes that the effects are more pronounced for smaller and less liquid stocks. Consistently with Chan (2003), Savor (2012) finds that significant price moves accompanied by analyst recommendation revisions result in drifts, while no-information ones are followed by reversals. Importantly, the drifts are produced only when the direction of the large price change corresponds to the direction of contemporaneous change in analyst recommendation. He infers that these results may be driven by the fact that investors underreact to fundamental news and overreact to other price shocks. Similarly, Larson and Madura (2003) report that large price moves unaccompanied by public news indicate the existence of initial overreaction, while large price declines accompanied by public news display price drifts. Tetlock (2010) analyzes a large archive of public news, and suggests that reversals are significantly more pronounced after no-news days. Moreover, he concludes that for many stocks, volume-induced momentum is present only on days with public news. Kudryavtsev (2018) documents that large price moves accompanied by the same-sign contemporaneous daily market returns are followed by significant short-term price reversals, whose magnitude increases over longer post-event time intervals while large price changes accompanied by the opposite-sign contemporaneous daily market returns lead to non-significant price drifts. He explains this finding by the increased availability of positive (negative) investment outcomes on the days, when the market index rises (falls), which may

cause an overreaction to the underlying positive (negative) company-specific shock, resulting in a subsequent stock price reversal.

3. Research Hypothesis

As discussed in the previous Section, previous literature either reports price reversals following large stock price moves or gets some kind of mixed evidence. This study concentrates on a factor, that may potentially serve as an indication of overreaction to company-specific shocks and may help to predict the dynamics of stock returns following large price moves.

Namely, I suggest that if a large price move for a given stock takes place after a short period when the stock's price moves in the same direction, then it may indicate that the fundamentals of the company-specific shock are more completely incorporated in the stock price, significantly increasing the probability of subsequent post-event price reversal. In other words, I hypothesize that if an event (large stock price move) is preceded by the same-sign short-term stock returns, then there may be a more complete reaction, or even overreaction, to the underlying news, so that during the subsequent period, the respective stock's price may be more likely to experience a reversal.

Thus, the study's major research hypothesis deals with the effect of pre-event stock returns on the post-event stock price dynamics, and may be formulated as follows:

Hypothesis: *If a large stock price increase (decrease) is preceded by relatively high (low) abnormal short-term stock returns, then the stock's cumulative abnormal returns during the post-event period should be lower (higher).*

4. Data Description and Methodology

For the purposes of my research, I employ the adjusted daily price and trading volume data for all the stocks that made up the S&P 500 Index and for the index itself (employed as a proxy for the general stock market index) for the period from 1993 to 2019.[4] For each large price move (according to the definition presented later in this Section), I match the respective company's market capitalization, as recorded on a quarterly basis at http://ycharts.com/, for the closest preceding announcement date.

As a benchmark of large daily stock price changes, I employ daily raw stock returns with absolute values exceeding 10% ($|SR0_i| > 10\%$), where $SR0_i$ refers to the event-day (Day 0) stock return corresponding to the event (large stock price move) *i*. This is a commonly used threshold that is assumed to be high enough to screen out most price movements that do not reflect substantial changes either in fundamentals or in investor sentiment.[5]

[4] The price and volume data were downloaded from www.finance.yahoo.com on February 2020.

[5] Following Kudryavtsev (2018), I alternatively employ the following proxies for large stock price moves: (i) daily raw stock returns with absolute values exceeding 8%; (ii) daily raw stock returns with

In order to allow the empirical analysis, I use a number of additional filtering rules, and for each large stock price change in my working sample, make sure that (i) there were historical trading data for at least 250 trading days before, and 20 days after the event; (ii) market capitalization information was available for the respective stocks; and (iii) the absolute value of the price changes did not exceed 50%. Following these filtering rules, I construct a working sample of 4,699 large price moves, including 1,887 price increases and 2,812 price decreases.

5. Results Description

5.1. Stock returns following large price moves: Total sample

In order to estimate and quantify stock price dynamics immediately before and after large price moves, I calculate daily abnormal stock returns (ARs) employing Market Model Adjusted Returns (MMAR)[6]. I define the estimation window as days -261 to -11 preceding the event, and within this window, for each event *i*, run the following regression of the respective stock's returns on the contemporaneous market (S&P 500 Index) returns:

$$SR_{it} = \alpha_i + \beta_i MR_{it} + \varepsilon_{it} \quad (1)$$

where: *SRit* represents the stock's return on day *t* (*t* runs from -251 to -11) preceding event *i*; and *MRit* refers to the market return on day *t* preceding event *i*. Subsequently, I use the regression estimates $\widehat{\propto_i}$ and $\widehat{\beta_i}$ for calculating ARs for each of 10 days preceding event *i*, and for each of 63 days following the event, as follows:

$$AR_{it} = SR_{it} - [\widehat{\propto_i} + \widehat{\beta_i} MR_{it}] \quad (2)$$

where: *ARit* represents the abnormal stock return on day *t* following event *i* (*t* runs from -10 to 63, excluding Day 0); and *SRit* and *MRit* refer to the stock and the market returns for the respective days, following event *i*.

In order to test the study's research hypothesis, I need to estimate the post-event stock price dynamics. To do so, I employ cumulative ARs (CARs) for Days 1 to 21, Days 1 to 42 and Days 1 to 63, roughly corresponding to one month, two months and three months after the large price move, respectively.

absolute values exceeding three standard deviations of the respective stock's daily returns over 250 trading days (roughly a year) preceding the event; (iii) daily raw stock returns with absolute values exceeding four standard deviations of the respective stock's daily returns over 250 trading days (roughly a year) preceding the event; (iv) daily abnormal stock returns (calculated according to the Market Model) with absolute values exceeding 8%; and (v) daily abnormal stock returns (calculated according to the Market Model) with absolute values exceeding 8%. The results (available upon request from the author) remain qualitatively similar to those reported in Section 5.

[6] Alternatively, I calculate ARs using Market Adjusted Returns (MAR) – return differences from the market index, and the Fama-French three-factor model. The results (available upon request from the author) remain qualitatively similar to those reported in Section 5.

Table 1 refers to the total sample of events and depicts CARs for the three specified post-event periods following large price increases and decreases, and their statistical significance. The results are in line with the findings of most of the previous studies. If the total sample of large price moves is considered, then it appears that they are followed by either non-significant or marginally significant reversals, which are slightly more pronounced following negative price moves.

5.2. Effect of short-term stock returns preceding large price moves on post-move stock price dynamics

For testing the main research hypothesis of the study, I divide the above-described sample of large stock price moves according to the magnitude of the short-term abnormal stock returns registered before the event. Table 2 presents CARs for Days 1 to 21, Days 1 to 42 and Days 1 to 63 following large price increases and decreases separately, the subsample representing the highest and the lowest 5-day pre-event CAR quintiles and deciles, and the respective CAR differences. Table 3 performs the same analysis based on the 10-day pre-event CAR classification[7]. The results support the existence of the effect of short-term pre-event returns on post-event stock price dynamics, indicating that:

- After large stock price increases preceded by the highest-quintile or decile 5- or 10-day CARs, that is, for the events characterized by a more complete price reaction to the underlying shock, there are significantly negative average CARs over all post-event periods, whose magnitude slightly increases as the post-event window is expanded. For example, the average CAR for days 1 to 63 after large stock price increases preceded by the highest-decile 5-day CARs is -1.28%. On the other hand, stocks whose 5- or 10-day CARs before large stock price increases are in the lowest quintile or decile, experience significantly positive average post-event CARs.
- Symmetrically, after large stock price decreases preceded by the lowest-quintile or decile 5- or 10-day CARs, there are significantly positive average CARs over all the post-event periods, whose magnitude slightly increases as the post-event window is expanded. For example, average CAR for days 1 to 63 after large stock price decreases preceded by the lowest-decile 5-day CARs reaches 1.52%. On the other hand, stocks whose 5- or 10-day CARs before large stock price increases are in the highest quintile or decile, exhibit significantly negative average post-event CARs.
- For both large stock price increases and decreases, average CAR differences between the events preceded by the highest- and the lowest-quintile or decile 5- or 10-day CARs, are highly significant, and their magnitude gradually increases as longer post-event periods are considered. For example, for post-event days 1 to 63, average CAR differences between large stock price increases (decreases) preceded by the highest- and the lowest-decile 5-day CARs is -2.06% (-2.20%). This result provides the major support for the

[7] In addition, I have classified large stock price moves by their 30-day pre-event CARs. The results with respect to the post-event CAR dynamics (available upon request from the author) are qualitatively similar to those presented in Section 5.

study's hypothesis, implying that post-event negative (positive) price reversals are significantly stronger for large stock price increases (decreases) preceded by relatively high (low) CARs.

5.3. Multifactor analysis

After documenting the effect of short-term stock returns preceding large price moves on post-event stock price dynamics, I test its persistence, controlling for additional, potentially relevant company- and event-specific factors. For this purpose, separately for large stock price increases and decreases, I run the following cross-sectional regressions for post-event days 1 to 21, 1 to 42 and 1 to 63:

$$CAR_{it} = \beta_0 + \beta_1 Preceding\_High_i + \beta_2 Preceding\_Low_i + \beta_3 MCap_i + \beta_4 Beta_i + \\ + \beta_5 SRVolat_i + \beta_6 |SR0|_i + \beta_7 AbVol0_i + \varepsilon_{it} \quad (3)$$

where: *CARit* represents the cumulative abnormal stock return following event *i* for the post-event window *t* (Days 1 to 21, 1 to 42 or 1 to 63); *Preceding_Highi* is the dummy variable, taking the value 1 if the 5- or 10-day CAR preceding event *i* is in the highest sample quintile, and 0 otherwise; *Preceding_Lowi* is the dummy variable, taking the value 1 if the 5- or 10-day CAR preceding event *i* is in the lowest sample quintile, and 0 otherwise[8]; *MCapi* denotes the natural logarithm of the firm's market capitalization corresponding to event *i*, normalized in the cross-section; *Betai* refers to the estimated Market Model beta for event *i*, calculated over the Days -261 to -11 and normalized in the cross-section; *SRVolati* is the standard deviation of the stock's returns over the Days -261 to -11 corresponding to event *i*, normalized in the cross-section; $|SR0|i$ represents the absolute Day-0 stock return representing event *i*; and *AbVol0i* is the abnormal Day-0 stock trading volume corresponding to event *i*, calculated as the difference between the stock's actual Day-0 trading volume and its average trading volume over Days -261 to -11, normalized by the standard deviation of its trading volume over the same estimation window.

Tables 4 and 5 report regression coefficient estimates for all the post-event windows, with 5- and 10-day pre-event periods, respectively, employed for measuring abnormal stock returns preceding the event. The results corroborate the study's hypothesis, demonstrating that:

- For the large stock price increases, with all the post-event windows being regarded, regression coefficients on *Preceding_High* are significantly negative and regression coefficients on *Preceding_Low* are significantly positive, indicating once again that negative post-event price reversals following large stock price increases are significantly more (less) pronounced if the latter are preceded by relatively high (low) short-term CARs.
- Similarly, for the large stock price decreases, with all the post-event windows being considered, regression coefficients on *Preceding_High* are significantly negative and

[8] I have repeated the regression analysis defining *Preceding_Highi* and *Preceding_Lowi* variables for the highest and the lowest pre-event CAR deciles, rather than quintiles. The results (available upon request from the author) remain qualitatively similar to those reported in Subsection 5.3.

regression coefficients on *Preceding_Low* are significantly positive, implying that positive post-event price reversals following large stock price decreases are significantly less (more) pronounced if the latter are preceded by relatively high (low) short-term CARs.

- For all the post-event windows following large stock price increases (decreases), the regression coefficients on *MCap* are significantly positive (negative), the regression coefficients on *Beta* are negative (positive) and marginally significant, and the regression coefficients on *SRVolat* are significantly negative (positive). These findings suggest that large stock price increases (decreases) occurring to low capitalization, high-beta and highly volatile stocks tend to be followed by more pronounced price reversals. These results may be potentially attributed to the fact that investors probably possess less fundamental information on these groups of stocks, which makes their reaction to these companies' salient events stronger, and in some cases, probably too strong, creating a room for subsequent price reversals. Once again, we may note that the effect of the short-term pre-event stock returns on the post-event stock price dynamics remains significant after accounting for the above-mentioned factors.
- The coefficients on |*SR0*| and *ABVOL0* are non-significant, indicating that the magnitude of the initial shocks, as expressed by both stock price change itself and the trading volume at the day of the shock, does not significantly affect the magnitude of post-event stock price reversals.

6. Concluding Remarks

In this study, I analyzed the correlation between stock returns before and after major price shocks. I hypothesized that if a large price move for a given stock takes place after a short period when the stock's price moves in the same direction, then it may indicate that the fundamentals of the company-specific shock are more completely incorporated in the stock price, significantly increasing the probability of subsequent post-event price reversal.

Analyzing a vast sample of large stock price moves, I found corroborative evidence for the study's hypothesis. I documented that both large price increases and decreases are followed by significant one to three-month price reversals (drifts) if they are preceded by the same- (opposite-) sign short-term cumulative abnormal returns. The effect remained significant after accounting for additional relevant company-specific (size, Market Model beta, historical volatility) and event-specific (stock's return and trading volume on the event day) factors, and proved to be robust to different proxies for defining large price changes and to different methods of adjusting returns, such as market-adjusted returns, market-model excess returns, and Fama-French three-factor model excess returns.

Based on the study's findings, we may conclude that the strategy based on buying (selling short) stocks that have experienced large price decreases (increases) preceded by relatively low (high) short-term abnormal returns may be promising, at least in a perfect stock market with no commissions. This conclusion may be an additional challenge for the Efficient Market Hypothesis, and probably calls for some further research that may concentrate on

analyzing data from additional stock markets and differentiating between groups of stocks based on public companies' characteristics and between periods of bull and bear markets.

References

Atkins, A. B., Dyl, E. A. (1990). Price Reversals, Bid-Ask Spreads and Market Efficiency. – Journal of Financial and Quantitative Analysis, 25(4), pp. 535-547.

Avramov, D., Chordia, T., Goyal, A. (2006). Liquidity and Autocorrelations in Individual Stock Returns. – Journal of Finance, 61(5), pp. 2365-2394.

Bremer, M., Hiraki, T., Sweeney, R. J. (1997). Predictable Patterns after Large Stock Price Changes on the Tokyo Stock Exchange. – Journal of Financial and Quantitative Analysis, 32(3), pp. 345-365.

Bremer, M., Sweeney, R. J. (1991). The Reversal of Large Stock-Price Decreases. – Journal of Finance, 46(2), pp. 747-754.

Brown, K. C., Harlow, W. V., Tinic, S. M. (1988). Risk Aversion, Uncertain Information, and Market Efficiency. – Journal of Financial Economics, 22(2), pp. 355-385.

Chan, W. S. (2003). Stock Price Reaction to News and No-News: Drift and Reversal after Headlines. – Journal of Financial Economics, 70(2), pp. 223-260.

Conrad, J. S., Hameed, A., Niden, C. (1994). Volume and Autocovariances in Short-Horizon Individual Security Returns. – Journal of Finance, 49(4), pp. 1305-1329.

Cooper, M. (1999). Filter Rules Based on Price and Volume in Individual Security Overreaction. – Review of Financial Studies, 12(4), pp. 901-935.

Cox, D. R., Peterson, C. R. (1994). Stock Returns following Large One-Day Declines: Evidence on Short-Term Reversals and Longer-Term Performance. – Journal of Finance, 49(1), pp. 255-267.

Daniel, K., Hirshleifer, D., Subrahmanyam, A. (1998). Investor Psychology and Security Market Under- and Overreactions. – Journal of Finance, 53(6), pp. 1839-1885.

DeBondt, W. F. M., Thaler, R. (1985). Does the Stock Market Overreact?. – Journal of Finance, 40(3), pp. 793-805.

DeBondt, W. F. M., Thaler, R. (1987). Further Evidence on Investor Overreaction and Stock Market Seasonality. – Journal of Finance, 42(3), pp. 557-580.

Fehle, F., Zdorovtsov, V. (2003). Large Price Declines, News, Liquidity and Trading Strategies: An Intraday Analysis. Working Paper, University of South Carolina.

Hamelink, F. (1999). Systematic Patterns Before and After Large Price Changes: Evidence from High Frequency Data from the Paris Bourse. Working Paper, Groupe HEC Paris.

Hong, H., Stein, J. C. (1999). A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets. – Journal of Finance, 54(6), pp. 2143-2184.

Howe, J. S. (1986). Evidence on Stock Market Overreaction. – Financial Analysts Journal, 42(3), pp. 74-77.

Ikenberry, D. L., Ramnath, S. (2002). Underreaction to Self-Selected News Events: The case of Stock Splits. – Review of Financial Studies, 15(2), pp. 489-526.

Kudryavtsev, A. (2018). The Availability Heuristic and Reversals Following Large Stock Price Changes. – Journal of Behavioral Finance, 19(2), pp.159-176.

Larson, S. J., Madura, J. (2003). What Drives Stock Price Behavior Following Extreme One-Day Returns. – Journal of Financial Research, 26,(1), pp. 113-127.

Lasfer, M. A., Melnik, A., Thomas, D. (2003). Stock Price Reaction in Stressful Circumstances: An International Comparison. – Journal of Banking and Finance, 27(10), pp. 1959-1977.

Lehmann, B. N. (1990). Fads, Martingales and Market Efficiency. – Quarterly Journal of Economics, 105(1), pp. 1-28.

Mazouz, K., Nathan, L. J., Joulmer, J. (2009). Stock Price Reaction Following Large One-Day Price Changes: UK Evidence. – Journal of Banking and Finance, 33(8), pp. 1481-1493.

Michaely, R., Womack, K. L. (1999). Conflict of Interest and the Credibility of Underwriter Analyst Recommendations. – Review of Financial Studies, 12(4), pp. 653-686.

Park, J. (1995). A Market Microstructure Explaining for Predictable Variations in Stock Returns following Large Price Changes. – Journal of Financial and Quantitative Analysis, 30(2), pp. 241-256.

Pritamani, M., Singal, V. (2001). Return Predictability Following Large Price Changes and Information Releases. – Journal of Banking and Finance, 25(4), pp. 631-656.

Ratner, M., Leal, R. (1998). Evidence of Short-Term Price Reversals Following Large One Day Movements in the Emerging Markets of Latin America and Asia. Working paper, Rider University, New Jersey, US.

Renshaw, E. F. (1984). Stock Market Panics: A Test of the Efficient Market Hypothesis. – Financial Analysts Journal, 40(3), pp. 48-51.
Savor, P. (2012). Stock Returns after Major Price Shocks: The Impact of Information. – Journal of Financial Economics, 106(3), pp. 635-659.
Shiller, R. J. (1981). Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?. – American Economic Review, 71(3), pp. 421-436.
Shleifer, A. (2000). Inefficient Markets: An Introduction to Behavioral Finance. Oxford University Press, New York.
Sturm, R. R. (2003). Investor Confidence and Returns Following Large One-Day Price Changes. – The Journal of Behavioral Finance, 4(4), pp. 201-216.
Tetlock, P. C. (2010). Does Public Financial News Resolve Asymmetric Information?. – Review of Financial Studies, 23(9), pp. 3520-3557.
Vega, C. (2006). Stock Price Reaction to Public and Private Information. – Journal of Financial Economics, 82(1), pp. 103-133.
Zarowin, P. (1989). Short-Run Market Overreaction: Size and Seasonality Effects. – Journal of Portfolio Management, 15(3), pp. 26-29.

Appendix

Table 1

Stock price dynamics following large stock price moves: Total sample

Days relative to event	Average CARs following large stock price moves, % (2-tailed p-values)	
	Large stock price increases	Large stock price decreases
1 to 21	-0.25	0.44
	(14.36%)	(12.61%)
1 to 42	-0.39	*0.55
	(12.08%)	(9.12%)
1 to 63	-0.41	*0.57
	(11.56%)	(9.01%)

*Asterisks denote 2-tailed p-values: *p<0.1*

Table 2

Stock price dynamics following large stock price moves as a function of 5-day CARs preceding the event

Panel A: Large stock price increases						
Days relative to event	Average post-event CARs, % (2-tailed p-values)					
	5-day pre-event CAR quintile			5-day pre-event CAR decile		
	Highest	Lowest	Difference	Highest	Lowest	Difference
1 to 21	***-1.12	***0.68	***-1.80	***-1.15	***0.70	***-1.85
	(0.03%)	(0.14%)	(0.00%)	(0.04%)	(0.17%)	(0.00%)
1 to 42	***-1.23	***0.74	***-1.97	***-1.26	***0.74	***-2.00
	(0.00%)	(0.06%)	(0.00%)	(0.00%)	(0.08%)	(0.00%)
1 to 63	***-1.28	***0.78	***-2.06	***-1.32	***0.80	***-2.12
	(0.00%)	(0.05%)	(0.00%)	(0.00%)	(0.03%)	(0.00%)
Panel B: Large stock price decreases						
Days relative to event	Average CARs following post-event returns, % (2-tailed p-values)					
	5-day pre-event CAR quintile			5-day pre-event CAR decile		
	Highest	Lowest	Difference	Highest	Lowest	Difference
1 to 21	***-0.62	***1.38	***-2.00	***-0.64	***1.36	***-2.00
	(0.21%)	(0.00%)	(0.00%)	(0.23%)	(0.00%)	(0.00%)
1 to 42	***-0.66	***1.45	***-2.11	***-0.67	***1.49	***-2.16
	(0.15%)	(0.00%)	(0.00%)	(0.13%)	(0.00%)	(0.00%)
1 to 63	***-0.68	***1.52	***-2.20	***-0.70	***1.55	***-2.25
	(0.10%)	(0.00%)	(0.00%)	(0.08%)	(0.00%)	(0.00%)

*Asterisks denote 2-tailed p-values: ***p<0.01*

Table 3

Stock price dynamics following large stock price moves as a function of 10-day CARs preceding the event

Panel A: Large stock price increases						
Days relative to event	Average post-event CARs, % (2-tailed p-values)					
	10-day pre-event CAR quintile			10-day pre-event CAR decile		
	Highest	Lowest	Difference	Highest	Lowest	Difference
1 to 21	***-1.14	***0.67	***-1.81	***-1.17	***0.70	***-1.87
	(0.02%)	(0.16%)	(0.00%)	(0.03%)	(0.18%)	(0.00%)
1 to 42	***-1.26	***0.75	***-2.01	***-1.28	***0.75	***-2.03
	(0.00%)	(0.05%)	(0.00%)	(0.00%)	(0.09%)	(0.00%)
1 to 63	***-1.29	***0.79	***-2.08	***-1.34	***0.81	***-2.15
	(0.00%)	(0.06%)	(0.00%)	(0.00%)	(0.03%)	(0.00%)
Panel B: Large stock price decreases						
Days relative to event	Average CARs following post-event returns, % (2-tailed p-values)					
	10-day pre-event CAR quintile			10-day pre-event CAR decile		
	Highest	Lowest	Difference	Highest	Lowest	Difference
1 to 21	***-0.63	***1.37	***-2.00	***-0.66	***1.38	***-2.04
	(0.20%)	(0.00%)	(0.00%)	(0.24%)	(0.00%)	(0.00%)
1 to 42	***-0.66	***1.48	***-2.14	***-0.69	***1.50	***-2.19
	(0.13%)	(0.00%)	(0.00%)	(0.14%)	(0.00%)	(0.00%)
1 to 63	***-0.69	***1.56	***-2.25	***-0.72	***1.58	***-2.30
	(0.11%)	(0.00%)	(0.00%)	(0.09%)	(0.00%)	(0.00%)

*Asterisks denote 2-tailed p-values: ***p<0.01*

Table 4

Multifactor regression analysis of stock price dynamics large stock price moves as a function of 5-day CARs preceding the event: Dependent variables – Stock CARs for different post-event windows

Panel A: Large stock price increases			
Explanatory variables	Coefficient estimates, % (2-tailed p-values)		
	CAR (1, 21)	CAR (1, 42)	CAR (1, 63)
Intercept	***-0.18	***-0.23	***-0.29
	(0.32%)	(0.14%)	(0.08%)
Preceding_High	***-0.93	***-0.96	***-0.98
	(0.00%)	(0.00%)	(0.00%)
Preceding_Low	***0.78	***0.85	***0.92
	(0.00%)	(0.00%)	(0.00%)
MCap	**0.24	**0.26	***0.28
	(1.23%)	(1.01%)	(0.72%)
Beta	-0.08	*-0.10	*-0.12
	(16.05%)	(9.86%)	(9.11%)
SRVolat	**-0.24	***-0.27	***-0.29
	(1.52%)	(0.92%)	(0.84%)
|SR0|	-0.05	-0.06	-0.05
	(19.85%)	(16.24%)	(20.25%)
AbVol0	0.03	0.04	0.06
	(35.19%)	(29.57%)	(18.74%)

Panel B: Large stock price decreases			
Explanatory variables	Coefficient estimates, % (2-tailed p-values)		
	CAR (1, 21)	CAR (1, 42)	CAR (1, 63)
Intercept	***0.35	***0.46	***0.48
	(0.00%)	(0.00%)	(0.00%)
Preceding_High	***-0.92	***-1.00	***-1.01
	(0.00%)	(0.00%)	(0.00%)
Preceding_Low	***0.98	***1.03	***1.07
	(0.00%)	(0.00%)	(0.00%)
MCap	***-0.37	***-0.40	***-0.41
	(0.19%)	(0.12%)	(0.10%)
Beta	0.11	*0.12	*0.14
	(12.38%)	(9.67%)	(9.23%)
SRVolat	**0.27	**0.29	**0.28
	(2.24%)	(1.81%)	(2.14%)
|SR0|	0.04	0.05	0.07
	(38.94%)	(34.58%)	(27.85%)
AbVol0	-0.04	-0.03	-0.06
	(42.30%)	(46.83%)	(27.49%)

*Asterisks denote 2-tailed p-values: *p<0.10; **p<0.05; ***p<0.01*

Table 5

Multifactor regression analysis of stock price dynamics large stock price moves as a function of 10-day CARs preceding the event: Dependent variables – Stock CARs for different post-event windows

Panel A: Large stock price increases			
Explanatory variables	Coefficient estimates, % (2-tailed p-values)		
	CAR (1, 21)	CAR (1, 42)	CAR (1, 63)
Intercept	***-0.17	***-0.24	***-0.28
	(0.37%)	(0.12%)	(0.09%)
Preceding_High	***-0.97	***-0.98	***-1.01
	(0.00%)	(0.00%)	(0.00%)
Preceding_Low	***0.79	***0.84	***0.97
	(0.00%)	(0.00%)	(0.00%)
MCap	**0.23	***0.27	***0.29
	(1.41%)	(0.87%)	(0.68%)
Beta	-0.09	*-0.10	*-0.11
	(13.27%)	(9.71%)	(9.44%)
SRVolat	**-0.24	***-0.26	***-0.27
	(1.68%)	(0.95%)	(0.88%)
|SR0|	-0.04	-0.05	-0.04
	(23.67%)	(20.40%)	(24.32%)
AbVol0	0.04	0.03	0.05
	(31.00%)	(34.55%)	(21.75%)

Panel B: Large stock price decreases			
Explanatory variables	Coefficient estimates, % (2-tailed p-values)		
	CAR (1, 21)	CAR (1, 42)	CAR (1, 63)
Intercept	***0.36	***0.45	***0.47
	(0.00%)	(0.00%)	(0.00%)
Preceding_High	***-0.96	***-1.01	***-1.04
	(0.00%)	(0.00%)	(0.00%)
Preceding_Low	***0.99	***1.08	***1.11
	(0.00%)	(0.00%)	(0.00%)
MCap	***-0.35	***-0.39	***-0.40
	(0.27%)	(0.14%)	(0.09%)
Beta	*0.12	*0.12	0.11
	(9.67%)	(9.87%)	(11.04%)
SRVolat	**0.28	**0.30	**0.29
	(1.99%)	(1.32%)	(1.83%)
|SR0|	0.03	0.04	0.04
	(42.08%)	(37.80%)	(39.36%)
AbVol0	-0.02	-0.04	-0.03
	(47.96%)	(39.54%)	(42.37%)

*Asterisks denote 2-tailed p-values: *p<0.10; **p<0.05; ***p<0.01*

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A MODEL OF NATURAL INTEREST RATE: THE CASE OF BULGARIA[2]

The proposed model estimation of the natural interest rate for Bulgaria is based on the seminal model of Laubach and Williams (2003), as important modifications are implemented in order to capture the specifics of the Bulgarian economy. As a small and open economy, the real effective exchange rate is included in measurement equations as well as the Eurozone output gap. Second, we incorporate stylised facts and observations about the behaviour of the Bulgarian economy, such as the steady-state growth rates of potential output and initial guidance about the level of natural interest rates. We circumvent the "pile-up" issue by imposing certain assumptions about the level and growth rates of potential output and time preferences of economic agents. In order to validate the consistency and reliability of the assumptions, we counterfactually evaluate the past and present BG monetary conditions by estimating the real rate gap, i.e. compare the observed real interest rate (r) against the natural rate (r).*

We find that, contrary to many advanced economies, the natural real interest rate of the Bulgarian economy does not show a declining trend, i.e. the economy after 2008, i.e. it is not under the precondition of "secular stagnation". This means that BNB's monetary space is far from being exhausted so far. This is due to the fact, that Bulgarian productivity growth (as a catching-up economy) is predominantly exogenous (imported) and the growth rate of productivity proved sustainable even after 2008 and well compensates for the detrimental demographics. The results from the Taylor rule exercise confirm counterfactually, that the Bulgarian short term interest rates are justified, thus the transition to the inflation targeting regime of ECB is expected to be smooth.

Keywords: NIR; secular stagnation; inflation expectations; real interest rate
JEL: B15; N10; E50; O47

1. Introduction

The debate about natural interest rate (NIR[3]) is among the most heated in the recent years due to the concept of the "secular stagnation" hypothesis put forward by L. Summers (Summers, 2013, 2015). He advocated that there might be an exhaustion of monetary space

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[3] The natural rate of interest is a real short-term rate when the economy is at full employment and stable inflation.

in front of many advanced central banks. Summers argued that „*it may have become all but impossible to boost growth by using the old standard of lowering interest rates to encourage more investment and consumer spending*". A constantly lower natural interest rate could bring the economy in the unwanted and detrimental equilibrium of stagnating growth for a long time as the central bank could not open further the real rate gap (r*-r) due to ZLB (Zero lower bound of the interest rates). Theoretically, it is the real rate gap that affects in reality, the investment decisions of corporates and the consumption of durable goods of the households as it is the ultimate driving factor behind saving/investment decisions of the economic agents.

The recent contemporary understanding about natural rates is dominated by the seminal contribution of Michael Woodford (Woodford, Walsh 2005). He postulates that, the natural rate is a certain level of the real interest rate where inflation is stable and the output gap is zero in the environment of flexible prices. The natural interest rate is considered in the long-term horizon and is not affected by cyclical variations of prices and output gaps. The natural interest rate is a theoretical concept and as an unobservable variable has to be estimated by a model.

A central bank that targets inflation needs to form a general understanding of the level, dynamics and behaviour of the natural interest rate, in order to evaluate whether and how much accommodative or tightened is the level of the short term interest rate. In the Taylor-style rules[4] for monetary policy, this natural rate is often denoted by r-star (r*). The Taylor rule tells a monetary policymaker, that if inflation is at target and there is a zero output gap, the real policy rate should be set to equal the natural interest rate. If the Taylor rule is close to the actual nominal policy rate, the central bank is perceived to have a reasonable, rule-based approach to monetary policy. Initially, J. Tylor assumed that the natural interest rate equals the average of very long-run real interest rate. The later research proved that this approach has shortcomings, as it does not allow for structural variation in the key macroeconomic variables, for instance, the downward trend of potential growth rate due to demographic and/or productivity factors.

2. Literature Overview

The natural interest rate, as an unobservable variable and has to be estimated by a model. In addition, it is time-varying and strongly influenced by another unobservable variable, namely the potential output, respectively the output gap. This complicates enormously the task of pinpointing the natural interest rate at time t_0 with a comfortable degree of certainty. Nevertheless, the body of literature striving to capture the natural interest rate grew strongly in the period after 2003 and exploded after 2013 (Brand, Bielecki, Penalver, 2018).

[4] $i_t = \pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - y_t^*)$ as i_t is the nominal policy rate, r_t^* is the natural interest rate, π_t is inflation, π_t^* is the inflation target, a_π and a_y are the response parameters (usually set to 0.5), and y_t and y_t^* are real GDP and potential GDP respectively.

*2.1. Laubach and Williams model for r**

The original monetary policy rule of Taylor holds the assumption that the natural rate is stable over a long period. In the long run, the output gaps average out to zero and so the average real interest rate will never be far away from the long-term natural interest rate. That assumption has been put into question by a key work of Laubach and Williams in 2003 (Laubach, Williams, 2003) and later enhanced by Holston in 2016 (Holston, Laubach, Williams, 2016). Laubach and Williams (hereafter LW), proposed a model for estimation of r* for the US economy that shows: 1) r* is not stable over long periods but time-varying due to structural factors; 2) is slowly declining towards 0, which raises the probability of moving the whole economy in a secular stagnation (due to exhaustion of monetary space).[5] In addition, they document noteworthy area of uncertainty around the point estimates.

LW have built a semi-structural model in a simple New Keynesian framework. Using a Kalman filter, they jointly estimate the three unobserved variables: natural interest rate (NIR), potential output and trend growth rate. LW adopt a semi-structural methodology, which makes use of the correlations among real output gap, core inflation and real interest rate gap, which is the difference between real interest and its equilibrium (natural) value. The observed variables include the real GDP and core inflation, while state variables include the trend growth rate, potential GDP, and a random-walk drift term mimicking households' time preferences.

LW model assumes an explicit relationship between the natural rate of interest r* and the estimated trend growth of GDP (g) and some time-preference parameters (z).

1) $r_t^* = c\ g_t + z_t$

Equation 1 says that the natural rate of interest r* is supposed to equal trend growth rate g in the absence of strong time preference of the economic agents z, namely households.

Technically, they use a state-space environment with two observation equations that represent a backwards-looking Philips curve and IS curve.

2) $\pi_t = B_\pi(L)\pi_{t-1} + \ b_y\overline{y}_{t-1} + b_i(\pi_t^I - \pi_t) + b_o(\pi_{t-1}^O - \pi_{t-1}) + \varepsilon_\pi$

Where the inflation π_t is determined by its own lag $B_\pi(L)\pi_{t-1}$, one lag in the output gap $b_y\overline{y}_{t-1}$ and two variables approximating shock in the relative prices – import inflation $b_i(\pi_t^I - \pi_t)$ and a lag in oil price $b_o(\pi_{t-1}^O - \pi_{t-1})$.

3) $\overline{y}_t = a_{t,1}\overline{y}_{t-1} + a_{t,2}\overline{y}_{t-2} + \frac{a_r}{2}\sum_{j=1}^{2}(r_{t-j} - r_{t-j}^*) + \ \varepsilon_y$

The output gap $\overline{y}_t$ is determined by its own two lags $a_{t,1}\overline{y}_{t-1} + a_{t,2}\overline{y}_{t-2}$, as well as a moving average of the real rate gap $\frac{a_r}{2}\sum_{j=1}^{2}(r_{t-j} - r_{t-j}^*)$ and an error term ε_y.

In the LW model, the state equations are three:

4) $y_t^* = y_{t-1}^* + g_{t-1} + \epsilon_t$

[5] With low r*, when an economy enters recession, the policymakers would be unable to lower the policy interest rates to stimulate activity and inflation due to ZLB.

5) $g_t = g_{t-1} + \epsilon_t$

6) $z_t = D_z\,(L) z_{t-1} + \epsilon_t$

A complex issue in the estimation is finding the values for the standard deviation of the trend growth of potential output and for the households' time preferences, $(\boldsymbol{z_t})$ the so-called "pile-up" issue as discussed in (Stock and Watson 1998). This problem suggests that when the variation in the trend component is small, compared to the overall variation in the series, the maximum likelihood estimates of the signal-to-noise ratio are likely to be biased towards zero. In other words, if the variation of the trend growth rate is small – which seems plausible for most economic time-series – the maximum likelihood estimator of the variance of its changes is biased towards zero, because a large amount of probability *piles-up* at zero in the density function. LW overcame the *pile-up issue* by imposing two assumptions.

1) They assumed that the standard deviation of the trend growth of potential output, (σ_g), is the standard deviation of the i.i.d shocks in the growth rate of potential output, divided by the standard deviation in the potential GDP level and the value obtained is the standard deviations of the quarterly trend growth rate. $\boldsymbol{\lambda_g} \equiv \frac{\boldsymbol{\sigma_g}}{\boldsymbol{\sigma_{y^*}}}$ (For annualised trend growth rate, the value was multiplied by 4).
2) The standard deviation for the households' time preferences, $(\boldsymbol{z_t})$denoted by $\boldsymbol{\lambda_z}$ and it is $\boldsymbol{\lambda_z} \equiv \frac{\boldsymbol{\sigma_z}}{\boldsymbol{\sigma_{\bar{y}}}} \frac{\boldsymbol{a_r}}{\sqrt{2}}$

The approach taken by LW is a technical compromise that uses a Median Unbiased Estimation (MUE) to determine the size of $(\boldsymbol{\lambda_z})$. Some literature on the issues cast doubts of its soundness (see (Buncic 2020)), as LW approach is found that it cannot recover consistently the ratio of interest $\boldsymbol{\lambda_z} \equiv \frac{\boldsymbol{\sigma_z}}{\boldsymbol{\sigma_{\bar{y}}}} \frac{\boldsymbol{a_r}}{\sqrt{2}}$ from MUE required for the estimation.

Finally, LW document a degree of uncertainty regarding estimates of the natural rate of interest and showed that any policy rules based on the assumption of a constant NIR or its mismeasurement lead to the imposition of wrong monetary policies. LW find estimates of the natural rate as useful, but insufficient in monetary policy decision making processes. Later, LW model has been applied to three other advanced economies – Canada, Euro Area, and UK. They find that large declines in trend GDP growth and natural rates of interest have occurred over the past 25 years in all four economies. These country-by-country estimates exhibit a substantial amount of comovement over time, suggesting an important role for global factors in shaping trend growth and natural rates of interest. In all four economies, the estimated trend growth rate has declined by 0.8 to 1 percentage points since 2007. This explains about half of the decline of the natural rates in the US and the euro area and 75 percent of the decline in Canada and the UK. The rest of the decline is attributed to unspecified factors.

2.2. Models modifying LW

The model of LW is exclusively designed for the body of US economy, as it captures the features of a big, relatively closed economy with stable structural issues regarding aggregate

supply and long time series of reliable data. In order to apply their model for other types of economies, the LW model needs to be modified, as not many economies resemble the US one.

The second reason for the many attempts to modify the LW model is to narrow the uncertainty band around the estimates, or to fix some perceived flaws of the model design. Berger and Kempa (Berger, Kempa 2014) made an adaptation in the LW model for the small and open economy like Canada. They included as an important factor in observation equations the real exchange rate, as it is related to the output gap through the current account, influences inflation via its effect on import prices, and impacts the interest rate by inducing expectations of mean reversion of the real exchange rate towards its equilibrium level. They point out that, in a small open economy, both aggregate demand and the Phillips curve contain the real exchange rate as an argument. As the interest gap may also be associated with an exchange rate misalignment through a potential interest rate – exchange rate nexus, the model is even extended by an equation linking the real interest rate to the real exchange rate.

Brand and Mazelis (Brand, Bielecki, and Penalver 2018) opt for another modification. They close the original framework with a Taylor rule instead of using real interest rates as an endogenously determined process. This requires constructing an output gap that pins down inflation in line with the inflation objective, as incorporated in the Taylor rule. They switch to a non-accelerationist Phillips curve, with the output gap pinning down deviations of inflation from the inflation objective, rather than from a unit-root trend. They further deviate from the original approach by using model-consistent inflation expectations.

Georgy Krustev (Krustev, 2019) augments the LW model with a financial cycle and the labour market featuring a non-accelerationist Phillips curve. He finds that the financial cycle is a missing variable in observation equations and its inclusion improves the performance of the model estimates.

(Hledik, Vlcek 2018) opt for another modification as they link the natural rate of interest to equilibrium GDP growth, which is adjusted for real exchange rate appreciation. This adjustment is needed because GDP growth only measures yields from production and ignores the effect of currency appreciation. Second, they use a semi-structural model, which is closed by a monetary policy rule. This model allows to work with forward-looking model-consistent expectations and impose a comprehensive set of restrictions, i.e. model equations, determining the natural interest rate, to identify the natural rate of interest. Third, they use calibration instead of Bayesian estimation. More specifically, they calibrate the standard errors of the Kalman filter arbitrarily to obtain economically intuitive impulse responses. The final estimates of the natural rate depend mainly on the time-dependent estimates of the growth of potential GDP and real equilibrium appreciation of the exchange rate.

The semi-structural models provide reliable information for the recent historical behaviour of the natural interest rate and its evolution at lower frequencies as the transitory shocks die out. Unfortunately, they provide little help to a policymaker, who needs a model to pinpoint the r* in time $t_{0,}$ i.e. now.

This problem is allegedly solved by a different approach, namely structural DSGE models. The structural DSGE models and error-correction models have sufficient ability to capture the changes of r* over the business cycle. This is important for a policymaker, but has its own flaws. For instance, DSGE suggest a very volatile natural interest as "advice" to a policymaker. A volatile natural interest rate is practically impossible to implement in the real world, as some smoothing and inertia are more preferred options for short term interest rate steering.

2.3. Models using an error-correction type of procedures

Lubik and Matthes (Lubik, Matthes, et al. 2015) compared the natural rate estimated using the Laubach and Williams approach with an estimate based on time-varying VAR models. They conclude that the two approaches provide similar results for the period since the 1980s. However, prior to this date, there was a significant difference in the results. Other researches find that the multivariate error-correction models can be used to estimate time-varying equilibrium using long-run relationships between macroeconomic variables. Estimates from this approach are done by (Fiorentini, et al., 2018). They use a long time series of a broad set of macroeconomic information, including total factor productivity and demographic developments. They set a local level model, which decomposes the observed real rate into a I(1) component, labelled r*, and an I(0) component, which resembles the real rate gap. Since the natural real rate in this model is a simple random walk, conditional forecasts are simply the most recently observed value. In the second part, Fiorentini et al. (2018) estimate a Panel error correction model (ECM) at an annual frequency over the period 1899-2016.

2.4. DSGE models for natural interest rate

In DSGE models, the natural rate of interest is an unobservable variable that can be extracted by estimating a fully structural model, in practice using a rich set of macroeconomic data. Most of the literature employs a definition of the natural rate of interest as the real interest rate that would prevail in a counterfactual economy under flexible prices and wages, and absent shocks to the mark-ups on goods and labour markets (Neri, Gerali 2019; Hristov, 2016). The whole class of DSGE models document a very volatile r* due to their ability to trace the impact of structural shocks on the natural rate of interest. They find that a risk premium shock is responsible for a significant part of the total variance of the natural rate of interest, as the risk premium shock modifies the households' effective discount rate for one-period risk-free (government) bonds.

3. Model Estimation of the Natural Rate: Bulgaria Case

To our knowledge, there is only one attempt so far for a r* estimation in order to derive a Taylor rule type for the Bulgarian economy. In 2004, "*The Currency Board: The only game in town*" (Hristov, 2004) shows that, in a hypothetical case, if BNB had followed (by then) inflation targeting regime with a monetary policy based on Taylor type rule, it would have

steered more stringent short term interest rates compared the observed in the Bulgarian O/N market. In that paper, the author follows the method borrowed from the New Zealand central bank (Archibald, Hunter, et al., 2001) in order to calculate r* as the simple average of the real observable interest rate for 1994-2003 in Germany (Eurozone) plus BG country risk premium.[6]

There is a certain string of shortcomings in using the averaging method for r* + risk premium. First, if the time window for real interest rates includes periods with significantly high inflation, as it was the case with 1990-1994 Germany, then the interpretation of results could be misleading. For instance, in the period of 1990-1994, there was temporary high inflation in Europe due to the unification of Germany and not because of supply-demand real structural balance. In addition, mechanistic add-on of a country risk premium is difficult to interpret, as that premium (or spread) alone has its own factors which drive it. The second problem is the estimation of the real interest rates as " ex-post" instead of " ex-ante" that would require an estimation of inflation expectations of the economic agents in the absence (in the Bulgarian case) of market-based instruments as inflation-indexed bonds or inflation swaps. In order to overcome the above-mentioned shortcomings, we estimate the inflation expectations (See Appendix A) in order to calculate the observed "*ex-ante*" real interest rate and then we make a model estimation of the natural rate for the Bulgarian economy.

In order to make a model estimation of the natural rate for the Bulgarian economy, we follow the general principles of Laubach and Williams, 2003 with some modifications due to data specifics and the institutional framework of the Bulgarian economy – namely small open economy under CBA monetary framework.

As in LW, we use a model (semi-structural), assuming the following neoclassical growth model relationship between potential output growth g and natural rate r*. This model implies that the natural rate of interest varies over time in response to shifts in preferences and the growth rate of output. In a steady state of the economy, a representative household intertemporal utility maximisation yields the relationship between the steady-state real one-period interest rate r* and steady-state growth.

7) $r* = \frac{1}{\sigma} g_c + \theta$

Where r* is the natural interest rate, σ is the intertemporal elasticity of substitution in consumption[7], i.e. the slope of the curve, g potential growth rate of the real GDP, a θ is the rate of time preference. Since r* is an unobservable variable, we relate it with observable variables using Kalman filter as it is done in LW model, in order to simultaneously estimate r*, output gap yt and the level of potential growth rate g.

Given the theoretical link between the natural rate of interest and output growth noted above, we assume (as in LW[8]) that the law of motion for the natural rate of interest is as follows:

[6] Country risk premium = spread of the BG yield over identical German sovereign bond.
[7] The amplitude/elasticity of the response of g to change in r*.
[8] LW assume a one-for-one relationship between the trend growth rate of output and the natural rate of interest r*, which corresponds to assuming σ = 1.

8) $r^* = c\ g_t + z_t$

The natural rate of interest r* equals the estimated trend growth of GDP (g_t) and some time-preference parameters (z) of households.

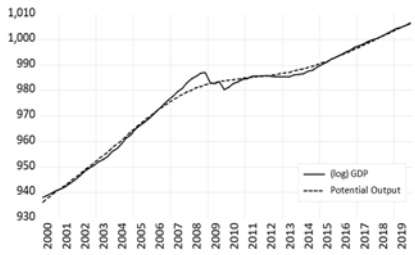
The natural rate of interest is not necessarily constant, but can fluctuate under the influence of specific shocks, such as aggregated demand and productivity shocks, or changes in the preferences of households. If the economy is not in balance, for instance, because prices are not able to adjust freely, the real interest rate can deviate from the natural rate, which will lead to inflationary or deflationary pressure.

3.2. Modelling of $\boldsymbol{y_t, r_t, rer_t}$ *and data transformations*

a) The output y_t

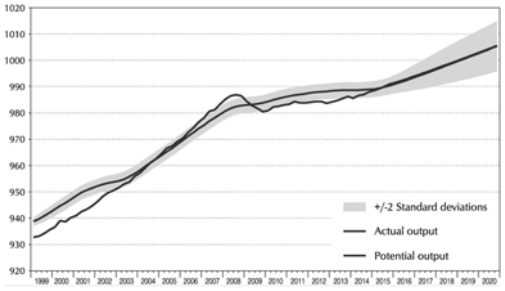
LW model the potential growth rate as trend growth. We use different specifications of potential output using HP filter for the extraction of trend and cycle, which proved to be more feasible for the specifics of the Bulgarian economy. For instance, the Bulgarian economy, as a small open economy that is strongly dependent on exogenous factors for growth. Thus, HP filter is assumed to be sufficiently reliable especially having sufficient historical data. The shortcomings are well known – uncertainty about λ parameter (pre-defined preferences on the smoothness of the trend series) and end sample bias. Indeed, there are few publications that employ multivariate filtering approaches that deliver slightly better results as (Kasabov, et al., 2017), among many others (Ganev, 2004, 2015; Tsalinski, 2006) that deliver slightly more refined and reliable results. In that publication, they use a multivariate model with a production function, Phillips curve and Okun's Law. Figures to compares the estimated output gap with measures obtained from methods like a simple HP filter and a multivariate model in (Kasabov, et al., 2017), we find some slight differences. The reason for the differences is that the multivariate approach is more consistent with the undergoing structural change of the economy in 2000-2003 and 2011-2015.

Figure 1
HP filtered potential output



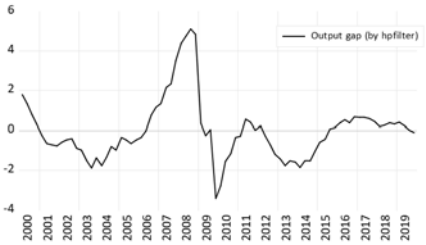
Source: own calculations.

Figure 2
Multivariate model of potential output



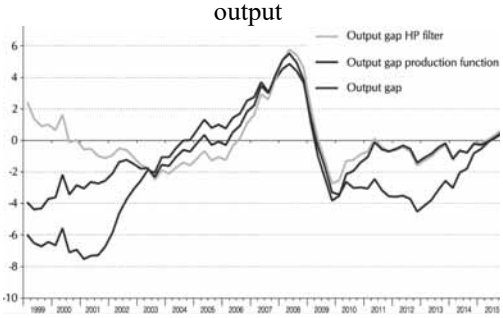
Source: Kasabov, et al., 2017.

Figure 3
Output gap (HPfilter) in % of potential output



Source: own calculations

Figure 4
Output gap (Multivariate) in % of potential output



Source: Kasabov, et al., 2017.

As a univariate filter, (HP) is not that strong in capturing structural changes in the economy, but the overall performance is reliable enough for the purposes of natural this (NIR) model as it is only one of the inputs, namely $\overline{y}_t$ in the observation equations (see eq. 12, 13). Most importantly, LW model jointly estimates the r_t^*, y_t^* and the g_t in state-space form using a Kalman filter which tends to smooth out the output variables in order to produce coherent results, thus negligible differences in potential output would not yield significant differences (Figure 10). In addition, a multivariate filter would complicate our already extensive LW-style model.

With that rationale, we chose to model the output (y_t) as decomposed into a stochastic trend component y_t^* (potential output) and a stochastic cyclical variation $\overline{y}_t$ (output gap) around the trend. To separate the trend from the cycle, we use HP filter as λ parameter = 1600.

9) $y_t = y_t^* + \overline{y}_t$

b) <u>The real interest rate</u>

The real interest rate r_t is decomposed to natural interest rate r_t^* and real rate gap $\overline{r}_t$.

10) $r_t = r_t^* + \overline{r}_t$

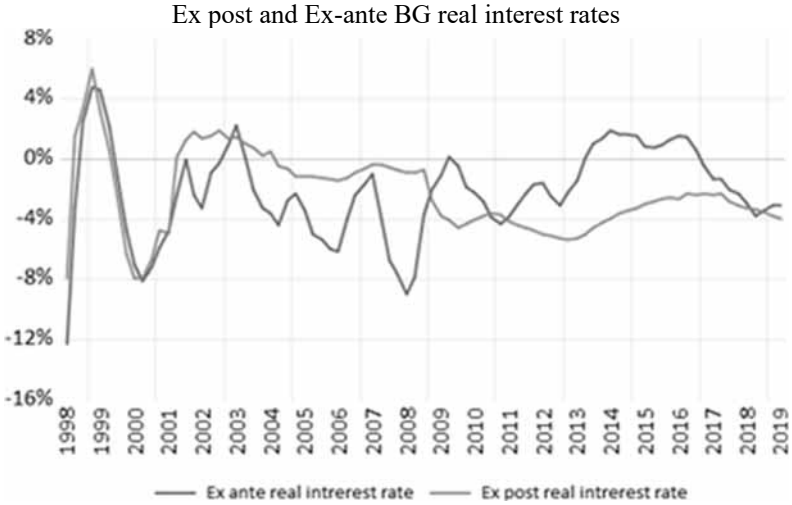
Though, the natural real rate r_t^* is unobservable variable, there are (in best case) quasi-observable real interest rates r_t that have key role in the assessment of the stance of the monetary policy. But the derivation of real interest rate has its own methodological issues that have to be addressed properly otherwise, the interpretation of results could be misleading.

The calculation of observed real interest rate is not a straightforward procedure, as it could be done by two differing approaches, 1) "ex-post" by subtracting observed inflation from nominal (i) rate or 2) "ex-ante" by subtracting of the model-based inflation expectation or by market-based financial instruments for inflation expectations (inflation linkers or inflation

swaps). In Appendix A, we have elaborated on a very simple model framework for the derivation of "ex-ante" real interest rate and "ex-post" real interest rates.

Figure 5

Ex post and Ex-ante BG real interest rates



c) The real exchange rate

The same applies to the real exchange rate rer_t , as it is decomposed to equilibrium exchange rate and exchange rate gap $\overline{rer}_t$. The equilibrium exchange rate (rer_t^{eq}) concept is itself a dubious to estimate, so we took a shortcut to approximate it as a simple average of the existing data.

11) $rer_t = rer_t^{eq} + \overline{rer}_t$

3.1. Signal equations– Philips curve, IS curve

The likelihood-function and the unobserved states can be derived through the Kalman filter. This filter uses the economic restrictions in the empirical model, the relationships between the real interest gap, the output gap, inflation and the effective exchange rate gap, to filter the unobserved states in the model. The Kalman filter works on the principle that the estimate of the unobserved state is adjusted based on how far away the model's prediction of GDP is from actual GDP given the behaviour of other variables. If the prediction is true, the filter does not adjust the estimate of the natural interest rate. If, on the other hand, actual GDP is lower than predicted by the model, then the policy rate must have been less accommodative than the model had predicted and hence that the real rate gap was more positive than previously thought.

a) Philips curve

12) $\pi_t = B_\pi(L)\pi_{t-1} + b_y\overline{y}_{t-1} + b_{rer}\left(RER_t^{eq} - RER_t\right) + b_o(\pi_{t-1}^O - \pi_{t-1}) + \varepsilon_\pi$

In short, the aggregate supply side is represented by a backward Philips curve, where the inflation expectations are assumed to be driven by a backward process; hence, the inclusion of lagged inflation terms $B_\pi(L)\pi_{t-1}$. The impact of excess demand on inflation is captured by the first lag of the output gap $b_y\overline{y}_{t-1}$. We modify the LW equation and instead of import inflation, we use a real exchange rate gap ($b_{rer}\left(RER_t^{eq} - RER_t\right)$). LW designed their model for a big and relatively closed economy as US. The Bulgarian economy, on the contrary, is a small and very open economy, which is affected by the gaps of RER from equilibrium levels and is related to dynamics of inflation. For instance, a big negative RER gap would facilitate a higher inflation than (hypothetically) targeted. Thus, in the spirit of (Berger and Kempa 2014) we think that the real exchange rate is the most important relative price of a small open economy, and should be a key element in the identification of the transitory and permanent components of output, inflation and the interest rate. As with LW we add a lag in oil price $b_o(\pi_{t-1}^O - \pi_{t-1})$ as relevant regressor.

b) IS curve

In our specification, we add a new regressor (independent variable) in the IS-equation, namely a coefficient capturing the effect of the Eurozone output gap, as it has a very strong effect on the Bulgarian output gap and captures the external environment.

13) $\overline{y}_t = a_{t,1}\overline{y}_{t-1} + a_{t,2}\overline{y}_{t-2} + \sum_{j=1}^{2} a_r(r_{t-j} - r_{t-j}^*) + a_{ez}\left(y_{ez,gap}\right) + \varepsilon_{\bar{y}}$

The output gap $\overline{y}_t$ is determined by its own two lags $a_{t,1}\overline{y}_{t-1} + a_{t,2}\overline{y}_{t-2}$, as well as a moving average of the real rate gap $\frac{a_r}{2}\sum_{j=1}^{2}(r_{t-j} - r_{t-j}^*)$ and error term ε_y. In addition, we put another regressor namely, the output gap in the Eurozone $a_{ez}\left(y_{ez,gap}\right)$ as this captures the international environment, which strongly influences the very open Bulgarian economy.

3.2. State equations

We depart from LW approach about the ”pile-up” issue and aim at a more simple technical solution that serves the purpose of managing the relationship between errors in the state equations. LW took the dubious procedure of MUE in order to estimate the initial values of that vector and make sure that there would be no clustering of errors to zero. We aim at avoiding the need of figuring out the ”pile-up” problem and take a ” shortcut” by calibrating values for the vector that contains the initial values using existing literature, which are also means of the variables. This is the way to implement previous knowledge and some stylised facts about historical developments in the economy.

14) $y_t^* = y_{t-1}^* + \frac{1}{4}g_{t-1} + (\lambda 1)\,\varepsilon_y$

The first state equation models the level of potential product y_t^* as an unobservable variable that depends on its own lag y_{t-1}^*, one lag of the trend growth rate $\frac{1}{4}g_{t-1}$ (multiplied by 0.25 because of quarterly data). The last element $(\lambda 1)\ \varepsilon_y$ is the variance of error from the IS equation (2). The coefficient (λ1) is the so-called "hyperparameter" that allows us to calibrate a number in order to control the variation of error term of y* and thus to simulate a shock on y*.

15) $r_t^* = g_{t-1} + z_{t-1}$

The natural interest rate r_t^* is modelled as one lag in the trend growth rate g_{t-1} and one lag in the time preference z_{t-1}.

16) $z_t = (c_1)z_{t-1} + (c_2)(\lambda 2)\epsilon_y$ $\quad c_1$*=0.5,* $c_2 = 0.5$

The time preference z_t is the residual in $r^* = c\ g_t + z_t$ and follows an autoregressive process. The coefficient *λ*2, is another "hyperparameter" that allows us to simulate shock on the level of the time preference of households. We calibrate equal weights of the coefficients c_1 and c_2.

17) $g_t = (c_1)g_{ss} + (c_2)g_{t-1} + (\lambda 3)\epsilon_y$ $\quad c_1$*=0.5,* $c_2 = 0.5$

g_t is the trend growth rate of the potential product that is modelled as a random walk process anchored around long-term trend growth rate at a steady state g_{ss}[9]. We calibrate equal weights of the coefficients c_1 and c_2. We calibrate the value to g_{ss} = 3.6 because this is the average growth rate for the whole sample period.

Calibrating lambdas is practically the most sensitive moment and source of the vulnerability of the coefficient estimates. At the same time, the calibration provides us with powerful "hands-on" approach in defining the behaviour of z and g, as well as y*, r*. This is the moment when the existing literature varies most.

Table 1

Parameters in existing literature

Parameter	Holston, Laubach and Williams (2017)	Belke and Klose (2019)	Fiorentini et al. (2018)
λg	0.033	0. 1176	0. 043
λz	0.036	0. 0006	0. 013
r*	3.693	2.438	3.543
g	12.128	0.973	4.413
y*	0.520	0.7125	0.526

In addition, the crucial parameters g_{ss} and r_t^*, that instruct the model about where to start in searching for r*, need to be consistently justified and counterfactually validated by recursive simulations. Typically, central banks put a lot of efforts in the designation of the level of potential output (or output gap), as it key element of the inflation targeting

[9] Theoretically, this is the steady-state economic growth - defined as the rate of growth that the economy would converge to in the absence of new shocks, or the highest level of economic activity that can be sustained over the long term (Casadio, Paradiso, Rao, 2012).

operational framework. Thus, they already use various models that cross-check the numerical findings with the reality and historical evidence.

3.3. Model estimation

Before we run the model, we have to impose certain values for the key coefficients of λ1, λ 2 and λ 3 as the lambdas aim to affect the estimates of the standard deviations of the innovations to the state equations.

a) Hyperparameters assumptions

Table 2

Hyperparameters

Lambdas	Base line	Description
$\lambda 1$ =	0.010	Short-term (iid shocks in the level of y*)/sd(iid shocks in the IS curve)
$\lambda 2$ =	0.020	long-run sd (shocks in time preferences z)/sd(iid shocks in the IS curve)
$\lambda 3$ =	0.073	long-run sd (shocks in rate of growth g)/sd(iid shocks in the IS curve)

We calibrate λ1 as a ratio of the standard deviation of $\lambda_g \equiv \frac{\sigma_g}{\sigma_{y^*}}$ errors in the IS-curve equation and equation that models potential growth. The rest of the calibration of the lambdas is based on existing literature.

b) Steady-state growth rates and natural interest rates

In addition to the hyperparameters, the model needs two important parameters about:

1) What is the long-term, steady-state growth rate of potential output g_{ss}.

2) What is the long-term, steady-state natural interest rate r_{ss}.

Due to its structural format, the model allows us to incorporate a stylised facts and observations about the behaviour of the Bulgarian economy. That assumptions inform the model where to start in searching for suitable values for parameters as potential growth estimation and natural rates. Table 3 shows our calibrated parameters about steady-state trend growth rate and natural interest rates for Bulgaria. In the table, we've added for comparison only the same variables for Eurozone because they are an important starting point for justification of the rationality of our baseline scenario.

Table 3

Steady-state growth rate of potential output and natural interest rate

	Eurozone	Bulgaria
g_{ss} Steady state growth rate (in %)	1.5	3.6
r_{ss} initial guidance for r*(in %)	1.0	1.5

Figure 6
Volume index of Bulgarian real expenditure per capita in PPS (EU15=100)

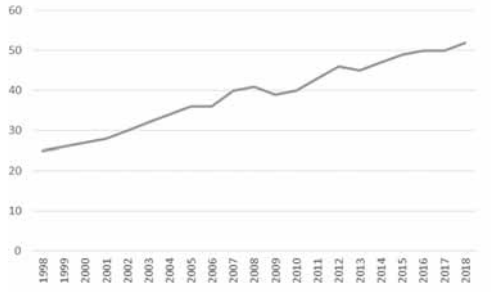
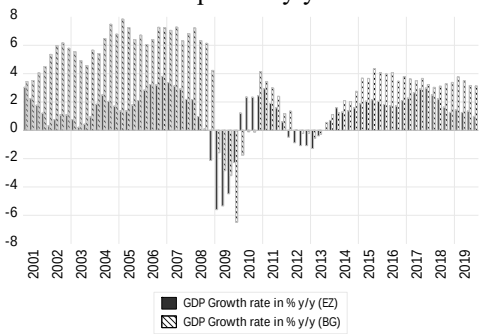


Figure 7
GDP growth rates of Bulgaria and Eurozone in percent y/y



Bulgaria is a catching-up economy, as its levels of incomes, GDP per capita and consumption are moving towards the Eurozone average, but currently they are only half of the identical variables for the Eurozone (Figure 2, Figure 3). On average, the rates of growth for GDP of the Eurozone for the period 1998-2019 are 1.5% and 3.1% for Bulgaria. In addition, ECB itself (Andersson et al., 2018) estimate the rate of potential output growth Eurozone and conclude that it has recovered most of its pre-crisis momentum and the current level is about 1.5%.

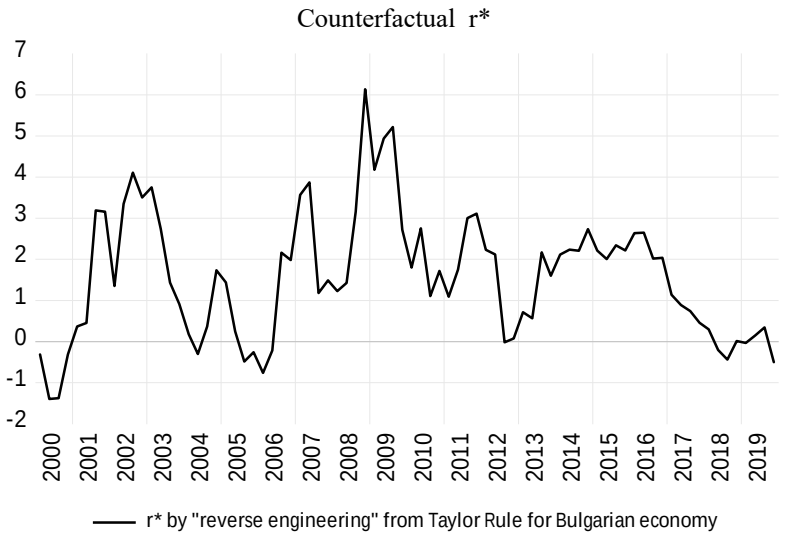
The explicit target for inflation in Eurozone is 2%[10] as the Bulgarian inflation expectations are anchored around 3.5% (Appendix A). The anchoring of Bulgarian inflation expectation around 3.5% gives us reason to assume that if hypothetically BNB followed inflation-targeting monetary regime, it would ”target” inflation near or range-bound 3.5% in medium to long run.

According to (Holston, Laubach, Williams, 2016), the r* for Eurozone is currently around 0%, but the average for the last 20 years is about 1.2%. In short, the Bulgarian economy, in the long run, grows twice faster and has twice higher inflation due to the catching-up effect. This means that the twice higher growth and twice higher inflation cancel out and the result is supposed to be identical level for the natural interest rate. We validate that proposition by ”reverse engineering” we rearranged a hypothetical Taylor rule for the Bulgarian economy assuming the market based nominal interest i_t is the intended policy rate of the central bank.

Taylor rule	“Reversed” Taylor rule
$i_t = \pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - \overline{y}_t)$	$r_{t,rev}^* = i_t - \pi_t - a_\pi(\pi_t - \pi_t^*) - a_y(y_t - \overline{y}_t)$

[10] HICP annual growth rate in percent.

Figure 8



Where the output gap ($\overline{y}_t$) is a deviation from HP modelled potential y_t, π_t^* is our modelled Bulgarian inflation expectations (i.e. 3.5%), a_y and a_π are equal (0.5). We find it rational to assume that the natural interest rate is hovering around 1.5% in the long run.

c) Data and transformations

We use seasonally adjusted quarterly data for Bulgaria from 2000Q1 to 2019Q4 for inflation (annualised first difference of the log CPI excluding food and energy), GDP (logs multiplied by 100)[11] taken from quarterly national accounts and Eurostat database, the effective real exchange rate calculated by BIS (logs multiplied by 100), and the ex-ante real interest rate for alternative specifications. For the period 2000 Q1 to 2019 Q4, the yield to maturity of 1 year BG government treasuries is used. For Oil prices, we use Brent in Euros (logs multiplied by 100). Inflation expectations are calculated from the model described in Appendix A.

The choice of variables is of particular importance in order to achieve reliable results in model estimation as even small changes due to data availability could compromise the outcome. For instance, the choice of inflation index – *core* of *headline* inflation CPI index could affect the real observable interest rate and Philips curve estimation in the observation equation. Or, more importantly, the choice of nominal interest rate is arguably crucial in order to interpret results more consistently. For the nominal interest rate, there are a variety of existing rates that affect the economy.

[11] Logs are multiplies by 100 in order to use them as regressors in OLS equations and take advantage of interpretation as percent changes in estimated coefficients. This is the most typical data transformation for variables that grow exponentially.

Figure 9

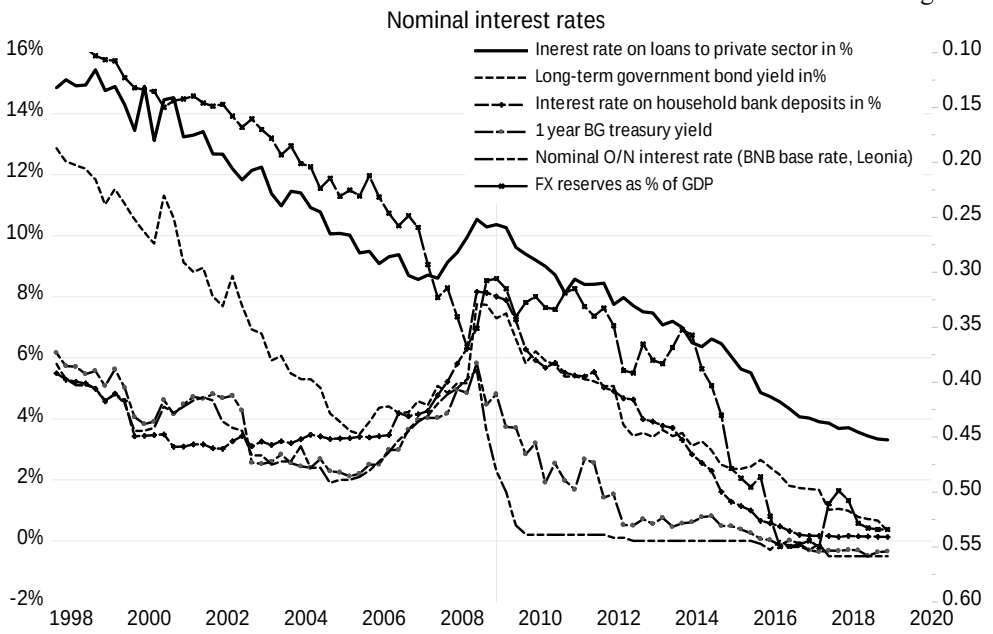


Figure 9 illustrates the existing data for the yields in percent of the relevant interest rates (on left-hand scale) in Bulgaria and (on right-hand scale inverted, bold black line) FX reserves to GDP ratio as a cross-check for financial conditions. We need the variable that contains maximum information about the financial conditions in the economy. Typical NIR models (as LW) use the O/N money market rates. Bulgarian monetary set-up is entirely defined by the Currency Board Agreement (CBA). This makes the O/N money market rates theoretically, obsolete as the central bank does not control the short term O/N rates in order to steer the monetary conditions in the economy. In addition, the money market daily turnover volumes are relatively small as the local banks do not use this vehicle to regulate their liquidity needs.

Table 4 presents the correlation of various rates to the ratio of FX reserves-to-GDP as a proxy for financial conditions.

The lending rate (Rate on loans to private sector) exhibits the strongest coefficient of correlation to FX reserves-to-GDP ratio. This finding confirms the theoretical expectation that this is the rate that most strongly affects the economic behaviour of economic agents. Unfortunately, the lending rate itself is quite problematic as it comprises significant liquidity and risk premiums that blur the overall calculation of the real interest rate. If we calculate the real interest rate as lending rate minus inflation rate, this could mechanically result in a higher real interest rate. Thus, we took the second-best, that it is the *1y BG treasury yield which* approximates reliably the financial conditions in the real economy – second highest correlation coefficient with FX reserves-to-GDP ratio, negligible liquidity and risk premiums and practically a part of the money market with a reliable time range of data.

Table 4

Correlation	Rate on loans to private sector	Long-term interest rate	Household deposit rate	1 year BG treasury	O/N interest rate	FX to GDP ratio
Rate on loans to private sector	1.00					
Long-term interest rate	0.94	1.00				
Household deposit rate	0.55	0.56	1.00			
1 year BG treasury	0.88	0.87	0.68	1.00		
O/N interest rate	0.83	0.76	0.43	0.91	1.00	
FX to GDP ratio	-0.96	-0.81	-0.48	-0.86	-0.79	1.00

4. Discussion of the Model Results

Table 5 present the results of the estimated model. The coefficients show the expected signs and the magnitude identical to results in other papers (Belke, Klose 2017). For instance, the two slope coefficients a_r and b_y have the expected signs and are statistically significant. We find this as an evidence that validates the choice of assumptions for hyperparameters and steady-state growth and r* are plausible and realistic.

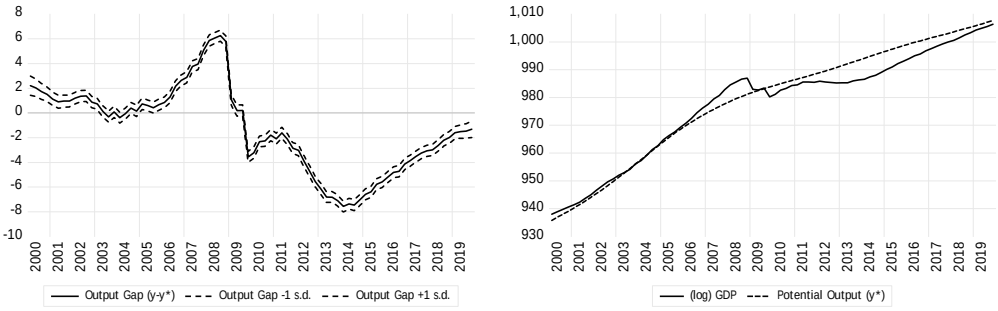
Table 5

Model estimation, Coefficients

Sspace: NEUTRAL_RATES				
Method: Maximum likelihood (BFGS / Marquardt steps)				
Sample: 2000Q1 2019Q4				
	Coefficient	**Std. Error**	**z-Statistic**	**Prob.**
IS Curve				
$a_{t,1}$	0.519	0.255	2.037	0.042
$a_{t,2}$	0.165	0.204	0.806	0.421
a_r	0.040	0.040	1.010	0.313
a_{ez}	0.956	0.115	8.279	0.000
Philips Curve				
B_π	1.009	0.003	362.7	0.000
b_y	0.085	0.026	3.228	0.001
b_{rer}	-0.039	0.015	-2.657	0.008
b_o	0.011	0.005	2.402	0.016
	Final State	**Root MSE**	**z-Statistic**	**Prob.**
r_t^*	2.612	1.275	2.049	0.041
z_t	0.139	1.101	0.126	0.900
g_t	2.491	0.689	3.616	0.000
Log likelihood	-188.909	Akaike info criterion		5.125
Parameters	11	Schwarz criterion		5.458
Diffuse priors	0	Hannan-Quinn criter		5.258

Figure 10

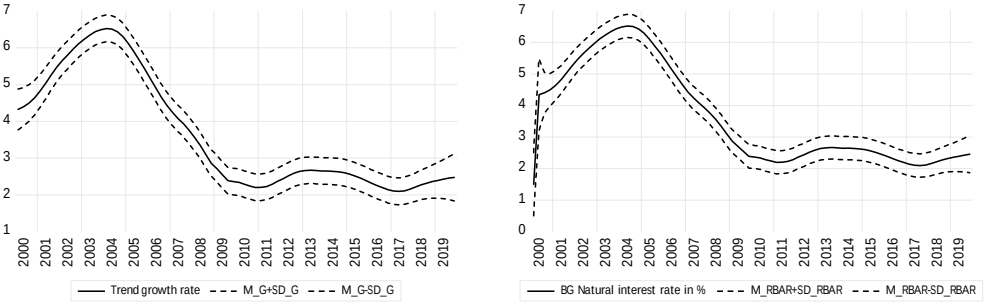
Potential growth, Output gap



The model estimate for trend growth (Figure 10, right chart) holds a slow-moving pattern as cyclical deviations from the trend take its toll on the long-term growth. This holds the assumption that in the short run, nevertheless peaks and troughs of cycles the economy keeps stable ability to grow. But in the medium to long run, a secular underperformance of growth pulls the potential output down in low-frequency mood. It is important to note that we aim at the estimation of real natural interest rate that is by definition a variable with a low frequency motion. Thus, the output gap goes with some margin around the trend (Figure 10, left) as the model itself approximates the cycle position of the economy. The Fig:10 shows that in the period right after 2000-2004, the economy has experienced mild negative output gap due to several factors as the recovery after the economic crisis 1996-1997 and the deep and profound structural change as a result from the reforms in a string of public and economic policies. In 2004-2008 the output gap has been closed as a period of strong output growth followed due to robust FDI inflow, housing prices surge and favourable external conditions. The global financial crisis in 2008 abruptly reversed the positive output gap and within three years, shifted the growth rate slightly below the trend. Since then, the real output slowly but consistently approaches the trend as up to 2019, the output gap is to be considered marginal.

Figure 11

Natural interest rate and trend growth rate of GDP



*4.1. Key observations from the results for Bulgarian r**

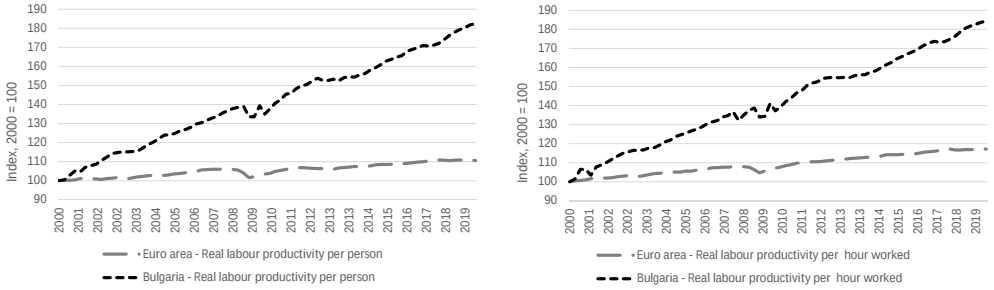
a) Observation 1

The most important observation about the natural interest rate (r*) is the absence of a sustainable declining trend over the whole sample period. Contrary to an overall decline in natural rates in many advanced economies in the last couple of decades, the Bulgarian economy does not show any measurable or pronounced sign of such a declining trend in r*. This is an essential difference, as it is the declining r* by and large the most important early warning indicator for the imminent era of ”secular stagnation”. The absence of a declining trend in Bulgarian r* after 2008 begs for an explanation as it seems counterintuitive at first glance.

The key explanation lies in the long-term driving factors for economic growth in Bulgaria. Bulgaria as catching-up economy “imports” productivity, thus Solow style[12] explanation for economic growth applies fully. The recent history suggests that the profound economic transformation after 1999, deep supply-side reforms that increased competition and mostly strong FDI flows from abroad is the profound driver of the productivity growth in the last 20 years (Figure 12). The reforms opened opportunities for *imported* technology, capital and knowledge.

Figure 12

Productivity growth, EA and BG, per person (left) and per hour worked (right)



b) Observation 2

Bulgarian r*, hoovers around 2.5%. Bulgaria is a catching-up economy, which grows twice faster than the Eurozone over the long term. This implies that the inflation is supposed to be higher during this catching-up process. Our simplified estimation, described in Appendix 1, confirms that the inflation expectations of the economic agents a centred around 3.5% on average in the long run as the inflation target in the Eurozone is (approximately) less than 2%. This fact suggests that it is reasonable to expect a higher natural interest rate.

[12] In Solow models (Solow, 1956, 1957), the productivity is exogenous variable and is the ultimate driver of growth in the long run.

Figure 13 illustrates a comparison between the r* of the Eurozone[13] and Bulgaria and shows that indeed Bulgarian r* is stably higher than the Eurozone r*. This is important because it allows a wider real rate gap (r-r*), thus a more accommodative monetary stance.

Figure 13
Natural Interest Rates (r*) BG and EZ

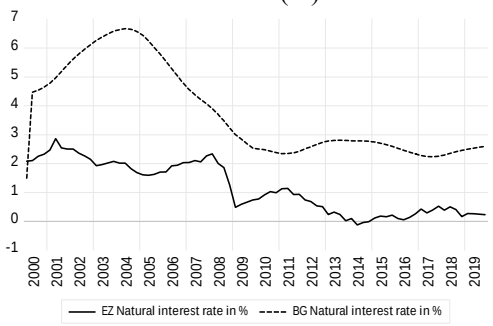


Figure 14
Output gap and real rate gap in %

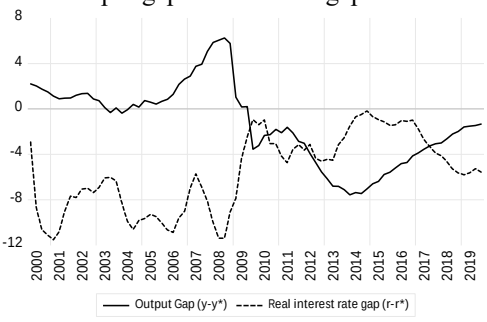


Figure 14 illustrates that in the case of Bulgaria, the negative real rate gap has supported a growth and a positive gap suppressed GDP growth in certain periods. Even visual inspections of Figure 14 gives a clearer evidence, that the real rate gap "works" and that all of our assumptions made in the model are justified. That proves that the results for the modelled Bulgarian natural interest rate are sufficiently reliable as general guidance for r*.

Figure 15
Scatterplot of Output gap to real rate gap

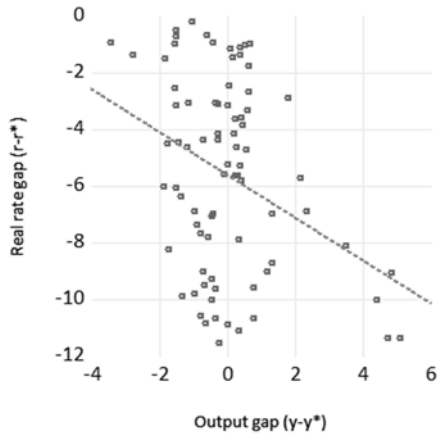
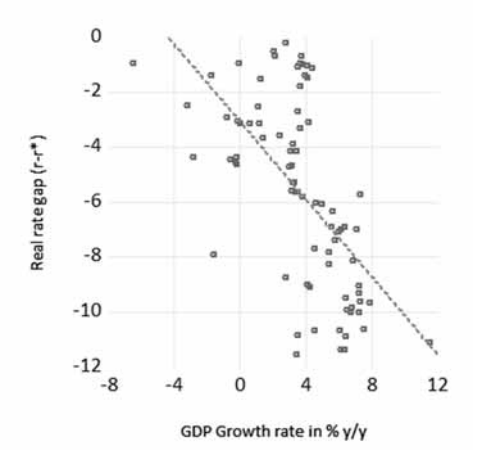


Figure 16
Scatterplot of real rate gap to GDP growth rate



[13] Eurozone r* source is Holston, Laubach, and Williams (2017) https://www.newyorkfed.org/research/policy/rstar.

For instance, in the period 2010-2016, the real rate gap happened to be sluggish, which led to anemic growth and very slowly closing of the output gap. The natural interest rate even moved to positive numbers in the period 2002-2008 due to a powerful rise of time preferences. This fact shifted the real rate gap negative for that period and precipitated significant overheating of the economy. The consequences were unsustainable asset prices overvaluations (”bubbles”) in Bulgarian real estate, Stock indexes and an unsustainable current account deficit.

Figure 17
Scatterplot of real rate gap to investment growth

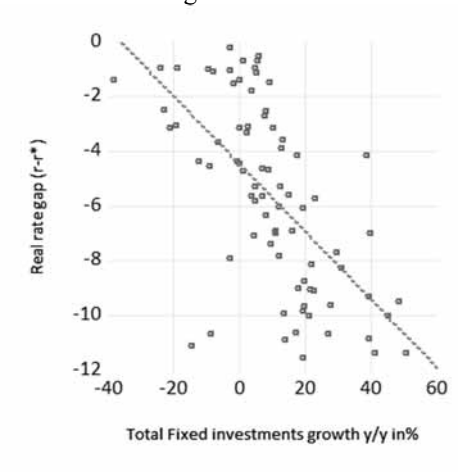


Figure 18
Investment by type as % of GDP

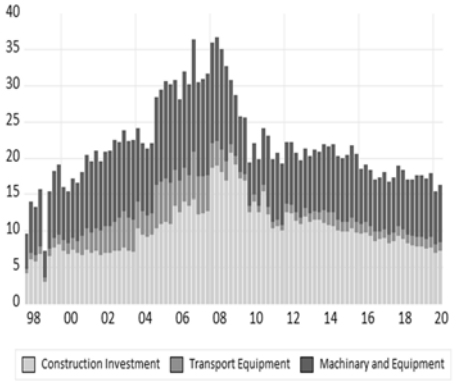


Figure 19
Scatterplot of real rate gap to credit growth

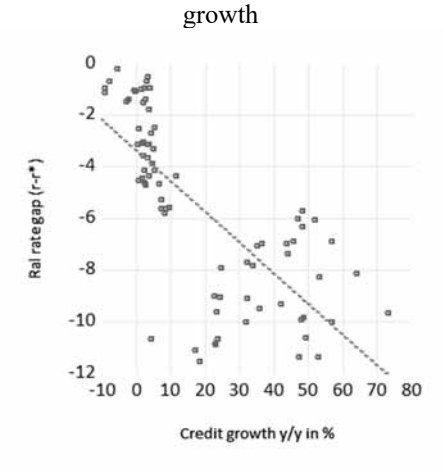
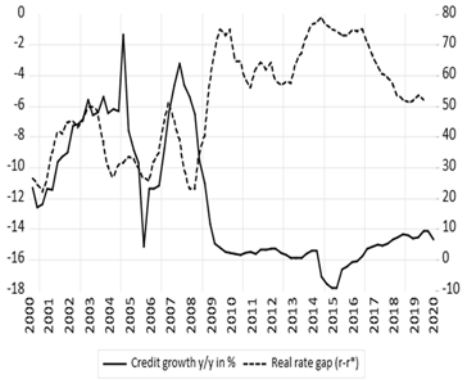


Figure 20
Dynamic of Real rate gap and credit growth



Figures 17 and 18 illustrate that the real rate gap affects moderately the decision process for the new investments. According to economic theory, the level of real interest rate is supposed to affect the saving/investment decisions of the economic agents. The theory of natural interest rate as defined in (Woodford, 2005) provides more robust results about the relationship between the real rate gap and saving/investment decision.

Figures 19 and 20 illustrate a similar picture that the real rate gap affects moderately the volume of credit in the economy.

4.2. Assumptions/result validation through a hypothetical Taylor rule

In order to check the reliability of our assumptions and the overall consistency of our model, we have calculated a simple Taylor model (Taylor 1993):

18) $i_t = \pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - \overline{y}_t)$

As r* we plugged the outcome of the model, the output gap $(y_t - \overline{y}_t)$ is also another modelled input to the model, π_t^* is our outcome for the long-term Bulgarian inflation expectations (i.e. 3.5%), a_y and a_π are equal (0.5). Typically i_t is a short term interest rate steered by the central bank, but in our case, this is not relevant and we took a slight change in using 1y treasury yield. We intentionally let the Taylor rule without any restrictions or inertia component in order to see the unrestricted behaviour of the prescribed interest in comparison to the observed ST rate on the market. Both specifications show that in the period 2000-2008, the ST interest rate is way too accommodative, thus stimulating the growth beyond potential and inflation above the figurative target of 3.5%. In the period 2012-2016, both specifications diverged the outcome.

Figure 21

$\boldsymbol{a_\pi}$ = 1.5 and $\boldsymbol{a_y}$ =0.5

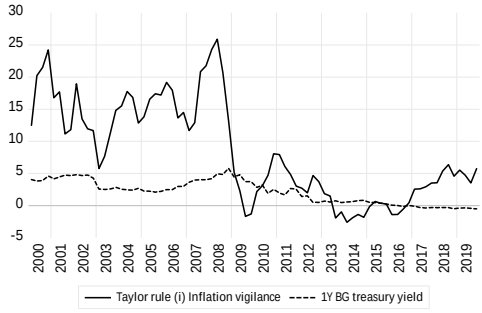


Figure 22

$\boldsymbol{a_\pi}$ = 0.5 and $\boldsymbol{a_y}$ =0.5

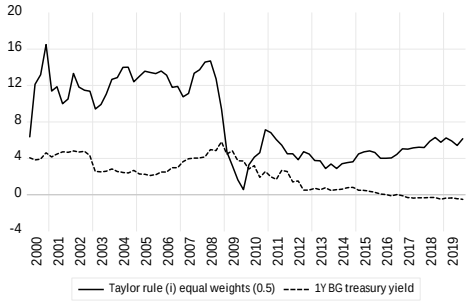


Figure12 says that a more inflation vigilant bank[14] should have lowered the short term rate further to achieve the inflation target. In that period Bulgarian economy experienced a period

[14] This implies that the central bank cares more about the inflation being on target than output gap being closed.

of very slow growth (even stagnation) and deflation. This fact adds evidence to the notion that if a central bank could not provide a negative real rate gap and/or negative nominal gap (against Taylor rule 'advice') than the aggregate demand and aggregate supply equilibrate through slower growth rates. Fig:13 represents a central bank that is equally concerned about inflation and welfare loss and defines short term rate nearly appropriate in the period 2012-2016 but gradually accommodative later on. It says contrary to the previous Figure, that in the period 2017-2019, the economy is running a little bit hot as it needed nominal short term rates near zero line.

A central bank could not allow a key interest rate, which it targets to go on wild swings or boats of volatility, thus some **inertia** is required in the Taylor rule procedures, which required a central bank to adjust interest rates only gradually (Clarida, Gali, Gertler, 2000; Rudebusch, 2005; Driffill, Rotondi, 2007). This implies the recognition that there are long and variable lags in the transmission of monetary policy, so there is a need to avoid tough "stop-and-go" policies and their consequences in terms of negative macroeconomic spillovers. In economic literature ρ usually goes around 0.8.

19) $$i_t = \rho(i_{t-1}) + (1-\rho)[(\pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - \overline{y}_t)]$$

Figure 23

$\boldsymbol{\rho = 0.8}$ $\boldsymbol{a_\pi}$ = 1.5 and $\boldsymbol{a_y}$ =0.5

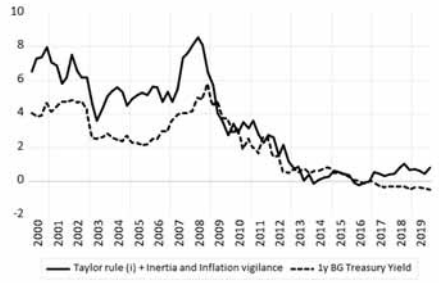


Figure 24

$\boldsymbol{\rho = 0.8}$ $\boldsymbol{a_\pi}$ = 0.5 and $\boldsymbol{a_y}$ =0.5

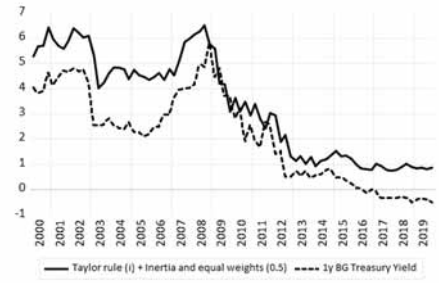


Figure 14 presents a Taylor rule with inertia as ρ = 0.8. That specification reflects the general understanding that a central bank is supposed to adjust slowly targeted short term rate to the ever-changing circumstances in the economy. The interpretation of the results is similar to Figure 13, as Figure 14 captures the most probable response function of BNB in the hypothetical case of steering short term rates.

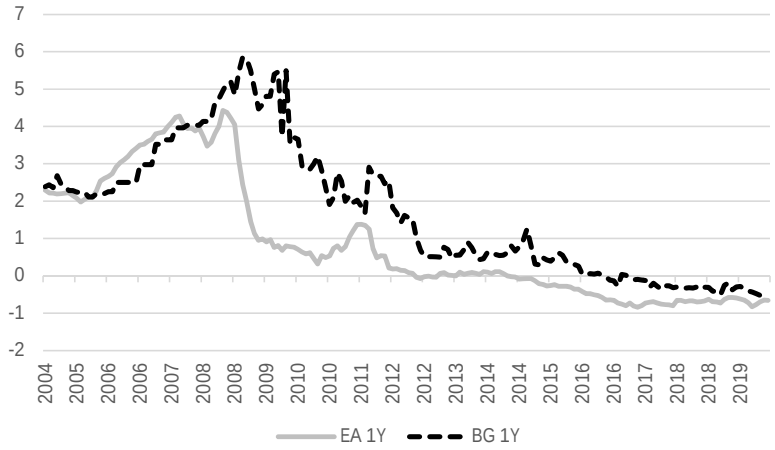
Though, we have elaborated a hypothetical case for (What if...) inflation targeting monetary set up instead of Currency Board Agreement (CBA[15]), the result from Taylor rule exercise proofs that even derived from purely market forces, the Bulgarian short term rates mimic what BNB would have done in case of inflation targeting regime.

[15] Bulgarian money market rates are driven purely on demand/supply balance without any BNB interference.

This is an important conclusion given that Bulgaria is on the doorstep of the Eurozone and the European Central Bank is going to steer directly the short term rates for the Bulgarian economy. Historical data show (Figure 16) that Bulgarian money market rates for a long period have been strongly influenced by the decision rate setting of ECB and due to the fixed exchange rate (EUR/BGN) and other transmission channels as trade, are transmitted easily to the local money market. For instance, a detailed and comprehensive research and analysis is done by Nenova, Ivanov, Ivanova (2019).

Figure 25

Yields on BG and EA treasuries 1Y maturity



The deviations happen mostly in times of market stress and reflect Bulgarian country-specific size of the risk-premium/liquidity premium over less risky Eurozone money market.

Very recent data show that the spread of BG rates to EZ rates practically disappeared. That means that Bulgarian short-term/money market rates would take direction continuously from ECB as it is now without any disruption to the present state of the monetary conditions in the economy. Trade and financial interlinkages between Bulgarian and Eurozone economies are more than intense that, as Taylor rules show, there is no even theoretical chance for a BNB's monetary policy substantially deviate from that of ECB.

5. Conclusion

The model estimation of natural interest rate (r*) is an important benchmark in assessing if a monetary policy of a central bank needs to be steered toward a positive or negative shift in order to achieve inflation on target and/or output on its potential level. The proposed model outcome is sensitive on input variables as the choice of ex-post vs. ex-ante real interest rates which needs to be addressed carefully. The model needs to be put in a context by building set of assumptions about crucial parameters as potential growth in steady state of the economy and prior knowledge or (intuition) about the most probable level of natural interest

rate in steady state of the economy. In addition, the model needs some assumptions about (hyper) parameters that reflect a genuine understanding about the potential; level and growth rate of the economy in the long run. If these assumptions are realistic, then a behaviour of the real rate gap is the ultimate benchmark for our knowledge-to-reality check.

Even with a reliable set of assumptions, the model that provides an estimation of unobservable variable as natural interest rate is subject to uncertainty or error in the outcome. Such uncertainty complicates a rule-based monetary policy implementation but is inevitable for any type of model that mimics a complicated reality with only a handful of variables.

Nevertheless, the estimated Bulgarian natural interest rate plugged into the hypothetical Taylor rule provides evidence that the assumptions are plausibly calibrated and close to reality, thus sufficiently justified.

References

Andersson, M., et al. (2018). Potential output in the post-crisis period. – Economic Bulletin Articles, 7.

Archibald, J., Hunter, L., et al. (2001). What is the neutral real interest rate, and how can we use it?. – Reserve Bank of New Zealand Bulletin, 64.3, pp. 15-28.

Belke, A., Klose, J. (2017). Equilibrium real interest rates and secular stagnation: An empirical analysis for euro area member countries. – JCMS: Journal of Common Market Studies, 55.6, pp. 1221-1238.

Berger, T., Kempa, B. (2014). Time-varying equilibrium rates in small open economies: Evidence for Canada. – Journal of Macroeconomics, 39, pp. 203-214.

Branch, W. A. (2004). The theory of rationally heterogeneous expectations: evidence from survey data on inflation expectations. – The Economic Journal, 114.497, pp. 592-621.

Brand, C., Bielecki, M., Penalver, A. (2018). The natural rate of interest: estimates, drivers, and challenges to monetary policy. – ECB Occasional Paper, 217.

Buncic, D. (2020). Econometric Issues with Laubach and Williams' Estimates of the Natural Rate of Interest. Available at SSRN.

Casadio, P., Paradiso, A., Bhaskara Rao, B. (2012). Estimates of the steady state growth rates for some European countries. – Economic Modelling, 29.4, pp. 1119-1125.

Clarida, R., Gali, J., Gertler, M. (2000). Monetary policy rules and macroeconomic stability: evidence and some theory. – The Quarterly journal of economics, 115.1, pp. 147-180.

Driffill, J., Rotondi, Z. (2007). Inertia in Taylor rules. SSRN 1028711.

Fiorentini, G., et al. (2018). The rise and fall of the natural interest rate".

Ganev, K. (2004). Statistical Estimates of the Deviations from the Macroeconomic Potential: An Application to the Economy of Bulgaria. Agency for Economic Analysis and Forecasting.

Ganev, K. (2005). Measuring total factor productivity: Growth accounting for Bulgaria. – Bulgarian National Bank Discussion Paper 48.

Ganev, K. (2015). A Small Model for Output Gap and Potential Growth Estimation: An Application to Bulgaria. – Bulgarian Economic Papers, N BEP 04.

Hledik, T., Vl˜cek, J. (2018). Quantifying the Natural Rate of Interest in a Small Open Economy – The Czech Case. Czech National Bank.

Holston, K., Laubach, T., Williams, J. C. (2016). Measuring the Natural Rate of Interest: International Trends and Determinants. – Federal Reserve Bank of San Francisco Working Paper 2016-11.

Hristov, A. (2016). Measuring the natural rate of interest in the eurozone: a DSGE perspective. – CESifo Forum, Vol. 17. 1. Mu¨nchen: ifo Institut-Leibniz-Institut fu¨r Wirtschaftsforschung an der..., pp. 86-91.

Hristov, K. (2004). The currency board: The only game in town. – Discussion Paper 40.

Kasabov, D., Kotseva, P., Yanchev, M. (2017). Relationship between inflation, potential output and structural unemployment in Bulgaria. – BNB, DP, 104, p. 2017.

Krustev, G. (2019). The natural rate of interest and the financial cycle. – Journal of Economic Behavior & Organization, 162, pp. 193-210.

Laubach, T., Williams, J. C. (2003). Measuring the natural rate of interest. – Review of Economics and Statistics, 85.4, pp. 1063-1070.

Lubik, T. A., Matthes, C., et al. (2015). Calculating the natural rate of interest: A comparison of two alternative approaches. – Richmond Fed Economic Brief Oct, pp. 1-6.
Minea, A., Rault, C. (2008). Monetary policy transmission: old evidence and some new facts from Bulgaria".
Nenova, M., Ivanov, E., Ivanova, N. (2019). Monetary policy transmission: old evidence and some new facts from Bulgaria. – Bulgarian National Bank.115/2019.
Neri, S., Gerali, A. (2019). Natural rates across the Atlantic. – Journal of Macroeconomics, 62.
Rudebusch, G. D. (2005). Monetary policy inertia: fact or fiction?. – FRB of San Francisco Working Paper 2005-19.
Solow, R. M. (1956). A contribution to the theory of economic growth. – The quarterly journal of economics, 70.1, pp. 65-94.
Solow, R. M. (1957). Technical change and the aggregate production function. – The review of Economics and Statistics, pp. 312-320.
Stock, J. H., Watson, M. W. (1998). Median unbiased estimation of coefficient variance in a time-varying parameter model. – Journal of the American Statistical Association, 93.441, pp. 349-358.
Summers, L. (2013). 14th Annual IMF Research Conference: Crises Yesterday and Today. – November, 8, p. 2013.
Summers, L. H (2015). Demand side secular stagnation. – American Economic Review, 105.5, pp. 60-65.
Taylor, J. B. (1993). Discretion versus policy rules in practice. – Carnegie-Rochester conference series on public policy, Vol. 39, pp. 195-214.
Tsalinski, Ts. (2006). Two Approaches to Estimating the Potential Output of Bulgaria. – BNB, N 57.
Woodford, M., Walsh, C. E. (2005). Interest and prices: Foundations of a theory of monetary policy. – Macroeconomic Dynamics, 9.3, pp. 462-468.

APENDIX A

Ex post real interest rates $[\, r_t^p = i_t - \pi_{t-1}^p]$

"Ex-post" rates include two disturbing components which could render them a misleading proxy for non-observable ex-ante real interest rates: inflation risk-premium and agents' inflation expectation errors. Researchers are frequently are bound to use "ex post" real rates assuming that, there is low volatility in the time series or, the representative economic agent extrapolates the current value of inflation in future periods due to limited information or weak rationality. This means that inflation expectations in (t+1) are assumed to be the same as in t. That method holds that economic agents form their inflation expectations on the basis of past inflation experience and adjust the expectations accordingly to the realised inflation proportionally but less than 1-to-1. The empirical research show that many agents fit sufficiently in that description (Branch, 2004).

For instance, the available data for Bulgaria shows a strong relationship between observed inflation and survey based inflation expectations. European Commission publishes monthly data for Bulgaria[16], which compares to monthly CPI index data show robust dependence to yearly inflation data at moment t. EC uses survey with a balance[14] of answers to the question about expected inflation in the next 12 months.

A simple statistical regression shows (Table 6) that near 2/3 of the economic agents form their inflation expectations extrapolating current inflation (R^2 = 62%) for the period 2004-2019.

$$\pi_t = \alpha + \beta_1 Bal_{t+12|-12|} + s$$

[16] https://ec.europa.eu/economy_finance/db_indicators/surveys/documents/series/nace2_ecfin_1907/consumer_inflation_nace2.zip.

Figure 26
Scatterplot, Survey based inflation expectations vs. observed inflation rates for Bulgaria

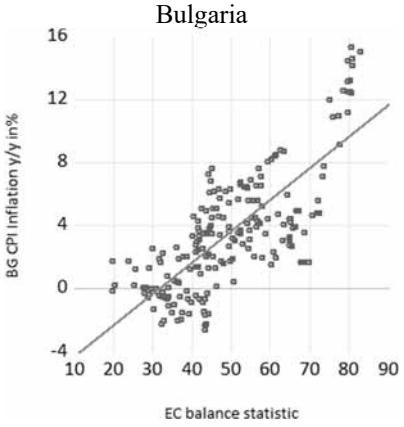


Figure 27
Survey based inflation expectations (rhs) and observed inflation rates y/y for Bulgaria

Table 6

Regression results: Equation 1

Coefficients	Period 2004-2009
intercept	-0.7291 (0.6615)
(EC) infl. expect	0.2143*** (0.0125)
R-squared	0.62
No. observations	182

Notes. $*p < 0.05$, $**p < 0.01$ $***p < 0.0001$

A formal regression analysis for the 2001-2019 show that there is a reliable significance of the estimated coefficients, but also some degree of autocorrelation in the error term and two periods of excess volatility due to global factors as economic recession in 2002-2003 and Eurozone crisis in 2010-2012. The visual perception of autocorrelation has been confirmed by formal ADF test. By adding additions variables as lags of observed inflation we can improve the stationarity or the residual.

Ex ante real interest rates [$r_t^e = i_t - \pi_t^e$]

Ex ante real interest rates are most easily derived from market instruments as inflation swaps or inflation linked government bonds. Unfortunately, the Bulgarian market has no such instruments. In addition, such instrument include not only expected inflation π^e, but also risk premium about forecast inflation and liquidity premium. The last two components could be significant factors in times of stress or volatility. That obstacle make us the move back to the previous example and overcome the problem with autocorelated residual. Thus, we add additional factors to survey based inflation expectation, namely inflation own lags

$$\pi_t = \alpha + \beta_1 Bal_t + \beta_1 \pi_{t-1} + s$$

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Ram Pratap Sinha[1]

PROFIT BENCHMARKING OF INDIAN GENERAL INSURANCE COMPANIES[2]

While there are several studies regarding the efficiency of Indian general insurance companies, the field of profit efficiency remains unexplored till date. In the present paper, a quantity-based ratio form model has been adopted for the estimation of profit efficiency. The profit efficiency scores so derived are then decomposed into revenue and cost efficiency components. Bootstrap-based and bias-corrected lower and upper bounds of profit, revenue and cost efficiency scores have also been estimated. The data set includes information pertaining to fifteen general insurance companies for the period 2011-12 to 2016-17. The outcome shows that the public sector insurers have done well in terms of revenue efficiency but needs to be concerned about cost-efficiency. Further, we have explored the linkage of profit, revenue and cost efficiency with solvency ratio and return on equity using Tobit regression. The results show that profit, revenue and cost efficiency have a strong linkage with both solvency ratio and return on equity.

Keywords: General insurance; Profit Efficiency; Revenue Efficiency; Cost Efficiency; Return on Equity; Solvency Ratio; Censored Regression
JEL: C61; D21; G22

Introduction

General insurance encompasses all other forms of insurance except life insurance. In the Indian context, the size of the general insurance relative to the total insurance market is quite small (approximately 23%). However, the origin of the industry is quite old. The modern form of the insurance business was first established in pre-independent India when Triton Insurance Co. Ltd was formed in 1850. This was followed by the establishment of the Bombay Mutual Life Insurance Society in 1870 and the Oriental Assurance Company in 1880. Subsequently, many general insurance companies were formed in India. Thus, there were more than a hundred general insurance companies in India at the time of its nationalisation in 1973, when the industry was nationalised. The process of nationalisation involved the establishment of General Insurance Corporation as the state-sponsored

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reinsurance company and the formation of four state-sponsored general insurance companies (by amalgamating 107 private general insurers).

In the 1990s, India embraced an open market economy with a greater role for the private sector. Financial sector reform was an integral part of the reform process, which was initiated with banking sector reform involving deregulation of private sector entry and introduction of prudential regulations of banking operations. At the same time, the Govt. of India set up a high powered committee on the Indian insurance sector (headed by Shri R. N. Malhotra) for examining the existing scenario and recommend appropriate measures for boosting competitive efficiency and strengthening the regulatory framework.

In the post-liberalisation phase, the sector underwent important regulatory and structural changes during the last two decades leading to a rapid growth of the industry. Table 1 provides an overview of the industry growth during the period 2011-12 to 2016-17.

Table 1

The General Insurance Industry in India

Particulars	2012	2013	2014	2015	2016	2017
Number of general insurance companies (including reinsurers)	28	28	29	29	30	31
Insurance Penetration	0.78	0.8	0.7	0.7	0.70	0.77
Insurance Density	10.5	11	11	11	11.5	13.2
Gross Direct Premium (Rs Crores)	54578	65023	79934	87151	99333	130971

Source: IRDA: Handbook of Insurance Statistics, various years.

The changing role of the general insurance sector in the Indian economy has attracted the attention of researchers and during the last few years, several research studies attempted to estimate the efficiency and productivity performance of the industry by adopting non-parametric methods. However, there is no study of the profit efficiency performance of the general insurance companies in India as yet. The present study seeks to fill this gap as it tries to measure the profit efficiency performance of 15 major general insurance companies in India for the period 2011-2012 to 2016-2017. The present study has a taken a two-stage approach. Thus in the first stage, the profit efficiency of the in-sample general insurance companies has been computed using the Farrell framework as well as the Directional Distance Function approach. In the second stage, the impact of several contextual variables (including solvency, return on equity and return of asset) on the efficiency scores is assessed using censored regression.

The paper has five sections and proceeds as follows. Section 1 provides a brief survey of the cross-country efficiency literature related to the non-life insurance industry. Section 2 reviews the research methodology and describes the two-stage approach adopted in the present study. Section 3 describes the analysis. Section 4 discusses the results. Section 5 provides the conclusion and policy implications.

1. Survey of Literature and Motivation for the Study

Among the literature devoted to the analysis of efficiency performance of financial services industries, there are relatively few efficiency studies on the non-life insurance sector. The extant literature made efficiency and productivity evaluation of general insurance companies under the assumptions of both global and local returns to scale. While the majority of the studies considered one stage production model, a few studies considered a two-stage model. Both parametric and non-parametric approaches have been used for estimating efficiency.

Toivanen (1997) examined the economies of scale and scope for non-life insurance companies of the Finland industry for the period 1989-1991. The study suggested that the creation of a branch network is important for acquiring market power or acquiring informational advantages. Fukuyama and Weber (2001) evaluated the efficiency and productivity growth of Japanese non-life insurance companies for the period 1983-1994. The study confirmed the presence of productivity improvement during 1983-1990, which was mainly driven by technological improvement. Choi and Weiss (2005) examined the performance of the U.S. property-liability industry using a stochastic frontier approach. Yang (2006) made use of a two-stage DEA (data envelopment analysis) model for estimating the efficiency of the Canadian life and health (L&H) insurance industry. Kao and Hwang (2006) applied a two-stage DEA model to evaluate the performance of 24 non-life insurance companies of Taiwan using data for the years 2001 and 2002. Barros, Nektarios and Assaf (2010) applied a two-stage robust estimation framework for estimating the efficiency performance of 71 Greek life and non-life insurance companies. Mahlberg and Url (2010) examined the impact of the single market project of the European Commission on the efficiency and productivity change of the German insurance companies for the period 1991-2006. Cummins and Xie (2013) examined efficiency, productivity and scale economies in the U.S. property-liability insurance industry. Jarraya and Bouri(2014) investigated profit efficiency and optimal production targets for the European non-life insurance industry for the period 2002-2008. Alhassan and Biekpe (2015) estimated efficiency, productivity and returns to scale for the non-life insurance market in South Africa for the time span 2007-2012. Ferro and Leon (2017) estimated the technical efficiency of Argentine non-life insurance companies for the period 2009-2014 using a stochastic frontier approach. The results indicated a low level of mean technical efficiency for the observed insurers, a stagnated level of efficiency during the later phase of the observed time period and a technical regress. Ilyas and Rajasekharan (2019a, 2019b) estimated the efficiency, total factor productivity and returns to scale economies of the Indian non-life insurance industry over the period 2005-2016. The first study (2019a) finds the Indian non-life insurance industry to be moderately technical, scale, cost and allocative efficient. The second study (2019b) found (using the Fare-Primont index) that the non-life insurance sector exhibits a very low level of total factor productivity. The total factor productivity growth observed during the observed period (2005-2016) is mainly attributable to scale-mix efficiency.

The extant literature on the efficiency of non-life/general insurance industries focused on primarily the technical efficiency and changes in total factor productivity of the observed insurers (with the exception of one study which covered cost efficiency). None considered profit efficiency. The motivation for the present study stems from the research gap.

2. Research Methodology

2.1. Evolution of profit efficiency methodology

In a market-driven economy, business enterprises produce goods and services with the end objective of earning profit. However, most of the efficiency studies concentrate on input or output oriented technical efficiency performance of the business firms. In the context of the business sector, this method certainly provides a partial picture of firm efficiency as profit efficiency implies both technical and allocative efficiency.

Nerlove (1965) perhaps made the earliest contribution to the profit efficiency literature. He had chosen gross profit (total revenue minus total variable cost) for measuring profit efficiency. However, a finite and benchmark (maximum) level of profit is needed for the measurement of profit efficiency. This necessitates that the profit function reaches a maximum at a particular point and declines thereafter. This necessity led to the emergence of the concept of restricted profit function [introduced by Mcfadden (1978)]. Subsequent contributions by Lee and Chambers (1986), Chambers, Chung Y and Färe (1998), Portela and Thanassoulis (2005), Cherchye, Kuosmanen and Leleu (2010) and Fare, He, Li and Zelenyuk (2019) provided new directions to the methodology of measuring profit efficiency.

For describing the methodology of profit efficiency measurement, we consider technology T_S given by T_S={$(x, y)|x$ can produce y} where $x \epsilon R_n^+$ represent a vector of inputs (x_1,x_2,....,x_n) and $y \epsilon R_m^+$ represents a vector of m outputs (y_1,y_2,....,y_m). Let p_{y1} ,p_{y2},....,p_{ym} represent the output prices and w_{x1} ,w_{x2},....,w_{xn} represent the input prices.

Let π be the profit arising out of the activity: $\pi=\sum_{i=1}^{m} p_{yi}\, y_i - \sum_{j=1}^{n} w_{xj}\, x_j$. We may define the maximum profit as: π^{max}(p,w)=Max {py-wx: (x,y) ϵT_S}, $p \epsilon R_m^+$ and wϵR_n^+.The profit function is assumed to satisfy the following conditions (Fare and Primont,1995):

(i) It is non-negative,non-increasing in w and non-decreasing in p,

(ii) The profit function is homogeneous of degree one in input and output prices,

(iii) The function is convex and continuous in positive prices.

Maximum profit is obtained by a firm when the profit function is tangential to the technology set (T_S). Let x^* and y^* be optimal levels of x and y for which profit is maximised. Thus $\pi^{max} = py^* - wx^*$.Beyond the maximum profit level, the profit function exhibits decreasing returns to scale. The implicit assumption is that the production possibilities are constrained by the physical or economic environment or by the existence of prior contracts relating to input procurement/output delivery (Mcfadden,1972). Fare, He, Li and Zelenyuk (2019) mentioned some additional constraints like requirement of minimum employment, input availability limits, budget constraints etc.

Nerlove (1965) formally introduced two concepts of profit efficiency. The first measure introduced by him was a ratio measure: $\pi_{effR} = \frac{\pi(w^0, P^0)}{(P^0Y^0 - w^0x^0)}$ where w^0 and p^0 represent observed input and output prices respectively and x^0 and y^0 stand for observed levels of x and y. The second measure is an additive measure : $\pi_{eff} = \pi(w^0,\ P^0) - (P^0Y^0 - w^0x^0)$.

Varian (1990) provided another measure of profit efficiency:

$\pi_v=\frac{\pi(w^0,P^0)-(P^0Y^0-w^0x^0)}{(P^0Y^0-w^0x^0)}=\frac{\pi(w^0,P^0)}{(P^0Y^0-w^0x^0)}$ -1. This measure indicates the per cent extra profit that the firm could earn by choosing the optimal instead of the observed input-output vector.

Chambers, Chung Y and Färe (1998) have presented a new measure of profit efficiency using the directional distance function approach:

$D_л(x^0,y^0,w^0,p^0,g_x,g_y)$ =max [β,$p^0(y^0+\beta g_x)$-$w^0(x^0-\beta g_y)\leq л^{max}$]. Thus profit efficiency $л_{eddf}=\frac{\pi(w^0,P^0)-(P^0Y^0-w^0x^0)}{p^0g_y+w^0g_x}$. It is evident from the ratio that the direction vectors $g_y$and g_x are used to normalise the distance function.

Portela and Thanassoulis (2005,2007) adopted the Geometric Distance Function (GDF) for estimating profit efficiency. The GDF is defined as the ratio of input and output related indices. The input index is computed as the ratio of target and observed levels of inputs. The output index is computed as the ratio of observed and target levels of output. Geometric averages are used to find out the average levels of targets and actual (of inputs and outputs). Portela and Thanassoulis (2005) applied this method for computing the profit efficiency of a set of Portuguese bank branches and decomposed them into technical and allocative components.

Cherchye, Kuosmanen and Leleu (2010) reviewed the alternative profit efficiency measures and they identified Varian's measure of profit efficiency as their preferred alternative for the estimation of short-run profit efficiency. Further, they showed that the gauge function [Mcfadden (1978)]can be represented as Varian's measure of profit efficiency at the shadow prices and provides an upper bound for the measure of profit efficiency, which applies to any system of market prices.

Fare et al. (2019) introduced a Farrell type distance function π_{DF}=max[f(μ,θ):θ(p^0y^0) − μ(w^0x^0)≤π^{max}] where θ(p^0y^0) and μ(w^0x^0) represent revenue and cost functions respectively. The relative profit efficiency measure is:

$\pi_F=\frac{\pi^{max}-\pi^0}{R^0}+1=\frac{\Delta\pi}{R^0}+1$. Since the numerator of the ratio on the right-hand side is both finite and positive, the profit efficiency measure is ≥1. This measure indicates that subject to the given level of input and output prices (w^0, p^0), the observed firm can augment its profit by$\left(\frac{\Delta\pi}{R^0}\right)$per cent of its revenue.

2.2 Estimation approach of the present paper

Since our data set includes some negative data, the present study considers a ratio based measure of profit, i.e. total revenue divided by total cost. Thus profit efficiency of an insurer is defined as the ratio of observed to optimal revenue-cost ratio.

For measuring profit efficiency with this ratio of ratio approach, we have used a Farrell type distance function which is a quantity-based approach. Following Farrell's (1957) approach regarding distance function, the profit distance function can be written as D_π=

max[β:$\pi_o(y,x)$β, (y,x)ϵT_S]. For an observed firm (firm "o"), the DEA program for profit maximisation (in the radial framework) for the firm can be written as :

$$\text{Max } \pi_o = \sum_{i=1}^{m} p_{yio}\, y_{io} - \sum_{j=1}^{n} w_{xjo}\, x_{jo}$$

$$\text{Subject to: } x_o \geq \lambda X,\ y_o \leq \lambda Y, \lambda \geq 0, \sum \lambda = 1$$

The profit efficiency of the firm can be computed as $\frac{\pi^o}{\pi^{max}}$. π_{max} stands for the benchmark profit.

As indicated earlier, when profit is negative, efficiency estimation creates obvious difficulties in the radial DEA model. However, we have taken the ratio of revenue and cost instead of taking the difference. Thus the DEA program for the observed firm becomes:

$$\text{Max } \pi_{ratio} = \frac{\sum_{i=1}^{m} P_{yio} Y_{io}}{\sum_{j=1}^{n} W_{xjo} X_{jo}}$$

$$\text{Subject to: } x_o \geq \lambda X,\ y_o \leq \lambda Y, \lambda \geq 0, \sum \lambda = 1$$

Ratio based profit efficiency of the firm can be computed as $\frac{\pi_o}{\pi_*}$where π_* is the optimal revenue-cost ratio. Thus it can be decomposed into revenue efficiency and cost efficiency components:

$\frac{\pi_o}{\pi_*} = (\frac{R_o}{R*}) \times (\frac{C_*}{C_o})$ where $(\frac{R_o}{R*})$ represents revenue efficiency and $(\frac{C_*}{C_o})$ represents cost efficiency.

2.3. Bootstrap estimation of lower and upper bounds of profit efficiency

DEA uses mathematical programming for constructing the frontier and provides point estimates of the efficiency scores. Simar and Wilson (1998) elaborated the procedure of bootstrap DEA, which can be used to construct lower and upper bounds of efficiency scores. Bootstrap is essentially a procedure of mimicking the population by resorting to resampling. In the case of frontier estimation, however, smoothed bootstrap method (which uses a Gaussian kernel density estimate) is essential to get consistent estimates of the frontier and efficiency.

2.4. Second stage regression

In the second stage analysis, we need to regress the profit efficiency scores obtained from the application of both the approaches on a few contextual variables. However, the profit efficiency scores are bounded from below and above, with the lower and upper bounds being 0 and 1, respectively. Consequently, the application of ordinary least squares for the purpose of regression would lead to biased estimates of the regression parameters. The problem can be countered either by resorting to data transformation (such as logarithmic or box-cox transformation) or by imposing restrictions (setting lower and upper bounds) on the dependent variable. In the present context, we have applied censored regression which is a generalisation of the standard Tobit model. In the censored regression framework, the

dependent variable can be either left or right-censored, or both left and right-censored. The lower or upper limit of the dependent variable can be any number. The censored regression model can be represented as:

$$Y^L = X'\beta + U$$

Y=m if Y*≤0,Y=Y* if m<Y*<n and Y=n if Y*≥n

Where Y^L is a latent (unobserved) variable and Y is the observed variable. X is a vector of explanatory variables. a and b are the lower and upper limits of the dependent variable. β is a vector of unknown parameters and U represents the disturbance term.

Censored regression models are usually estimated by the Maximum Likelihood method. Under the assumption that the disturbance term u is normally distributed with mean 0 and variance σ^2, the log-likelihood function can be written as:

$LogL = \sum[Im log\varphi(\frac{a-X'\beta}{\sigma}) + In\log\varphi(\frac{X\prime\,\beta-b}{\sigma})+(1\text{-Im-In})\{log\theta(\frac{Y-X'\beta}{\sigma})\text{-}log\sigma\}]$

where $\varphi(.)$ and $\theta(.)$ denote the probability density function and the cumulative distribution function of the standard normal distribution and Im & In are the indicator functions with

Im=1 if Y=m and Im=0 if y>m and In=1 if Y=n and In=0 if y>n.

3. Data, Results and Discussion

Measurement of profit efficiency requires the identification of inputs, outputs and prices. However, the specification of variables (and price parameters) in the context of the insurance industry is a challenging proposition because of the existence of multiple approaches towards the description of the productive activities of insurers.

Eling and Luhnen (2010) identified three major types of inputs used in the insurance industry: labour (including agents and office staff), business services (including items such as travel, communications and advertisement) and capital (including debt and equity capital). On the output side, Leverty and Grace (2010) found three alternative approaches for choosing outputs: the financial intermediation approach, the user cost approach and the value-added approach. In the context of banking and other financial intermediaries (who are engaged in fund-based activities), this approach treats financial service firms as intermediaries who bridge the gap between demanders and suppliers of funds. The value-added approach considers those activities as outputs, that contribute significant value-added as assessed using operating cost allocations (Berger, Hanweck and Humphrey, 1987). Broadly speaking, the value-added approach assumes that the insurers provide three major services: risk-pooling and risk-bearing, real financial services and intermediation. Some studies have used net premiums as value-added, while some others have used incurred benefits and the changes in reserves as output proxies (Jarrya and Bouri, 2013).

The present study seeks to estimate profit efficiency and consequently we need to identify the major activities which contribute to insurer revenue as well as the principal contributors of cost. Since we do not have very detailed information on various inputs which contribute

towards operating expenses, the number of offices maintained by the in-sample insurers is considered as the proxy input for capturing branch level activities. The relative input price is operating expenses incurred by the relative insurer per office. The expenses on account of claims, submitted by the insured, are considered as the second cost element. Since we do not have information about the number of outstanding policies at the insurer level, the price of this input is taken as unity. On the output side, we have considered net premium income and investments as the two outputs. Since we do not have insurer specific information about the number of policies sold by the general insurance companies, the price of net premium income is also taken as unity. Finally, the rate of return on investment is considered as the price of investment. Table 2 provides an overview of the inputs, outputs and prices.

Table 2

Inputs, outputs and prices

Description	Input	Output	Price
Offices	√	-	Operating expenses per office
Claims incurred	√	-	Unity
Net Premium Income	-	√	Unity
Investment	-	√	Rate of return on investment

The current study is based on the observations for fifteen general insurance companies for six consecutive financial years: 2011-12 to 2016-17. The in-sample general insurance companies include eleven private sector and four public sector general insurance companies. The relative data have been collected from two main sources: Annual Reports of IRDA for the respective years and the Handbook on Indian Insurance Statistics published by IRDA for the years 2012-13,2014-15 and 2016-17. The audited accounts of the in-sample insurers have also been consulted, where found necessary.

The present study has a two-stage process. The first stage includes three segments. The first segment provides point estimates of profit efficiency estimated under variable returns to scale. The second segment includes lower and upper bounds of profit efficiency scores. The third segment provides estimates of scale efficiency. In the second stage, we have explored the relationship of profit efficiency with contextual variables.

4. Results and Economic Explanations

4.1. Efficiency estimates

The present sub-section has three segments. The first segment (4.1.1) provides descriptive statistics of profit efficiency scores for the in-sample insurance companies and then provides the decomposition of mean profit efficiency into revenue and cost components. Further, it includes the decomposition of efficiency across ownership categories. The second segment (4.1.2) includes the interval estimates of profit, revenue and cost-efficiency. The third segment (4.1.3) provides information about returns to scale and scale efficiency.

4.1.1. Point estimates of profit efficiency performance

Table 3 presents the descriptive statistics of efficiency scores of the in-sample general insurance companies for the observed period. The efficiency scores are computed relative to the year wise profit frontiers constructed on the basis of sample data and consequently, efficiency scores are not comparable across time periods. However, the mean efficiency scores and the related standard deviation do provide us with an idea about the performance variability relative to the economic (profit) frontier. Thus, from the observed results, we find that divergence in performance (as indicated by movements in the mean and standard deviation of efficiency) has increased across the first five years. However, the mean efficiency score has improved (and standard deviation has declined) in the last year under observation. The number of efficient decision-making units (insurers) was 9 and 10 for the first two years under observation (2011-12 and 2012-13) and declined to 8 for the subsequent two years (2013-14 and 2014-15).In the last two years, the total number of efficient units was 6 and 9 respectively. The insurer wise mean and standard deviation of profit, revenue and cost efficiency scores for the entire time span under observation are included in appendix table A1-A3. On the other hand, insurer wise profit, revenue and cost efficiency scores for each year under observation are included in appendix tables A4-A6.

Table 3

Descriptive statistics of efficiency scores (2011-12 to 2016-17)

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Mean efficiency score	0.9435	0.9325	0.9169	0.8859	0.8198	0.9330
Standard deviation	0.0904	0.1036	0.1039	0.1475	0.2286	0.1058
Maximum	1	1	1	1	1	1
Minimum	0.6743	0.7230	0.7385	0.5466	0.4087	0.6529
No of efficient DMUs	9	10	8	8	6	9

Source: Calculated.

The profit efficiency performance so estimated can be decomposed into revenue and cost efficiency components. Table 4 provides the mean revenue efficiency estimates for the period under observation. It shows that between 2011-12 and 2015-16, mean revenue efficiency has declined in a secular fashion. Similarly, mean cost efficiency has also declined during the period (with the exception of 2012-2013).

Table 4

Decomposition of profit efficiency

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Mean Revenue efficiency	0.9801	0.9566	0.9476	0.9274	0.9378	0.9859
Mean Cost efficiency	0.9611	0.9720	0.9658	0.9524	0.8662	0.9460
Overall	**0.9435**	**0.9325**	**0.9169**	**0.8859**	**0.8198**	**0.9330**

Source: Calculated.

We are also interested to know how efficiency performance varies across ownership categories (private and public sector general insurers). Table 5 provides the relative summary information.

The table indicates that during the first four years under observation (2011-12 to 2014-15), public sector general insurance companies exhibited superior mean efficiency scores compared to the private sector insurers. The trend is reversed in the next two years (2015-16 and 2016-17). Decomposition of the profit efficiency into revenue and cost efficiency shows that during the entire observed period, public sector insurers performed better than the private sector counterparts in respect of mean revenue efficiency. However, this is not the case with mean cost efficiency.

Table 5

Efficiency variations across private and public sector general insurers

Category & Efficiency type	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Private Sector Revenue efficiency	0.9731	0.9409	0.9307	0.9011	0.9205	0.9834
Private Sector Cost efficiency	0.9608	0.9619	0.9698	0.9583	0.8984	0.9916
Private Sector Profit efficiency	0.9371	0.9080	0.9049	0.8677	0.8388	0.9758
Public Sector Revenue efficiency	0.9993	1	0.9941	0.9997	0.9854	0.9930
Public Sector Cost efficiency	0.9620	1	0.9548	0.9363	0.7776	0.8206
Public Sector Profit efficiency	0.9614	1	0.9501	0.9361	0.7673	0.8156

Source: Calculated.

4.1.2. Interval estimation of profit efficiency

As mentioned earlier, DEA provides us with point estimates of efficiency and interval estimates can not be obtained. In order to overcome this problem, we have applied the bootstrap technique for getting interval estimation of efficiency. However, in the present context, the conditional density has bounded support over the interval (0,1) and is right discontinuous at 1. Consequently, the naive bootstrap method would have provided inconsistent estimates of efficiency. Accordingly, we have used smoothed bootstrap technique outlined in Simar and Wilson (1998) to generate lower and upper bounds of profit, revenue and cost efficiency scores for the period under observation. The bootstrap-based mean estimates of profit, revenue and cost are, however, not significantly different from the point estimates and consequently not reported. Table 6 provides the lower and upper bounds of profit efficiency, Table 7 provides the lower and upper bounds of revenue efficiency and table 8 provides the lower and upper bounds of cost-efficiency. The insurer wise details about profit, revenue and cost efficiency lower and upper bounds are presented in Tables A7-A12.

Table 6

Mean lower and upper bounds of profit efficiency scores

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Profit efficiency (lower bound)	0.9326	0.9237	0.9038	0.8728	0.8016	0.9238
Profit efficiency (upper bound)	0.9547	0.9420	0.9278	0.8987	0.8346	0.9420

Source: Calculated.

Table 7

Mean lower and upper bounds of revenue efficiency scores

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Revenue efficiency (lower bound)	0.9692	0.9478	0.9366	0.9147	0.9233	0.9767
Revenue efficiency (upper bound)	0.9856	0.9662	0.9580	0.9381	0.9490	0.9912

Source: Calculated.

Table 8

Mean lower and upper bounds of cost efficiency scores

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Cost efficiency (lower bound)	0.9499	0.9629	0.9533	0.9395	0.8536	0.9237
Cost efficiency (upper bound)	0.9719	0.9813	0.9770	0.9649	0.8792	0.9421

Source: Calculated.

4.1.3. Scale efficiency and returns to scale

We have estimated profit efficiency in the present study based on the assumption that the profit function can not be globally CRS. Table 9 provides the local estimates of mean scale efficiency across ownership categories, while table A 13 (included in the appendix) presents the insurer wise scale efficiency scores. Table 10, on the other hand, provides summary information regarding returns to scale. Appendix table A14 provides detailed information regarding insurer wise returns to scale.

Table 9

Mean scale efficiency of public and private sector general insurers

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Private sector insurance companies	0.9538	0.9662	0.9534	0.9388	0.7217	0.9425
Public sector insurance companies	0.7832	0.6869	0.7344	0.6242	0.3240	0.7336
Overall	0.9083	0.8917	0.8950	0.8549	0.6156	0.8868

Source: Calculated.

Table 10

Returns to scale composition of the in-sample insurers

Particulars	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Number of insurers exhibiting CRS	4	4	3	4	2	5
Number of insurers exhibiting IRS	3	7	3	4	8	4
Number of insurers exhibiting DRS	8	4	9	7	5	6

Source: Calculated.

4.2. Linkage with contextual variables

In assessing the financial health of general insurers, there are two important and widely accepted indicators of performance: return on equity and solvency ratio. In the present part of the study, we explore the relationship of profit/revenue/cost efficiency scores (point estimates as well as lower and upper bounds of efficiency estimates) with the aforementioned contextual variables in terms of censored regression. Table 11 presents the regression results relating to profit efficiency estimates (mean, lower bound and upper bound of profit efficiency). Table 12 considers mean, lower bound and upper bound of revenue efficiency as

the dependent variables. Finally, table 13 represents the regression of cost efficiency estimates (mean, lower bound and upper bound) on the contextual variables.

The results indicate that the coefficients of both solvency ratio and return on equity are statistically significant at 95% level of confidence for the profit efficiency and cost efficiency regressions. This is along the expected lines. However, when we take point estimate or lower bound of revenue efficiency as the dependent variables, the coefficient of return on equity becomes statistically significant only at 91% level of confidence. Further, return on equity is not significant at all if we take the upper bound of revenue efficiency as the dependent variable.

Table 11

Profit efficiency regression

Dependent variable	Explanatory variable	Coefficient	Std. Error	Co-efficient/Standard error	p-value
Profit efficiency	Intercept	0.2381	0.1623	1.467	0.1425
	Solvency Ratio	0.3974	0.0925	4.297	<0.0001
	Return on Equity	0.2485	0.1199	2.071	0.0384
Profit efficiency lower bound	Intercept	0.2887	0.1659	1.741	0.0818
	Solvency Ratio	0.3724	0.0978	3.807	0.0001
	Return on Equity	0.2188	0.1126	1.942	0.0521
Profit efficiency upper bound	Intercept	0.4099	0.1429	2.869	0.0041
	Solvency Ratio	0.3151	0.0850	3.709	0.0002
	Return on Equity	0.1909	0.0947	2.017	0.0437

Source: Calculated.

Table 12

Revenue efficiency regression

Dependent variable	Explanatory variable	Coefficient	Std. Error	Co-efficient/Standard error	p-value
Revenue efficiency	Intercept	0.5722	0.1292	4.4291	<0.00001
	Solvency Ratio	0.2419	0.0674	3.5908	0.0003
	Return on Equity	0.1509	0.0871	1.7336	0.0830
Revenue efficiency lower bound	Intercept	0.5048	0.134451	3.754	0.0002
	Solvency Ratio	0.2747	0.0698	3.933	<0.0001
	Return on Equity	0.1691	0.0939	1.800	0.0719
Revenue efficiency upper bound	Intercept	0.6235	0.169256	3.684	0.0002
	Solvency Ratio	0.2683	0.0841	3.192	0.0014
	Return on Equity	0.1459	0.1274	1.146	0.2518

Source: Calculated.

Table 13

Cost efficiency regression

Dependent variable	Explanatory variable	Coefficient	Std. Error	Co-efficient/Standard error	p-value
Cost efficiency	Intercept	0.4301	0.1174	3.6639	0.00025
	Solvency Ratio	0.3170	0.0747	4.2464	0.00002
	Return on Equity	0.1715	0.07931	2.1618	0.03063
Cost efficiency lower bound	Intercept	0.3595	0.1239	2.902	0.0037
	Solvency Ratio	0.3528	0.0781	4.520	<0.0001
	Return on Equity	0.1875	0.0880	2.131	0.0330
Cost efficiency upper bound	Intercept	0.4951	0.1103	4.488	<0.0001
	Solvency Ratio	0.2872	0.0701	4.097	<0.0001
	Return on Equity	0.1568	0.0729	2.149	0.0316

Source: Calculated.

4. Conclusion and Policy Implications

The present study provides us with some important results about profit efficiency, which are important for SWOT analysis and future policy formulation. First, except for the last year under observation, mean profit efficiency has declined over the years. Decomposition of profit efficiency into revenue and cost efficiency components shows that this is primarily due to a decline in mean revenue efficiency. Second, the decomposition of results across ownership categories shows that the private sector general insurers have a higher mean profit efficiency than their public sector counterparts. However, the public sector general insurers have done better than the private sector insurance companies in terms of revenue efficiency but done badly in respect of cost-efficiency. Third, estimation of local returns to scale reveals, that all the public sector general insurance companies have exhibited decreasing returns to scale and the mean scale efficiency of the public sector insurers is much lower than the private insurers. Fourth, there is a strong linkage of profit efficiency with solvency and return on equity. These outcomes facilitate the process of identification of the industry leaders and laggards and the restructuring initiatives for the general insurers with weak financial health.

In the present study, we have considered a quantity-based model of profit efficiency where input and output prices are considered as given during the period of analysis. As a consequence, the possibility of improvement by considering the price factor can not be captured in the present framework. Future research studies may take into cognisance of this issue and proceed accordingly.

References

Alhassan, A. L., Biekpe, N. (2015). Efficiency, Productivity and Returns to Scale Economies in the Non-life Insurance Market in South Africa. – The Geneva Papers on Risk and Insurance-issues and Practice, 40(3), pp. 493-515.

Barros, C. P., Nektarios, M., Assaf, A. (2010). Efficiency in the Greek insurance industry. – European Journal of Operational Research, 205(2), pp. 431-436.

Berger, A. N., Hanweck, G. A., Humphrey, D. B.(1987). Competitive viability in banking: scale, scope, and product mix economies. – Journal of Monetary Economics, 20, pp. 501-520.

Chambers, R., Chung, Y., Färe, R. (1998). Profit, directional distance functions, and Nerlovian efficiency. – Journal of Optimization Theory and Applications, 98(2), pp. 351-364.

Cherchye, L., Kuosmanen, T., Leleu, H. (2010). Technical and economicefficiency measures under short run profit maximising behavior. – Res. Econom. Louvain, 76(2), pp. 163-173.

Choi, B., Weiss, M. A. (2005). An empirical investigation of market structure, efficiency, and performance in property-liability insurance. – Journal of Risk and Insurance, 72(4), pp. 635-673.

Cummins, J. D., Xie, X. (2013). Efficiency, productivity and scale economies in the U.S. property-liability insurance industry. – Journal of Productivity Analysis, 39(2), pp. 141-164.

Eling, M., Luhnen, M. (2010). Frontier Efficiency Methodologies to Measure Performance in the Insurance Industry: Overview, Systematisation, and Recent Developments. – The Geneva Papers on Risk and Insurance – Issues and Practice, 35(2), pp. 217-265.

Färe, Rolf and Primont, Daniel (1995). Multi-Output Production and Duality: Theory and Applications. Boston, USA, Kluwer.

Färe,R., Xinju, H., Sungko, L., Zelenyuk, V. (2019). A Unifying Framework for Farrell Profit Efficiency Measurement. – Operations Research, https://doi.org/10.1287/opre.2018.1770.

Farrell, M. J. (1957). The Measurement of Productive Efficiency. – Journal of The Royal Statistical Society, Series A, General, 120(3), pp. 253-281.

Ferro, G., León, S. A. (2017). Stochastic Frontier Analysis of Efficiency in Argentina's Non-Life Insurance Market. – Geneva Papers on Risk and Insurance – Issues and Practice, 43 (1), pp. 158-174.

Fukuyama, H., Weber, W. L. (2001). Efficiency and Productivity Change of Non-Life Insurance Companies in Japan. – Pacific Economic Review, 6(1), pp. 129-146.
Ilyas, A. M., Rajasekharan, S. (2019a). An empirical investigation of productivity and efficiency in the Indian non-life insurance market. – Benchmarking: An International Journal.
Ilyas, A. M., Rajasekharan, S. (2019b). Productivity of the Indian non-life insurance sector: New evidence using Fare-Primont index approach. – International Journal of Productivity and Performance Management.
Jarraya, B., Bouri, A. (2013). Efficiency concept and investigations in insurance industry: A survey. – Management Science Letters, 3, pp. 69-81.
Jarraya, B., Bouri, A. (2014). Optimal Production Plan and Profit Efficiency in European Non-Life Insurance Companies. – Procedia Economics and Finance, 13, pp. 69-81.
Kao, C., Hwang, S. N. (2008). Efficiency decomposition in two-stage data envelopment analysis: an application to non-life insurance companies in Taiwan. – European Journal of Operational Research, 185(1), pp. 418-429.
Lee, H., Chambers, R. (1986). Expenditure Constraints and Profit Maximization in U.S. Agriculture. – American Journal of Agricultural Economics, 68(4), pp. 857-865.
Mahlberg, B., Url, T. (2010). Single Market effects on productivity in the German insurance industry. – Journal of Banking & Finance, 34(7), pp. 1540-1548.
Mcfadden, D. (1978). Cost, Revenue and Profit Functions. – In: Melvyn Fuss and Daniel Mcfadden. (eds.). Production Economics: A Dual Approach to Theory and Applications, Amsterdam, North Holland.
Nerlove, M. (1965). Estimation and identification of Cobb-Douglas production functions. Rand McNally Company, Chicago, Illinois.
Portela, M. C. S. A., Thanassoulis, E. (2005). Profitability of a sample of Portuguese bank branches and its decomposition into technical and allocative components. – European Journal of Operational Research, 162(3), pp. 850-860.
Portela, M. C. S. A., Thanassoulis, E. (2007). Developing a Decomposable Measure of Profit Efficiency Using DEA. – The Journal of the Operational Research Society, 58(4), pp. 481-490.
Shephard, R. W. (1953). Cost and Productions. Princeton: Princeton University Press.
Shephard, R. W. (1970). Theory of Cost and Productions. Princeton: Princeton University Press.
Simar, L., Wilson, P. W. (1998). Sensitivity Analysis of Efficiency Scores: How to Bootstrap in Nonparametric Frontier Models. – Management Science, 44(1), pp. 49-61.
Toivanen, O. (1997). Economies of scale and scope in the Finnish non-life insurance industry. – Journal of Banking & Finance, 21(6), pp. 759-779.
Varian, H. R. (1990). Goodness-of-fit in optimising models. – Journal of Econometrics, 46(1-2), pp. 125-140.
Yang, Z. (2006). A two-stage DEA model to evaluate the overall performance of Canadian life and health insurance companies. – Mathematical and Computer Modelling, 43(7-8), pp. 910-919.

Table A1

Descriptive statistics of profit efficiency for the in-sample period

Insurer	Profit Efficiency	Standard Deviation
Bajaj Allianz	0.9858	0.0348
Cholamandalam	0.9027	0.0947
Future Generali	0.7653	0.2419
HDFC Ergo	0.8921	0.1104
ICICI Lombard	1.0000	0.0000
IFFCO Tokio	1.0000	0.0000
Reliance	0.6901	0.1115
Royal Sundaram	0.7769	0.1612
SBI General	0.9999	0.0002
Shri Ram General	0.9600	0.0980
Tata AIG	0.9862	0.0337
National	0.9342	0.1023
New India	1.0000	0.0000
Oriental	0.7495	0.1851
United	0.9366	0.0988

Source: Calculated.

Table A2

Descriptive statistics of revenue efficiency for the in-sample period

Insurer	Revenue Efficiency	Standard Deviation
Bajaj Allianz	0.9947	0.0130
Cholamandalam	0.9492	0.0595
Future Generali	0.8272	0.2239
HDFC Ergo	0.9260	0.0847
ICICI Lombard	1.0000	0.0000
IFFCO Tokio	1.0000	0.0000
Reliance	0.8099	0.0654
Royal Sundaram	0.8893	0.0732
SBI General	0.9999	0.0002
Shri Ram General	0.9647	0.0865
Tata AIG	0.9968	0.0080
National	0.9972	0.0052
New India	1.0000	0.0000
Oriental	0.9895	0.0104
United	0.9944	0.0103

Source: Calculated.

Table A 3

Descriptive statistics of cost efficiency for the in-sample period

Insurer	Cost Efficiency	Standard Deviation
Bajaj Allianz	0.9908	0.0225
Cholamandalam	0.9492	0.0475
Future Generali	0.9151	0.0704
HDFC Ergo	0.9610	0.0352
ICICI Lombard	1.0000	0.0000
IFFCO Tokio	1.0000	0.0000
Reliance	0.8392	0.1456
Royal Sundaram	0.8571	0.1251
SBI General	1.0000	0.0000
Shri Ram General	0.9940	0.0147
Tata AIG	0.9893	0.0263
National	0.9360	0.0994
New India	1.0000	0.0000
Oriental	0.7548	0.1836
United	0.9402	0.0943

Source: Calculated.

Table A4

Insurer wise Profit efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9147	1	1
Cholamandalam	0.9614	0.8141	0.7977	1	0.8427	1
Future Generali	0.8489	0.7877	0.9997	0.5466	0.4087	1
HDFC Ergo	0.8954	0.9212	0.8227	0.7133	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.6743	0.7230	0.7385	0.6797	0.4940	0.8313
Royal Sundaram	0.9277	0.7418	0.8353	0.7724	0.4823	0.9021
SBI General	1	1	1	1	0.9995	1
Shri Ram General	1	1	0.7599	1	1	1

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Tata AIG	1	1	1	0.9174	1	1
National	1	1	1	1	0.7887	0.8165
New India	1	1	1	1	1	1
Oriental	0.8456	1	0.8003	0.7442	0.4538	0.6529
United	1	1	1	1	0.8267	0.7929

Source: Calculated.

Table A5

Insurer wise Revenue efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9681	1	1
Cholamandalam	0.9918	0.9018	0.8573	1	0.9442	1
Future Generali	0.9871	0.8807	1	0.6047	0.4909	1
HDFC Ergo	0.9505	0.9534	0.8683	0.7837	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.7771	0.7760	0.8103	0.7236	0.8916	0.8810
Royal Sundaram	0.9980	0.8377	0.9133	0.8514	0.7993	0.9361
SBI General	1	1	1	1	0.9995	1
Shri Ram General	1	1	0.7882	1	1	1
Tata AIG	1	1	1	0.9805	1	1
National	1	1	1	1	0.9870	0.9964
New India	1	1	1	1	1	1
Oriental	0.9971	1	0.9766	0.9987	0.9800	0.9843
United	1	1	1	1	0.9746	0.9915

Source: Calculated.

Table A6

Insurer wise Cost efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9449	1	1
Cholamandalam	0.9694	0.9027	0.9305	1	0.8926	1
Future Generali	0.8599	0.8944	0.9997	0.9039	0.8326	1
HDFC Ergo	0.9420	0.9662	0.9474	0.9102	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.8676	0.9317	0.9114	0.9394	0.5540	0.8313
Royal Sundaram	0.9295	0.8856	0.9146	0.9072	0.6035	0.9021
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.9641	1	1	1
Tata AIG	1	1	1	0.9357	1	1
National	1	1	1	1	0.7992	0.8165
New India	1	1	1	1	1	1
Oriental	0.8481	1	0.8195	0.7452	0.4631	0.6529
United	1	1	1	1	0.8483	0.7929

Source: Calculated.

Table A7

Insurer wise lower bound of Profit efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.8850	0.8194	1
Cholamandalam	0.9340	0.7868	0.7707	1	1	1
Future Generali	0.8229	0.7616	0.9707	0.5198	0.7522	1
HDFC Ergo	0.8654	0.8938	0.7943	0.6860	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	0.3395	1
Reliance	0.6465	0.6953	0.7115	0.6507	0.6118	0.8026
Royal Sundaram	0.9030	0.7174	0.8075	0.7439	0.4576	0.8716
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.7289	1	1	1
Tata AIG	1	1	1	0.8905	0.7275	1
National	1	1	1	1	0.7436	0.7900
New India	1	1	1	1	1	1
Oriental	0.8171	1	0.7740	0.7159	0.7224	0.6276
United	1	1	1	1	0.8499	0.7657

Source: Calculated.

Table A8

Insurer wise lower bound of Revenue efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9383	1	1
Cholamandalam	0.9648	0.8760	0.8288	1	0.9168	1
Future Generali	0.9586	0.8515	1	0.5795	0.4603	1
HDFC Ergo	0.9254	0.9282	0.8406	0.7562	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.7486	0.7490	0.7842	0.6969	0.8645	0.8540
Royal Sundaram	0.9713	0.8122	0.8864	0.8255	0.7738	0.9072
SBI General	1	1	1	1	0.9724	1
Shri Ram General	1	1	0.7594	1	1	1
Tata AIG	1	1	1	0.9540	1	1
National	1	1	1	1	0.9600	0.9692
New India	1	1	1	1	1	1
Oriental	0.9693	1	0.9504	0.9699	0.9546	0.9568
United	1	1	1	1	0.9466	0.9635

Source: Calculated.

Table A9

Insurer wise lower bound of Cost efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9179	1	1
Cholamandalam	0.9440	0.8771	0.9057	1	0.8671	1
Future Generali	0.8311	0.8661	0.9718	0.8783	0.8059	1
HDFC Ergo	0.9134	0.9384	0.9212	0.8832	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.8410	0.9036	0.8843	0.9125	0.5246	0.8039
Royal Sundaram	0.9011	0.8588	0.8862	0.8738	0.5773	0.8730
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.9389	1	1	1
Tata AIG	1	1	1	0.9092	1	1
National	1	1	1	1	0.7722	0.7888
New India	1	1	1	1	1	1
Oriental	0.8182	1	0.7912	0.7180	0.4361	0.6249
United	1	1	1	1	0.8210	0.7648

Source: Calculated.

Table A10

Insurer wise upper bound of Profit efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1.0000	1	1	0.9425	0.8746	1
Cholamandalam	0.9885	0.8424	0.8250	1	1	1
Future Generali	0.8772	0.8148	1	0.5747	0.8065	1
HDFC Ergo	0.9229	0.9511	0.8493	0.7419	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	0.3943	1
Reliance	0.7026	0.7502	0.7639	0.7056	0.6669	0.8563
Royal Sundaram	0.9583	0.7721	0.8640	0.8012	0.5125	0.9279
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.7871	1	1	1
Tata AIG	1	1	1	0.9430	0.7845	1
National	1	1	1	1	0.7997	0.8440
New India	1	1	1	1	1	1
Oriental	0.8716	1	0.8274	0.7715	0.7748	0.6822
United	1	1	1	1	0.9048	0.8199

Source: Calculated.

Table A11

Insurer wise upper bound of Revenue efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	1	1	0.9954	1	1
Cholamandalam	1	0.9318	0.8834	1	0.9719	1
Future Generali	1	0.9052	1	0.6347	0.5181	1
HDFC Ergo	0.9793	0.9811	0.8957	0.8120	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.8047	0.8065	0.8371	0.7516	0.9187	0.9064
Royal Sundaram	1	0.8680	0.9407	0.8781	0.8269	0.9619
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.8136	1	1	1
Tata AIG	1	1	1	1	1	1
National	1	1	1	1	1	1
New India	1	1	1	1	1	1
Oriental	1	1	1	1	1	1
United	1	1	1	1	1	1

Source: Calculated.

Table A12

Insurer wise upper bound of Cost efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1.0000	1	1	0.9708	1	1
Cholamandalam	0.9976	0.9324	0.9569	1	0.9206	1
Future Generali	0.8853	0.9217	1	0.9314	0.8623	1
HDFC Ergo	0.9686	0.9920	0.9749	0.9387	1	1
ICICI Lombard	1	1	1	1	1	1
IFFCO Tokio	1	1	1	1	1	1
Reliance	0.8935	0.9602	0.9393	0.9677	0.5794	0.8594
Royal Sundaram	0.9566	0.9125	0.9422	0.9329	0.6336	0.9305
SBI General	1	1	1	1	1	1
Shri Ram General	1	1	0.9934	1	1	1
Tata AIG	1	1	1	0.9612	1	1
National	1	1	1	1	0.8272	0.8439
New India	1	1	1	1	1	1
Oriental	0.8761	1	0.8481	0.7702	0.4906	0.6785
United	1	1	1	1	0.8746	0.8185

Source: Calculated.

Table A13

Insurer wise scale efficiency scores

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	1	0.9280	0.9991	0.8503	0.7604	1
Cholamandalam	0.9952	0.9920	0.9993	1	0.6698	0.9533
Future Generali	0.9091	0.9399	0.7355	0.9253	0.7190	0.7266
HDFC Ergo	0.9839	1	0.9906	0.9922	0.6717	1
ICICI Lombard	0.7415	0.8011	0.8410	0.8064	1	0.9452
IFFCO Tokio	0.8892	1	1	1	1.0000	1
Reliance	0.9761	0.9729	0.9653	0.9405	0.7463	0.9644
Royal Sundaram	0.9969	0.9947	0.9675	0.8854	0.6566	0.9025
SBI General	1	1	1	1	0.4262	1
Shri Ram General	1	1	0.9894	1	0.5921	1
Tata AIG	1	1	1	0.9271	0.6969	0.8752
National	0.7536	0.9280	0.6858	0.5922	0.3021	0.7360
New India	0.7693	0.9920	0.6963	0.6058	0.2552	0.6710
Oriental	0.8508	0.9399	0.7908	0.7314	0.4316	0.7974
United	0.7591	1	0.7648	0.5672	0.3072	0.7298

Source: Calculated.

Table A14

Insurer wise returns to scale

Insurer	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bajaj Allianz	Constant	Decreasing	Decreasing	Decreasing	Decreasing	Constant
Cholamandalam	Increasing	Increasing	Increasing	Constant	Increasing	Increasing
Future Generali	Increasing	Increasing	Increasing	Increasing	Increasing	Increasing
HDFC Ergo	Decreasing	Increasing	Decreasing	Increasing	Increasing	Constant
ICICI Lombard	Decreasing	Decreasing	Decreasing	Decreasing	Constant	Decreasing
IFFCO Tokio	Decreasing	Constant	Constant	Constant	Constant	Constant
Reliance	Decreasing	Decreasing	Decreasing	Decreasing	Increasing	Decreasing
Royal Sundaram	Increasing	Increasing	Increasing	Increasing	Increasing	Increasing
SBI General	Constant	Constant	Constant	Constant	Increasing	Constant
Shri Ram General	Constant	Constant	Decreasing	Constant	Increasing	Constant
Tata AIG	Constant	Constant	Constant	Increasing	Increasing	Increasing
National	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing
New India	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing
Oriental	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing
United	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing	Decreasing

Source: Calculated.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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IMPACT OF TRANSPORT AND TECHNOLOGICAL INFRASTRUCTURE IN ATTRACTING FDI IN PAKISTAN[3]

This study analyzes the long run and short-run impact of transportation and technological infrastructure in attracting FDI in Pakistan, while transportation infrastructure is disaggregated into roads, rail, and air transport, and technological infrastructure is disaggregated into telecommunication, oil, and power consumption. The study uses annual time series data of Pakistan from 1973 to 2018 and applies the ARDL bounds testing approach for analysis. Results show that all the indicators of infrastructure, i.e. roads, railways, air transport, telecommunication infrastructure, power and oil consumption, have a positive and statistically significant impact on FDI in the long run. Oil and power consumption shows a greater impact on FDI because foreign investors associate the country's development with its energy consumption. Transport infrastructure needs more improvement and development to facilitate foreign investments in the country. Government, as well as the private sector, has to pay attention to improving infrastructure facilities not only to fetch more FDI but for the economic progress of the country. Investment in infrastructure is required to provide better and efficient transport and technological infrastructure to facilitate the production process.
Keywords: FDI; Infrastructure; Transportation; Technology; Pakistan
JEL: C32; F21; O18

1. Introduction

The process of openness of economies and globalization in the world has brought more investments to developing countries. FDI is a key factor in the development of an economy as it is a source of finances and stimulate economic growth (Khadaroo, Seetanah, 2009). FDI reduces the technological, financial and skill deficits in developing countries. The main benefits of FDI to the developing nations include an increase in employment, productivity

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and capital formation, improvements in technology, infrastructure, skills development, export participation and market access. Recognizing the importance of FDI, developing countries have started to improve their policies which are inhibiting investments and have been moving towards more liberal investments and trade regimes (Singh et al., 2008).

There are a number of factors that determine FDI inflows in an economy, among those factors, infrastructure is an important and crucial factor, which determines FDI by influencing the desirability of location decisions for foreign firms. Infrastructure is defined as economic arteries and veins. It includes roads networks, ports, railways, power lines and pipes, telecommunications, education, health and sanitation. Infrastructure is the basic structure required for the proper functioning of an economy. It is an important component of an economy required for its development and is also considered as one of the macroeconomic indicators of economic growth (Fitrandi et al., 2014). Infrastructure is not only required for a country to grow, but it also helps to attract more investments in the economy and is considered as the pre-condition for both economic growth and attracting FDI (Pradhan et al., 2013). The growing importance of infrastructure and its association with FDI and economic growth have grabbed the attention of researchers and policymakers from the last few decades.

Better infrastructure like a well-developed communication system, roads network, provision of electricity reduces the cost of doing business by reducing delivery time, lowering labour cost and better communication (Kinda, 2010). Adequate infrastructure facilitates not only foreign investment, but also domestic investments in the economy. An efficient infrastructure attracts foreign investors to run their business smoothly and facilitates the production process and results in an increase in employment as well, thus helping both consumers and producers and improves the quality of life (Rehman et al., 2011). Among different components of infrastructure; advancement in transportation, telecommunication and technological infrastructure is of great importance and required to maintain the economic progress and competitiveness of a country.

Transportation infrastructure is considered as one of the important components of an economy because economic opportunities are generally related to the mobility of people, goods, and information. According to Robbins and Perkins (2012), foreign investors associate the level of a country's economic development with the modernized transport system. Investors are likely to invest in the countries, having efficient transport system, which lowers the cost of production and easy access to markets (Saidi, 2016). Efficient transport infrastructure and high connectivity of roads and railway networks are associated with economic development and prosperity. However, technological infrastructure is also an important factor for the development of an economy. Technological infrastructure mainly includes power generation and telecommunications. A stable communication between the host country and investors is required for increasing business and trade, which increases investment opportunities and economic prosperity. During the last few years, the telecommunication sector was the major recipient of FDI in Pakistan (Zeb et al., 2014). Continuous advancement in technological infrastructure helps a country to upgrade its industries and production as well as to face the challenges of the global economy. Another component of technology infrastructure is power generation which is also a major issue in Pakistan as electricity shortfalls affect the production process and all other sectors and industries of the economy, which makes investors hesitant to invest (Talat, Zeeshan, 2013).

Transportation infrastructure is considered as a backbone of strong and dynamic economies (Quazi, 2007). Governments of developed nations use significant portions of their budget in improving transportation infrastructure. But the cost of these projects is too high for developing and less developed nations because they do not have sufficient funds to complete the projects on their own. So, they require foreign investments for the improvement of their infrastructure for the proper functioning of the economy. Attracting more FDI in India fosters transport infrastructure and increases economic growth (Pradhan et al., 2013). Being a developing country, Pakistan also requires foreign investments to cope up with the resource gap and maintain economic growth. The literature had shown infrastructure as a determinant of FDI, but the association of FDI with transport and technological infrastructure in Pakistan is not focused much. This study explores the long run and short-run impact of transportation and technological infrastructure in attracting FDI in Pakistan. However, transportation infrastructure is disaggregated into roads, rail, and air transport, while technological infrastructure is disaggregated into telecommunication, oil and power consumption.

The rest of the study is structured in the following manner. Previous literature is discussed in section 2. Methodology and data are described in section 3. Results are analyzed in section 4. Section 5 contains a conclusion and policy recommendations.

2. Literature Review

Asiedu (2002) examined the determinants of FDI in seventy developing countries from 1988 to 1997. The results showed that infrastructure, trade openness and high return on investments positively increase FDI inflows. Moreover, infrastructural developments and high returns have positively affected FDI in non-SSA countries and are insignificant in SSA countries. Shah et al. (2004) studied the role of infrastructure as a determinant of foreign direct investment in Pakistan from 1960 to 2000. The results suggested that infrastructural provision has positive effects on inward FDI. However, infrastructure had a significant relationship with the investment opportunities, thus attracting FDI in the country. Sahoo (2006) identified the determinants of FDI by using data on market size, labour force, growth rate, infrastructure index and trade openness from 1975 to 2003 for South Asian countries. The results of the study depicted that transportation infrastructure attracts more FDI to developing countries.

Quazi (2007) studied investment climate and determinants of FDI in Latin America for 9 countries from 1995 to 2004. The study revealed that better infrastructure along with trade openness, high return and familiarity of investors with host country significantly increases FDI inflows and lack of economic freedom decreased FDI inflows. Khadaroo and Seetanah (2009) investigated the link between transport infrastructure and FDI in African countries from 1984 to 2002. Results showed that transport capital had a positive and significant effect on FDI, while the countries with improved transport and infrastructure had significantly attracted more investment. Kinda (2010) explored the effect of infrastructure and financial development on foreign investments from 1970 to 2003 for fifty-eight developing countries. Results indicated that an increase in physical infrastructure mainly communication infrastructure positively affected FDI inflows in SSA countries.

Babatunde (2011) explored the interaction between trade, infrastructure, foreign direct investment and economic using unbalanced panel data for forty-two SSA countries from 1980 to 2003. Results depicted that trade openness had a positive and significant relationship with infrastructural development and FDI, which helped to increase economic growth. Rehman et al. (2011) studied the role of infrastructure in attracting FDI in Pakistan from 1975 to 2008 by using the ARDL approach. The results showed that infrastructure positively attracted foreign direct investment both in the short and long run. Barzelaghi et al. (2012) investigated the role of transportation infrastructure, trade intensity and market size in FDI attraction in Iran from 1974 to 2007. Results of cointegration indicated that transport infrastructure positively and significantly affected FDI in the long run, but no significant impact was seen in the short run.

Sharma et al. (2012) analyzed the determinants of FDI in Malaysia from 1971 to 2004. The results depicted a positive impact of physical infrastructure on FDI in the short run only, while in the long run, FDI and the quality of physical infrastructure were negatively related. Ab et al. (2013) studied the determinants of FDI inflows in developing countries using panel data from1982 to 2008 for thirty-two developing countries. Results depicted that infrastructure had a positive impact on FDI attraction except for trade openness which did not show a strong influence on FDI. Lodhi et al. (2013) investigated the factors that affected FDI in Pakistan from 1976 to 2010. The result showed that the coefficient of electricity generation was highly significant and positively related to the inflow of FDI in Pakistan.

Pradhan et al. (2013) analyzed the long-run relationship between transport infrastructure, foreign direct investment and economic growth in India from 1970 to 2012. Results showed the presence of long-run relationships between transport infrastructure, FDI and GDP. However, there was bidirectional causality between FDI and economic growth, while transport infrastructure showed one-way causality to FDI and economic growth. Zafar (2013) examined the factors affecting foreign direct investment in Pakistan, India and Bangladesh from 1991 to 2010. The study found that infrastructure is statistically significant in bringing FDI in India but insignificant in Pakistan. Nourzad et al. (2014) analyzed the interaction between foreign direct investment and infrastructure in forty-six countries from 1980 to 2000. The findings indicated that all three types of infrastructure, i.e. telecommunication, power generation, and roads or highways helped to improve the marginal effect of FDI on real income.

Fitrandi et al. (2014) examined the relationship between infrastructure development and FDI inflows in thirty provinces of Indonesia from 2000 to 2009. The results showed that the coefficients of all proxies to infrastructure development were significantly positive and the provinces with the higher level of infrastructure were associated with more FDI inflows. Wekesa et al. (2016) studied the effects of transport, energy, communication and water and waste infrastructure on inward FDI in Kenya from 1970 to 2013. Results showed a positive impact of transport infrastructure on FDI inflows. Saidi (2016) analyzed the impact of road transport on the economic growth through its role in attracting foreign direct investment to Tunisia from 1975 to 2014. The results demonstrated that if the total size of the road network in Tunisia increases, then the volume of FDI inflows increases as well, while economic growth has a significant impact on FDI inflows in Tunisia.

Anarfo et al. (2017) examined the role of infrastructural development and natural resources in FDI attraction in Ghana from 1975 to 2014. Results showed that infrastructural development and natural resources play a positive and significant role in attracting FDI in Ghana. Och et al. (2017) studied the factors influencing FDI inflows from 1994 to 2014. Results revealed that infrastructure measured as length of paved roads did not show a significant impact on FDI in either short or long run. Ozcan (2018) examined the impact of transport infrastructure and services on foreign direct investment (FDI) to Turkish provinces from 2000 to 2010. Results suggested that an increase in air traffic and road density have a positive and significant impact on FDI in turkey.

Yousaf and Erum (2018) investigated the impacts of infrastructure on domestic investment from 1975 to 2013. Results showed that length of roads, telephone lines and GDP have a positive and significant impact on investments, while inflation and interest rate have a negative impact on investments. Jaiblai and Shenai (2019) explored the determinants of FDI in ten Sub-Saharan economies from 1997 to 2017. Findings of the study revealed that better infrastructure, smaller markets, higher openness and depreciation in the exchange rate attracted more FDI in the Sub Saharan economies.

The literature has shown infrastructure as a major determinant of FDI. Existing literature can be divided into two strands; one showed a significant impact of infrastructure in attracting FDI, while the other strand showed no significant impact of infrastructure on FDI. However, few studies are conducted in Pakistan to examine the impact of transport and technological infrastructure on FDI attraction. The present study fills the gap in the existing literature by analyzing the impact of different indicators of transport and technological infrastructure on FDI attraction in Pakistan.

3. Methodology and Data

The relationship between FDI and infrastructure is examined by a number of studies that showed FDI as a function of infrastructure and other variables, i.e. domestic market size, political risk, inflation rate, economic openness, human capital, exchange rate, taxes, and cost of labour (Aseidu, 2002; Sahoo, 2006; Jameel and Khadaroo, 2009; Rehman et al., 2011; Fitrandi et al., 2014; Wekesa et al., 2016; Anarfo et al., 2017 and Och et al., 2017). However, following Wekesa et al. (2016), this study includes major social, economic and political factors as determinants of FDI. Hence, the model becomes:

$$FDI= f (GDPPCG, CF, TO, INF, ER, INFRA)$$

where, FDI is foreign direct investment, GDPPCG is GDP per capita growth as a proxy for market size, CF is capital formation, TO is trade openness, INF is the inflation rate, ER is the exchange rate, and INFRA is infrastructure.

This study disaggregates infrastructure into transportation infrastructure and technological infrastructure. However, to get an even better picture of infrastructure on FDI, transportation infrastructure is further disaggregated into roads, railways, and air transport, while technological infrastructure is further disaggregated into telecommunication, oil

consumption, and power consumption. Hence, the study estimates the following nine econometric models:

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 ROADS_t + \varepsilon_t \quad (1)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 RAIL_t + \varepsilon_t \quad (2)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 AIR_t + \varepsilon_t \quad (3)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 TRANSI_t + \varepsilon_t \quad (4)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 TELE_t + \varepsilon_t \quad (5)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 POWER_t + \varepsilon_t \quad (6)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 OIL_t + \varepsilon_t \quad (7)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 TECHI_t + \varepsilon_t \quad (8)$$

$$FDI_t = \alpha_o + \alpha_1 GDPPCG_t + \alpha_2 CF + \alpha_3 TO_t + \alpha_4 INF_t + \alpha_5 ER_t + \alpha_6 TRANSI_t + \alpha_7 TECHI_t + \varepsilon_t \quad (9)$$

Where, FDI is foreign direct investment, GDPPCG is GDP per capita growth, CF is capital formation, TO is trade openness, INF is the inflation rate, ER is the exchange rate, ROADS is road transport measured as total length of roads in kilometres, RAIL is railways measured as goods transported million ton-km, AIR is air transport measured as freight carried million ton-km, TRANSI is composite transportation infrastructure index which includes roads, rail, and air transport, TELE is telecommunication infrastructure measured as a number of fixed telephone lines per 1000 people, POWER is power consumption measured as electricity power consumption (KWH per capita), OIL is oil consumption measured as kg of oil equivalent per capita, TECHI is composite technological infrastructure index which includes telecommunication, oil consumption and electricity consumption.

The first step in analyzing the time series data is to check the stationarity of the variables because if there is a unit root problem in data, the results are misleading. The most widely used tests for checking unit root are Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests. Dickey and Fuller (1981) gave Augmented Dickey-Fuller (ADF) test to check stationarity, while Phillips and Perron (1988) gave PP test for unit root. After stationarity tests, the cointegration between variables is checked. Engle and Granger (1987) and Johansen and Juselius (1990) methods for cointegration required the variables to have the same order of integration. However, Pesaran et al. (2001) introduced a technique of cointegration called Autoregressive Distributive Lag Model (ARDL), which is applicable on a mixture of variables, i.e. I(0) and I(1). ARDL bounds testing approach to cointegration has the assumptions that the dependent variable should be integrated of order I(I) and none of the variables should be integrated of order I(2). Error Correction Model (ECM) can be derived from ARDL by a simple linear transformation. The error correction term (ECT) shows short-run dynamics by maintaining the long-run information. The specification of ARDL model is as follows:

$$\Delta Y_t = \delta_o + \sum_{i=1}^{k} \Delta\alpha_i \, Y_{t-1} + \sum_{i=1}^{k} \Delta\beta_i \, X_{t-i} + \varphi_1 Y_{t-1} + \varphi_2 X_{t-1} + \varepsilon_{it}$$

where, Y is the dependent variable and X represents the explanatory variable. The terms with Δ on the right-hand side shows the first difference of the variables. α, and β represents the short-run dynamics while, φ_1 and φ_2 are the long-run coefficients showing a marginal change in the dependent variable, due to change in explanatory variables.

The following null hypothesis is tested for cointegration:

H_o: $\varphi_1 = \varphi_2 = 0$ (There is no co-integration)

H_1: $\varphi_1 \neq \varphi_2 \neq 0$ (There is cointegration)

F-statistics computed by ARDL bounds test is compared with the upper bounds and lower bounds. If the value of F-statistics falls outside the upper bounds than null hypothesis is rejected and there is cointegration between the variables. The value should not fall below lower bounds because, in that case, the null hypothesis is not rejected. But, if the value of F-statistics falls between the lower and upper bounds, then the results of the test will be inconclusive. Moreover, the causality among the variables is checked by the Granger causality test. Ganger (1988) presented a method for checking causality between variables.

Following Wekesa et al. (2016), this study constructs the composite transport and technological infrastructure index through principal component analysis (PCA) as:

$$\pi_i = W_1 X_{j1} + W_2 X_{j2} + \cdots + W_n X_{jn}$$

Where, π_i is the composite index for i^{th} category that is transportation index and technological index and W_i is the weight of the j^{th} indicator. PCA is used to identify a hidden pattern and the correlated variables in the dataset. It is used to reduce the original variables into a smaller number of variables explaining most of the variance in the original variables. Instead of including all the infrastructure variables in a single equation, indexes of transport and technological infrastructure are formulated to avoid the misleading results, due to the presence of correlation between the infrastructure variables.

The study uses annual time series data of Pakistan from 1973 to 2018. The data for foreign direct investment (FDI) inflow as a percentage of GDP, GDP per capita growth (GDPPCG), capital formation (CF) measured as total gross fixed capital formation as a percentage of GDP, inflation (INF) measured as GDP deflator annual percentage, the exchange rate (ER) measured as official exchange rate (LCU per $), and trade openness (TO) measured as total trade as a percentage of GDP are collected from Pakistan Economic Survey (various issues) published by Government of Pakistan. ROADS is road transport measured as a total length of roads in kilometres, RAIL is railways measured as goods transported million ton-km, AIR is air transport measured as freight carried million ton, TELE is telecommunication infrastructure measured as a number of fixed telephone lines per 1000 people, OIL is oil consumption measured as kg of oil equivalent per capita, POWER is power consumption measured as electricity power consumption (KWH per capita) are collected from Pakistan Economic Survey (various issues) as well. TRANSI is a composite transportation infrastructure index (which include roads, rail, and air transport) and TECHI is a composite technological infrastructure index (which include telecommunication, oil consumption and electricity consumption) are constructed through principal component analysis (PCA).

4. Results

The results of the ADF and PP tests are reported in table 1 and suggest that dependent variable FDI is integrated of order I(1), while the explanatory variables GDPPCG, capital formation, inflation, and rail are integrated of order I(0), while trade openness, roads, air, telecommunication infrastructure, oil consumption, power consumption, transport index and technology index are integrated of order I(1). Unit root tests revealed mix order of integration of variables. The results of both the tests show that none of the variables is integrated of order I(2).

Table 1

Results of ADF and PP Unit Root Tests

Variables	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)		Order of Integration	
	At Level	At 1st difference	At Level	At 1st difference	ADF	PP
FDI	-3.3446*	-4.4693***	-2.0351*	-4.4320***	I(I)	I(I)
GDPPCG	-4.9905***	----	-4.9873***	----	I(0)	I(0)
CF	-3.7181**	----	-3.7044**	----	I(0)	I(0)
TO	-2.6008	-7.6082*	-2.6397	-7.8468***	I(I)	I(I)
INF	-4.6457***	----	-4.6491***	----	I(0)	I(0)
ER	-1.8249	-4.2108*	-1.8884	-4.1224***	I(I)	I(I)
ROADS	0.6040	-4.0977**	0.5029	-3.9390***	I(I)	I(I)
RAIL	-3.8541**	----	-2.2898	-4.4169***	I(0)	I(I)
AIR	-1.6701	-5.6000***	-1.5302	-5.5704***	I(I)	I(I)
TELE	-2.6834	-3.7315***	-1.7885	-5.4007***	I(I)	I(I)
POWER	0.9842	-5.4228***	1.3951	-5.4172***	I(I)	I(I)
OIL	-3.1087	-4.3114***	-2.1796	-4.3114***	I(I)	I(I)
TRANSI	0.6301	-4.0875**	0.4803	-3.9288***	I(I)	I(I)
TECHI	-2.2925	-3.6557***	-1.6366	-5.3169***	I(I)	I(I)

*Note: ***, **, * shows significance at 1%, 5% and 10% respectively.*

To check the presence of cointegration, ARDL bound test is applied. The results of ARDL bound tests for all the models are reported in table 2 and show that the value of F-statistic in all the models fall above the upper bounds value at 1% level of significance. Hence, the null hypothesis of no cointegration between the variables is rejected, which implies that a long-run relationship exists between the variables.

The results of the long-run and short-run dynamics for all the models are shown in table 3, panel A and panel B, respectively. Results of the long run show that GDP per capita growth (GDPPCG) and inflation (INF) have a positive and significant impact on FDI in the long run in all the models. GDPPCG is positively related to FDI because investors are likely to invest in strong and healthy economies in order to earn more profits (Aseidu, 2002). Inflation has a significant positive impact on FDI because when there is an increase in FDI inflows, it exerts an upward pressure on the local currency, which affects the export industries negatively and lead towards an increase in inflation. The exchange rate (ER) shows a negative and significant impact on FDI, while a number of studies found similar results (Anarfo et al., 2017; Rehman et al., 2011; Zafar, 2013). Weak currencies pull in FDI because the rate of return by investing in weak currencies is greater than investing in strong currencies. Capital formation (CF) and trade openness (TO) have a statistically insignificant impact on FDI in

the long run, however, trade openness in models V and IX is negative and significant, which implies that trade openness is beneficial for FDI only if the trade is export-based.

Table 2

Bound Test for Total and Sectoral Oil, Coal, Gas and Electricity Consumption

Dependent Variable: FDI	F-Statistics	1 percent critical values Bound Test		Co-integration Exist
Model		I(0)	I(1)	
Model-I: $F_{(GDPPCG,TO,INF,ER,ROADS)}$ (1, 0, 2, 3, 2, 0, 0)*	5.3917	3.15	4.43	Yes
Model-II: $F_{(GDPPCG,TO,INF,ER,RAIL)}$ (1, 1, 1, 1, 0, 2, 1)*	5.3541	3.6	4.9	Yes
Model-III: $F_{(GDPPCG,TO,INF,ER,AIR)}$ (3, 1, 1, 3, 0, 3, 1)*	4.7113	2.66	4.05	Yes
Model-IV: impact of transport index on FDI $F_{(GDPPCG,TO,INF,ER,TRANSI)}$ (1, 0, 2, 0, 0, 2, 0)*	4.5465	2.66	4.05	Yes
Model-V: impact of telecommunication infrastructure on FDI $F_{(GDPPCG,TO,INF,ER,TELE)}$ (1, 1, 0, 0, 1, 3, 0)*	4.3903	2.66	4.05	Yes
Model-VI: impact of power consumption on FDI $F_{(GDPPCG,TO,INF,ER,POWER)}$ (1, 0, 1, 3, 2, 0, 0)*	4.9661	3.15	4.43	Yes
Model-VII: impact of oil consumption on FDI $F_{(GDPPCG,TO,INF,ER,OIL)}$ (1, 2, 2, 3, 0, 2, 1)*	6.0051	2.66	4.05	Yes
Model-VIII: impact of technology index on FDI $F_{(GDPPCG,TO,INF,ER,TECHI)}$ (1, 1, 1, 3, 0, 3, 1)*	5.4947	3.6	4.9	Yes
Model-IX: impact of transport and technology index on FDI $F_{(GDPPCG,TO,INF,ER,TRANSI,TECHI)}$ (1, 2, 1, 2, 1, 1, 2, 1)*	5.0250	2.96	4.26	Yes

**The model is not suffering from serial correlation, heteroscedasticity and specification error.*

The results of model-I show that roads (ROADS) have a positive and statistically significant effect on FDI in the long run, while Fitrandi et al. (2014), Jameel and Khadaroo (2009), Pradhan et al. (2013), Saidi (2016), and Wekesa et al. (2016) also found similar results. Roads have a positive impact on FDI because a good roads network decrease the cost of production by reducing delivery time and increasing the ease to transport goods from one place to another, thus attract more investors. Results of model-II and model-III show that railways and air transport have a positive and statistically significant impact on FDI. A better and efficient transportation by railways decrease the cost of transportation and attracts investors to invest in a country (Wekesa et al., 2016). Composite transportation infrastructure index (TRANSI) is incorporated in model-IV, which shows that the transportation index has a positive and statistically significant impact on FDI. Sahoo (2006) and Wekesa et al. (2016) also found similar results.

Table 3

Long Run and Short Run Dynamic of Transportation and Technological Infrastructure on FDI

Dependent Variable FDI									
Var	Model-I	Model-II	Model-III	Model-IV	Model-V	Model-VI	Model-VII	Model-VIII	Model-IX
Panel A: Long Run									
GDPPCG	0.1009*** (0.1816)	0.4319*** (0.1526)	0.4871** (0.1847)	1.1163*** (0.2953)	0.0219*** (0.1218)	0.5638*** (0.1104)	0.5812*** (0.1955)	0.3190** (0.1280)	0.7773*** (0.2124)
CF	-0.0691 (0.1986)	-0.0831 (0.1456)	-0.1182 (0.1222)	-0.2651 (0.1208)	0.3854 (0.1570)	-0.1820 (0.1007)	-0.3006 (0.3037)	0.0071 (0.2098)	-0.0044 (0.1295)
TO	0.0487 (0.0559)	0.0039 (0.0595)	-0.0686 (0.0646)	-0.0651 (0.0475)	-0.1278** (0.0668)	-0.0317 (0.0504)	0.1545 (0.0799)	-0.0598 (0.0551)	-0.1495* (0.0764)
INF	0.1009*** (0.0350)	0.2402*** (0.0576)	0.0929** (0.04124)	0.1291** (0.0489)	0.1678*** (0.0769)	0.0782*** (0.0274)	0.1117** (0.0473)	0.0462 (0.0637)	0.1767*** (0.0500)
ER	-0.0293** (0.0141)	-0.0973*** (0.0330)	0.0103*** (0.0030)	-0.0611*** (0.0173)	-0.0445** (0.0154)	-0.0527*** (0.0092)	-0.0402* (0.0220)	-0.0865** (0.0342)	-0.0340** (0.0148)
ROADS	0.0001*** (0.0000)	----	----	----	----	----	----	----	----
RAIL	----	0.0005** (0.0002)	----	----	----	----	----	----	----
AIR	----	----	0.0082*** (0.0029)	----	----	----	----	----	----
TRANSI	----	----	----	0.0001*** (0.0000)	----	----	----	----	0.0001* (0.0000)
TELE	----	----	----	----	0.0012* (0.0003)	----	----	----	----
POWER	----	----	----	----	----	0.0168*** (0.0022)	----	----	----
OIL	----	----	----	----	----	----	0.0250*** (0.0075)	----	----
TECHI	----	----	----	----	----	----	----	0.0008** (0.0003)	0.0009** (0.0004)
Panel B: Short Run ECM									
ECT(-1)	-0.4111*** (0.0421)	-0.3879*** (0.0395)	-0.4414*** (0.0535)	-0.3184*** (0.0382)	-0.2506*** (0.0287)	-0.5075*** (0.0568)	-0.3503*** (0.0412)	-0.4361*** (0.0431)	-0.4026*** (0.0437)

*Note: Standard errors are in parenthesis. ***, **, * shows significance at 1%, 5% and 10% respectively.*

The result of model-V shows that telecommunication infrastructure (TELE) has a positive and statistically significant impact on FDI. An efficient communication between hosts and investors is required for the smooth running of the business. Anarfo et al. (2017), Aseidu (2002), Fitrandi et al. (2014), Rehman et al. (2011), and Wekesa et al. (2016) also found similar results. The long-run results of model-VI and model-VII show that power consumption (POWER) and oil consumption (OIL) have a positive and statistically significant impact on FDI. Investors associate the level of development of a country with its energy consumption (Sahoo, 2006). Lodhi et al. (2013), Nourzad et al. (2014) and Wekesa et al. (2016) also found similar results. Composite technological infrastructure index is incorporated in model-VIII and shows that there is a positive and statistically significant impact of the technological index on FDI. Advancement in technology is required for efficient production (Sahoo, 2006). Results of model-IX show that both composite transport and technological indexes have a positive and statistically significant impact on FDI. However, the impact of the technological index is greater on FDI as compared to the transportation index. An efficient infrastructure facilitates the production process and attracts

foreign investors to invest in a country. These findings are similar to Fitrandi et al. (2014), Nourzad et al. (2014) and Wekesa et al. (2016).

Table 4

Results of Causality Test

Model	F-statistics	Causality
GDPPCG → FDI	1.7538	No
FDI → GDPPCG	2.9256**	Yes
Inflation → FDI	0.3161	No
FDI → Inflation	1.7257	No
ER → FDI	0.6978	No
FDI → ER	8.2830***	Yes
CF → FDI	0.1897	No
FDI → CF	4.9298**	Yes
TO → FDI	0.1073	No
FDI → TO	0.3958	No
Transport index → FDI	2.5194*	Yes
FDI → Transport index	0.9998	No
Technology index → FDI	7.5425***	Yes
FDI → Technology index	6.6128***	Yes
Railways → FDI	1.3189	No
FDI → Railways	6.2175***	Yes
Roads → FDI	3.2031**	Yes
FDI → Roads	0.9145	No
Air transport → FDI	2.4350*	Yes
FDI → Air transport	1.3419	No
Telecommunication infrastructure → FDI	6.5839***	Yes
FDI → Telecommunication infrastructure	6.8112***	Yes
Power consumption → FDI	2.1858*	Yes
FDI → Power consumption	5.8103***	Yes
Oil consumption → FDI	2.5329*	Yes
FDI → Oil consumption	3.4030**	Yes

*Note: ***, **, * shows significance at 1%, 5% and 10% respectively.*

The results of short-run dynamics by converting ARDL into ECM are reported in table 3, panel B and show that the value of ECT for all the models is negative and significant. The value reveals the speed of adjustment and negative sign shows convergence in the short run. In sum, results show that technological infrastructure shows a stronger impact on FDI as compared to transport infrastructure. Among transport infrastructure indicators, air transport affects FDI with a greater magnitude as compared to roads and railways. Among technological infrastructure indicators, oil consumption has a greater impact on FDI than telecommunication and power consumption, while the magnitude of the technological infrastructure index is greater than the transportation index. These results clearly demonstrate that oil and power consumption have a greater impact on FDI in the long run as compared to all other infrastructure indicators used in the analysis.

Results of the Granger causality test are reported in table 4. Results show the presence of unidirectional causality from FDI to per capita GDP growth, exchange rate, capital formation, and railway infrastructure. Unidirectional causality also exists from roads, air transport, and composite transport index to FDI. It implies that an increase in railways increases FDI

inflows, while for increasing roads and air transport FDI is required. However, bidirectional causality exists among telecommunication infrastructure, power consumption, oil consumption, composite technological index and FDI. It shows that not only improvements in technology infrastructure require foreign investments but also more investments are attracted in these sectors.

5. Conclusion

An efficient infrastructure facilitates domestic investment as well as attract foreign investors. Advancement in transportation and technological infrastructure is of great importance and are required to maintain the economic growth and competitiveness of a country. This study explores the long run and short-run impact of transportation and technological infrastructure in attracting FDI in Pakistan, while transportation infrastructure is disaggregated into roads, rail, and air transport, and technological infrastructure is disaggregated into telecommunication, oil and power consumption. The study uses annual time series data of Pakistan from 1973 to 2018 and applies the ARDL bounds testing approach for analysis.

The results of the study show that transport and technological infrastructure have a positive and significant impact on FDI in Pakistan. All the indicators of infrastructure, i.e. roads, railways, air transport, telecommunication infrastructure, power and oil consumption, have a positive and statistically significant impact on FDI in the long run. Among these indicators, oil consumption and power consumption show a greater impact on FDI because foreign investors associate the country's development with its energy consumption. The increase in market size and inflation encourages FDI inflows, while the trade openness and capital formation play an insignificant role in attracting FDI in the case of Pakistan. Granger causality test implies that the increase in railways increases FDI inflows, while FDI is required for increasing roads and air transport and bidirectional causality exists among telecommunication infrastructure, power consumption, oil consumption, technological index and FDI. An efficient and advanced transportation and technological infrastructure are required for economic prosperity. Among the number of infrastructure indicators used in the study; power and oil consumption are the factors that attract more FDI in Pakistan. More FDI is attracted in the energy sector rather than improvement of roads, railways and air transport. It implies that transport infrastructure needs more improvement and development to facilitate foreign investments in the country. In order to increase economic prosperity, infrastructure facilities should be improved. On the other hand, FDI is also required to improve infrastructure facilities in Pakistan.

Government, as well as the private sector, has to pay attention to improving infrastructure facilities not only to fetch more FDI but for the economic progress of the country. Investment in infrastructure is required to provide better and efficient transport and technological infrastructure to facilitate the production process.

References

Ab, Q., Muthiah, R., Irfan, S. (2013). Determinants of FDI Inflows to Developing Countries: A Panel Data Analysis. – Journal of International Business and Economy, 14(2), pp. 29-47.

Anarfo, B. E., Agoba, M. A., Abebreseh, R. (2017). Foreign Direct Investment in Ghana: The Role of Infrastructural Development and Natural Resources. – African Development Review, 29(4), pp. 574-588.

Asiedu, E. (2002). On the Determinants of Foreign Direct Investment to Developing Countries: Is Africa different?. – World Development, 30(1), pp. 107-119.

Babatunde, A. (2011). Trade Openness, Infrastructure, FDI and Growth in Sub Saharan African Countries. – Journal of Management Policy and Practice, 12(7), pp. 27-36.

Barzelaghi, T. M., Dizaji, M., Laleh, M. M. (2012). The Effect of Transportation Infrastructure on FDI attraction in Iran. – International Journal of Economics and Finance, 4(2), pp. 153-161.

Dickey, D. A., Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. – Econometrica, 49, pp. 1057-1072.

Engle, R. F., Granger, C. (1987). Co-integration and error correction: representation, estimation and testing. – Econometrica, 55(2), pp. 251-276.

Fitriandi, P., Kakinaka, M., Kotani, K. (2014). Foreign direct investment and infrastructure development in Indonesia: Evidence from province level data. – Asian Journal of Empirical Research, 4(1), pp. 71-94.

Granger, C. (1988). Some recent developments in a concept of causality. – Journal of Econometrics, 39, pp. 199-211.

Jaiblai, P., Shenai, V. (2019). The Determinants of FDI in Sub-Saharan Economies: A Study of Data from 1990-2017. – International Journal of Financial Studies, 7(43), pp. 1-31.

Johansen, S., Juselius, K. (1990). Maximum Likelihood Estimation and Inference on Co-integration with application for the Demand for Money. – Oxford Bulletin of Economics and Statistics, 52(2), pp. 169-210.

Khadaroo, J., Seetanah, B. (2009). The Role of Transport Infrastructure in FDI: Evidence from Africa using GMM Estimates. – Journal of Transport Economics and Policy, 43(3), pp. 365-384.

Kinda, T. (2010). Increasing Private Capital Flows to developing Countries: The Role of Physical and Financial Infrastructure in 58 countries: 1970-2003. – Applied Econometrics and International Development, 10(2), pp. 57-72.

Lodhi, N. R., Siddique, A. M., Habiba, U. (2013). Empirical Investigation of the Factors Affecting Foreign Direct Investment in Pakistan: ARDL Approach. – World Applied Sciences Journal, 22(9), pp. 1318-1325.

Nourzad, F., Greenwold, N. D., Yang, R. (2014). The Interaction between FDI and Infrastructure Capital in the Development Process. – International Advances in Economic Research, 20(2), pp. 203-212.

Och, M., Baerbig, C., Jadamba, T. (2017). Determinants of inward FDI in Mongolia: An ARDL Bounds Testing Approach to cointegration. – Asian Economic and Financial Review, 7(3), pp. 307-333.

Ozcan, C. I. (2018). Transport infrastructure and the geography of foreign direct investments in Turkey. – International Journal of Transport Economics, XLV (3), pp. 463-484.

Pesaran, H. M., Shin, Y., Smith, R. J. (2001). Bounds testing approaches to the analysis of long run relationships. – Journal of Applied Econometrics, 16(3), pp. 289-326.

Phillips, P.C.B., and Perron, P. (1988). Testing for a unit root in time series regression. – Biometrica, 75, pp. 335-346.

Pradhan, P. R., Norman, R. N., Badir, Y., Samadhan, B. (2013). Transport Infrastructure, Foreign Direct Investment and Economic Growth Interactions in India: The ARDL Bounds Testing Approach. – Social and Behavioral Sciences, 104, pp. 914-921.

Quazi, R. (2007). Foreign Direct Investment in Latin America: A panel regression study. – International Journal of Business and Finance Research, 1(1), pp. 1-13.

Rehman, A. C., Ilyas. M., Alam, M. H., Akram. M. (2011). The Impact of Infrastructure on Foreign Direct Investment: The Case of Pakistan. – International Journal of Business and Management, 6(5), pp. 268-276.

Robbins, G., Perkins, D. (2012). Mining FDI and Infrastructure development on Africa's East Coast: Examining the recent experience of Tanzania and Mozambique. – Journal of International Development, 24(2), pp. 220-236.

Sahoo, P. (2006). Foreign Direct Investment in South Asia: Policy, trends, impact and determinants. – ADB Institute Discussion Paper, N 56, pp. 4-76.

Saidi, S. (2016). Impact of road transport on foreign direct investment and economic growth: Empirical evidence from simultaneous equations model. – Journal of Business Management and Economics, 7(2), pp. 64-71.

Shah, Z., Masood, A. Q., Siddiqui, R. (2004). The Determinants of Foreign Direct Investment in Pakistan: an Empirical Investigation. – Pakistan Development Review, 42(4), pp. 697-714.

Sharma, K., Nayagam, J., Chung, H. H. (2012). Determinants of Foreign Direct Investment in Malaysia: New evidence from cointegration and Error Correction Model. – Journal of Developing Areas, 46(1), pp. 71-89.

Singh, R. D., McDavid, H., Birch, A., Wright, A. (2008). The Determinants of FDI in Small Developing Nation States: An Exploratory Study. – Social and Economic Studies, 57 (3/4), pp. 79-104.

Talat, A., Zeeshan, A. (2013). Foreign Direct Investment (FDI) in Pakistan: Measuring the Impact of Cost of war against terrorism, Political Instability and Electricity Generation. – Caspian Journal of Applied Science Research, 2(3), pp. 117-127.

Wekesa, C. T., Wawire, H. N., Kosimbei, G. (2016). Effects of Infrastructure Development on Foreign Direct Investment in Kenya. – Journal of Infrastructure Development, 8(2), pp. 1-18.

Yousaf, A., Erum, N. (2018). The Role of Infrastructure in promoting domestic investment in Pakistan. – Pakistan Journal of Applied Economics, Special Issue, pp. 543-562.

Zafar, M. (2013). The Determinants of Inward FDI in SAARC Countries: Evidence from a Time Series data Analysis. – Journal of Economics and Sustainable Development, 4(5), pp. 105-114.

Zeb, N., Qiang, Fu., Shabbir, M. (2014). Telecommunication Infrastructure and FDI in Pakistan: An Empirical Study. – Global Journal of Management and Business Research, 14(4), pp. 1-5.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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DETERMINANTS OF ECONOMIC CITY SIZE[3]

The attraction and economic contribution of cities differ across cities in Pakistan. The purpose of this study is to look into what are the drivers of this difference. A balanced panel data set which has equal number of observations for fourteen cross-sectional units (cities), is used for analyzing determinants of economic city size. In-migration is a major factor in determining the economic as well as the physical size of a city. It not only increases the mass but also alters production by increasing labour supply and demand for production. Amenities also significantly influenced city size. Positive amenities of a city tend to increase city size while the negative ones decrease it. Further, the greater the size of the informal sector in a city, the greater it contributes to national growth and GDP. Imports and exports both tend to raise production and consumption in the city, which eventually boosts the size of the city. Finally, the effect of being a port city is also significant and positively relates to the economic size of the city.
Keywords: City; Economic Size; Fixed effect; Specialization; Amenities
JEL: C1; R0; O1; O4

1. Introduction

Specialization is a process of effective allocation of abundant resources towards some specific task intending to minimize per-unit cost. Different regions are blessed with different resource allocations and when these regions make effective use of the resources, they become more competitive in relation to other regions. This process is referred to as Regional Specialization. As per the neo-classical theory of trade, the concept of comparative advantage is what explains the specialization patterns of a region in terms of relative production cost (Ricardo, 1817) and relative factor endowments (Heckscher, 1919; Ohlin, 1933). The comparative advantage leading to regional specialization frames the basis of city emergence via scale economies (O Sullivan, 1993). Economies of scale can be achieved in production

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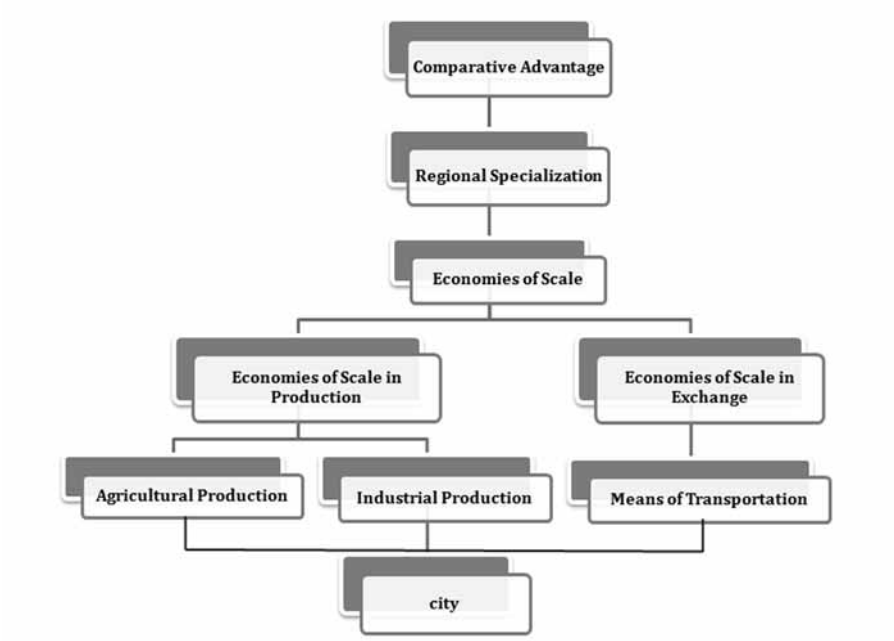
and exchange through factor specialization[4] and divisibility of indivisible input cost.[5] The presence of specialization accelerates the process of urbanization. To fully exploit economies of scale, the trading firms locate at places that can efficiently collect and distribute large volumes of output. The agglomeration or concentration of trading workers bids up the price of land that causes people to economize on land by occupying small residential units, the result is an increase in population density in a relatively smaller geographical area, an urban area or a city. Now these rural and urban regions prosper by the exchange of what they produce, i.e. agricultural production by the rural sector and manufactured goods & services by urban sectors. The pace of this prosperous growth of both sectors will be dependent on the means of transportation between them. The more efficient the means of transportation are, the faster will be the growth of these regions. Cities differ in their sizes depending on the type of agglomeration economies. The pace, number and variety of firms clustering in an area defines its size along with the technology a firm adopted (Figure 1).

Figure 1

Process of city emergence



Source: Author's visualization for city emergence.

The size of a city is the expansion or development of an urban area either in a geographical or economic sense. Physical city size is an expansion of a city geographically, i.e. covering

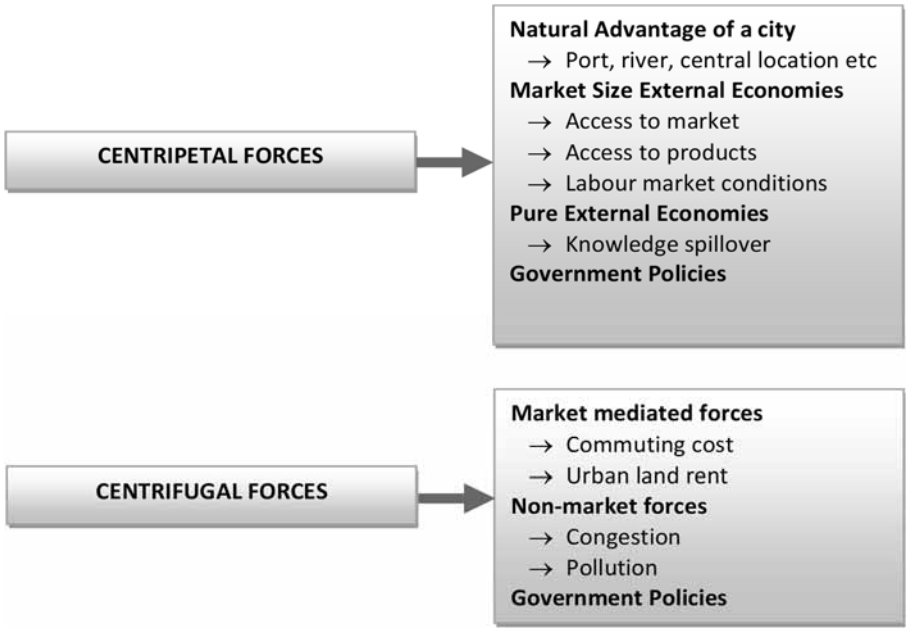
[4] Factor specialization is a process by which worker's skill and efficiency increases with repetition and spend less time switching between tasks

[5] Indivisible input cost is the fixed cost of capital that must be bore for production which then spreads over the entire production. The more one produce the less will be the unit fixed cost.

greater land area. Economic city size refers to degree of participation of a city in the economic development of a country. The city population has a dual role to play towards city size determination. It affects physical city size by increasing the number of persons, who require a greater land area for their accommodation. On the other hand, it contributes towards greater aggregate demand via increased labour supply and a number of consumers. The population's physical contribution may or may not dominate its economic contribution. It is the economic city size rather than physical that matters more because with population growth, a city's output might grow further, may remain stagnant or can even decline (Cohen, 2004) and (Sridhar, 2010). The Economic size of the city is different for different cities depending on its centripetal and centrifugal forces as reflected by various urban growth models. Centripetal and centrifugal forces are shown on Figure 2.

Figure 2

Factors for Uneven Regional Development



Source: Author's presentation.

Centripetal forces tend to expand the city, while centrifugal forces tend to shrink it. It is the war between these two forces that affect the city size. The economic size of the city will increase if centripetal forces out-weight centrifugal forces and will shrink if centripetal forces short-length centrifugal forces. The attraction and economic contribution of cities differ across cities in Pakistan as well. The objective of this study is to look into what are the drivers of this difference, using regression analysis.

The rest of the paper is organized as follows. The next section provides a review of the important theoretical and empirical literature. Section three describes the econometric methodology of research. Data sources and construction of variables is discussed in section

four. In the next section (section five), determinants of the economic size of cities are empirically investigated. Finally, section six discusses the main conclusions of this research along with contribution and policy recommendations.

2. Review of Literature

This section provides a review of previous literature that supports the research design both by theory and empirics. Theoretical literature provides linkages between the key variables, while the empirical literature is equipped with evidences and techniques of estimation regarding these linkages.

2.1. Theoretical review of literature

Cities won't flourish at the same pace though they usually grow over time. Population growth on its own is economically important for city growth because more population means more investment is required in housing and infrastructure (roads, hospitals, schools, sanitation, etc.) for facilitating their accommodation and commuting. The easiness in travelling, accessibility of housing, and the level of income determine the population size of cities as individuals from other regions or places are attracted by such area amenities (Rosen, 1979; Roback, 1982). Economic size of the city in terms of its earning and productivity itself is linked with a city's population size. Fujita (1988), Helsley & Strange (1990), Glaeser (1994), Duranton & Puga (2002) explicitly acknowledge agglomeration benefits or city's production advantages. Henderson (1974) provided his seminal contribution to city size literature which focused on the trade-off between agglomeration economies and urban cost for the existence of the city, along with impressive implications for its population growth. Henderson developed a general equilibrium model of city size on the basis of optimization behaviour of labour, firms and capital owner. Henderson defines the optimum size of the city and the equilibrium size of the city on the basis of social and economic considerations. The optimum size of the city is defined as that which maximizes the participant's potential welfare in the economy and the Equilibrium size of the city is determined by the decisions about investment and perceived location of labourers and capital owners, every one attempting to attain their own welfare level.

Equilibrium city size is the economic size of the city as it is based on the rational behaviour of economic agents. The market behaviour of factor owners is depicted by labourers moving between cities to maximize welfare and capital owners investing to maximize the rent of capital. It is the behaviour of firms that determines city size. The size of a city varies depending on the type of production specialization of different goods and services traded domestically or internationally. Different degrees of scale economies in production across cities have different levels of commuting and congestion costs which in turn defines cities of different sizes. The above discussion supports neo-classical urban system theory, which states that it is the tension between centripetal and centrifugal forces that determines optimal city size. Centripetal forces are the forces that come to play because of the agglomeration of

localization[6] and urbanization economies,[7] while for the emergence of centrifugal forces, commuting costs and land rents within the city play their part (Krugman, 1994). But by no means it's necessary that these market forces do result in the emergence of an optimal city. Random urban system theory steps forward to present the rationale for this and state that the city's size distribution is actually their type distribution where the type distribution depends on the city's individual characteristics, which then determine a city's economic size.

2.2 Empirical Review of Literature

The literature on the size of cities predicts that a country's urban population growth, induced by industrialization or technological change, will be contained by growth in both city population sizes and the number of cities in a country (Black, Henderson, 1999; Henderson, Wang, 2005, 2007). Mills & Becker (1986) founds that a city's population grows faster with faster industrial employment growth and national population growth in cities of India (Sridhar, 2010) also estimate the determinants of city growth in India using District level data from 1999-2006. Their main findings were that increase in Literacy rate, the ratio of manufacturing to services employment and primary school population coverage have a positive significant relationship with net district domestic product per capita. Bere et al. (2014) looked at the drivers of economic growth for seven Romanian cities using data from 1996-2010. The study found research & development expenditure and migration as a significant positive factor for the growth of these cities while unemployment and population growth influence the growth process negatively in Romania. Da Meta et al. (2005) analyzed the factors that influence the growth of Brazilian cities. They came to the conclusion that improvements in transportation facilities, increase in rural population supply, and labour force educational attainment inclination have sturdy impacts on the pace of growth of Brazilian cities. They also found that crime rate measured by homicide rate-limiting city growth. Moomaw & Shatter (1996) estimate city growth, as measured by percent urban population, by using 1960, 1970 & 1980 data of 90 countries. They found that GDP per capita, percentage of the labour force in agriculture and in industry, trade openness, as measured by export to GDP ratio, the proportion of foreign assistance to GDP and regional dummies significantly explained the size of the population. Without the inclusion of regional dummies, literacy rates were also a significant determinant of the city population, but after the inclusion of dummies, it became insignificant.

Huff & Angeles (2011) took 32 cities of six South East Asian countries as a unit of analysis. They established a conclusion that Globalization measured by Industrial production, main city dummy and government expenditures have a positive and significant impact on city population growth. Erdem & Tugcu (2011) also empirically investigate the city growth reflected from an increase in city GDP using time series data from 1990 to 2001 for fourteen Turkish cities. Using the fixed effect model, they have shown that population, gross fixed

[6] Localization economies refer to intra-industry benefits enjoyed by firms in a specific industry by locating near to one another.
[7] Urbanization economies refer to inter-industry benefits enjoyed by industries clustering near to one another.

capital formation, call deposited bank loan and exports notably explained city-level growth rate of GDP. On the other hand, imports have no noteworthy relationship with city growth.

Using 1970, 1980 and 1990 data sets of Metropolitan Statistical Areas (MSA's) of United States Mills & Lubuele (1995) regressed the MSA's population on the lag of population, square lagged of population, wage, employment and regional dummies. Results indicated that MSA's population was influenced strongly by wages, employment and lagged population. Black and Henderson (1999) explored the determinants of city population growth of 318 MSAs in the 48 States of USA on the basis of time-series data from 1940 to 1990. They set up strong evidence that it is human capital growth that becomes the basis of city growth. Employment moves parallel to investment in human capital. Manufacturing employment was also found significant. Increased education reflecting higher human capital relatively benefit larger cities more than the smaller ones as concluded by Henderson & Wang (2007) backed by a data set comprising major city from 142 countries and a time span of 40 years (1960-2000). They further identified that openness is more likely to expand port city's growth.

3. Econometric Methodology for Estimation

The study provides empirical evidence on the determinants of economic city size, which will be performed using data from 2005-06 to 2014-15 from various secondary sources. The model used for finding the impact of various variables influencing the size of a city by time is expressed symbolically in equation-1. Panel analysis with fixed effects accounting for individual city characteristics by time is applied for regressing this model.

$$ESC_{jt} = \alpha + \beta_0 HC_{jt} + \beta_1 IFS_{jt} + \beta_2 FDI_{jt} + \beta_3 EX_{jt} + \beta_4 IM_{jt} + \beta_5 U^{+}_{jt} + \beta_6 U^{-}_{jt} + \beta_7 DL + \beta_8 In\_Mig_{jt} + \mu \quad (1)$$

Where j represents the cross-sectional unit, that is, city (j=1,..., 14), t shows time (t=2006 to 2013) and μ represent error term.

The tabulation on Table 1 briefly explains the symbols of the models and the sign they are expected to take with respect to the dependent variable.

A balanced panel data set that has an equal number of observations for fourteen cross-sectional units (cities) is used for analyzing determinants of economic city size. Data on the above-mentioned variables are taken from various sources for the years 2005-06 to 2012-13.[8] Considering the heterogeneity of the dataset, different types of techniques are applied to estimate model-1 for comparative purposes and then the most appropriate one is finalized for estimation. These include the pooled OLS, Fixed effect, i.e. Least Square Dummy Variable (LSDV) and random effect model.

[8] 2011-2012 data is not available for LFS based variables.

Table 1

Variable Description and Expected sign with respect to regressand

Variable Symbol	Variable Description	Expected Sign w.r.t dependent variable
ECS	Economic city size	Dependent variable
In_Mig	Migration inflows	Positive
FDI	Foreign direct investment	Positive
IFS	Informal sector	Positive
EX	Exports	Positive
IM	Imports	Negative
HC	Human capital measured by average years of schooling	Positive
DL	Dummy for location	_
UI^-	Index for Negative Urban Amenities.	Negative
UI^+	Index for Positive Urban Amenities.	Positive
Positive Amenities include		
Education	Number of educational institutions	
Health	Beds per hospital	
Financial Institutions	Number of local financial intermediaries (Banks)	
Negative Amenities include		
Crime	No reported crimes	
Congestion and Transport	Number of vehicles	

Pooled OLS

In pooled OLS, it is assumed that all coefficients are constant across time and cross-sectional units, so there is neither significant temporal nor cross-sectional effects. In pool OLS, all the data is pooled as one and ordinary least square regression is performed on Model 1. Despite the simplicity of the model, the pooled OLS might disfigure the real depiction of the relationship between the regressand and the regressors across the cross-sections.

Fixed Effect (FE) Model

The fixed Effect (FE) model investigate the relationship among predictor and predictand variables within a cross-section (country, cities, etc.). Each cross-section has its own individuality that may or may not influence the predictor variables. The FE model assumes that something within the individual may be influenced or biases the predictor or outcome variables and that need to be controlled. This is the rationale behind the assumption of the correlation between the cross section's error term and predictor variables. The FE model eliminates the effect of those time-invariant characteristics and gives the net effect of the predictors on the outcome variable. Additionally FE model assumed that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Each cross-section is different, therefore, the cross section's error term and the constant (which captures individual characteristics) should not be correlated with the others. In the case of correlation between error terms, the FE model is not suitable since inferences may not be correct and Random Effect (RE) model may give better results; this is the main reason for applying the Hausman test.

Random Effect (RE) Model

The basis for applying the random-effects model is that in contrast to the FE model, the variation across cross-sections is assumed to be random and uncorrelated with the predictor or independent variables included in the model and allows for time-invariant variables to play a role as explanatory variables.

Model Specification Test

To check which model is better, a formal test for the two models is used. The pooled regression model is used as the baseline for our comparison. We can perform this significance test with an F test resembling the structure of the F test for R^2change.

$$F = \frac{(R^2_{FE} - R^2_{POLS})/(N-1)}{(1-R^2_{LSDV})/(NT-N-k)} \quad (2)$$

Where: T denotes time, N is the no. of cross-sectional units and k is the no. of regressors in the model. The significant probability of F statistics indicates that each cross-sectional unit is not statistically zero and does have its significant individual impact.

Pool Vs Random effect Model

To choose between the pool and random effect model, Lagrange Multiplier (LM) Test proposed by Breusch–Pagan is conducted under the null hypothesis that pool OLS is better against the random effect estimation of the model.

Random Vs Fixed effect Model

To decide whether the FE model is more appropriate or the RE model, Hausman (1978) test is commonly used, which tests the null hypothesis that the coefficients estimated by the RE model are the same as the ones estimated by the FE model. With a significant P-value, the FE model is appropriate; otherwise, it is safe to use the RE model.

4. Data Sources and Variable Construction

This research covers a micro-panel dataset of seven years (2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, and 2012-13) and fourteen major cities defined by LFS. These fourteen cities are Karachi, Hyderabad, Sukkur, Lahore, Faisalabad, Rawalpindi, Islamabad, Bahawalpur, Sargodha, Sialkot, Gujranwala, Multan, Peshawar and Quetta. The data for the variables used for this research is principally obtained from Census of manufacturing industries (CMI), Labour force survey (LFS) and Federal Bureau of Statistics for fourteen cities of Pakistan. The research also gets benefited from the published data from the State bank of Pakistan (SBP), Education Statistics of Pakistan, Pakistan Statistical Yearbook, Com Trade (United Nations), Pakistan Telecommunication Authority, Banking Statistics of

Pakistan etc. The construction of variables is a bit complex for the majority of the variables. Hence each had to be discussed one by one along with their relationships.

Economic City Size (ECS)

The city's economic size is best reflected by its contribution to the Real Gross Domestic Product (RGDP) of a nation. In Pakistan, the city-level GDP data is not readily available from secondary sources; thus, using a top-down approach, the national level GDP disaggregate at the city level. The methodology used for generating city level RGDP is stated below.

Estimation of Gross Domestic Product (GDP) at City Level

The city-level real GDP is calculated using a top-down approach, a statistical technique, for disaggregating the annual aggregate value of sector-wise real GDP using a suitable base for this disaggregation. These sectors include agriculture, manufacturing and services. For obtaining City-wise, the real GDP production of these three sectors is added up at the City level as per the production method for GDP measurement.

Deciding Base for Disaggregation

The base of disaggregation, industry-wise employment, is suggested by the very basic production equation regarded as a cornerstone in the foundation of production theory. Consider the Cobb-Douglas production function.

$$Y = AL^{\alpha}K^{1-\alpha} \tag{3}$$

Here A is the factor productivity, α is the labour share, $(1-\alpha)$ is the share of capital and $K\ and\ L$ are the labour and capital, respectively. As capital is fixed in the short run, labour became the base for disaggregation, which tends to be considered even a stronger base for disaggregation when it is applied to abundant labour countries like Pakistan.

Production of industry belongs to the sector mentioned above is also dependent upon the same production function as

$$\boldsymbol{RGDP_s = \sum_{j=1}^{n} K_j L_j} \tag{4}$$

Here,

$RGDP_s$ = Real GDP of sector s

K_j = Capital in industry j

L_j = labour employed in industry j

Estimation of GDP

After identifying the base for disaggregation, estimation of district-wise real GDP was conducted as per the formulation below

$$\boldsymbol{RGDP_{ct}} = \sum_{s=1}^{3} \frac{\boldsymbol{RGDP_{st}}}{\boldsymbol{L_{st}}} * \boldsymbol{L_{stc}} \quad (5)$$

$$\boldsymbol{Subject^{9}\ to}\ \sum_{c=1}^{n} \boldsymbol{RGDP_{stc}} = \boldsymbol{RGDP_{st}} \quad (6)$$

Here s stands for the sector, c for city and t is for the year.

Trade Openness

City-wise trade openness is calculated using the following formulation

$$\mathbf{TO_{jt}} = \frac{\mathbf{IM_{jt}} + \mathbf{EX_{jt}}}{\mathbf{RGDP_{jt}}} \quad (7)$$

Where

TO_{jt} = degree of trade openness in city j at time t.

EX_{jt} = Total export of city j at time t.

IM_{jt} = Total import of city j at time t.

$RGDP_{jt}$ = Real GDP of city j at time t.

The above formulation for trade openness demands city-wise data for imports and export, which is not available, but industry-wise import and export data is available at a country level. Hence it had to be generated using industry-wise establishments engaged in production in city j. Imports/exports for cities are calculated by summing their industry-wise share in total import/exports by individual industries on the basis of the share of establishments belonging to all industries in city j out of the total establishments belonging to all industries in the country.

The following equations are used to generated exports and imports by cities under consideration.

For export

$$\mathbf{EX_J} = \sum_{i=1}^{n} \frac{\mathbf{s_{ij}}}{\mathbf{s_i}} (\mathbf{EX_i}) \quad (8)$$

Where

EX_j = Total export of city (j).

[9] Subjective function is based on the assumption that LFS covers all existing regions in the country.

$S_{ij} =$ Total no of the industrial establishment (i) in city j.

$S_i =$ Total no of the industrial establishment (i) in all cities.

$EX_i =$ Total export of establishment i.

A greater number of industrial establishments in a city would result in more production by the city for local consumption and export purposes.

For import

$$\boldsymbol{IM_J} = \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \frac{\boldsymbol{S_{ij}}}{\boldsymbol{S_i}} (\boldsymbol{IM_i}) \quad (9)$$

Where:

$IM_j =$ Total import of city (j).

$S_{ij} =$ Total no of the industrial establishment (i) in city j.

$S_i =$ Total no of the industrial establishment (i) in all cities.

$IM_i =$ Total import of establishment i.

Production needs inputs that are locally available as well as those that have to import from abroad. Thus, with more industrial establishments locating in the region, more materials from abroad are expected to be imported.

Foreign Direct Investment (FDI)

Foreign direct investment in Pakistan is inclined more towards the services sector and within the services sector, financial businesses and telecommunications are the major heads receiving such investment (Nazeer et al.; 2017). A weighted index for foreign direct investment is calculated using the number of foreign banks and the number of foreign telecommunication franchises for resembling FDI inflow in cities. Symbolically, the formula for the index is

$$\mathbf{FDI\ Index_{jt}} = \mathbf{w_1 FB_{jt}} + \mathbf{w_2 FTF_{jt}} \quad (10)$$

Where, $w_1 = 1/3$, and $w_2 = 2/3$ are the weights given to foreign bank branches (FF) and foreign telecommunication franchises (FTF) in city j (j = 1, 2...., 14) at time t respectively depending on their degree of consumption, ease of access and spread spatially. Telecommunication is given more weight than foreign banks because it can be observed easily that individuals demanding foreign telecommunication company's services stand far above those demanding services from foreign banks. Interestingly, one may not have a bank account these days, even in a local bank, but they usually have a cell phone which again may be used for multiple SIMs. FDI is positively related to economic city size as more investment means more employment opportunities, more migration, increased aggregate demand and more production. Thus economic activities in the region further accelerate.

Positive urban amenities index

Index for positive city-wise amenities is a weighted average of three-dimension indices, education health and financial institutions.

$$\boldsymbol{UI_{jt}^{+} = w_1 EI_{jt} + w_2 HI_{jt} + w_3 FI_{jt}} \quad (11)$$

Where, w represents fractional weights (w_1=w_2= 2/5 and w_3 =1/5) allotted to the education index (EI_{jt}), health index **(**HI_{jt}**)** and financial institutions **(**FI_{jt}**)**, j represents city and t is for a time following the methodology of Human Development Index (HDI) constructed in the United Nation Development Report (UNDR) 1990. In the construction of dimension index for education, the methodology of UNDR (2010) is adopted as indicators within a dimension are non-mutually exclusive and in this case, arithmetic mean is not appropriate; therefore, the geometric mean is a more suitable measure.

Dimension Index for Education

$$\boldsymbol{EI_{jt} = \sqrt[7]{PS_{jt} \times MS_{jt} \times SS_{jt} \times DC_{jt} \times TC_{jt} \times IC_{jt} \times VI_{jt}}} \quad (12)$$

Where,

Education index (EI_{jt}): Geometric index of a number of educational institutions including Primary School (PS_{jt}), Middle School (MS_{jt}), Secondary School (SS_{jt}), Degree College, intermediate college (IC_{jt}), and vocational institute (VI_{jt}).

Dimension Index for Health

The dimension index of health is calculated using the formula

$$\boldsymbol{HI_{jt} = \frac{NB_{it}}{NH_{it}} \times 1000} \quad (13)$$

Where

HI_{jt} = Beds per hospital for 1000 persons.

NB_{jt} = Total no of beds in city i.

NH_{jt} = Total no of hospitals in city i.

Dimension index for a financial institution

FI_{jt} = number of local financial intermediaries (banks) in a city.

An increase in positive urban amenities index tends to increase a city's size economically as they accelerate economic activities such as production, employment, migration, etc.

Negative urban amenities index

The formula for urban amenity indicator index for negative amenities (UI_{jt}^{-}) is

$$\boldsymbol{UI_{jt}^{-} = \frac{CTI_{jt}+CI_{jt}}{n}} \quad (14)$$

Where

UI_{jt}^{-} = Negative urban amenities index

CTI_{jt} = Dimension index for Congestion and Transportation.

CI_{jt} = Dimension index for crime.

Dimension index for Congestion and Transportation (CTI_{jt}): Index calculated from the number of vehicles in a city giving more weight to heavy traffic than the lighter one. This data is gathered for cars, bicycles, buses, taxies, rickshaws constituting light traffic while trucks, tractors, pickup/delivery vans, etc., for heavy traffic representation.

$$\mathbf{CTI_{jt}} = \boldsymbol{W_1(LT) + W_2(HT)} \quad (15)$$

Dimension index for Crime (CI_{jt}): Index for crime is estimated using cases of murders (M), attempt to murders (AM), kidnapping (K), dacoity (D), robbery (R) and vehicle theft (VT) and snatching (S) with more weight given to murders.

$$\mathbf{CIjt} = \boldsymbol{W_1(M) + W_2(AM) + W_3(K) + W_4(D) + W_5(R) + W_6(VT) + W_7(S)} \quad (16)$$

Informal Sector (IFS)

Data for employment in the informal sector was generated as per its definition in LFS. LFS define the informal sector at the household level. It includes employment in all own-account enterprises whatever their size is, secondly enterprises with ten or less employed persons who may be the owner(s) himself/themselves, the contributing family workers, the employees, whether employed on an occasional or a continuous basis, or as an apprentice and lastly it excludes all enterprises engaged in agricultural activities or wholly engaged in non-market production, Symbolically

$$\boldsymbol{IFS_{jt} = OAE_{jt} + \lim_{L \leq 10} SE_{jt} - AE_{jt}} \quad 17$$

IFS_{jt} = employment in informal sector area in j at time t.

OAE_{jt} = Own account enterprise employment in j at t.

$\lim_{L \leq 10} SE_{jt}$ = Small enterprise employment limited individually to 10 or less labour in j at t

AE_{jt} = Agriculture enterprise employment in j at t.

Human Capital (HC)

For an individual city's human capital attainment, an average year of schooling is calculated using data from LFS. Economic size of a city is expected to be raised with rising human capital attainment as more human capital attainment means more productive labour force and more production in economic terms.

5. Empirical Results

Descriptive statistics and graphical representation of the variables used in this analysis are reported in the appendix at the end, along with the correlation matrix (A1 to A3). Prior to the estimation of coefficients of variables determining the size of a city, a number of pre-estimation tests are conducted so as to choose the correct type of model and technique to be used. As per the correlation matrix (A2) multi-collinearity is not found to be an issue though autocorrelation is (A7).

For choosing the correct type of model, three tests are performed. Considering the heterogeneous nature of the dataset, first, a test to choose between the pool and fixed effect model is conducted. The results of this test are reported in Table A4 in the appendix, supporting that the fixed effect model is more appropriate. Similarly, results of the test performed to select among the pool and random effect model are also reported in Table A5 favouring the random effect model. In both tests, the pool model is found to be inappropriate for estimation in this case though the alternate in both is accepted. Now to choose between the two suggested models, fixed and random effect models, a third test proposed by Hausman (1978) is applied with the null hypothesis that the difference between the two models is inconsistent and in such a case, a random effect model is preferred; otherwise fixed effect model is more appropriate. Hausman test results in table A6 is significant, rejecting the null hypothesis against the alternative one. Thus fixed effect model is selected for estimating the regression model presented in equation 1.

Further, the Pasaran test for observing cross-sectional dependence is also presented in the appendix in Table A9, which is found significant, indicating the dependence across cross-sections. Heteroskedasticity is also encountered in the model (A8). Table A10 reports the Davidsons and Mckinnon test for log or linear transformation of the model. This test supports the linear model rather than its log transformation. To account for correcting the problems of heteroscedasticity, autocorrelation and cross-sectional dependence, this research followed Driscoll-Kraay's (1998) procedure to deal with these problems. Standard errors produced by this procedure are robust to general forms of cross-sectional (spatial) and temporal dependence as this non-parametric procedure of estimating standard errors imposes no restrictions on the limiting behaviour of the number of panels. Further, in finite samples, the size of the cross-sectional dimension does not constitute a constraint on feasibility even if the number of panels is much larger than T. The results of the FE model with Driscoll-Kraay standard errors are reported in Table 2.

As per the results reported above, except for FDI and years of schooling, all other variables are found to be significant with the correct sign relationship with the dependent variable. In-migration is a major factor in determining the economic as well as the physical size of a city. It not only increases the mass but also alters production by increasing labour supply and demanders for production. Economic size of a city is significantly influenced by the amenities it holds. Positive amenities of a city tend to increase city size while the negative ones decrease it by attracting/repelling migrants and enhancing/ turning down the productive efficiency of the city, respectively. Further, the greater the size of the informal sector in a city, the greater it contributes to national growth and GDP. Imports and exports both tend to raise production and consumption in the city, which eventually boost the size of the city.

Table 2

Regression Results with Driscoll-Kraay standard errors

Regression Results with Driscoll-Kraay standard errors				
Method: Fixed-effects regression				
Number of groups = 14			Maximum lag:	2
F(8, 13) = 3105.19			Number of obs = 98	
Prob > F = 0.0000			within R-squared = 0.9137	
Dep var: ECS	**Coef.**	**Std. Err.**	**T**	**P>|t|**
In_Mig	0.02351	0.01268	1.85	0.087
UI^{+}	90.9131	21.5209	4.22	0.001
UI^{-}	-13.616	3.01136	-4.52	0.001
HC	688.255	1268.61	0.54	0.597
IFS	0.23485	0.03173	7.4	0
FDI	85.5836	87.1743	0.98	0.344
IM	0.0302	0.01569	1.93	0.076
EX	0.10878	0.04442	2.45	0.029
Constant	-18759	15139.8	-1.24	0.237

Source: Authors' estimation.

Finally, the effect of being a port city is also significant and positively relates to the economic size of the city.[10] Being a port city accelerated the trade activities and industries also tend to be located near the port city so as to minimize their unit cost, thus leading to the greater physical and economic size of the port city.

6. Conclusion

Cities are the centre of economic growth, creativity and modernization. The economic structure of cities is of immense importance not only from the point of view of city development and growth but also for the national development and growth. It is better to understand city dynamics for understanding national growth and development. Despite of the crucial importance of cities, unfortunately, in Pakistan, the city-level analysis is rarely cited. This research makes an attempt to fill this gap in the existing literature in the context of Pakistan. To choose the suitable estimation technique prior to estimation of coefficients of variables determining the size of a city, several pre-estimation tests are conducted. The results of pooled vs. fixed effect test supported the fixed effect model. Similarly, tests performed to select among the pool and random effect model, favour the random effect model. In both tests, the pool model is found inappropriate for estimation. Now to choose between the two suggested models, fixed and random effect, Hausman (1978) test is applied with the null hypothesis that fixed effect model and random effect model estimators do not differ substantially and in such a case, random effect model is preferred; otherwise fixed effect model is more appropriate. The result of the Hausman test significantly rejects the null

[10] See Table A11 in the appendix for FE regression results incorporating dummy variable. This regression does not follow Driscoll-Kraay's procedure. FE with Driscoll-Kraay command does not allow for manual regression.

hypothesis against the alternative one. Thus fixed effect model is selected for estimating the regression model.

The results mentioned that expansion of the informal sector and migration inflows cause the economic size of the city to be larger. Positive amenities, as reflected by the provision of education, health and banking services also found to have a significant impact in expending city size; on the other side, negative amenities like congestion and crime rate of a city contract city's economic size. The volume of trade (import and exports) has a significant positive impact in enhancing city growth economically. Finally, the effect of being a port city is also significant and positive. A port is more prone to increased concentration of trade activities and industries generating substantial employment opportunities, which in turn enhance consumption and production.

On the basis of the conclusionp drawn from the analysis few policies are suggested for accelerating the city's economic growth leading to the growth of the national economy.

- Foreign trade plays an essential role in the process of growth and development of a region. This fact is also apparent from this research as both regression and causality results demonstrate that export and import have a significant impact in expanding the size of major cities of Pakistan. The policymaker should take into consideration this piece of information while formulating policies about growth. Government should facilitate those industries which are export-oriented, like agro-based industries, to increase foreign exchange earnings. These foreign exchange earnings can be used to established new industries, that require foreign inputs and also discourages monopolies.
- Karachi is the only port city so far, developing Gawadar as the second port city will facilitate not only trade but also the economic growth of Gawadar, which has the potential to be in the major cities of Pakistan. Human capital, as measured by the average years of schooling, has a significant impact on cities economic participation (GDP). This shows the importance of the education system in the cities and at large, to increase the growth rate of the nation. The positive amenity index that captures the provision of education also appears to be statistically significant, endorsing the importance of the education system. Considering these facts government should formulate policies for targeting both improvements in the provision, by allocating supplementary budget on education, and attainment via providing awareness regarding the importance of education. Similarly, the role of the health sector in promoting economic size is also imperative. This research has established significant linkages among health services and the economic size or growth of cities. Unfortunately, Pakistan's budget allocation on health as a percentage of GDP is lowest in the South Asian region[11]. The health sector requires serious attention of policymakers as Pakistan need far-reaching reforms of the health sector.
- When cities grow to a certain level, they start to produce negative amenities such as congestion, pollution and an increase in crime rate. These negative amenities have a significant impact on contracting the economic city size. The role of policymakers is to

[11] Antonia Settle (2010) Post Budget Orientation Series, Federal Budget Health Sector.

minimize these negative amenities of cities by improving transportation and the judicial system as per the city requirement.

References

Bere, R. C., Adrian, O., Bucerzan, I. (2014). Determinants of economic growth in cities acting as growth poles in regions from Romania. – Procedia Economics and Finance, 10, pp. 357-365.

Black, D., Henderson, J. V. (1999). A theory of urban growth. – Journal of Political Economy, 107, pp. 252-284.

Cohen, B. (2004). Urban Growth in Developing Countries: A Review of Current Trends and Caution Regarding Existing Forecast. – World Development, 32(1), pp. 23-51.

Da Mata, D., Deichmann, U., Henderson, J. V., Lall, S. V., Wang, H. G. (2005). Determinants of City Growth in Brazil. – National Bureau of Economic Research (NBER) Working Paper 11585.

Driscoll, J. C., Kraay, A. C (1998). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. – Review of Economics and Statistics, 80, pp. 549-560.

Duranton, G., Puga, P. (2004). Micro-foundations of urban agglomeration economies. – Handbook of Regional and Urban Economics: Cites and Geography, 4(5), pp. 2063-2117.

Duranton, G., Puga, D. (2002). Diversity and Specialization in Cities: Why, where, and when does it matter?. – Urban Studies 37(3), pp. 533-555.

Erdem, E., Tugcu, C. T. (2011). Investigating the Macroeconomic and Qualitative Dynamics of Urban Economic Growth: Evidence from the Most Productive Turkish Cities. – International Journal of Business and Social Science, 2 (13), Special Issue.

Fujita, M., Thisse, J. (2002). Economics of Agglomeration. Cambridge University Press

Glaeser, E. (1994). Cities, Information, and Economic Growth. – A Journal of Policy Development and Research, 1(1), pp. 9-47.

Hausman, J. A. (1978). Specification Tests in Econometrics. – Econometrica, 46(6) pp. 1251-1271.

Heckscher, E. (1919). The effect of foreign trade on distribution of income. – Economisk Tidskrift, pp. 497-512.

Helsley, R. W., Strange, W. C. (1990). Matching and Agglomeration Economies in a System of Cities. – Regional Science and Urban Economics, 20(2) pp. 189-212.

Henderson, J. V., Wang, H. G. (2007). Urbanization and City Growth: the role of institutions. – Regional Science and Urban Economics 37, pp. 283-313.

Henderson, J. V., Wang, H. G. (2005). Aspects of the rural-urban transformation of countries. – Journal of Economic Geography, 5, pp. 23-42.

Henderson, J. V. (1974). The Sizes and Types of Cities. – American Economic Review, 64, pp. 640-657.

Huff, G., Angeles, L. (2011). Globalization, Industrialization and Urbanization in Pre-World War II Southeast Asia. – Explorations in Economic History, 48(1) pp. 20-36.

Krugman, P. (1994). Urban Concentration: The Role of Increasing Returns and Transport Costs. Conference Paper, World Bank Annual Conference on Development Economic.

Mills, E. S., Becker C. M. (1986). Studies in Indian Urban Development. Oxford University Press for the World Bank.

Mills, E. S., Lubuele, L. S. (1995). Projecting Growth of Metropolitan Areas. – Journal of Urban Economics, 37, pp. 344-360.

Moomaw, R. L., Shatter, A. M. (1996). Urbanization and economic development: A bias toward large cities?. – Journal of Urban Economics, 40(1), pp. 13-37.

Nazeer, M., Tabassum, U., Alam, S. (2017). Banking and Telecommunication influencing migration in major cities of Pakistan. – Pakistan Journal of Applied Economics, 27(1), pp.101-120.

Ohlin, B. (1933). Interregional and international trade Cambridge. MA: Harvard University Press.

O'Sullivan, A. (1993). Urban Economics. Homewood, 2nd Edition.

Ricardo, D. (1817). On the Principles of Political Economy and Taxation. Batoche Books, Canada.

Roback, J. (1982). Wages, Rents, and the Quality of Life. – Journal of Political Economy, 90, pp. 1257-1278.

Rosen, K. T., Resnick, M. (1980). The size distribution of cities: An examination of the Pareto law of primacy. – Journal of Urban Economics, 8(2), pp. 165-186.

Rosen, S. (1979). Wage-based indexes of urban quality of life. – In: Mieskowski, P., Straszheim, M. (eds.). Current issues in urban economics. Johns Hopkins University Press, Baltimore, pp. 74-104.

Sridhar, K. S. (2010). Determinants of City Growth and Output in India. – Review of Urban and Regional Development Studies, 22(1), pp. 22-38.

APPENDIX

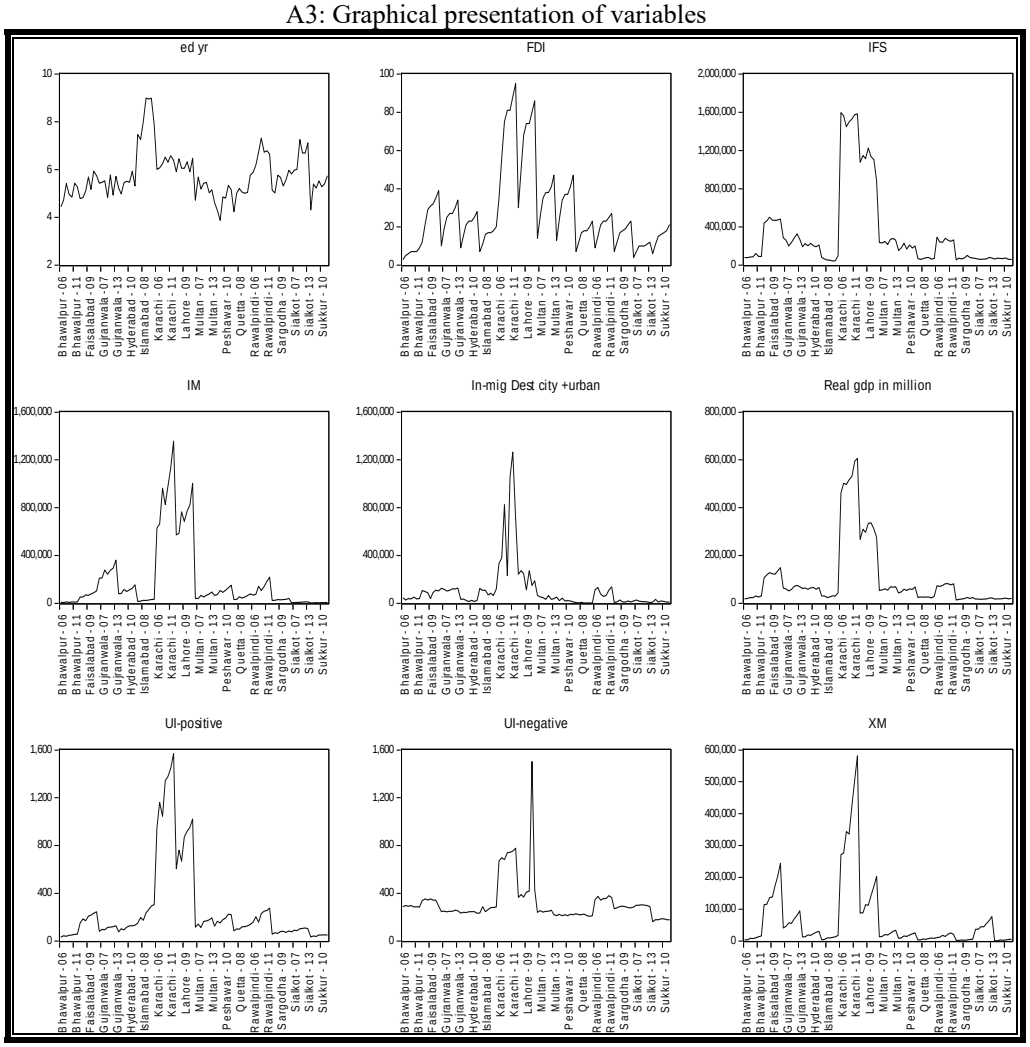
A1: Descriptive summary of the variables

Descriptive Summary	ED_YR (Years)	FDI (units)	IFS (No.)	IM (Rs.ML)	IN_MIG_ DEST_CITY__U RBAN (No.)	REAL_GD P_IN_ (Rs. ML)	UI_ POSITIVE (No.)	UI_ NEGATIVE (No.)	XM (Rs.ML)	TO
Mean	5.763013	27.07143	336588.1	182098.9	105660.1	101142.4	262.6837	318.6748	64772.38	246871.3
Median	5.523397	21	199955	65755.88	40226	56382.76	128.5	280.417	18729.79	87029.93
Maximum	8.993373	95	1595665	1357262	1264857	606593.3	1570	1503.745	580982.4	1938245
Minimum	3.870027	3	43786	2589.206	254	13278.73	35	161.2182	1320.03	4058.361
Std. Dev.	0.980423	21.27544	428385.2	290823.2	197550.2	140419.3	346.1547	177.389	108182.9	386719.6
Skewness	1.230167	1.567222	1.938967	2.188231	4.053929	2.290143	2.309001	3.893935	2.748149	2.390035
Kurtosis	5.008825	4.822002	5.467351	6.946606	20.73622	7.23577	7.307846	22.8663	10.93993	8.323851
Jarque-Bera	41.19522	53.67307	86.26526	141.8106	1552.936	158.9264	162.8576	1859.227	380.7778	209.0359
Probability	0	0	0	0	0	0	0	0	0	0
Sum	564.7753	2653	32985633	17845691	10354690	9911959	25743	31230.13	6347693	24193384
Sum Sq. Dev.	93.23928	43906.5	1.78E+13	8.20E+12	3.79E+12	1.91E+12	11622837	3052285	1.14E+12	1.45E+13
Observations	98	98	98	98	98	98	98	98	98	98

A2: Correlation matrix of the variables used

Correlation Matrix	ED_YR	FDI	IM	IFS	UI_POSITIVE	UI_NEGATIVE	XM
ED_YR	1.000000						
FDI	0.131208	1.000000					
IM	0.175977	0.696227	1.000000				
IFS	0.135645	0.486097	0.595186	1.000000			
UI_POSITIVE	0.290174	0.750571	0.647468	0.646330	1.000000		
UI_NEGATIVE	0.225746	0.668115	0.744020	0.763746	0.749897	1.000000	
XM	0.164023	0.777890	0.746580	0.687993	0.787938	0.716715	1.000000

A3: Graphical presentation of variables



A4: Choice of model between pool OLS and fixed effect model

Choice of Model
Pool vs FE/LSDV Model
Ho: Pool model is better i.e
(1) 2007.Years = 0
(2) 2008.Years = 0
(3) 2009.Years = 0
(4) 2010.Years = 0
(5) 2011.Years = 0
(6) 2013.Years = 0
(7) 2.cities = 0
(8) 3.cities = 0
(9) 4.cities = 0
(10) 5.cities = 0
(11) 6.cities = 0
(12) 7.cities = 0
(13) 8.cities = 0
(14) 9.cities = 0
(15) 10.cities = 0
(16) 11.cities = 0
(17) 12.cities = 0
(18) 13.cities = 0
(19) 14.cities = 0
F(19, 70) = 14.38
Prob > F = 0.0000

A5: Choice of model between pool OLS and random effect model

Choice of model		
Pool vs RE Model		
Breusch and Pagan Lagrangian multiplier test for random effects		
ECS[cities,t] = Xb + u[cities] + e[cities,t]		
Ho: variances across entities is zero		
Estimated results:	Var	sd = SQRT(Var)
ECS~n	1.97E+10	140419.3
E	2.73E+07	5220.311
U	4.43E+07	6658.969
Test: Var(u) =0		
chibar2(01)	=	56.58
Prob > chibar2	=	0

A6: Choice of model between random and fixed effect model

Choice of Model				
Huaseman Test Results				
FE vs RE Model				
Coefficients	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	xtreg_fe	xtreg_re	Difference	S.E.
Inmig~n	0.02351	0.027816	-0.0043065	.
UIpositive	90.9131	100.6254	-9.712341	4.811898
UInegative	-13.616	-14.1443	0.5278915	.
edyr	688.255	-296.905	985.1598	766.4804
IFS	0.23485	0.205194	0.0296536	0.0164018
FDI	85.5836	78.39586	7.187772	49.41431
im	0.0302	-0.00407	0.0342702	0.0147467
xm	0.10878	0.163318	-0.0545381	0.0314189
b = consistent under Ho and Ha; obtained from xtreg				
B = inconsistent under Ha, efficient under Ho; obtained from xtreg				
Test: Ho: difference in coefficients not systematic i.e RE model is more efficient and consistent				
chi2(4)	=	(b-B)'[(V_b-V_B)^(-1)](b-B)		
	=	-38.84		
Prob>chi2	=	0		

A7: Wooldridge test for autocorrelation in panel data

Wooldridge test for autocorrelation in panel data		
H0: no first-order autocorrelation		
F(1, 13)	=	25.873
Prob > F	=	0.0002

A8: Modified Wald test for group-wise heteroskedasticity in FE regression model

Modified Wald test for group wise heteroskedasticity in FE regression model		
Ho: Heteroskedasticity exists		
chi2 (14)	=	3268.63
Prob>chi2	=	0

A9: Pesaran's test of cross sectional independence

Pesaran's test of cross sectional independence		
Ho: No cross-sectional dependence	Coeff.	Prob.
Pesaran's test of cross sectional independence	3.209	0.0013

A10: Davidson and MacKinnon Test for log or linear model transformation

Davidson and MacKinnon Test		
Model	Decisive variable	Probability of coefficient
Linear	Ho: Log model is better Fitted_log	0.6776
Logarithm	Ho: Linear model is better Fitted_linear	0.0271

A11: Panel regression results using LSDV approach

Panel regression results using LSDV approach				
No. of obs		=	98	
F (27, 70)		=	3047.4	
Prob> F		=	0	
Dep. Var.: ECS	Coef.	Std. Err.	T	P>|z|
ln_Mig	0.022058	0.006479	3.4	0.001
UIpositive	85.58398	16.11579	5.31	0
UInegative	-12.8301	5.218983	-2.46	0.014
edyr	4140.011	1706.095	2.43	0.015
IFS	0.247207	0.016865	14.66	0
FDI	468.1515	167.3241	2.8	0.005
im	0.01794	0.01977	0.91	0.364
xm	0.12782	0.040189	3.18	0.001
dport	68928.83	29294.36	2.35	0.019
_cons	-16914.3	8653.41	-1.95	0.051
Cities				
2	-38509.7	7784.46	-4.95	0
3	-33500.5	6104.303	-5.49	0
4	-8598.98	4341.29	-1.98	0.048
5	-22005.6	6514.786	-3.38	0.001
6	0	(omitted)		
7	-97799.5	23971.46	-4.08	0
8	-28956.2	5512.479	-5.25	0
9	-19432.6	4774.132	-4.07	0
10	-4917.52	2990.616	-1.64	0.1
11	-21489.6	6403.877	-3.36	0.001
12	-9740.58	3178.432	-3.06	0.002
13	-17324.4	3841.903	-4.51	0
14	-4541.6	3106.729	-1.46	0.144
Years				
2007	-2099.48	2276.86	-0.92	0.356
2008	-5397.34	3107.326	-1.74	0.082
2009	-8486.53	3458.757	-2.45	0.014
2010	-10198.8	3266.3	-3.12	0.002
2011	-11624.9	3553.834	-3.27	0.001
2013	-11985.8	3853.288	-3.11	0.002

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Burim Gashi[1]

IMPACT OF BANK-SPECIFIC AND MACRO DETERMINANTS ON NON-PERFORMING LOANS OF POLISH BANKING SECTOR[2]

The aim of this paper is to examine the determinants of non-performing loans (NPLs) in Poland. We investigate macroeconomic and bank-specific determinants of NPLs – for a panel of 18 banks from Poland, using annual data for the period 2005-2018. We apply two alternative estimation techniques: fixed-effects model and system Generalised Method of Moments. The results show the bank-specific determinants, with an impact on the amount of NPLs include return on equity and growth of gross loans,, while the most important macroeconomic factors influencing NPLs in Poland are GDP growth, domestic credit to the private sector, public debt and unemployment.
Keywords: Non-performing loans; Macroeconomic determinants; bank-specific determinants; Poland; Generalised Method of Moments
JEL: C23; C51; G21; G2

1. Introduction

In the last two decades, the deregulation, technological change and globalisation of goods and financial markets, have strengthened competition among banks. According to Jeong, Jung (2013), competition increased banks' credit risk, *i.e.* affected their loan portfolios in terms of their bad loan screening procedures and relaxing borrowing criteria. Moreover, the credit risk of the banks is very often linked to the ratio of NPLs, which can be generally defined as loans in default or close to being in default. Brownbridge (1998) points out that it was confirmed over the past decades that most of the banking failures or crises are caused by NPLs, e.g. the 1997 Asian financial crisis Yang (2003) and the 2008 global financial crisis Diwa (2010). Furthermore, according to Khemraj and Pasha (2009) the increase of NPLs has been associated with bank failures and financial crises in both developing and developed countries. This was confirmed during the global financial crisis in 2007-2008, when the levels of NPLs significantly increased across countries. While almost all countries in the world were faced with the rapid growth of NPLs, after 2007-2008, the growth varied significantly among

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different groups of countries, and among countries in the same group. For example, in 2008 the number of NPLs as a share of total loans in high-income countries from the Organization for Economic Co-operation and Development (OECD) was 3%, and increased to 8% in 2014, while in Central and Southeastern Europe, it was 4% in 2002, and reached almost 15% in 2014.

The Polish economy is one of the most advanced among the Central and Eastern European (CEE) countries. According to Eurostat and the European Commission, its economy has been one of the fastest-growing among the EU Member States (GDP grew by 4.6% in 2017). Furthermore, the financial system in Poland is dominated by the banking sector, which incorporates 80% privately owned banks and several state-owned ones. Also, the foreign capital is a common thing in Poland's banking sector, accounting to 60% of the total banking assets. At the end of 2017, the Polish financial landscape was made up of 35 commercial banks, 553 cooperative banks and 28 branches of credit institutions. In 2017, the ownership structure of the Polish banking sector changed. That year, the Polish banking sector's assets totalled €427.17 billion. The prudent credit policy and relatively good results of the Polish economy have allowed banks to maintain the NPL ratio at a relatively low level (6.8%), lower than at the end of 2016 The European Banking Federation (2018).

Considering the foregoing, the objective of this paper is to examine how bank-specific and macroeconomic determinants affect the level of NPLs in Polish commercial banks. There are many studies that explore the determinants of NPLs in many countries and regions, but a relatively small number of authors include the Polish banking sector in their research. To the best of the authors' knowledge, only one relevant study examines the determinants of NPLs in Poland, that of Głogowski (2008), but it covers the period before the global financial crisis (1996-2006). The determinants of NPLs of Polish banks were also analysed in the four-panel countries' studies conducted by Çifter (2012), Jakubík and Reininger (2013), Erdinc and Abazi (2014) Staehr and Uusküla (2017), but only as part of a group of countries of Central, Eastern, and South-Eastern Europe (CESEE) and never as a single country.

Keeping in mind the aforementioned studies, we offer a novel approach to the issue of NPLs in Poland. In this study, we employ an unbalanced panel, of 18 banks in Poland representing 80% of the total assets of Polish banks, using annual data, from 2005 to 2018. The selected period covers mainly the crisis and post-crisis times, as well as the last three years of the pre-crisis boom (2005-2007*).* According to Maddala (2001), the main advantage of panel data, as compared to other types of data, is the fact that the approach allows testing and adjustment of the assumptions that are implicit in cross-sectional analysis. Furthermore, in this study, we use the banks' public reports. Namely, our focus on the bank-level data eliminated the aggregation bias problem and enabled the researcher to disentangle the effects of various internal determinants (as controlled by the banks' management) on NPLs. In addition, to avoid the risk of providing inconsistent and biased results, by using only one estimation technique, in our study, we implement two alternative estimation models (fixed-effects model and system Generalised Method of Moments).

The structure of the paper is as follows. Following the introduction, Section 2 reviews the literature on empirical findings relevant for both the macroeconomic and bank-level determinants of NPLs. The methodology and the sources of the data employed are presented

in Section 3. Section 4 explains the analysis and empirical results of determinants of NPLs. Section 5 concludes the paper and offers policy recommendations.

2. Literature Review

In the last few years, especially after the financial crisis of 2007-2008, the studies which investigated determinants of banks' credit risk gained in importance (Khemraj, Pasha, 2009). However, when it comes to modelling in this field, there is no universally accepted rule or principle to be used as a basic tool in all studies. The empirical results of studies differ, depending on the time periods and different specifics of each of the countries. There are, however, some common elements as well. Namely, NPLs are usually measured by the ratio of NPLs to total loans. The internal determinants usually consist of bank-specific variables, such as the size of the bank, equity to total assets ratio, return on equity, growth of gross loans. The macroeconomic determinants include GDP growth, inflation, unemployment, public debt. In the sequel of this paper, we give a short summary of the empirical literature that emphasises the NPLs determinants in Poland.

To our best knowledge, only one relevant study that of Glogowski (2008), has analysed determinants of NPLs, of 108 Polish banks in the period between 1996 to 2006, applying panel fixed and random effects models. In his study, Glogowski used only macroeconomic determinants (Real GDP growth, rate of loans issued to households and corporations, borrower debt burden, bank-level credit growth and share of real estate loans in loans to households) only.

The author finds evidence on the importance of the set of macroeconomic variables, consisted of real GDP growth, real interest rates and unemployment.

Out of the panel studies that have analysed CESEE countries, we focus on four-panel countries' studies (Çifter, 2012; Jakubík, Reininger, 2013; Erdinc, Abazi, 2014; Staehr, Uusküla, 2017).

Çifter (2012) examines the effect of concentration of banks on NPLs in ten Central and Eastern European (CEE) countries; the short-run effect of bank concentration is tested with the Generalised Method of Moments System and the instrumental variable approaches, and the long-run one is tested with the Fully Modified Ordinary Least SFquare (FMOLS) approach. The results show that the bank concentration is an insignificant factor on NPLs, either in the short or in the long run of the panel data set. On the other hand, individual FMOLS results reveal that the concentration of banks reduces the NPLs in Estonia, Latvia, and Slovakia, while decreasing those in Bulgaria, Croatia, Lithuania, Poland, and Slovenia in the long run.

Using the difference GMM and system GMM models, Jakubik and Reininger (2013) analysed determinants of NPLs in nine CESEE countries (Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Russia, Slovakia and Ukraine). In their paper, they used several macro determinants: real GDP, private sector, national stock exchange index, credit-to-GDP ratio, exchange rate. The empirical results show that real GDP growth is the main driver that is negatively correlated with the dynamics of NPLs.

Erdinc and Abazi (2014) analysed determinants of NPLs in 20 emerging European countries (Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia FYR, Moldova, Poland, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Turkey, and Ukraine), using several panel methods (Fixed and Random Effect, Difference and System-GMM) and annual data from 2000 to 2011. Empirical results show that real GDP growth, inflation rate and bank profitability have a significant impact on NPLs. The results also suggest that higher lending rates may lead to adverse selection problems and hence reduce the loan quality.

Staehr and Uusküla (2017) estimated panel data models that use macroeconomic and macro-financial variables to forecast the ratio of NPLs in all EU countries, using quarterly data from 1997Q4 to 2017Q1. The results of their paper showed that the ratio of NPLs exhibits substantial persistence and higher GDP growth, lower inflation and lower debt are robust leading indicators of the ratio of lower NPLs. The current account balance and real house prices are important indicators for Western Europe, but are less relevant in the case of Central and Eastern Europe.

3. Data and Methodology

This section identifies the sources of our data, presents the data, and describes the regression models that we applied to investigate the effects of internal and external factors on NPLs.

3.1 Data Source and Sample Characteristics

In our study, we used an unbalanced panel of 18 banks in Poland. The data are based on the annual frequency for 2005-2018. According to Rinaldiand Sanchis-Arellano (2006), unbalanced panel data include more observations and their results are less dependent on a particular period.

The data used in the empirical analysis came from two main sources. The data for the bank-specific determinants (equity to total assets ratio, ROE and growth of gross loans) were obtained from the Bankscope database of Bureau van Dijk. The financial information was derived from balance sheets, income statements, and notes from the annual reports. Bankscope had up to 20 years worth of data available, covering the total sample period. The data for macroeconomic determinants – GDP growth (annual percentage), unemployment, inflation, consumer prices (annual percentage), domestic credit to the private sector (percentage of GDP) – public debt, and fiscal position (budget surplus deficit) as a percentage of GDP, were obtained from the World Development Indicators database. The selection of the variables included in the paper was inspired by the previously reviewed literature where selected determinants were usually used and the availability of data.

Within our presentation of the independent determinant, we considered both bank-specific determinants and macroeconomic characteristics. The factors that we used as control determinants, which may explain the NPLs of banks, are:

- Macroeconomic determinants: Real GDP growth – GDPG; Inflation – INF; Unemployment – UN; Domestic credit to private sector (% of GDP) – DCPS; Public debt-PD; fiscal position (budget surplus or the budget deficit) as a percentage of GDP-FISCALP.
- Bank-specific determinants: Ratio of equity to total assets – ETA; Return on equity – ROE; Growth of gross loans – GGL.

As discussed in the introductory part, the economic model that we used in the empirical analysis cover bank-specific and macroeconomic determinants and their potential impact on NPLs. Before attempting to identify potential bank-specific and macroeconomic determinants of NPLs, it is necessary to define the dependent determinant. In the literature, to date, there is no internationally harmonised definition that has been applied in all or most countries of the world for a considerable period of time. The most commonly used definition outlined by the Basel Committee on Banking Supervision, specifies that NPLs should include all loans that are 90 days overdue. In spite of that, countries report their statistics differently in such a way that some include all the loans which are 31 days past due, some countries take into account 61 or 30 days. According to Jakubík and Reininger (2013), efforts towards harmonising NPL definitions have been gathering steam only in recent years, in the wake of the financial and economic crisis. In this context, it is worth mentioning that Bankscope reports the level of "impaired loans", which may be different from the official classification of NPLs. "Impaired loans" is an accounting concept, which reflects cases in which it is probable that the creditor will not be able to collect the full amount that is specified in the loan agreement, while "NPL" is a regulatory concept, which primarily reflects loans that are more than 90 days past their due date Report of the Working Group on NPLs in CESEE (2012). Acknowledging these differences, we follow Klein (2013), Petkovski and Kjosevski (2018) and treat "impaired loans" as NPLs. In this analysis, our dependent variable will be the logit transformation of the ratio of impaired (NPLs) to total (gross) loans, as this transformation ensures that the dependent variable spans the interval (-∞;+∞) (as opposed to between 0 and 1) and is distributed symmetrically (Salas, Saurina 2002; Espinoza, Prasad, 2010).

Macroeconomic Determinants

In the literature (Babouček, Jančar, 2005; Jimenez, Saurina, 2005; Nkusu, 2011; Skarica, 2013; Klein, 2013; Beck et al., 2013; Us, 2016), the real GDP growth stands out as the main macroeconomic determinant of NPLs. Having this in mind, we include the annual growth rate of real GDP in our analysis. The literature notes that when there is a slowdown in the economy, a rise in the NPLs can be observed. Skarica (2013). According to Us (2016). the explanation behind this relationship is that when the economy is growing and the income of borrowers is increasing, the debt-servicing capacity improves, as does the overall financial stability as well. In other words, the growing economy associated with the growth of the general level of income and the reduced financial stress and, hence, GDP growth, should be negatively correlated with NPLs Nkusu (2011). Therefore, we anticipate a negative relationship between GDP growth and NPLs.

The inflation as the general consumer prices' rate is another macroeconomic factor that has been investigated, particularly because of the unclear and ambiguous evidence that generated this determinant. Thus, higher inflation can make debt servicing easier by reducing the real value of outstanding loans. On the other hand, inflation can be taken to decrease the real income in the long-run and therefore, leaving the debtors with a smaller amount of funds for repaying the debt. In the literature, many authors (Fofack, 2005; Rinaldi, Sanchis-Arellano, 2006; Gunsel, 2008; Skarica, 2013; Klein, 2015; Us, 2016), find a positive correlation between the inflation rate and NPLs On the other hand, the negative relationship between these two determinants was observed by Sofoklis and Nikolaidu (2011). Therefore, we do not expect precise results with regard to this relationship.

Similar to inflation, exchange rate depreciation may have a negative or a positive effect on NPLs. Thus, exchange rate depreciation in a country with flexible exchange rate regimes and a large amounts of lending in foreign currency, may have a positive effect on NPL accumulation (Klein, 2013; Beck, 2015). On the other hand, currency depreciation can improve the debt servicing capabilities of export-oriented firms and lower the NPL ratio. A significant proportion of loans extended by Polish banks is nominated in foreign currencies. Some of these loans were taken out by households without matching income.

Consequently, changes in the exchange rate can influence the cost of loan repayment and the burden it places on household incomes Głogowski (2008). A depreciation of the zloty can thus increase loan losses of banks that have a large proportion of loans in their portfolios. On the other hand, during the investigated period, the quality of loans was better than that of zloty loans, which suggests that the influence of exchange rate changes could have been minor.

The rate of export increase may provide additional information regarding the impact of economic conditions. A decline in exports should lead to a fall in company revenue, and therefore, companies face a lower ability to repay their credit. This contributes to a relatively higher NPL percentage to total loan (Clichici, Colesnicova, 2014)

In order to show the level of indebtedness of the private sector in the economy, we included the level of domestic credit to the private sector (% of GDP) in our model. According to (Pesola, 2005; Nkusu, 2011), high levels of debt make debtors much more vulnerable to adverse shocks because that directly affect their income and, therefore, their ability to service their obligations Pesola (2001), states that instability of the financial system becomes visible when the level of indebtedness is growing continuously, and unfavourable shocks are then more strongly experienced. Therefore with this variable, we expect a positive correlation with the NPLs.

The last macroeconomic determinant that we used in our model is unemployment, which is the control variable for the health of the economic environment and is also closely related with banks' performance. When it comes to unemployment, bank performance suffers when unemployment increases because there will be fewer individuals seeking to cooperate with banks, fewer bank accounts and services, which leads to increased NPLs. In other words, according to Messai and Jouini (2014), rise in the unemployment rate actually limits the current and future purchasing power of households and enterprises, also adversely affecting their cash flows and, therefore, increasing debt burden accompanies the increasing

unemployment rate Empirical studies that have investigated the relationship between unemployment and NPLs, found a positive correlation (Głogowski, 2008; Makri et al., 2014; Messai, Jouini, 2014; Kurumi and Bushpepa, 2017). Thus, based on the above arguments, there is a positive relationship between unemployment and NPLs.

Fiscal determinants

In some European countries, the 2008/2009 crisis from first affected fiscal indices and then extended to the banks. Taking this point into consideration, we included two public finance variables (DEBT and FISCALP) in our investigation. First, we used public debt, which is a form of financial obligation, incurred by the government or borrowings and repayments. With this determinant, we expect a positive relationship with NPLs, since an additional increase of public debt can influence the credit ratings of the government and consequently the liquidity of the banks. In other words, the banks tend to invest their liquidity reserves in government securities and with the deterioration of the government credit rating, the rating of government securities is also affected this way, the banks continue their operation under the pressure of liquidity. According to Reinhart and Rogoff (2010), the need of dealing with the liquidity pressure limits the banks' placement of loans and subsequently, the debtors cannot renew their loans which can cause an increasing trend in the level of NPLs. In other words, it has been posited that banking and sovereign crises are closely connected, and banking crises, in fact, can either precede or be the result of a sovereign crisis as in the case of Greece Louzis et al. (2012).

The second fiscal determinant that is employed in our model is the government's fiscal position (budget surplus or deficit) as a percentage of GDP. According to Hyde (2002), a surplus can indicate an increase in taxes or a decrease in government expenditures or both at the same time, while a deficit implies a decrease in tax revenues and a rise in government expenditure or both at the same time. According to Makri et al. (2014), since a variable FISCALP has by nature an adverse relationship with PD, it is expected to be negatively correlated with NPLs. In other words, this negative correlation is due to the fact that it can indicate a better fiscal position of the country, less expensive financing, and reduced risk, and expectations of a sustainable fiscal position are improved. Bearing this in mind, we expected a negative correlation with NPLs in the case of this determinant.

Bank-Specific Determinants

The first determinant that we used in our model is the profitability ratio (ROE) as a measure of banks' past performance, because banks' profitability is linked to their risk-taking behaviour. Swamy, 2012 points out that if the banks are more profitable that will lead to lower levels of NPLs. According to Boudrigaet al. (2009), inefficient banks with lower profitability are tempted to resort to less reliable and risky placements to increase their profitability and/or meet the demands of regulatory authorities The vast majority of the literature has observed a negative impact of the profitability ratios on the NPLs (Godlewski, 2004; Louzis et al. 2010; Makri et al., 2014; Selma, Jouini, 2013; Messai, Jouini, 2014). According to Makri et al. (2014), this relationship is due to the poor performance of the banks

decreased profitability which further motivates managers to lend to riskier borrowers, in order to rise profitability, which, in the end, leads to the growth of NPLs. Therefore, we expect a negative sign before this explanatory variable.

The share of equity in total assets is the next determinant that is included in our model. In most of the studies (Berger, De Young, 1997; Salas, Saurina, 2002; Klein, 2013), there is a negative relationship between equity in total assets and NPLs. But on the other hand, there are studies where this connection can be positive (Rajan, Dahl, 2003; Boudriga et al., 2009; Espinoza, Prasad, 2010). According to Quagliarello (2007), the positive relationship is due to the fact that the higher the risk appetite of a bank, the greater the share of capital to existing shareholders invested in the bank, in order to convince other shareholders to invest in and support the bank. Having these facts in mind in the case of this determinant, we expected an ambiguous correlation with NPLs.

According to Petkovski et al. (2018), the credit policy of the bank plays an essential role in determining the subsequent levels of NPLs. In order to maximise the short-run benefits, managers seek to rapidly expand the credit activities and may, hence, take inadequate credit exposures (Castro, 2012; Beck et al., 2013; Klein,2013). In the literature, the results based on this determinant are mixed. For example, in the study of Dash and Kabra (2010), they indicate the presence of a positive correlation between credit growth and NPLs, while other studies (Salas, Saurina, 2002; Quagliarello, 2007; Boudriga et al. 2009; Dash, Kabra, 2010; Swamy, 2012) found a negative correlation. Therefore, the effect of individual credit growth can go in both directions and we expected an ambiguous correlation with NPLs.

Table 1 presents descriptive statistics for the determinants involved in the regression model. Key figures, including mean, standard deviation, and minimum and maximum values, are reported. This table gives an overall description of the data used in the model and serves as a data screening tool to spot unreasonable figures. According to Table 1, there were observations missing regarding bank-specific determinants. This is mainly due to unreported figures in annual financial reports from some banks. Also, from Table 1, we can see that the NPLs variable has a mean value of 7.62, which goes up to a maximum of 40 and down to a minimum of 0.19. The high maximum value is due to the period when the data is collected, which covers the years of the world economic and financial crisis, the effects of which spilt over the Polish banking system, with some banks being affected more than others. Furthermore, we can see from Table 1 that ROE and GGL have negative values. Based on the data, we can say that there are significant differences among the banks in Poland in terms of all variables selected. Namely, in the case of ROE, there are banks where this determinant has a negative value of -25.2, but it can also go up to as much as 38.1. It is similar to the other variables. It is thus similar in the case of macroeconomic variables, where we have large oscillations in the analysed period, especially UN, which has the largest variations between the minimum and the maximum values.

Table 1

Descriptive statistics

	NPL	ROE	ETA	GGL	GDPG	DCPS	INF	EXPORT	EXR	UN	PD	FISCALP
Mean	7.62	10.0	11.0	15.7	3.96	47.1	1.96	44.2	4.11	9.10	50.3	-3.62
Median	6.67	10.4	10.4	10.1	3.72	50.5	2.12	44.5	4.16	9.29	50.4	-3.65
Max	40.0	38.1	42.2	157.7	7.03	54.5	4.23	52.1	4.48	17.7	55.7	-0.4
Min	0.19	-25.2	0.71	-87.2	1.39	27.1	-0.87	35.9	3.61	3.8	44.2	-7.3
Std. Dev.	5.29	7.61	4.91	26.41	1.52	8.4	1.62	4.28	0.22	3.41	3.42	1.88
Observ	182	211	225	202	252	252	252	252	252	252	252	252

Source:Author's calculations.

3.2. Methodology

In the main objective of this study is to examine the impact of bank-specific and macroeconomic factors on the volume of NPLs, using panel data for a sample of 18 banks from 2005 to 2018. Hsiao (1986) listed several advantages of panel data compared to other types of data. First of all, panel data provide more information, more variability, less collinearity among other variables, a greater degree of freedom, and higher efficiency. Second, panel data can not only capture and measure effects that are not detectable in cross-section time-series analysis but also provide a platform on which to test more complicated behavioural models. For that reason, a precise econometric model is developed incorporating all the widely recognised variables mentioned above. Also, the model is summarised in accordance with the existing models in the vast literature and the variables involved are also supported by substantial empirical evidence.

In general, the following econometric model is developed:

$$y_{it} = \alpha_0 + \beta_i BANK_{i,t} + \beta_i MAC_{i,t} + \varepsilon_{it} \quad (1)$$

where y_{it} denotes the NPLs to total gross loans, α_0 is the intercept, BANK denotes the bank-specific variables, and MAC denotes the macroeconomic factors. Note that i corresponds to the examined bank of the sample and *t* to the year, while ε denotes the error term.

In order to obtain deeper insight into the relevance of the explanatory variables, their coefficients are estimated by employing two estimation techniques: Fixed Effects Model (without the variable NPLt-1 from equation (1), since it can lead to inconsistent results), and System GMM, as well as the necessary relevant tests which will be explained more specifically further in the paper.

The starting point in each panel model is the assessment of fixed and random effects. They are well documented in the literature, such as, for example, in Wooldridge (2002, 2007). In short, the analysis of fixed effects assumes that the units of interest (in our case, the banks) are fixed and that the differences between them are not of interest. The random-effects model, on the other hand, provides a lock to the population from which the sample was extracted. For our analysis of the banks, the model of fixed effects would be adequate. Namely, in short panels, the estimates obtained can differ considerably and the fixed effects should therefore be employed when we strongly believe that the units in the model are not random drawings

from a larger sample, in which case the RE is preferred (Judge et al., 1988). In addition to this, we also conducted the Hausman test (1978) for distinguishing between the models of fixed and random effects. Moreover, the suitable equation for estimation through fixed effects model becomes:

$$NPLi,t= \alpha0 + \beta1ETA,t + \beta2ROEi,t + \beta3GGLi,t + \beta4GDPGi,t + \beta5DCPS\ i,t + \beta6INFi,t\ \beta7EXPORTi,t\ \beta8EXRi,t + \beta9UNi,t + \beta10PDi,t + \beta11FISCALPi,t + \varepsilon i,t \quad (2)$$

The models of fixed and random effects imply that all the variables on the right side of the model (1) are exogenous. However, for some of them, it can be argued that there is a reciprocal causation, as part of them arise from the balance sheets of the banks themselves. Such feedback may cause inconsistency in the assessment of the model of fixed or incidental effects. In order to overcome it, the model can be evaluated by means of the so-called instrumental variables technique, in which potentially endogenous variables are instrumented with variables that are highly correlated with the particular regressor but are not correlated with the error member Wooldridge (2007). In particular, the panel data prepared for this study is a linear functional relationship, a dynamic left-handed variable, not strictly exogenous as some of the variables and fixed effects that were observed with the first estimation technique. Accordingly, the structured model for the determinants of NPLs is a perfect match for GMM estimation and therefore, we decided to proceed with the aforementioned technique to obtain more relevant and unbiased results. Additionally, following the past papers with dynamic panel data Makri et al. (2014), Us (2016), Klein (2013), Beck and Levine (2004), Cheng and Kwan (2000) and many others that are similar to this one, focused on the objectives alike and handling an equivalent panel data set, utilised the System GMM.

With System GMM we avoid the dynamic panel bias" in the fixed effects model by transforming the data to first differences to remove the fixed effects and uses the lagged levels of the right-handed independent variables as instruments. But, still, in panel datasets with limited time dimension or lower T (such as in our case), this estimation can be less precise Blundell and Bond (1998). As a result, the System GMM is applied in order to avoid this concern. This approach actually involves two equations: one in levels in which the instruments are presented by the lagged first differences, and the other in the first differences with lagged levels as instruments Arellano and Bover (1995). Under this approach, the lagged bank-level variables were modelled as pre-determined (thus instrumented GMM-style in the same way as the lagged dependent variable) while the country-level and the global variables were treated as strictly exogenous (instrumented by itself as an "IV style" instrument, Roodman (2009).

However, the equation that we aim to estimate in this research paper in order to observe the impact of the bank-specific and macroeconomic variables on NPLs is the following

$$NPLi,t= \alpha0 + \gamma0NPLt\text{-}1 + \beta1ETA,t + \beta2ROEi,t + \beta3GGLi,t + \beta4GDPGi,t + \beta5DCPS\ i,t + \beta6INFi,t\ \beta7EXPORTi,t\ \beta8EXRi,t + \beta9UNi,t + \beta10PDi,t + \beta11FISCALPi,t + \varepsilon i,t \quad (3)$$

This equation also incorporates the lagged dependant variable that was excluded earlier from the fixed effects estimation since the first one can result in "dynamic panel bias", and the

latter will be absorbed by the model's intercept. Nevertheless, the reasons behind the choice of Arellano-Bond GMM Estimator are elaborated above.

Based on all of the above, the further analysis evaluates the economic model (1) through 2-panel methods: the method of fixed effects and the system-GMM method. The choice between the fixed and random effects will be made based on the Hausman test (1978). The validity of instruments selected for parametric evaluation can be tested using the Sargan test. The second group of tests refers to tests of serial correlations in different residuals (first-order **AR (1)** and second-order **AR (2)** serial correlation). The first-order autocorrelation in the differed residuals does not imply that the estimates are inconsistent (Arellano, Bond, 1991, p. 282). However, the second-order autocorrelation would imply that the estimates are inconsistent.

4. Results and Discussion

In this section, we begin with an analysis of the results of multicollinearity. One of the assumptions of the linear regression model is that there is no multicollinearity among the independent (explanatory) determinants. If the correlation between explanatory determinants is high, estimation of the regression coefficients is possible, but with large standard errors and, as a result, the population values of the coefficients cannot be estimated precisely. According to Kennedy (2008), multicollinearity is a problem when the correlation is above 0.80, which was not the case here. The correlation among the variables selected is broadly in line with the economic theory. The matrix shows that, in general, the correlation between the selected determinants was not strong, suggesting that multicollinearity problems were either not severe or non-existent.

Table 2

Correlation matrix

	NPL	ROE	GGL	ETA	GDPG	INF	EXR	EXPORT	DCPS	UN	PD	FISCALP
NPL	1											
ROE	-0.2	1										
GGL	-0.26	0.05	1									
ETA	0.34	0.01	-0.18	1								
GDPG	-0.09	0.21	0.2	-0.06	1							
INF	-0.09	0.18	0.09	-0.01	0.11	1						
EXR	0.03	-0.35	-0.14	-0.005	-0.37	-0.21	1					
EXPORT	-0.03	-0.25	-0.11	0.03	0.06	-0.41	0.56	1				
DCPS	0.003	-0.42	-0.14	0.03	-0.38	-0.26	0.8	0.74	1			
UN	0.08	0.35	0.06	-0.005	-0.07	0.14	-0.54	-0.78	-0.79	1		
PD	0.1	-0.3	-0.16	0.03	-0.67	-0.18	0.67	0.31	0.65	-0.16	1	
FISCALP	-0.1	0.06	-0.04	0.02	0.38	-0.42	0.09	0.7	0.13	-0.4	-0.24	1

Source: Author's calculations.

The results of the unit root test are presented in Table 3. The unit root analysis, according to ADF Fisher-type tests, can not be rejected in three determinants (UN, INF and DEFI), while the results of PP Fisher-type tests indicate that the null hypothesis of non-stationarity can be rejected for all our determinants. The results of the Breitung test indicates that the hypothesis

of non-stationarity cannot be rejected for three of the determinants (NPL, DCPS and ETA). However, bearing in mind that the other two unit tests (ADF and PP Fisher-type) show that these determinants are stationary at their levels, we include PD, DCPS and ETA in our models, and we treat them as non-stationary variables at their levels.

Table 3

Panel unit root tests

Test variables	ADF-Fisher Chi-square		PP-Fisher Chi-square		Breitung	
	Level	First Difference	Level	First Difference	Level	First Difference
NPLs	45.19***		61.96***		-1.534*	
PD	0.793**		0.784*		0.782	-3.727***
UN	30.61	91.98***	66.07***		-6.715***	
GDPG	88.57***		51.69**		-7.578***	
INF	32.94	93.80***	14.5055*		-4.756***	
DCPS	162.3***		443.6***		3.624	-13.02**
EXPORT	64.05***		72.24***		-4.98***	
EXR	43.05***		57.09**		-9.68***	
ROE	59.66***		98.56***		-2.895***	
ETA	46.70*		82.21***		0.558	-0.462*
GGL	64.10***		82.76***		-2.537**	
DEFI	0.595	158.90***	0.985*		-4.190***	

***, **, * denote statistical significance at the 1, 5, 10 percent level, respectively

Source: Author's calculations.

In Table 4, we report the empirical results of the fixed effects model and system GMM. Despite their differences, all approaches arrive at essentially similar results as to the sign and the statistical significance of most determinants in the regression specification. This confirms that our results are robust to different specifications, although the precision of the estimated coefficients differs across different methods that we have used in our study.

The results presented in Table 4 broadly confirm that both bank-level and macroeconomic factors play a role in affecting the banks' asset quality. The models seem to fit the panel data reasonably well, having fairly stable coefficients. First, the Hausman test (with a *p*-value of 0.012) shows that we can reject the null hypothesis that the random effect model is preferred and proceed with the estimation employing the fixed effects model. Thus, the Hausman test indicates to us that it is the fixed effects model that should be used during the estimation. Furthermore, the Hansen test shows that the chosen instruments are valid in the system GMM (with a*p*-value of 0.697). Also, the results under both models (difference and system GMM) show that the residuals demonstrate no serial correlation of order two, although a first-order autocorrelation is present in both models, yet, this does not imply that the estimates are inconsistent. According to Arellano and Bond (1991), inconsistency would be implied if a second-order autocorrelation was present, but this is rejected in our case by the test for AR(2) errors.

The results for the lagged dependent variable have a positive and statistical significance in both of the models that estimated its coefficient, which is confirmed by the dynamic character of the model's specification. The value of the lagged NPLs is 0.23 suggest that a shock to NPLs would be likely to have a prolonged effect on the Polish banking system. These results

are similar to those obtained by previous studies, as in Beck et al. (2005) where the lagged NPLs' value was between 0.19 and 0.29 and in Otasevic (2014), where the values of lagged NPLs were between 0.12 and 0.27.

Table 4

Estimation Results

Variables	Fixed Effects (FE) regressions	System GMM
NPL(-1)		0.23*** (0.45)
Const	15.06** (7.35)	10.06*** (5.43)
ETA	-0.086 (0.05)	-0.216 (0.26)
ROE	-0.024* (0.01)	-0.074 (0.11)
GGL	-0.034*** (0.01)	-0.016* (0.01)
GDPG	-0.675*** (0.27)	-0.943*** (0.23)
DCPS	-0.387*** (0.12)	-0.313*** (0.07)
INF	-0.038 (0.19)	0.240 (0.18)
EXPORT	0.038 (0.03)	0.059 (0.05)
EXR	0.35** (0.11)	0.40* (0.15)
UN	0.413 (0.25)	0.645*** (0.21)
PD	0.360** (0.16)	0.363*** (0.12)
DEFI	-0.212 (0.19)	-0.021 (0.11)
Number of Banks	18	18
Hausman test (p-value)	0.012	
Number of instruments		13
Hansen test (p-value)		0.697
Test for AR(1) errors		0.053
Test for AR(2) errors		0.338

1. Arellano-Bond test shows that the average autocovariance in residuals of order 1 is 0 (HB0B: No autocorrelation).
2. Arellano-Bond test indicates that the average autocovariance in residuals of order 2 is 0 (HB0B: No autocorrelation).
Standard errors are in parenthesis
*,** and *** show that the null hypothesis can be rejected at 10%, 5% and 1% significance levels, respectively

Source: Author's calculation

Starting with bank-specific determinants, only individual credit growth in three models (FE, difference and system GMM) has a statistically significant and negative relationship with NPLs. Despite the theoretical justification of the positive relationship as we mentioned before, there are also studies such as (Swamy, 2012; Boudriga at al., 2009; Sukrishnalall, Pasha, 2009), who establish a negative link between these two variables. These results probably reflect the conservative lending stance adopted by commercial banks after 2002-2014 due to their bad lending experience with the real sector and the general decline in the

real economy. In that period, the amount of NPLs in Poland reached a record high of 22.6% in June 2003. This is in line with Quagliarello (2007), who argued that a positive result of GGL may be the result of certain specifics, regulations and history in the separate banking systems that they have and the banks are more conservative and more careful in the dissemination of the credit offer.

The ROE related results indicate that profitability has a significant and negative impact on NPLs, but only in the first model with a fixed effect with a value of (-0.24). This result confirms the hypothesis that less profitable banks, in general, take higher credit risk and demonstrate the validity of the hypothesis of "bad management", reflected in the reduced profitability, which, in turn, motivates managers to go for increased risk exposure, therefore creating the growth of bad loans. The result is in line with the study of Klein (2013), where ROE was also statistically significant only under the fixed model, while being not significant under the difference and system GMM. So, the results are compatible with the economic intuition and the theoretical arguments discussed previously in this study. Again, the result reinforces the theoretical argument of bad management in the bank, which will eventually lead to a weakening of the efficiency in the procedure for underwriting bank loans. However, this result does not hold when the endogeneity of return on assets is controlled for in the GMM-IV estimation.

We found that GDP growth has a significant and negative impact on NPLs, which means that an increase in the domestic product causes a decrease of NPLs in both models. The results support the negative correlation with the non-performing loans in the CEE region aligned with the results from Makri et al. (2014), Skarica (2013), Us (2016), Fofack (2005) and Salas and Saurina (2002). The sign of these variables fulfil our expectations as well and one unit change in the GDP will lead to 0.943 units change in the opposite direction in the NPL ratio. This means that when the economy is booming, the income of the people is also increasing and they have more cash flows to repay their outstanding debts. Conversely, in times of economic recession, when the GDP falls, the wages are as well disrupted and the people are left with less income needed for meeting their loan obligations. Consequently, it influences the level of the non-performing loans and they increase substantially (Makri et al., 2014). The fact that economic growth is statistically significant (at the level of significance of 1%) in all models is confirmed by the robustness of the results obtained.

The results of DCPS indicate a statistically significant explanation power with a negative sign of the NPLs. If we considered this determinant in the context of one of the bank-specific determinants (credit growth), we could conclude that rapid credit growth would lead to faster growth of NPLs. Namely, they both had positive signs in line with the literature (Dash, Kabra, 2010), which condemned unsustainable lending booms as a factor that led to increased financial fragility. This result may also justify the central bank's actions to limit excessive lending growth to ensure financial stability.

With respect to the impact of the exchange rate, our results are in line with the results of other macro-studies on NPLs De Bock and Demyanets (2012) and Beck, Jakubík and Piloiu (2013) Klein (2013). Moreover, our results confirm the following observation by the ESRB (2011): "In some countries, foreign currency loans have higher non-performing loan (NPL) ratios and higher levels of loan restructuring. This conclusion is reached when the vintage of loans

is taken into account, i.e. generally borrowers that took out a foreign currency-denominated mortgage loan at a stronger exchange rate tend to have higher default ratios. This further demonstrates that, most likely, at least some borrowers are unaware of the risks in which they engage when taking out a foreign currency loan." However, the ESRB (2011) also remarks: "In some countries, such as Poland, data shows that foreign currency loans tend to perform better than the domestic currency ones." In a similar vein, some micro-level evidence shows mixed results on the performance of foreign currency mortgage loans. Apart from methodological issues, there are economic explanations why foreign currency loans may not show higher NPL ratios than local currency loans (Jakubík, Reininger, 2013). (1) The materialisation of foreign interest rate risk can have an influence on the nonperformance of foreign currency loans. In countries with a floating exchange rate, such risk materialisation can substantially mitigate the impact of exchange rate changes. Indeed, as the ESRB (2011) mentions, in some countries (for example, Poland and Romania), the negative effects of local currency depreciation were partly offset by declining interest rates in euro and Swiss francs. This beneficial form of risk materialisation was a result of both the prevalent interest rate-setting regime and the specific situation in advanced economies and global financial markets during the crisis years of the time period examined in our study. In some countries with fixed/pegged regimes, borrowers in foreign currency did not suffer from currency devaluation but rather benefited from foreign interest rate cuts during the crisis years. (2) Another explanation may be borrower selection as a result of prudent behaviour on banks' own initiative and/or of early measures by authorities (like the "Recommendation S" in Poland) that guided the extension of foreign currency loans above all to higher-income borrowers. (3) A third economic reason may be the bank practice of converting foreign currency loans into domestic currency when they are close to becoming delinquent or being restructured, as the ESRB (2011) highlights in the annexe to its recommendation. Especially the latter point suggests that it may be misleading to compare (only partially available) bank-level or supervisory data on NPL ratios disaggregated by currency. Rather, estimating the impact of exchange rate changes on the aggregated NPL ratio (comprising both foreign and domestic currency loans) may provide more reliable insights. Referring to the corresponding results of such estimates in our study, we highlight that we found a significant and sizeable adverse impact of currency depreciation on the NPL ratio, *although* borrower selection had been at work to a varying degree in the countries of our sample (probably most notably so in Poland).

As we expected, unemployment has a positive and statistical significance at 1%. As was anticipated, it is found a strong positive relationship between the unemployment rate and the non-performing loans in Poland. This sign alludes to the assumption that when unemployment between people increases, it limits their cash flows and resources since they are not working and consequently constrains their ability to repay the outstanding loans and therefore, that increase contributes to the raising of the NPLs in the loan portfolios. This justification and the obtained results are aligned with Makri et al. (2014), Messai and Jouini (2014), Louzis et al. (2010) and Bofondi and Ropele (2011), who represented evidence of the unemployment rate significantly and positively related to the NPLs. Thus, the estimated value of the coefficient suggests enlargement of the non-performing loans of 0.65 units in a case when the unemployment rate will go up by one unit, all else equal. Also, the p-value reveals the statistical significance at a level of 1%.

The last macroeconomic variable that is statistically significant is public debt. The public debt of the country also confirms the predictions for a positive relationship with the non-performing loans corroborated by many research studies such as Makri et al. (2014) and Reinhart and Rogoff (2010). In particular, the fixed effects model estimates coefficient with a value of 0.066, which implies that if the government debt increases by one unit, under all else equal, the non-performing loans will be positively affected by 0.36 units. Besides, it demonstrates statistical significance at a level of 5%. Thus, the justification of this relationship is that increase in the public debt can deteriorate the rating of the government securities and subsequently, it can influence banks' liquidity since they are usually inclined to invest their liquidity reserves in government securities. Consequently, the banks limit the issuing of new loans and since borrowers cannot renew their loans, the non-performing loans might increase (Reinhart, Rogoff, 2010).

We may conclude that the estimations for the overall period suggest that the selection of the independent variables is plausible and most of the regressors yield statistically significant coefficients, which also have the expected signs.

The main conclusion of this paper is that the NPLs in Poland are generally shaped by the macroeconomic factors in the period analysed. Second, the factors that demonstrate a statistically significant and positive correlation with the NPLs ratio are the following: the lagged non-performing loans ratio, the GGL, and ROE of bank-specific factors, as well as the GDPG, DCPS, UN and PD from the group of macroeconomic factors. Also, the signs of these variables are in line with the initial expectations.

In summary, we may conclude that in the period between 2005 to 2018, the NPLs were mostly influenced by macroeconomic factors. This paper found that bank-specific factors also have an impact, although a relatively smaller one, on the level of NPLs. Bearing this in mind, the banking sector in Poland should continue to further improve the quality of their management, as despite the theoretical justification of the positive relationship between credit growth and NPLs, in our case, this relationship has a negative value which confirms that banks in Poland are well-managed in terms of approving and collecting loans again.

Conclusion

In this paper, we examined the macroeconomic and bank-specific and determinants of NPLs for a panel of 18 banks from Poland, using annual data for the period 2005-2018. We employ two alternative estimation techniques: the fixed effects model and the System Generalised Method of Moments. During our research, we could not find another empirical paper that is focused entirely on the issue of macroeconomic and bank-specific determinants of NPLs in Poland, with the exception of only one, but which covers the period before the global financial crisis (1996-2006).

Based on the empirical results, we can see that relatively different results are shown through the four alternative estimation techniques. The general conclusion that can be drawn is that in the period under consideration, the NPLs in Poland were mostly shaped by macroeconomic factors. Specifically, we found that, from among the macroeconomic determinants, GDP

growth and domestic credit to the private sector have a strong negative effect on the level of NPLs, while public debt and unemployment have a positive one. This paper also finds that out of the bank-specific factors, individual credit growth in the case of three models (FE, difference and system GMM) demonstrates the most significant and negative relationship with NPLs statistically.

We have several suggestions for further research. First, it would be possibly interesting for future authors to extend the sample and comparatively analyse certain countries, similar to Poland (the Czech Republic, for example), in order to elucidate the determinants that affect NPLs. Second, as a measure of credit risk, it would be beneficial to also apply changes in the status of NPLs, or bad debt reserves, along with the ratio of NPLs over total loans. Third, future studies could provide a breakdown of all NPLs to NPLs to enterprises and to households and then apply such a breakdown of NPLs to enterprises by type of activity and to households by type of loan. Such findings could help the policymakers to identify the loan categories that are mostly exposed to NPLs and, consequently, to concentrate on those categories in order to mitigate the credit risk and strengthen the financial stability of the country.

References

Arellano, M., Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. – Journal of Econometrics 68, pp. 29-51.

Arellano, M., Bond, S. (1991). Some tests of specification for panel data. Monte Carlo evidence and an application to employment equations. – Review of Economic Studies 58, pp. 277-297,.

Babouèek, I., Janèar, M. (2005). A VAR Analysis of the Effects to Macroeconomic Shocks to the Quality of the Aggregate Loan Portfolio of the Czech Banking Sector. – Working Paper Series 1, Prague, Czech National Bank,.

Babouèek, I., Janèar, M. (2005). Effects of macroeconomic shock to the quality of the aggregate loan portfolio. – Working Paper, Czech National Bank, Vol. 1, pp. 1-62.

Blundell, R., Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. – Journal of Econometrics 87, pp. 115-143.

Beck, T., Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. – Journal of Banking & Finance, 28(3), pp. 423-442.

Beck, R., Jakubik, P., Piloiu, A. (2013). Non-performing loans. What matters in addition to the economic cycle?. – Working Paper Series, N 1515, European Central Bank.

Beck, T., Demirgüç-Kunt, A., Maksimovic,V. (2005). Financial and Legal Constraints to Firm Growth: Does Firm Size Matter?. – Journal of Finance", 60, pp. 137-177.

Berger, A., DeYoung, R. (1997). Problem Loans and Cost Efficiency in Commercial Banks. – Journal of Banking and Finance, 21, pp. 849-870.

Blaschke, W., Jones, M. (2001). Stress testing of financial systems: An overview of issues, methodologies and FSAP experiences. – IMF Working Paper, 01/88, Washington.

Bunn, P., Cunningham, A., Drehmann, M. (2005). Stress testing as a tool for assessing systemic risk. – Financial Stability Review, pp. 116-126.

Boudriga, A., Boulila, N., Jellouli, S. (2009). Does bank supervision impact non-performing loans: cross-country determinants using aggregate data?. – MPRA Paper, N 18068.

Castro, V. (2012). Macroeconomic determinants of the credit risk in the banking system: the case of the GIPSI. – NIPE WP, 11/ 2012.

Çifter, A. (2012). Bank Concentration and Non-Perfoming Loans in Central and Eastern European Countries. – Journal of Business Economics and Management.

Dash, M., Kabra, G. (2010). The determinants of non-performing assets in Indian commercial bank: An econometric study. – Middle Eastern Finance and Economics, 7, pp. 94-106.

Erdinc, I., Abazi, E. (2014). The Determinants of NPLs in Emerging Europe, 2000-2011. – Journal of Economics and Political Economy, Vol 1, N 2.

Espinoza, R., Prasad, A. (2010). Non-performing Loans in the GCC Banking Systems and their Macroeconomic Effects. – IMF Working Paper, 10/224.

Fofack, H. (2005). Non-Performing Loans in Sub-Saharan Africa: Causal Analysis and Macroeconomic Implications. – World Bank Policy Research Working Paper, N WP 3769.

Ghosh, A. (2015). Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. – Journal of Financial Stability, pp. 93-104.

Cheng, L. K., Kwan, Y. K. (2000). What are the determinants of the location of foreign direct investment?. – The Chinese experience Journal of International Economics, Vol. 51, N 2, 379-40.

Gunsel, N. (2008). Micro and Macro determinants of bank fragility in North Cyprus economy. – International Research Journal of Finance and Economics, ISSN 1450-2887.

Godlewski, C. (2004). Capital Regulation and Credit Risk Taking : Empirical Evidence from Banks in Emerging Market Economies. Institut d'Etudes Politiques, Université Robert Schuman, Strasbourg 3.

Głogowski, A. (2008). Macroeconomic determinants of Polish banks' loan losses – results of a panel data study. – NBP Working Papers 53, Narodowy Bank Polski, Economic Research Department.

Hoggarth, G., Logan, A., Zicchino, L. (2005). Macro stress tests of UK banks. – BIS papers, pp. 392-408.

Hsiao, C. (1986). Analysis of Panel Data, Econometric Society monographs. N 11, New York: Cambridge University Press

Jakubík, P., Reininger, T. (2013). Determinants of Nonperforming Loans in Central, Eastern and Southeastern Europe Focus on European Economic Integration. – Oesterreichische Nationalbank, N 3, pp. 48-66.

Jimenez, G., Saurina, J. (2005). Credit cycles, credit risk, and prudential regulation. – Banco de Espana.

Judge, G. G., Hill, R. C., Griffiths, W., L¨utkepohl, H., Lee, T. C. (1998). Introduction to the Theory and Practice of Econometrics. New York John Wiley and Sons.

Kennedy, P. (2008). A Guide to Econometric 6th edition. Malden. Massachusetts: Blackwell Publishing.

Khemraj, T., Pasha, S. (2009). The determinants of non-performing loans: an econometric case study of Guyana. Presented at the Caribbean Centre for Banking and Finance Bi-annual Conference on Banking and Finance, St. Augustine, Trinidad.

Klein, N. (2013). Non-Performing Loans in CESEE;Determinants and Impact on Macroeconomic Performance. – IMF Working Papers, 13/72.

Kurumi, L., Bushpepa, O. (2017). Do macroeconomic variables affect the level of non-performing loans? Sixth Conference of Students of the Agricultural University of Tirana. Tirana.

Khemraj, G. Pasha, T. Sukrishnalall. (2009). The determinants of non-performing loans: an econometric case study of Guyana. – Munich Personal RePEc.

Kjosevski, J., Petkovski, M. (2018). Non-performing loans in Baltic States: determinants and macroeconomic effects. – Baltic Journal of Economics, pp. 25-44.

Lu, Wei., Yang, Z. (2012). Stress Testing of Commercial Banks' Exposure to Credit Risk: A Study Based on Write-off Nonperforming Loans. – Asian Social Science, Vol. 8, N 10.

Louzis, D., Vouldis, A., Metaxas, V. (2010). Macroeconomic and bank-specific determinants of non performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios. – Working Paper, N118.

Maddala, G. S. (2001). Introduction to Econometrics. 3rd edition. Chichester, John Wiley and Sons.

Makri, V., Tsagkanos, A., Bellas, A. (2014). Determinants of Non-Performing Loans: The Case of Eurozone. – Panoeconomicus, pp. 93-206.

Messai, A. S., Jouini, F. (2013). Micro and Macro Determinants of Non-performing Loans. International. – Journal of Economics and Financial Issues, 3(4), pp. 852-860.

Nkusu, M. (2011). Non-performing Loans and Macrofinancial Vulnerabilities in Advanced Economies. – IMF Working Paper, 11/161.

Otašević, D. (2013). Macroeconomic determinants of the quality of banks' loan portfolio in Serbia. – Working paper series, National Bank of Serbia.

Pesola, J. (2001). The role of macroeconomic shocks in banking crises. Bank of Finland. Research department.

Pesola, J. (2005). Banking fragility and distress: An econometric study of macroeconomic Determinants. – Research Discussion Papers, 13.

Quagliarello, M. (2007). Banks' Riskiness Over the Business Cycle: a Panel Analysis on Italian Intermediaries. – Applied Financial Economics, 17(2), pp. 119-138.

Rajan, R., Dahl, C. (2003). Non-performing Loans and Terms of Credit of Public Sector Banks in India: An Empirical Assessment. – Occasional Papers, Reserve Bank of India, Vol. 24, pp. 81-121.

Rinaldi, L., Sanchis-Arellano, A. (2006). Household Debt Sustainability, what Explains Household Non-Performing Loans? An Empirical Analysis. – Working Paper Series 570, European Central Bank.

Reinhart, C. M., Rogoff, K. S. (2010). Growth in a Time of Debt. – American Economic Review: Papers & Proceedings, 100.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. – Stata Journal, Vol. 9, N 1, pp. 86-136.

Report of the working group on NPLs in Central, Eastern and Southeastern Europe, (2012): European Banking Coordination Vienna Initiative.

Salas, V., Saurina, J. (2002). Credit Risk in Two Institutional Regimes: Spanish Commercial and Savings Banks. – Journal of Financial Services Research, Vol. 22, pp. 203-224.

Skarica, B. (2013). Determinants of non-performing loans in Central and Eastern European countries. – Financial Theory and practice, 38 (1), pp. 37-59.

Sofoklis, V., Nikolaidu, E. (2011). Investigating the Determinants of Non-performing Loans in the Romanian Banking System: An Empirical Study with Reference to the Greek Crisis. – Economics Research International.

Staehr, K., Uusküla, L. (2017). Forecasting models for non-performing loans in the EU countries. – Working Papers of Eesti Pank, 10.

Swamy, V. (2012). Impact of Macroeconomic and Endogenous Factors on Non- Performing Banks Assets. – International Journal of Banking and Finance, Vol 9, N 1, Article 2.

The European Banking Federation. (2018). Poland's banking sector: Facts & Figures.

Wooldridge, J. M. (2007). Econometric Analysis of Cross Section and Panel Data, MIT Press Books. The MIT Press, ed. 1, Vol. 1.

Wong J., Choi K. F., Pak-Wing, Fong. (2008). A Framework for Stress-Testing Banks' Credit Risk. – Journal of Risk Model Validation, pp. 3-23.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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ASSESSMENT OF TECHNOLOGICAL COMPETITIVENESS OF UKRAINE IN TERMS OF ASSOCIATION WITH THE EU[7]

Research background: The paper accounts for the problem of assessing the factors of the formation of Ukraine's technological competitiveness in the face of new challenges for the state in the process of developing relations with the EU.
Purpose of the article: The aim of the report is to assess the level of technological competitiveness of the Ukrainian economy and determine the most important factors for its further development in the conditions of association with the EU.
Methods: The article presents the scheme of research of technological competitiveness of Ukraine on the basis of qualitative and economic-statistical analysis, analysis of comparative advantages, cluster and correlation-regression analysis.
Findings & Value added: The analysis of world rankings has shown that the technological competitiveness of Ukraine determines comparative factor advantages in coverage of higher education, availability of scientific staff, and quality of research institutions, but low state support, lack of stability, and problems in institutional development hamper the country's innovative potential. The identification of competitive advantages in trade in high-tech products demonstrates that Ukraine remains an importer of high-tech products; relatively small comparative competitive advantages among the high-tech products of Ukraine has only products of the

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aerospace industry. Cluster analysis showed that Ukraine is in the same cluster as Poland. Bulgaria and Romania, which have not yet fully consistent with the level of technological competitiveness of EU leaders; among the strengths of Ukraine are the development of human resources and labour effect. The correlation analysis between the components of the Global Innovation Index and the factors of increasing Ukraine's competitiveness indicates a moderate link between the development of clusters, the ratio of expenditures on R&D to GDP, and the export of ICT services. In order to increase the level of technological competitiveness of Ukraine: to increase both foreign investments and state financing; improvement of regulatory acts, reduction of corruption, institutional improvement; support of technologies through regional cluster programs or "smart specialisation"; integration into the European Research Area.
Keywords: technological competitiveness; Global Innovation Index; high-tech products; comparative advantages; EU-27 and Ukraine
JEL: C15; F13; F17; O14; O24; O52; O57

Introduction

Presently, in a highly globalised and competitive world, technological change and innovation are the basis of the long-term economic growth of any successful country. As a consequence, the development of economic policy-based countries, based on the development of the scientific, technological, and innovation environment, will contribute to their sustainable economic growth and global competitiveness. At the same time, in the conditions of competition's intensification in foreign and domestic markets for the leading countries of the world, the problem of advanced production technologies' introduction of the 21st-century new industrial revolution is substantially aggravated.

In a highly globalised and competitive world, the basis for a country's long-term economic growth is technological change and innovation. At the same time, the core of technological change and innovation is scientific development. In this context, countries should formulate economic policies to develop a science, technology, and innovation environment in society and the economy that will promote sustained economic growth and global competitiveness (Sener et al., 2011).

Technological readiness is a key element in the growth of each national economy. It is impossible to imagine any aspect of human activity without technological tools. In addition, technology plays a significant role in shaping lifestyles, work, and communication in modern societies. Given this important role in social life and business, the results achieved in technological readiness largely determine the quality of life of citizens and the attractiveness of the economy of a given country. Consequently, the level of competitiveness in terms of technological readiness largely determines the overall competitiveness of a national economy in the global world. These are the main reasons why technological readiness requires special treatment in the formulation of a country's strategic development and why it should be monitored and improved in every national economy that advocates an open development model (Radivojevic et al., 2018).

Thus, competitiveness now is the ability to manage change and adapt to it through innovation. Achieving and maintaining competitiveness requires a constant increase in productivity and

constant adaptation to changes in the economic environment (European Investment Bank, 2016).

When change is the only constant, an economy that can attract new ideas, methods, or products faster than others will have an advantage. That is why the use of technological opportunities and innovations can accelerate the growth and development of any economy (The Global Competitiveness Report, 2018).

The economic growth and the national well-being of the country are also determined by the adequate functioning of the banking system (Radukanov, 2014).

According to the European Commission definition, technological competitiveness is the ability of a national economy to generate long-term economic growth, productivity, and well-being, through technological and innovative development. Such development requires an environment for innovation and has the following elements: a high level of education; investment in research and development; and a developed innovative infrastructure, including high-quality research institutions capable of generating knowledge and supporting new technologies; extensive cooperation in scientific and technological development between universities and industry; protection of intellectual property rights, high levels of competition and access to venture capital and finance (Priede, Pereira, 2013).

In this regard, it is essential to assess the risks associated with capital markets. Economic actors are affected by many factors (at the macro and micro levels) with different intensities. This requires companies to be careful about the rapidly changing market environment, which invariably reflects on competitiveness (Radukanov, 2017).

The importance of traditional competitive advantages has diminished considerably in the twenty-first century, and it is only through participation in technological competition in the world market that the competitiveness of national economies is now substantially enhanced. According to Holroyd, supporting scientific and technological innovation in the long term constitutes the main source of competitive advantage (Holroyd, 2007). In most cases, the technological competitiveness of an economy is described by researchers in the context of the impact of a technological factor on the dynamics of foreign trade, innovative competitiveness or innovative support for industrial modernisation (Fedulova, 2008).

Research is gradually reflecting technological competitiveness in the measurement of the domestic development potential of a country's economy. According to K. Momaya, technological competitiveness is the ability to develop, transfer, absorb, produce or commercialise technologies to maintain competitiveness (Momaya, 2001). J. Fagerberg linked technological competitiveness with innovation potential (Fagerberg, 1988). This is also the position of M. Cassidy, D. O'Brien, who, by technological competitiveness, understand the innovative and adaptive potential of the economy (Cassidy, 2007). J. Howells defines a country's scientific and technological competitiveness as a country's ability to create and retain competitive advantages in the generation, diffusion and application of new knowledge through efficient use, building and modernising its scientific and technological capacity in the context of globalisation (Howells, Michie, 1998).

In our view, an approach to analysing the competitiveness of the economy in terms of technological capabilities suggests that competitive differences among countries arise

because of differences in their technological capabilities, that is, their ability to absorb, adapt, and efficiently use technology for development, efficiency and productivity.

By 2030, world-renowned institutions and international industry associations are predicted to be able to launch a revolution in industrial production only by introducing, first and foremost, high-tech industries. The wave of the new industrial revolution will drive the rise of new digital industrial technologies known as Industry 4.0, based on industries such as nanomaterials, 3D printing, genetic engineering, molecular biotechnology, cloud computing, multidimensional modelling, the Internet of Things, and artificial intelligence (OECD, 2015; UNIDO, 2014).

Exports of high-tech products are the main indicator measuring technological competitiveness, i.e., the commercialisation of research and development and innovation in international markets. It is the development, exploitation, and commercialisation of new technologies that are vital to a country's competitiveness in the modern economy. High-tech products are a key driver of economic growth, productivity, and welfare, and tend to be a source of high value-added and well-paid employment (European Innovation Scoreboard, 2018).

This revolution is connected with the problem of levelling and improving the EU's economic performance. The dynamics of Europe's future development will depend on the quality of its scientific and technological innovations. In this context, EU Member States should develop economic policies to create a science, technology, and innovation environment that will promote sustained economic growth and global competitiveness. Considering the rather ambiguous state of development of Ukraine's high-tech sphere, the problem of assessing factors of formation of technological competitiveness of Ukraine in the face of new challenges for the state in the process of development of relations with the EU.

The aim of this study is to assess the level of technological competitiveness of the Ukrainian economy and determine the most important factors for its further development in the conditions of the new industrial revolution and association with the EU.

Literature Review

The impact of technological changes and industrial revolutions on the country's international competitiveness is the subject of study by a wide range of foreign economists and analysts. In addition, many well-known scientists offer their own methods for assessing the country's technological competitiveness depending on the influence of various factors of the macro-environment, as well as the direct impact of export volumes and structure on competitiveness.

In their works, Jonson et al. (2010) show that Western European nations, along with the USA and Japan, have been recognised as the most competitive economies in the world. Eastern European countries are generally considered to be lagging behind. They are examining the accuracy of these descriptions and the prospects for change in the coming decade. Georgia Tech 'High Tech Indicators' (HTI) contributes to the National Science Foundation (NSF) Science & Engineering Indicators. They cover 33 highly developed and rapidly industrialising countries. Our model of technological competitiveness contains four

components: National Orientation, Socioeconomic Infrastructure, Technological Infrastructure, and Productive Capacity that promote 'Technological Standing'. They present indicator values, derived from survey and statistical panel data, for 13 European nations (plus the USA as a benchmark), for 1993-2005 and draw inferences about future high tech competitiveness. We are witnessing limited technological progress in the Eastern European States. The outlook for Europe is somewhat uncertain, given the sharp increase in competition from Asia.

Porter et al. (2014) showed that the Georgia Institute of Technology, with the support of the National Science Foundation, had completed a decade of developing national high-tech competitiveness indicators. This paper reports on the standing, emphasis, and rate of change of high tech competitiveness for 28 nations. Results show strong standing for the '4 Asian tigers', comparable to many Western European countries. Their five '6 Asian Cubs' are experiencing rapid growth in high-tech production and export opportunities; the four tigers are no longer growing fast. Patterns are presented and discussed as well for 'the Big 3' (Japan, USA, Germany), three non-European developed economies, two former Eastern Bloc countries, and three Latin American nations. Their group of 180 experts predicts a surge in global high-technology export competition over the next 15 years.

To explain these implications, it is necessary to refer to M. Porter's concept of the competitiveness of nations. "The only meaningful concept of competitiveness at the national level is productivity. (…) A nation's standard of living depends on the capacity of its companies to achieve high levels of productivity— and to increase productivity over time" (Weresa M., 2019).

Porter defines the competitiveness of a location as the productivity that companies located there can achieve. He uses this definition of competitiveness to understand the drivers of sustainable economic prosperity at a given location (Ketels, 2006).

Hans-Erik Edsand, following the logic of post-materialist value theory, the rise in GDP per capita and education levels in developing countries suggests that the relevance for including environmental awareness in a developing country study is steadily rising (Edsand, 2019).

Regarding the first aspect, innovative technological competitiveness of the economy is considered in economic literature, in the first place, from the viewpoint of creation and introduction of modern and advanced technologies (Edsand, 2019; Weresa, 2019; Fedulova, 2008). It is the result of public policy of accumulation and use of intellectual capital and introduction of modern technologies that secure the growth of labour productivity and sustainability of production technological and business processes and increases the level of added value in science-intensive economy sectors. However, the approach does not sufficiently take into account the role of business, innovative infrastructure, domestic developments and social effects of technologies introduction.

At the same time, today, all countries must take into account the influence of the main factors of the new industrial revolution. The most widespread concept today, Industry 4.0, was named in 2011 by German businessmen, politicians, and scientists, who identified it as a way of increasing the competitiveness of the German manufacturing industry through the enhanced integration of "cyber-physics systems" (or CPS) into production processes. In the

report, Kagermann et al. (2013) the main points of this concept were formulated, and its further development was described in the works of Ross (2016), Schwab (2016), which emphasise that today advanced production technologies are mainly 3D-printing, cloud technology, Internet things, new materials, robotics, and artificial intelligence.

Thus, we can conclude that Industry 4.0 technologies, combining the factors Smart TEMP (T (technology) – smart technologies, E (environmental) – smart environment, M (manufacturing) – smart production, P (products) – smart products), create new markets and industries, contribute to the growth of labour productivity, the competitiveness of sectors and national economies (Matyushenko, 2016, 2017).

But competitiveness is examined within the framework of industrial development and global challenges (Vasyltsiv et al., 2020; Matyushenko, 2016). It is the capacity of industry to introduce and use advanced technologies for competition and solution of global problems (population decline, poverty, environment, new energy, social security). However, in this case, the emphasis shifts from the development of the national economy to the global social level.

The Fagerberg paper (1996) provides an overview of the literature on technology and competitiveness. First, the concept of a country's international competitiveness and various theoretical approaches to the relationship between trade and growth are discussed. A number of empirical studies on the impact of technology (as evidenced by R&D, patents, etc.) on exports are then examined. As a result, the author summarises the findings and discusses lessons for policy. Moreover, America and Zamora Torres (2014), based on foreign experience, argue that the share of high-tech products delivered to world markets is directly dependent on the development of national innovation infrastructure.

The question of improving the economic performance in the EU countries and finding an effective response to the current global challenges is directly linked to the widespread introduction of these advanced industrial technologies by the new industrial revolution in European countries (Balcerzak, 2015; Barca et al., 2012; Becker et al., 2012; Prokopenko et al., 2018).

Many economists have examined specific aspects of the impact of a country's export capacity on its competitiveness in world markets. Thus, Hausmann and Clinger (2006) used one approach to assess the export potential for competitiveness. Looking at the "commodity space" of world exports, they note that a country's level of competitiveness depends on the food basket it exports. The greater the share of a country's high-tech products in world exports, the more competitive it will be. This position has been confirmed by the analysis of statistics from more than 100 countries. Building on this view, Hidalgo & Hausmann (2009) argues that a country's export potential is influenced by a country's income level (namely, GDP): high-tech goods can be exported by high-income countries. It is clear that this point cannot be unconditionally and unequivocally accepted with regard to individual countries.

Melnyk (2008) argues that the components of export potential include: the potential of internal resources (a function of the technical and technological base, staff qualifications, management methods, finance); the potential of the target foreign market; market access conditions, which include national (trade policy of the country, the system of support for

export production) and external conditions (trade regime of the exporting country). Indeed, these factors influence the formation of export potential. However, Melnyk only points to the existence of functional dependence of export potential on these indicators, without its further formalisation. Therefore, it is not possible to practically use the approach.

To forecast exports, Kireiev (2001, pp. 435-436) proposes to use regression equations of supply and demand. Accordingly, the demand for national products of the country is determined on the basis of the sum of weighted by the correction factors of real-world GDP and the export price index. This equation is based on the assumption of the existence of global development cycles. In fact, countries are developing locally: around the "centre countries" of production and export of goods are "satellite countries", which have similar economic indicators because of the close trade links between them.

Bogomazova (2003) also provides a regression model for estimating export potential, describing the country's exports on the basis of three variables: the nominal exchange rate of the hryvnias against the US dollar, foreign direct investment inflows into Ukraine, and industrial and agricultural growth rates. In our opinion, such a model does not fully characterise the possibilities of forecasting Ukraine's exports, because regression models are quite difficult because the economic situation is changing very quickly.

In assessing the impact of regulatory authorities on the foreign trade of high-tech products in Ukraine, scientists note the possibility of using cause-effect relationships between indicators characterising the market's business processes and government regulatory instruments that can be quantified (Sushchenko et al., 2016; Koval et al., 2019).

Thus, each of these methodological approaches to assessing the competitiveness of the country, taking into account the export potential of the economy, has its own unique features, advantages, and analytical components.

In our opinion, the strength of the methodological approach is Jonson et al. (2010), Porter et al. (2014) is the use of four components in the technology competitiveness model – national orientation, socio-economic infrastructure, technological infrastructure, and productive potential, as well as the use of high-tech technology indicators to assess their competitiveness. In addition, the authors influence the export of technology (based on research and development, patents, etc.). At the same time, such research requires the processing of a large amount of statistical information, which is often difficult for ordinary researchers to access. In our view, a qualitative analysis based on comprehensive indicators is useful for a comprehensive and sufficiently simple assessment of a country's technological competitiveness.

Scientists and business analysts such as Kagermann et al. (2013), Ross (2016), Schwab (2016), investigated the influence of the factors of the new industrial revolution on the technological competitiveness of the country. At the same time, they came to the conclusion that today, in the context of insufficient statistics on the impact of specific breakthrough technologies on the country's economic development, the best quality indicators of the country's technological competitiveness remain integral indicators, primarily such as Global Competitiveness Index of World Economic Forum, the Global Innovation Index, IMD World Competitiveness Ranking and others.

Another group of scientists (América, Zamora-Torres, 2014; Balcerzak, 2015; Becker, et al., 2012; Fagerberg, 1996; Hausmann, Klinger, 2006; Hidalgo, Hausmann, 2009; Bogomazova, 2003; Kireiev, 2001; Koval et al., 2019; Melnik, 2008; Sushchenko et al., 2016) investigated the impact of trade in technological goods on economic growth and conducted various assessments of the impact of a country's export potential on its technological competitiveness.

The synthesis and analysis, combination and critical contemplation of the abovementioned approaches provide the grounds to conclude that innovative technological competitiveness is the leading element that forms competitive advantages of economy and is defined by the level of science and technology development, sector of the digital economy, up-to-datedness and efficiency of used technologies, volumes of their penetration into the system of the national economy and economic relations at all levels, availability of financial support and resources provision and efficiency of the use of innovative technological activity's results.

An analysis of the results of these studies showed that indicators such as the ratio of high-tech exports to GDP of a country, the ratio of the number of employees involved in research and development to the employed population of the country, the ratio of research and development expenditure (R&D expenditure) to the country's GDP, relative (comparative) country advantages by product group and other categories are useful for a comprehensive assessment of a country's export potential. These indicators are often used to assess a country's export potential in a comprehensive manner and to identify the comparative advantages of its exports.

In addition, cluster analysis and correlation-regression analysis should be added to the above methodological approaches in order to allow for a comparative analysis of different countries.

Thus, there is the problem of some combination of these methodological approaches in order to establish a comprehensive and relatively simple methodological approach to assessing a country's technological competitiveness (as in the case of Ukraine); taking into account the impact of the new industrial revolution and Ukraine's association with the EU.

Research Methodology

The article proposes a methodical approach to the study of the technological competitiveness of the country, which includes four stages:

I. Qualitative analysis of four international integral indicators, namely:

- the Global Competitiveness Index of World Economic Forum (GCI WEF), including an indicator of technological readiness (9th pillar: Technological readiness) and indicator of innovation (12th pillar: Innovation);
- the IMD World Competitiveness Ranking (IMD WCR), in particular, an indicator of infrastructure;
- the IMD World Digital Competitiveness Ranking (IMD WDCR) to assess the country's ability to develop and implement digital technologies;

- the Global Innovation Index (GII) to study the detailed indicators of innovation activities in the world.

II. For the study of the main comparative advantages of Ukraine's high-tech trade, it is proposed to use the Melnik (2008) methodology and to analyse the following indicators:

the ratio of exports of high-tech goods to the country's GDP:

$$QE_{HQ} = \frac{E_{HQ}}{GDP} \times 100\% \quad (1)$$

the ratio of the number of employees involved in research and development to the employed population of the country:

$$\frac{\text{R\&}D\ employees}{\text{employed population of the country}} \times 100\% \quad (2)$$

the ratio of research and development expenditure (R&D expenditure) to the country's GDP:

$$\frac{\text{R\&}D\ expenditure}{\text{GDP of the country}} \times 100\% \quad (3)$$

the indicator of the relative or comparative advantage of the country. The country's (i) comparative advantage coefficient (CA) for a given product group or industry (j) is an indication of whether a country has a relative advantage in the exports of a particular product group or whether this advantage is shared by its partners:

$$CA_{ij} = \ln [(Ex_{ij}/Im_{ij}) / (Ex_i/Im_i)] \quad (4)$$

Ex_{ij}, Im_{ij} – export and import of j-goods of the i-country;

Ex_i, Im_i –export and import of the i-country.

III. Positioning the country in a European competitive environment through *cluster analysis*.

IV. Modeling the relationship between indices and factors of technological competitiveness based on *correlation and regression analysis*.

The correlation analysis is used to determine and study the relationship between the indicators studied and to establish the relative degree of dependence of the performance indicator on each factor.

The main purpose of multiple regression analysis is to consider the relationships between a dependent variable and several independent variables. It is necessary to analyse the relationship between the resulting variable and the many factors, and then to identify the factors that most influence the outcome. This analysis can predict the value of a finite variable depending on the values of certain factors.

The forecast linear equation that estimates the multiple regression model that will be used (5):

$$Y = a + b_1 \times X_1 + b_2 \times X_2 + b_3 \times X_3 + \ldots + b_n \times X_n; \quad (5)$$

Y is the dependent variable, what is being predicted or explained;

X_1; X_2; X_3;X_n are the independent variables, that are explaining the variance in Y;

'a' is the constant or value of function with zero value of all factors;

b_1;b_2; b_3; b_n are the regression coefficients.

R_2 will be used to describe the precision of the process model. If the value exceeds 0.7, the model is considered reliable.

We will choose Ukraine and the 27 EU countries as a model for the study, because we are interested in how Ukraine's technological competitiveness has changed since the signing of the association agreement with the EU.

We will choose 2011-2019 (2020 at the time of the article's submission) as the research period, as 2011 (according to the world's leading experts) was the beginning of a period of economic recovery in the leading economies after the global financial crisis of 2008-2009. It was also in 2011 that they first began to speak of a new industrial revolution, the main factors of which were having a growing impact on the technological competitiveness of the world's leading economies, particularly those of the European Union, and associated countries.

The result of the research is the identification of the main ways to increase the level of technological competitiveness of Ukraine.

Results

The results of the comparative analysis of the four indicators of Ukraine's competitiveness, namely the GCI WEF (including Technological readiness and innovation), IMD WCR, IMD WDC Rand GII, are presented in Table 1to Table 6 (The Global Competitiveness Reports (2011-2019), IMD World Competitiveness Ranking (2020), IMD World Digital Competitiveness Ranking (2017-2020), The Global Innovation Index (2011-2020)).

The analysis of the world rankings has shown that Ukraine's technological competitiveness is determined by comparative factor advantages in the coverage of higher education, the availability of scientific personnel and the quality of research institutions, but low state support, lack of stability and problems in institutional development hamper the country's innovative potential. Indicators that determine the technological competitiveness of Ukraine demonstrate the low position of the country. So, in 2019-2020 Ukraine ranks 85th out of 140 countries in the GCI WEF, 55th out of 63 countries in the IMD WCR, 58th of 63 countries in the IMD WDCR, 45th out of 141 countries in the GII.

The evaluation of comparative advantages and indicators of export efficiency of the main industries of high-tech products of Ukraine was conducted using the methodological approach of Melnik (2008, pp. 241-271) based on formulas 1-4. The results of calculations of the comparative advantages calculations are shown in Table 7 and Figure 1 (United Nations Commodity Trade (2011-2019), World Bank Open Data (2011-2019)).

It was found that Ukraine remains predominantly an importer in the world market of high technology products, because its foreign trade in high-tech products is characterised by a low share of these products in total exports of the country and a significant trade deficit. The insignificant presence of Ukraine in the world markets of high-tech products is due to the

outdated structure of production, low R&D costs and the decline in innovation activities of domestic enterprises. Despite the difficult financial and economic situation in the country, exports of telecommunications, computer and information services have been found to be increasing annually, and in 2020, exports of ICT services in Ukraine amounted to 5.1 billion in value terms. Forecast data indicates that this sector of services will continue to grow. The analysis of comparative advantages has shown that Ukraine has only relatively small comparative advantages in the markets of foreign countries in such high-tech products, as aircrafts, space crafts and their parts. The average comparative advantage was 2.21, while in other cases it was negative.

Positioning the country in a European competitive environment through cluster analysis on all 10 indicators of the European Innovation Scoreboard (EIS) for the EU-27 and Ukraine (Table 8). The result of clustering is shown in Figure 2, where 7 clusters with a threshold value of 310 were identified and presented in Table 9 (European Innovation Scoreboard (2019), Eurostat (2019)).

According to the EIS, all EU member states are divided into four different groups. Denmark, Finland, Luxembourg, the Netherlands and Sweden are "innovative leaders" with innovation indicators that are significantly higher than the average in the EU. Austria, Belgium, France, Germany, Ireland and Slovenia are "active innovators" that are productivity above or close to the EU average. Indicators of Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia and Spain are below the EU-27 average. These countries are "moderate innovators". Bulgaria and Romania are "emerging innovators", which performance is significantly lower than the EU average. By level of innovation development, Ukraine is in the same cluster with Bulgaria, Romania, Poland, and Latvia, which have not yet fully been able to adapt their economies to the level of technological and innovative competitiveness of countries such as Germany, the Netherlands, Finland, Austria. Thus, these countries belong to the cluster of "emerging innovators".

Ukraine is a part of cluster 7 (Figure 3), that is far behind the others. The most problematic indicators are "Attractive research system" and "Innovators". If the average EU figure equals 136.6 and 95.9, then for cluster 7, these indicators will be 33.7 and 18.8, respectively. Some advantages countries of cluster 7 have only in indicators of "Innovation-friendly environment" (141.3) and "Employment impacts" (91.7), reflecting general trends in Ukraine. Thus, the cluster analysis showed that Ukraine is now in a single cluster with countries, such as Bulgaria, Romania, Poland, and Latvia, which have not yet fully been able to adapt their economies to the level of technological and innovative competitiveness of the leading countries.

Among countries in cluster 7, Poland and Latvia have the most innovative development. Their strengths include "Innovation-friendly environment", "Employment impacts", "Firm investments", and "Human resources" indicators (Table 8). In Bulgaria, "Intellectual assets" (at the level of Belgium and France) and "Employment impacts" (the highest level among the cluster, which is equal to the same indicator for countries such as Germany and Denmark) are among the greatest advantages of innovative development. Ukraine is the second-to-last cluster country. Romania has the lowest indicators among the EU-27 countries for the components of the "European Union Innovation Scoreboard" like "Human resources",

"Attractive research systems", "Firm investments", "Innovators", "Intellectual assets", "Employment impacts". But the available results show that Ukraine has some strengths in the European competitive environment, such as innovation-friendly environment and labour.

For deeper conclusions, further analysis was made of the state of development of technology competition infrastructure (Figure 4). Compared to other countries in the cluster, Ukraine has the lowest level of infrastructure development in the cluster. Poland and Bulgaria are leading on this indicator.

The development of the tax system is important not only for the creation of a country's business environment, but also for the assessment of its technological competitiveness. For the analysis of the tax system, the development of the total tax rate and contributions as a percentage of profit (Figure 5) for 2016-2020 was analysed. In 2020, the highest tax rate was in Ukraine (45.2%), although during 2016-2018, this rate tended to decrease. In countries such as Latvia, Poland and Bulgaria, the tax rate has not changed much during 2016-2020 and is always at a certain level of 28-40%. Romania has the lowest income tax rate among the countries studied, which was 20% in 2020. Accordingly, it is Romania that has the most attractive tax conditions for technological competitiveness.

Analysis of labour market conditions for Ukraine and Bulgaria, Latvia, Poland and Romania is given by indicators such as "Workers' rights", "Ease of hiring foreign labour", "Internal labour mobility" (Figure 6). According to the Global Competitiveness Index of World Economic Forum, the more the value of the measure, the higher the value of the indicator. So in 2020, Poland had the best employment conditions, including for foreign workers. Employment conditions in Ukraine are at the average level among cluster countries.

Discussion

To assess the degree of influence of factors of innovation development on the indices that determine the global and technological competitiveness of Ukraine, we will use the method of correlation and regression analysis based on the main indicators of the GCI WEF (including Technological readiness and innovation), the IMD WDCR, the GII and our own calculations.

The factors we chose (independent variables X1-X12) can be divided into the following categories, Table 10:

1. Conditions for creating educational and institutional capacity: expenditure on education (X1), the number of graduates in science and technology (X2), quality of research institutions (X3), the ratio of the number of employees involved in research and development to the employed population(X4);
2. Innovation financing: the ratio of R&D expenditure to the country's GDP(X5), FDI inflows (X6);
3. Innovative infrastructure: access to ICT (X7), state of cluster development (X8);

4. The economic effect of innovation: the ratio of exports of high-tech products to industrial exports (X9), the ICT services exports (X10), the number of PCT patents (X11), income from intellectual property use (X12).

As dependent variables (Y1-Y5), the indices that reflect the competitiveness of Ukraine were selected, namely the GCI WEF (Y1) and its main indicators, such as "Technological readiness" (Y2) and "Innovation" (Y3); the GII (Y4) and the IMD WDCR (Y5).

Based on the table of initial data for the indicated indicators in the period 2011-2019, a correlation analysis was carried out, the results of which are presented in Table 11.

The data given in Table 11 show that the GCI WEF of Ukraine has basically a very weak relationship with such factors as the number of graduates in science and technology, expenditure on education, the quality of research institutions, the ratio of R&D expenditures to GDP, and FDI inflows. The GCI WEF is closely related to only one indicator of the state of cluster development (0.594), and has little in common indicators such as ICT access, ICT services exports and education expenditure.

The relationship between technological development and the factors we have chosen is weak or moderate. There is a strong correlation between this index and expenditure on education (-0.729) and income from intellectual property use (-0.730), state of cluster development (0.516), the ratio of R&D expenditure to GDP (-0.624) and access to ICT (-0.371).

The relationship of innovation potential to the factors selected is mostly either strong, very weak or almost non-existent. Thus, indicators such as access to ICT (0.844), income from intellectual property use (-0.909), export of ICT services (0.802), number of PCT patents (0.703) and the ratio of R&D expenditure to GDP have a significant relationship with Ukraine's innovation potential (-0,755).

The correlation between the GII and the factors we have selected shows that the relationship between them is mostly moderate or strong. The three main factors are the ratio of R&D expenditure to GDP (-0.879 – a very close relationship), state of cluster development (-0.727) and the ratio of high-technology exports to industrial exports (-0.743).

The IMD WDCR has the greatest connection with indicators such as FDI inflows (0.802), the number of PCT patents (0.787), and income from intellectual property use (-0.734).

To complete the study, a multiple regression analysis was conducted based on the factors the correlation with which the correlation was strongest.

On the basis of the multiple regression analysis of the modelling and prediction of changes in the values of the main indices that determine the global and technological competitiveness of Ukraine, it has been possible to establish the following:

The coefficient of determination is insignificant ($R^2 = 0,5592$), so the reliability of the model is very low and the results of regression analysis on this factor indicate that there is no relationship between the Global Competitiveness Index and the selected factors. Building a model does not make sense (Table 12, 13).

$Y = 2.5351 + 0.0707 \times X_2$.

The increase in the number of graduates in science and technology by 1% will increase the index of technological development (in the GCI WEF) at 0.0707; $R^2 = 0.752202$(Table 14, 15).

$Y= 3.1108 + 0.0006 \times X_1 – 0.033 \times X_3$.

Improving the quality of research institutions by 1 point will increase the index of innovation potential (in the GCI WEF) to 0.0006. Increasing the revenues from the use of the intellectual property for $1 million will reduce the index of innovation potential by 0.033; $R^2 = 0.893797$ (Table 16, 17).

$Y = 50.8041 +0.4271 \times X_2$.

Increasing the level of the cluster development by 1 point will increase the GII by 0.4271; $R^2 = 0.924411$ (Table 18, 19).

$Y= 51.52405 + 2.106391 \times X_1 – 1.71027 \times X_2 + 1.651747 \times X_3$.

An increase of 1% in FDI inflows would result in an increase of 2,106391 points in the IMD WDCR. An increase of 1% in exports of high-tech products to industrial exports would result in an increase of 1,71027 points in the IMD WDCR, and an increase in the number of PCT patents would result in an increase of 1,651747 points in the IMD WDCR; $R^2 = 0,840884$ (Table 20, Table 21).

Conclusions

The analysis of world rankings has shown that the technological competitiveness of Ukraine is determined by comparative factor advantages in coverage of higher education, availability of scientific staff and quality of research institutions, but low state support, lack of stability and problems in institutional development hamper the country's innovative potential.

Ukraine remains predominantly an importer in the global market of high-tech products, because its foreign trade in high-tech products is characterised by a low share of these products in total exports of the country and a significant trade deficit. It has only small comparative advantages in the markets of foreign countries in such high-tech products, as aircrafts, space crafts and their parts.

The conducted cluster analysis indicates that Ukraine is now in the same cluster with the countries Bulgaria, Romania, Poland, and Latvia, which have not yet fully adapted their economies to the level of technological and innovative competitiveness of the leaders of the countries. The strengths of Ukraine in the European competitive environment include innovation-friendly environment and labour.

Thus, the modelling and forecasting of the development of the main indices, which determine the global and technological competitiveness of Ukraine, showed and made possible the following author's recommendations:

1) It is required to ensure an increase in the number of such graduates by creating and improving research centres at the universities;

2) It is required to diagnose the operation quality of research institutions, develop strategies for their improvement and to achieve adequate state funding for science. The country needs the development of intellectual property legislation and support for small and medium-sized enterprises, which are the driving force behind the country's innovation activity;

3) It is required to develop a program of innovative industrial clusters, which provide for a system of incentives for participants and related fringe benefits and improve the mechanisms of state financial support of cluster development;

4) Ukraine should improve its investment climate. State support is required for the development of high-tech industries and increase in the volume of those types of production, which revealed comparative advantage. It is necessary to increase the funding of science and development (grants, patents, etc.).

In addition, to increase the level of technological competitiveness of Ukraine, it is also necessary to:

a) increase both foreign investment and state financing by improving the country's investment climate, increasing the availability of credit resources for high-tech enterprises and creating special lending programs;

b) broad reform of governance and basic institutions, reduction of corruption, restoration of trust in the government, a reform of the judicial system, improvement of regulatory acts and other institutional improvements;

c) reforming the state and supporting small and medium enterprises, supporting technologies based on the formation and expansion of regional cluster programs or through "smart specialisation";

d) introduction of technology exchange programs, production experience, integration of Ukraine into the world scientific and technological information space, first of all within the framework of the EU.

References

América, J., Zamora-Torres, I. (2014). Countries' competitiveness on innovation and technology. – Global Journal of Business Research, 5, pp. 73-83. http://www.theibfr2.com/RePEc/ibf/gjbres/gjbr-v8n5-2015/GJBR-V8N5-2014-7.pdf.

Balcerzak, A. P. (2015). Europe 2020 strategy and structural diversity between old and new member states. Application of zero-unitarisation method for dynamic analysis in the years 2004-2013. – Economics & Sociology, 8 (2). doi: 10.14254/2071-789X.2015/8-2/14.

Barca, F., McCann, P., Rodríguez-Pose, A. (2012). The case for regional development intervention: place-based versus place-neutral approaches. – Journal of Regional Science, 52 (1). doi.org/10.1111/j.1467-9787.2011.00756.x.

Becker, S. O., Egger, P. H., von Ehrlich, M. (2012). Too much of a good thing? On the growth effects of the EU's regional policy. – European Economic Review, 56 (4). doi: 10.1016/j.euroecorev.2012.03.001.

Bogomazova, V. M. (2003). Metody prohnozuvannya pokaznykiv zovnishn′oekonomichnoyi diyal′nosti. Methods of forecasting indicators of foreign economic activity. Kyiv.

Cassidy, M. (2007). Ireland's Competitiveness Performance. – Quarterly Bulletin No 2, Dublin: Central Bank of Ireland, pp. 93-127.

Doing Business 2020 / International Bank for Reconstruction and Development / The World Bank. URL: https://www.doingbusiness.org.
Edsand, H.-E. (2019). Technological Innovation Systems and the wider context: A framework for developing countries. – Technology in Society, 58, pp. 3-19. https://ideas.repec.org/p/unm/unumer/ 2016017.html.
European Investment Bank. (2016). Restoring EU competitiveness. http://www.eib.org/attachments/efs/ restoring_eu_competitiveness_en.pdf.
European Innovation Scoreboard. (2018). Official website of the European Commission. https://ec.europa.eu/docsroom/documents/30281/attachments/1/translations/en/renditions/native.
European Innovation Scoreboard. (2019). Official website of the European Commission. https://op.europa.eu/en/publication-detail/-/publication/d156a01b-9307-11e9-9369-01aa75ed71a1/language-en/format-PDF/source-136061387.
Eurostat. (2018). Official Website. http://ec.europa.eu/eurostat/data/database.
Fagerberg, J. (1988). International Competitiveness. – The Economic Journal, Vol. 98, N 391, pp. 355-374.
Global Competitiveness Report 2011-2018. World Economic Forum. http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2011–2018.
Global Competitiveness Report 2018. World Economic Forum. URL: http://www3.weforum.org/docs/GCR2018/ 05FullReport/TheGlobalCompetitivenessReport2018.pdf.
Global Competitiveness Report 2019. World Economic Forum. URL: http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf.
Global Innovation Index 2011 – 2018. INSEAD / Global Innovation Index. https://www.globalinnovationindex.org/userfiles/file/GII-2011-18_Report.pdf
Global Innovation Index Report 2020 // Official Website. https://www.globalinnovationindex.org/gii-2020-report#.
Hausmann, R., Klinger, B. (2006). Structural Transformation and Patterns of Comparative Advantage in the Product Space. John F. Kennedy School of Government, Harvard University. https://growthlab.cid.harvard.edu/files/growthlab/files/128.pdf.
Hidalgo, C. A., Hausmann, R. (2009). The Building Blocks of Economic Complexity. – PNAS. 106(26), pp. 10570-10575.
Holroyd, C. (2007). Science and Technology Policies, National Competitiveness, and the Innovation Divide. – Working Paper No 32. Waterloo, Canada: The Centre for International Governance Innovation.
IMD World Competitiveness Ranking 2017. Country profile Ukraine. https://www1.imd.org/globalassets/wcc/docs/country-profile-samples/ukraine.pdf.
IMD World Competitiveness RankingOnline 2020.Country profile Ukraine// Official Website. https://worldcompetitiveness.imd.org/countryprofile/UA/wcy.
IMD World Digital Competitiveness Ranking 2017-2018. https://www.imd.org/globalassets/wcc/docs/imd_world_digital_competitiveness_ranking_2017-18.pdf.
IMD World Digital Competitiveness Ranking2020.Country profile Ukraine// Official Website. https://worldcompetitiveness.imd.org/countryprofile/UA/digital.
Johnson, D. M., Porter, A. L., Roessner, J. D., Newman, N. C., Jin, X.-Y. (2010). High-tech Indicators: Assessing the Competitiveness of Selected European Countries. – Technology Analysis and Strategic Management, 22(3), pp. 277-296. DOI: 10.1080/09537321003647313.
Howells, J., Michie, J. (1998). Technological Competitiveness in an International Arena. International – Journal of the Economics of Business, 5:3, pp. 279-293, https://doi.org/10.1080/13571519884396.
Kagermann, H., Wahlster, W., Helbig, J. (2013). Securing the future of German manufacturing industry. Recommendations for implementing the strategic initiative INDUSTRIE 4.0. Final report // The Industrie 4.0 Working Group; National Academy of Science and Engineering; German Research Center for Artificial Intelligence. https://www.din.de/blob/76902/e8cac883f42bf28536e7e8165993f1fd/recommendations-for-implementing-industry-4-0-data.pdf.
Ketels, Ch. (2006). Michael Porter's Competitiveness Framework – Recent Learnings and New Research Priorities. – Journal of Industry Competition and Trade. 6(2), p. 116. https://www.researchgate.net/publication/5151058_Michael_Porter's_Competitiveness_Framework-Recent_Learnings_and_New_Research_Priorities.
Kireiev, A. P. (2001). International Macroeconomics: An Open Economy and Macroeconomic Programming: Textbook. Moscow: Internationalrelations [Mezhdunarodnaya makroekonomika: otkrytaya ekonomika i makroekonomicheskoye programmirovaniye]. ISBN 5-7133-1028-0.

Koval, V., Duginets, G., Plekhanova, O., Antonov, A., Petrova, M. (2019). On the supranational and national level of global value chain management. – Entrepreneurship and Sustainability Issues, 6(4), pp. 1922-1937. https://doi.org/10.9770/jesi.2019.6.4(27).

Loktionova, M. (2017). Assessment of the development of trade in high-tech products of Ukraine in terms of association with the EU. http://www.dnu.dp.ua/docs/ndc/konkyrs_stud/ES/1_3.pdf.

Laktionova, O., Dobrovolskyi, O., Karpova, T. S., Zahariev, A. (2019). Cost Efficiency of Applying Trade Finance for Agricultural Supply Chains. – Management Theory and Studies for Rural Business and Infrastructure Development, 41(1), pp. 62-73. doi:https://doi.org/10.15544/mts.2019.06.

Matyushenko, I. (2016). Technological Competitiveness of Ukraine under Conditions of a New Industrial Revolution and Development of Convergent Technologies. – The Problems of Economy, 1, pp. 108-120. URL: https://www.problecon.com/export_pdf/problems-of-economy-2016-1_0-pages-108_120.pdf.

Matyushenko, I., Khaustova, V., Knjazev, S. (2017). Institutional support of innovative R&D in the formation of single research area in the EU and Ukraine. – Nauka and Innovations, 13 (2). doi.org/10.15407/scine13.02.005.

Melnik, T. M. (2008). Export potential of Ukraine: methodology for evaluation and analysis. International economic policy [Eksportnyy potentsial Ukrayiny: metodolohiya otsinky ta analiz]. 1-2. http://nbuv.gov.ua/UJRN/Mep_2008_1-2_11.

Momaya K. (2001) International Competitiveness: Evaluation and Enhancement, New Delhi: Hindustan Publishing.

Momaya, Kirankumar, Technology Management and Competitiveness: Exploratory Case of a Renewable Energy Firm from India (January 18, 2014). Available at SSRN: https://ssrn.com/abstract=2381111 or http://dx.doi.org/10.2139/ssrn.2381111.

Odinokova, T., Bozhinova, M., Petrova, M. (2018). Promotion of Innovative Entrepreneurship Under Sustainable Development. – E3S Web Conferences Vol. 41, 04015 (2018). eISSN: 2267-1242, IIMS, Kemerovo, Russian Federation, https://doi.org/10.1051/e3sconf/20184104015.

OECD. (2015). Enabling the next production revolution: issues paper. https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/IND(2015)2&docLanguage=En.

Porter, A. L., Roessner, J. D., Newman, N. C., Cauffiel, D. (2014). Indicators of high technology competitiveness of 28 countries. – International Journal of Technology Management, 12(1). DOI: 10.1504/IJTM.1996.025477.

Priede, Q. J., Pereira, E.T. (2013). Innovation as a key factor in the international competitiveness of the European Union. – European integration studies, 7, pp. 212-221. http://eis.ktu.lt/index.php/EIS/article/viewFile/4228/2979.

Prokopenko, O., Holmberg, V., Omelyanenko, V. (2018). Information and communication technologies support for the participation.,of universities in innovation, R.,networks (comparative study). – Innovative Marketing, 14(3), pp. 17-29. http://dx.doi.org/10.21511/im.14(3).2018.03.

Radivojevic, V., Krstić, B., Stanišić, T. (2018). The role of technological readiness in the global competitiveness of Serbian economy. – Facta Universitatis Series: Economics and Organization, 15, pp. 111-123.

Radukanov, S. (2014). Study of the resource efficiency of banks in Bulgaria. – Annual Doctoral Research Almanac, Vol. 7, D. A. Tsenov Academy of Economics, pp. 323-349.

Radukanov, S. (2017). Market risk assessment under risk methodology (VaR)-specifications and application. – Socio-Economic Analysis, Vol. 9, N 2, Veliko Tarnovo, pp. 182-194.

Ross, A. (2016). The Industries of the Future. New York: Simon &Schuster.

Schwab, K. (2016). The Fourth Industrial Revolution. World Economic Forum.

Sener, S., Saridogan, E. (2011). The effects of science-technology-innovation on competitiveness and economic growth. – Procedia - Social and Behavioral Sciences, 24, pp. 815-828. https://ac.elscdn.com/S1877042811016557/1-s2.0-S1877042811016557-main.pdf?_tid=d0f12d18-2c77-4585-bf37-d474a3b3163d&acdnat=1540312110_68ae4a8ee3c837675efb4c85c9ce36de.

Sushchenko, O., Trunina, I. (2016). Creation of innovation clusters as a line of enterprise competitiveness improvement in the field of foreign economic activity. – Actual Problems of Economics, 177(3), pp. 191-198.

Technological Competitiveness of Telecommunication Industry in India: Glimpse of Reality, Opportunities and Challenges (2009). – Global Journal of Business Excellence, Vol. 2, N 1, pp. 22 -33.

Tekhnolohichna modernizatsiia promyslovosti Ukrainy (2008) / Fedulova L.I; Nats. akad. nauk Ukrainy, Derzh. ustanova "In-t ekonomiky ta prohnozuvannia". K.: Chetverta khvylia.

UNIDO. (2014). The future of manufacturing: Driving capabilities, enabling investments. Global Agenda Council on the Future of Manufacturing. UNIDO. http://www3.weforum.org/docs/Media/GAC14/Future_of_Manufacturinggg_Driving_Capabilities.pdf/.

United Nations Commodity Trade Statistics Database. (2011-2019). http://comtrade.un.org/db/mr/rfCommoditiesList.aspx?px=S4&cc=/

Vasyltsiv, T., Irtyshcheva, I., Lupak, R., Popadynets, N., Shyshkova, Y., Boiko, Y., Ishchenko, O. Economy's innovative technological competitiveness: Decomposition, methodic of analysis and priorities of public policy. – Management Science Letters, 10 (13), p. 3174. https://www.researchgate.net/publication/341620174_Economy%27s_innovative_technological_competitiveness_Decomposition_methodic_of_analysis_and_priorities_of_public_policy.

Viton, P. A. (2010). Notes on spatial econometric models. – European Journal of Operation Research, 192 (1). doi:10.1016/j.ejor.2008.01.032.

Weresa, M. A. (2019). Technological competitiveness of the EU member states in the era of the fourth industrial revolution. – Economics and Business Review, 5 (19), 3, p. 53. https://doi.org/10.18559/ebr.2019.3.4.

World Bank Open Data (2011-2019). https://data.worldbank.org/.

ANNEX

Table 1

Positions of Ukraine on the main components of the Global Competitiveness Index (GCI WEF) 2011-2019

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rank	82/ 144	73/ 144	84/ 148	76/ 144	79/ 140	85/ 138	81/ 137	83/ 140	85/ 141
Basic requirements	98	79	91	87	101	102	96	98	99
1. Institutions	131	132	137	130	130	129	118	110	104
2. Infrastructure	71	65	68	68	69	75	78	57	57
3. Macroeconomic environment	112	90	107	105	134	128	121	131	133
4. Health and primary education	74	62	62	43	45	54	53	94	101
Efficiency enhancers	74	65	71	67	65	74	70	71	70
5. Higher education and training	51	47	43	40	34	33	35	46	44
6. Goods market efficiency	129	117	124	112	106	108	101	73	57
7. Labor market efficiency	61	62	84	80	56	73	86	66	59
8. Financial market development	116	114	117	107	121	130	120	117	136
9. Technological readiness	82	81	94	85	86	85	81	77	78
10. Market size	38	38	38	38	45	47	47	47	47
Innovation and sophistication factors	93	79	95	92	72	73	77	72	73
11. Business sophistication	103	91	97	99	91	98	90	86	85
12. Innovation	74	71	93	81	54	52	61	58	60

Source: the study based on GCIWEF (2011-2019)

Table 2

Dynamics of the main indicators of technological development of Ukraine (GCI WEF) 2011-2019

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Technological readiness	3.74	3.6	3.28	3.5	3.45	3.58	3.8	3.84	3.9
Availability of latest technologies	4.6	4.8	4.3	4.1	4.3	4.3	4.1	4.2	4.3
Firm-level technology absorption	4.6	4.8	4.3	4.2	4.2	4.4	4.3	4.3	4.4
FDI and technology transfer	3.8	4	3.6	3.7	3.8	3.7	3.5	-	-
Internet users, % pop.	23	30.6	33.7	41.8	43.4	49.3	52.5	53.0	58.9
Fixed-broadband Internet subscriptions /100 pop.	8.1	7	8.1	8.8	8.4	11.8	12	12.6	12.3
Internet bandwidth kb/s/user	2.6	9.8	14.3	52.9	40.7	45.7	79.9	-	-
Mobile-broadband subscriptions /100 pop.	-	4.4	5.5	5.4	7.5	8.1	22.6	41.7	45.2

Source: the study based on GCIWEF (2011-2019)

Table 3

Dynamics of key indicators of Ukraine's innovation potential (GCI WEF) 2011-2019

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Innovation	3.1	3.2	3.0	3.2	3.4	3.4	3.4	3.4	3.5
Capacity for innovation	3.4	3.3	3.2	3.6	4.2	4.4	4.3	4.2	4.3
Quality of scientific research institutions	3.6	3.7	3.6	3.8	4.2	4.2	3.9	3.8	3.9
Company spending on R&D	3	2.7	2.7	3.1	3.4	3.3	3.2	3.3	3.4
University-industry collaboration in R&D	3.6	3.6	3.4	3.5	3.5	3.5	3.4	3.5	3.6
Gov't procurement of advanced technology products	3.1	3.2	3	2.9	3	3.1	3	3.2	3.2
Availability of scientists and engineers	4.3	4.8	4.5	4.3	4.7	4.7	4.7	4.6	4.8
PCT patents applications/million pop.	0.3	2.1	2.9	3.2	3.6	3.9	3.6	3.7	3.9

Source: the study based on GCIWEF (2011-2019)

Table 4

Dynamics of the Competitiveness Index of the Ukrainian economy (IMD WCR) 2011-2020

Years	Rank	Infrastructure		
		Technological	Scientific	Education
2011-2012	57/59	48		
		45	43	33
2012-2013	56/59	51		
		53	42	34
2013-2014	49/59	45		
		51	42	32
2014-2015	49/60	44		
		47	42	24
2015-2016	60/61	48		
		54	41	31
2016-2017	59/61	50		
		58	41	30
2017-2018	60/63	53		
		60	44	45
2018-2019	59/63	53		
		55	48	41
2019-2020	55/63		55	
		56	52	43

Source: the study based onIMDWCR (2011-2020)

Table 5

Positions of Ukraine on the main components of the World Digital Competitiveness Ranking (IMD WDCR) 2014-2020

	2014	2015	2016	2017	2018	2019	2020
Overall performance	50	59	59	60	58	60	58
Knowledge	29	40	44	45	39	40	38
Talent	46	55	58	57	55	57	52
Training & education	4	15	20	26	22	21	19
Scientific concentration	42	39	45	45	40	49	50
Technology	58	60	60	62	61	61	59
Regulatory framework	47	55	55	56	54	54	54
Capital	56	60	60	62	61	62	59
Technological framework	58	60	58	60	57	60	58
Future readiness	58	61	61	61	61	62	61
Adaptive attitudes	58	60	60	58	53	59	56
Business agility	42	58	59	56	53	45	51
IT integration	58	61	60	60	61	61	62

Source: the study based on IMDWDCR (2014-2020)

Table 6

Key Indicators of the Global Innovation Index (GII) for Ukraine 2020

Indicator	Score/ value	Rank
Human capital & research	40.5	39
2.1 Education	56.9	23
2.1.1 Expenditure on education, % GDP	5.4	26
2.1.2 Government funding/pupil, secondary, % GDP/cap	30.3	12
2.1.3 School life expectancy, years	14.9	54
2.2 Tertiary education	43.9	32
2.2.1 Tertiary enrolment, % gross	82.7	14
2.2.2 Graduates in science & engineering, %	25.3	35
2.3 Research & development (R&D)	20.5	44
2.3.1 Researchers, FTE/mn pop.	988.1	52
2.3.2 Gross expenditure on R&D, % GDP	0.5	69
2.3.3 Global R&D companies, top 3, mn US$	39.8	38
2.3.4 QS university ranking, average score top 3	21.2	49
Knowledge & technology outputs	35.1	27
6.1 Knowledge creation	41.6	23
6.1.1 Patents by origin/bn PPP$ GDP	5.4	20
6.1.2 PCT patents by origin/bn PPP$ GDP	0.5	36
6.1.3 Utility models by origin/bn PPP$ GDP	23.0	1
6.1.4 Scientific & technical articles/bn PPP$ GDP	9.5	55
6.2 Knowledge impact	28.7	45
6.2.1 Growth rate of PPP$ GDP/worker, %	2.4	39
6.2.2 New businesses/th pop. 15–64	1.7	61
6.2.3 Computer software spending, % GDP	0.0	19
6.2.4 ISO 9001 quality certificates/bn PPP$ GDP	4.5	58
6.2.5 High- & medium-high-tech manufactures, %	16.8	61
6.3 Knowledge diffusion	35.0	32
6.3.1 Intellectual property receipts, % total trade	0.1	46
6.3.2 High-tech net exports, % total trade	1.9	56
6.3.3 ICT services exports, % total trade	5.4	9
6.3.4 FDI net outflows, % GDP	0.2	96

Source: the study based on GII (2020)

Table 7

The value of the indicator of comparative advantage for Ukraine in main high-tech industries in 2011-2019

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aircraft and spacecraft	1,94	2,29	2,41	2,22	2,25	1,87	2,18	2,71	2,00
Pharmaceuticals	-2,50	-2,36	-2,27	-2,25	-2,20	-2,11	-2,10	-2,12	-2,50
Office, accounting and computing machinery	-1,71	-1,67	-1,92	-2,44	-2,28	-2,46	-2,55	-2,74	-2,49
Radio, TV and communications equipment	-0,80	-0,55	-0,77	-0,81	-1,16	-1,09	-1,22	-0,65	-1,08
Medical, precision and optical instruments	-1,20	-1,76	-1,57	-1,25	-1,28	-1,55	-1,72	-1,76	-1,78

Source: own calculations based on United Nations Commodity Trade Statistics Database (2011-2019)

Table 8

Source data for the cluster analysis on the main indicators of the European Union Innovation Scoreboard for EU and Ukraine

	Humanr esources	Attractive research systems	Innovation-friendly environment	Finance and support	Firm investments	Innovators	Linkages	Intellectual assets	Employment impacts	Sales impacts
Ukraine	53,40	17,27	169,63	11,30	45,13	20,18	37,55	20,90	86,86	35,15
Slovakia	94,30	56,38	87,32	28,29	82,73	37,25	63,03	39,85	140,54	114,23
Slovenia	127,30	100,95	143,03	36,57	134,66	61,36	116,25	81,94	105,27	67,73
Sweden	216,98	210,95	310,18	141,05	175,53	103,43	154,93	122,64	167,78	89,22
Romania	13,64	32,77	112,94	48,11	10,57	0,00	40,48	23,78	45,19	62,07
Portugal	105,07	135,20	227,24	96,22	124,46	156,33	64,92	70,80	96,15	55,42
Poland	75,36	36,65	211,02	46,81	95,84	14,31	40,68	65,84	106,15	55,67
Netherlands	175,53	220,98	280,54	139,01	98,20	112,24	159,42	105,23	138,59	93,71
Malta	88,73	87,58	233,14	106,98	105,75	53,20	17,10	128,61	187,23	59,02
Latvia	75,99	52,51	138,30	126,72	73,84	35,70	56,34	59,09	100,25	50,82
Luxembourg	177,95	236,20	236,20	122,67	81,91	126,84	90,16	141,04	189,20	84,75
Lithuania	119,47	54,29	187,53	97,67	101,13	98,82	108,96	52,43	64,72	53,17
Italy	61,45	111,14	121,18	65,21	94,88	116,85	69,05	96,18	87,01	80,36
Ireland	175,23	171,08	149,53	83,10	113,90	118,67	84,10	53,36	200,86	128,70
Hungary	51,48	66,76	144,47	53,39	106,56	30,39	60,65	44,50	150,19	84,68
Croatia	65,70	50,24	71,37	44,83	117,94	85,99	67,50	32,81	80,89	38,29
France	159,41	140,94	143,14	159,11	108,90	113,97	103,08	78,89	93,00	88,67
Finland	198,53	173,53	321,58	158,75	168,70	153,29	167,92	118,73	93,54	90,08
Spain	177,85	105,21	197,25	90,40	83,58	40,92	67,93	70,12	114,85	83,96
Greece	92,69	77,99	76,73	61,50	85,37	130,97	129,70	39,13	57,37	67,58
Estonia	140,54	121,60	137,96	104,89	123,33	95,05	133,79	112,74	79,11	66,43
Denmark	206,89	224,56	329,62	167,89	139,59	86,59	154,14	137,40	118,34	73,85
Germany	108,73	105,35	169,76	138,36	190,03	122,38	139,59	119,78	113,88	119,12
Czechia	84,42	83,72	121,55	66,78	121,71	86,72	92,67	51,69	148,78	94,68
Cyprus	118,76	145,25	140,13	86,90	101,07	73,55	61,41	98,03	75,62	98,49
Bulgaria	60,08	29,42	74,59	13,45	52,91	23,97	35,59	77,89	120,10	40,26
Belgium	133,53	190,72	158,14	131,08	158,96	133,63	168,53	81,73	95,46	103,90
Austria	143,26	167,85	130,65	109,55	127,20	135,09	187,75	126,30	75,42	83,94

Source: the study based on European Innovation Score board (2019)

Table 9

The composition of the selected clusters of the EU countries and Ukraine according to the indicators of the European innovation scoreboard (EIS)2019

Cluster	Countries
Cluster 1	Finland, Netherlands, Denmark, Sweden
Cluster 2	Belgium, Germany, Austria, France, Estonia
Cluster 3	Ireland, Luxembourg
Cluster 4	Malta
Cluster 5	Cyprus, Italy, Portugal, Slovenia, Lithuania, Spain
Cluster 6	Croatia, Greece, Czech Republic, Hungary, Slovakia
Cluster 7	Ukraine, Romania, Poland, Bulgaria, Latvia

Source: own calculations based on EIS (2019)

Table 10

Source data for correlation between development factors and indices that determine global and technological competitiveness of Ukraine

	Expenditure on education, % of GDP	Graduates in science and technology, %	Quality of scientific research institutions	Ratio of employees involved in R&D to the employedpopulation,%	Ratio of R&D expenditures to GDP,%	FDI inflows (% of GDP)	ICT access	State of cluster development	Ratio of high-tech products export to industrial exports, %	ICT services exports, % of total exports of services	PCT patents applications, million pop.	Income from the intellectual property use, mln $
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
2011	5,9	26,3	3,6	0,947	0,738	4,417	47,9	28,6	3,277	17,923	0,3	107
2012	5,9	26,3	3,7	0,877	0,754	4,651	48,6	35,4	4,737	19,34	2,1	124
2013	6,2	25,6	3,6	0,822	0,759	2,46	52,7	31,17	4,134	22,204	2,9	167
2014	6,7	25,6	3,8	0,792	0,649	0,634	61,6	33,3	4,129	30,482	3,2	118
2015	6,7	25,5	4,2	0,778	0,617	3,351	62,7	32,5	3,994	31,442	3,6	85
2016	6	25,5	4,2	0,627	0,700	3,689	64,8	32,5	3,295	31,756	3,9	73
2017	5,9	26,7	3,9	0,608	0,600	2,165	66	35,5	2,795	33,513	3,6	72
2018	5,9	26,7	3,9	0,600	0,600	2,6	66	35,5	2,900	31,3	3,7	74
2019	5	24,2	3,5	1,100	0,4	3,2	66,5	37,3	2	31,7	3,9	74

	Global Competitiveness Index	Technological readiness (GCI)	Innovation (GCI)	Global Innovation Index	World Digital Competitiveness Ranking
	У1	У2	У3	У4	У5
2011	4,000	3,74	3,1	35,00	-
2012	4,140	3,6	3,2	36,10	-
2013	4,050	3,28	3,0	35,80	54
2014	4,140	3,5	3,2	36,30	50
2015	4,030	3,45	3,4	36,45	59
2016	4,000	3,58	3,4	35,72	59
2017	4,110	3,8	3,4	37,62	60
2018	4,010	3,84	3,4	43,00	58
2019	4,120	3,9	3,5	47,00	60

Source: own calculations based on GCIWEF (2011-2019), GII (2011-2019), IMDWDCR (2017-2019)

Table 11

Correlation between factors of development and indices that determine the global and technological competitiveness of Ukraine

	GlobalCompetitivenessIndex	Technological readiness (GCI)	Innovation (GCI)	GlobalInnovationIndex	WorldDigitalCompetitivenessRanking
Expenditure on education, % of GDP	-0,12381	-0,729	-0,37023	-0,70557	-0,57762
Graduates in science and technology, %	-0,19581	0,0893	-0,30045	-0,41941	-0,01487
Quality of scientific research institutions	-0,40208	-0,203	0,477786	-0,30827	0,268272
Ratio of employees involved in R&D to the employed population,%	0,324322	0,096	-0,19326	0,288689	-0,05928
Ratio of R&D expenditures to GDP,%	-0,2739	-0,623	-0,75517	-0,87914	-0,47486
FDI inflows (% of GDP)	-0,33551	0,165	0,033029	-0,10409	0,802082
ICT access	0,015384	0,371	0,843931	0,565446	0,604922
Stateofclusterdevelopment	0,593752	0,516	0,594049	0,726723	0,475249
Ratio of high-tech products export to industrial exports, %	0,146648	-0,789	-0,6702	-0,74305	-0,6957
ICT services exports, % of total exports of services	0,063871	0,270	0,80242	0,447864	0,514709
PCT patents applications, million pop.	0,146025	0,040	0,702985	0,470915	0,787447
Income from the intellectual property use, mln $	0,172407	-0,730	-0,90995	-0,47957	-0,73414

Source: own calculations based on GCIWEF (2011-2019), GII (2011-2019), IMDWDCR (2017-2019)

Table 12

Source data for multiple regression analysis between the Global Competitiveness Index (GCI WEF) and selected factors

	Global Competitiveness Index	State of cluster development	FDI inflows (% of GDP)	Ratio of high-tech products export to industrial exports, %
	У1	X1	X2	X3
2011	4,000	28,6	4,417	3,277
2012	4,140	35,4	4,651	4,737
2013	4,050	31,17	2,46	4,134
2014	4,140	33,3	0,634	4,129
2015	4,030	32,5	3,351	3,994
2016	4,000	32,5	3,689	3,295
2017	4,110	35,5	2,165	2,795
2018	4,010	35,5	2,6	2,900
2019	4,120	37,3	3,2	2,000

Source: own calculations based on GCI WEF (2011-2019)

Table 13

Results of multiple regression analysis between the Global Competitiveness Index (GCI WEF) and selected factors

Multiple R	0,747846
R^2	0,559273
F	2,114964
Significance F	0,216959
Y	3,461275
X1	0,015957
X2	-0,01125
X3	0,030031

Source: own calculations based on GCI WEF (2011-2019)

Table 14

Source data for multiple regression analysis between Technological Readiness (composed of GCI WEF) and selected factors

	Technological readiness (GCI)	Ratio of high-tech products export to industrial exports, %	Graduates in science and technology, %	Income from the intellectual property use, mln $
	У2	X1	X2	X3
2011	3,74	3,277	26,3	107
2012	3,6	4,737	26,3	124
2013	3,28	4,134	25,6	167
2014	3,5	4,129	25,6	118
2015	3,45	3,994	25,5	85
2016	3,58	3,295	25,5	73
2017	3,8	2,795	26,7	72
2018	3,84	2,900	26,7	74
2019	3,9	2,000	24,2	74

Source: own calculations based on GCI WEF (2011-2019)

Table 15

Results of multiple regression analysis between Technological Readiness (composed of GCI WEF) and selected factors

Multiple R	0,867296
R^2	0,752202
F	5,059245
Significance F	0,056462
Y	2,535193
X1	-0,1627
X2	0,070742
X3	-0,00166

Source: own calculations based on GCI WEF (2011-2019)

Table 16

Source data for multiple regression analysis between Innovation (GCI WEF) and selected factors

	Innovation (GCI)	Quality of scientific research institutions	ICT access	Income from the intellectual property use, mln $
	У3	X1	X2	X3
2011	3,1	3,6	47,9	107
2012	3,2	3,7	48,6	124
2013	3,0	3,6	52,7	167
2014	3,2	3,8	61,6	118
2015	3,4	4,2	62,7	85
2016	3,4	4,2	64,8	73
2017	3,4	3,9	66	72
2018	3,4	3,9	66	74
2019	3,5	3,5	66,5	74

Source: own calculations based on GCI WEF (2011-2019), GII (2011-2019)

Table 17

Results of multiple regression analysis between Innovation (GCI WEF) and selected factors

Multiple R	0,945408
R^2	0,893797
F	14,02652
Significance F	0,007198
Y	3,110847
X1	0,000642
X2	0,008395
X3	-0,0033

Source: own calculations based on GCI WEF (2011-2019), GII (2011-2019)

Table 18

Source data for multiple regression analysis between Global Innovation Index (GII) and selected factors

	Global Innovation Index	Ratio of R&D expenditures to GDP, %	State of cluster development	ICT services exports, % of total exports of services
	У4	X1	X2	X3
2011	35,00	0,738	28,6	17,923
2012	36,10	0,754	35,4	19,34
2013	35,80	0,759	31,17	22,204
2014	36,30	0,649	33,3	30,482
2015	36,45	0,617	32,5	31,442
2016	35,72	0,700	32,5	31,756
2017	37,62	0,600	35,5	33,513
2018	43,00	0,600	35,5	31,3
2019	47,00	0,4	37,3	31,7

Source: own calculations based on GII (2011-2019)

Table 19

Results of multiple regression analysis between Global Innovation Index (GII) and selected factors

Multiple R	0,924411
R^2	0,854537
F	9,790969
Significance F	0,015561
Y	50,80415
X1	-32,7322
X2	0,4271
X3	-0,21111

Source: own calculationsbased on GII (2011-2019)

Table 20

Source data for multiple regression analysis between the Digital Competitiveness Index (IMD WDCR) and selected factors

	World Digital Competitiveness Ranking	FDI inflows (% of GDP)	Ratio of high-tech products export to industrial exports, %	PCT patents applications/million pop.
	У5	X1	X2	X3
2013	54	2,46	4,134	2,9
2014	50	0,634	4,129	3,2
2015	59	3,351	3,994	3,6
2016	59	3,689	3,295	3,9
2017	60	2,165	2,795	3,6
2018	58	2,6	2,900	3,7
2019	60	3,2	2	3,9

Source: own calculations based on IMD WDCR (2013-2019)

Table 21

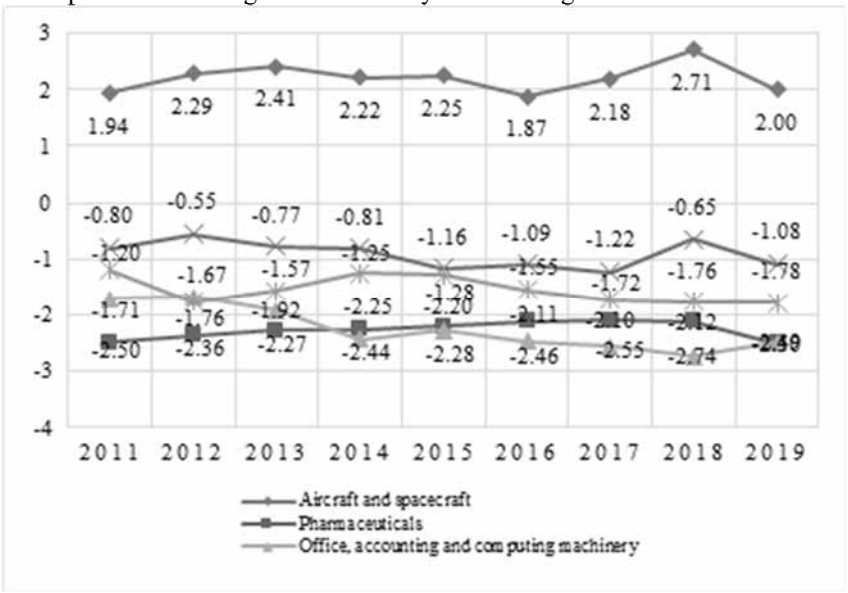
Results of multiple regression analysis between the Digital Competitiveness Index (IMD WDCR) and selected factors

Multiple R	0,916997
R^2	0,840884
F	5,284739
Significance F	0,102451
Y	51,52405
X1	2,106491
X2	-1,71027
X3	1,651747

Source: own calculationsbased on IMDWDCR (2013-2019)

Figure 1

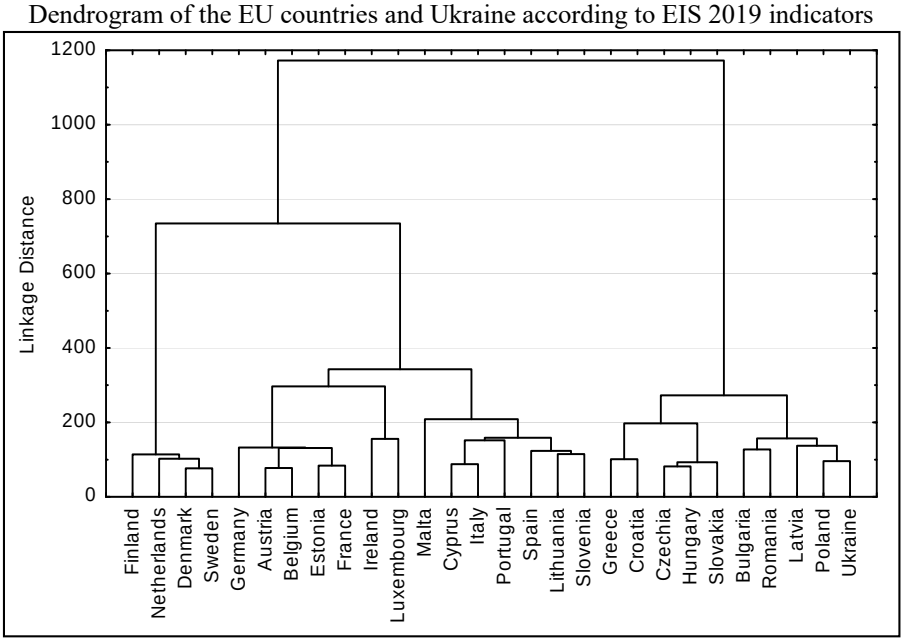
The comparative advantages of Ukraine by the main high-tech industries 2011-2019



Source: own calculations based on United Nations Commodity Trade Statistics Database (2011-2019)

Figure 2

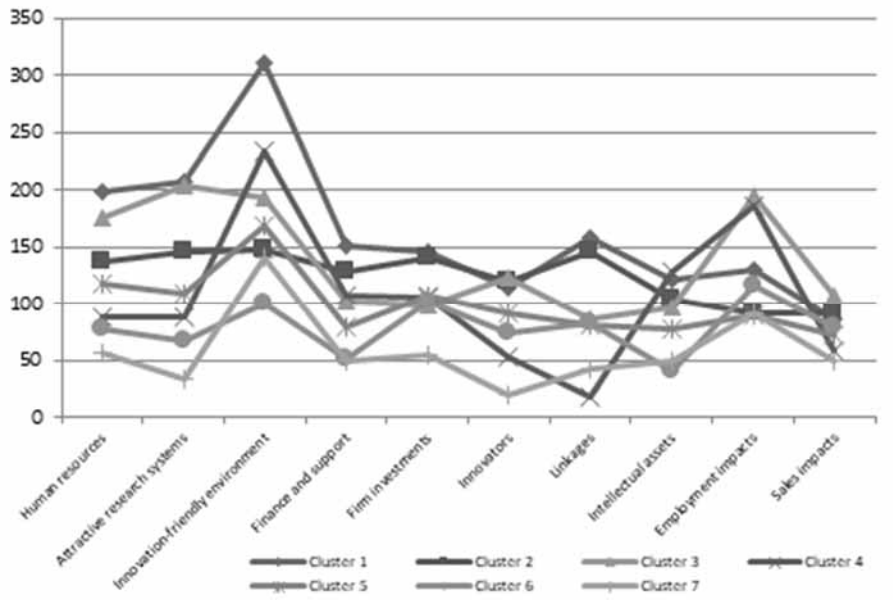
Dendrogram of the EU countries and Ukraine according to EIS 2019 indicators



Source: own calculations based on EIS (2019)

Figure 3

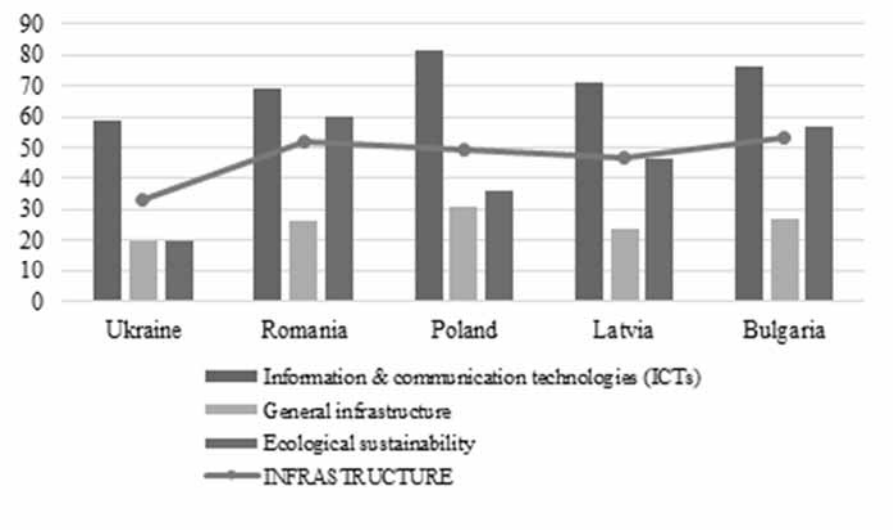
State of development of received clusters by EIS 2019indicators



Source: own calculations based on EIS (2019)

Figure 4

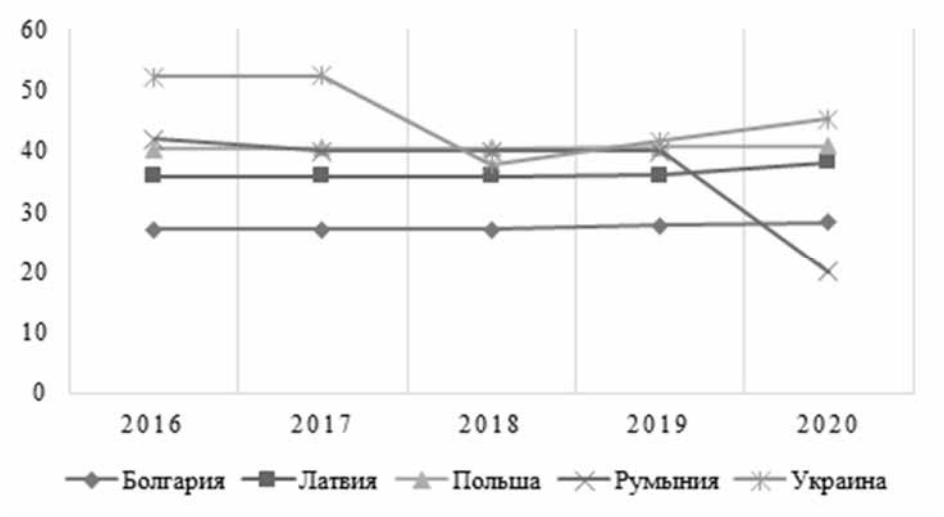
State of development of Infrastructure in the countries of the seventh cluster by GII 2020 indicators



Source: the study based on Global Innovation Index (2020)

Figure 5

State of development of tax system in the countries of the seventh cluster by DB 2020 indicators



Source: the study based on Doing Business (2020)

Figure 6

State of development of Labour market in the countries of the seventh cluster by GCI WEF (2020) indicators

Source: the study based on GCI WEF (2020)

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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DEVELOPMENT OF TERRITORIAL SELF-GOVERNMENT IN RUSSIA BASED ON CROWDFUNDING NETWORK INTERACTION BETWEEN BUSINESS STRUCTURES AND LOCAL SELF-GOVERNMENT BODIES[6]

The crisis caused by Covid-19 is very dangerous for the social and economic stability of the regions of the Russian Federation. There is a deterioration in the dynamics of the budget deficit of the constituent entities of the Russian Federation in 2020. The Government of the Russian Federation is planning to provide non-targeted financial support to the budgets of the constituent entities of the Russian Federation, while maintaining the existing approaches to the distribution of subsidies for equalization, to mitigate it. The long-term dependence of the majority of the country's regions on Federal budget subsidies and the implemented policy of artificial financial equalization of the regions can give rise to dependent moods in weak regions and deprive them of an incentive to develop strong regions. In the context of budget deficits at the regional and especially at the local levels, the search for additional sources of funding to solve the tasks that are socially significant for the territories becomes particularly urgent. The most effective way to finance municipal projects is to combine the funds of citizens, businesses, local and regional budgets. Regions should find alternative sources of

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financing for their projects, including through "people's financing" and the activation of the territorial self-government development based on the crowdfunding mechanism and its use in building an effective network of interaction between business structures and local self-government bodies.

The article solves the following problems: the dynamics, problems and prospects of development in Russia of such instruments of "people's financing" as initiative budgeting and self-taxation are analyzed. The current scheme of self-taxation of citizens in the country was developed with a list of its shortcomings in implementation. Examples of implemented crowd projects for the development of territories of the Russian Federation, primarily in the field of public initiatives, are considered. A crowdsourcing platform, which has allowed to influence the process of territorial self-government in Russia since 2018, was identified and described. The scheme of network interaction between business structures and local governments based on crowdfunding IT platforms is proposed. Methodological recommendations for the implementation of this scheme are given. The use of the crowdfunding mechanism in the territorial self-government of regions can help to solve the tasks set out in a number of state programs of the Russian Federation.

Keywords: territorial development; investment mechanisms; crowdfunding; network interaction

JEL: R1

1. Introduction

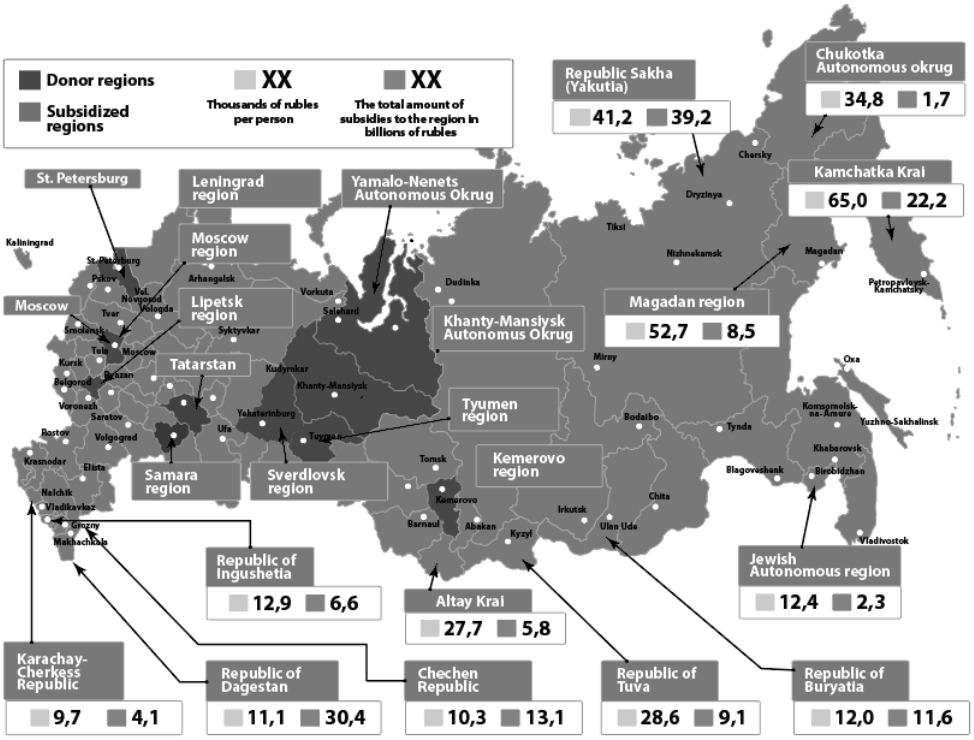
An old Russian proverb says: "Many a little makes a mickle", which means that if you take a little from each person, then together you will get something significant, enough for one person. This proverb has become even more relevant due to the economic problems in Russia and the world caused by the COVID-19 pandemic. Owing to the global pandemic in the first half of 2020, the Russian economy was simultaneously affected by two powerful shocks: an acute deterioration in foreign trade conditions due to the collapse of oil prices; forced drastic reduction in business activity due to restrictions aimed at curbing the spread of the virus. On December 18, 2020, Russian Finance Minister Siluanov A. stressed that the achievement of national development goals of the Russian Federation largely depends on the regions: "The constituent entities of the Russian Federation should concentrate on implementing the national projects. All financial, legislative, and administrative resources should be focused on this. The Federal budget funds allocated to the regions for the implementation of national goals should be used quickly" *(https://www.minfin.gov.ru)*.

It is worth noting that despite the fact that in the Russian Federation, each region is financially independent from the point of view of its own budget, it is necessary to understand that there is a certain redistribution of earned funds through the central state bodies. The regions that earn more than they need for domestic spending are donors, and they are called budget-makers. Other regions that do not have a developed industry or do not produce a sufficiently large amount of minerals are on budget subsidies – they are called subsidized. The problem of the imbalance in the financial solvency of the regions of the Russian Federation has existed for several years. Figure 1, presents the data on donor regions and subsidized regions for 2010. The donor regions are highlighted in dark grey, and the subsidized regions are

highlighted in light grey. The conclusion is obvious: only a few regions of the Russian Federation are financially independent of the Federal budget, that is, they "feed themselves".

Figure 1

Data on donor regions and subsidized regions of the Russian Federation for 2010, where the first indicator of subsidies to the region is measured in thousands of rubles per person, the second indicator reflects the total amount of subsidies to the region in billions of rubles

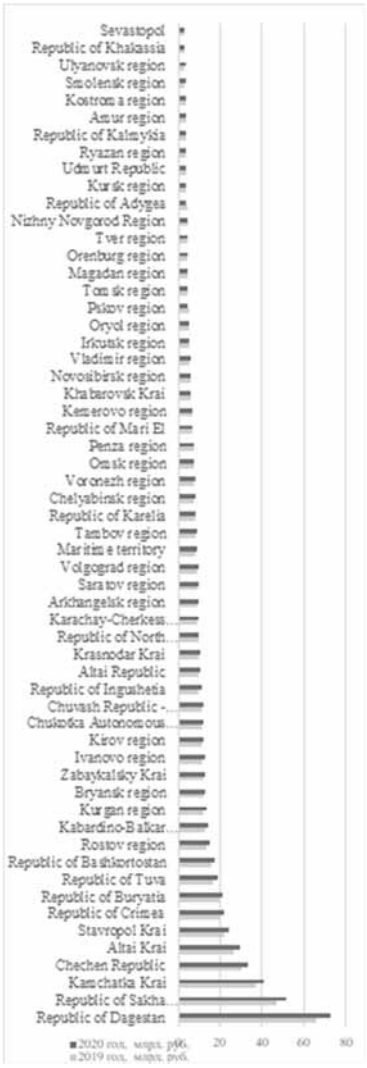


Source: Sochina, 2019.

The total number of subsidized regions for the period 2010-2020 is practically unchanged, and the "subsidies map" still does not look financially attractive for many regions of the Russian Federation. If we talk about overall statistical indicators, the situation in Russia looks like this: out of 85 subjects, only 13 leave money to the Federal budget – that is, they are donors, the remaining 72 need additional funds from the budget, to some extent *(https://vybory-91.livejournal.com)*. Figure 2 shows the dynamics of Federal subsidies to the regions of the Russian Federation (maximum values) for 2019 and 2020.

Figure 2

Dynamics of Federal subsidies to the regions of the Russian Federation for 2019-2020



Region Name	2019, billion rubles	2020, billion rubles
Republic of Dagestan	66,266	72,892
Republic of Sakha (Yakutia)	46,907	51,598
Kamchatka Krai	37,39	41,129
Chechen Republic	30,441	33,485
Altai Krai	26,838	29,522
Stavropol Krai	22,083	24,291
Republic of Crimea	20,371	21,862
Republic of Buryatia	19,875	21,454
Republic of Tuva	16,933	18,626
Republic of Bashkortostan	15,612	17,173
Rostov region	13,631	14,994
Kabardino-Balkar Republic	12,748	14,023
Kurgan region	12,347	13,382
Bryansk region	12,165	13,25
Zabaykalsky Krai	11,975	12,918
Ivanovo region	11,743	12,659
Kirov region	11,508	12,364
Chukotka Autonomous Okrug	11,24	12,353
Chuvash Republic - Chuvashia	11,115	12,226
Republic of Ingushetia	10,165	11,181
Altai Republic	9,868	10,711
Krasnodar Krai	9,737	10,493
Republic of North Ossetia - Alania	9,539	10,062
Karachay-Cherkess Republic	9,147	9,85
Arkhangelsk region	9,059	9,811
Saratov region	8,955	9,557
Volgograd region	8,919	9,523
Primorsky Krai	8,702	9,375
Tambov region	8,657	9,097
Republic of Karelia	8,115	8,135
Chelyabinsk region	7,669	8,015
Voronezh region	7,4	7,974
Omsk region	7,396	7,71
Penza region	7,286	7,226
Republic of Mari El	6,93	7,075
Kemerovo region	6,86	6,941
Khabarovsk Krai	6,432	6,405
Novosibirsk region	5,823	6,134
Vladimir region	5,653	5,988
Irkutsk region	5,558	5,255
Oryol region	5,444	5,027
Pskov region	4,931	4,721
Tomsk region	4,778	4,685
Magadan region	4,729	4,504
Orenburg region	4,57	4,493
Tver region	4,363	4,41
Nizhny Novgorod Region	4,26	4,343
Republic of Adygea	4,198	3,977
Kursk region	4,072	3,784
Udmurt Republic	4,009	3,733
Ryazan region	3,967	3,665
Republic of Kalmykia	3,93	3,634
Amur region	3,615	3,506
Kostroma region	3,518	3,477
Smolensk region	3,268	3,475
Ulyanovsk region	3,187	3,464
Republic of Khakassia	3,149	3,199
Sevastopol	2,908	3,118

Source: https://rosinfostat.ru.

It is important to understand the trend that is developing in Russia. The data for the last 27 years, with a changing number of donor regions, are as follows: in 1993, there were 35 donor entities in the country; in 1997, their number dropped sharply to 8; in 2001, their number

increased to 25; to date, there are 13. As can be seen from the statistics, the list of subsidized regions in Russia practically does not change. In any case, this applies to the ten regions that receive the maximum amount of subsidized funds and demonstrate the most acute shortage of enterprises, their own resources and other things that could help them form greater financial independence. The Covid-19 pandemic has exacerbated the differentiation between Russian regions, acting as a certain catalyst for this problem. It should be mentioned that the total public debt of the constituent entities of the Russian Federation has been declining since 2017 as a result of improved tax collection and increased fiscal sustainability. But the formed budget imbalance in the first four months of 2020 contributed to the growth of public debt by 2.1 % compared to last year and amounted to 2,086.8 billion rubles as of May 1, 2020, in April 2020, the debt increased by 31.6 billion rubles. The debt growth was recorded in 30 regions of the Russian Federation. Table 1 shows the top 10 regions that increased public debt in the four months (January-April) of 2020.

Table 1

Top 10 regions that increased public debt in January-April 2020

No	Constituent entity of the Russian Federation	Debt as for 01.05.2019, bln rub.	Debt as for 01.05.2020, bln rub	Dynamics, %
1	St. Petersburg	30,1	55,0	+82.7
2	Irkutsk region	12,3	20,5	+66.7
3	Kamchatka Krai	4,0	5,9	+46.1
4	Novosibirsk region	35,1	49,5	+41.0
5	Republic of Buryatia	7,3	10,0	+36.3
6	Moscow region	125,7	168,0	+33.6
7	Sverdlovsk region	66,8	86,2	+29.0
8	Voronezh region	14,5	17,7	+21.6
9	Republic of Kalmykia	4,1	5,0	+20.2
10	Tomsk region	29,1	34,4	+18.4

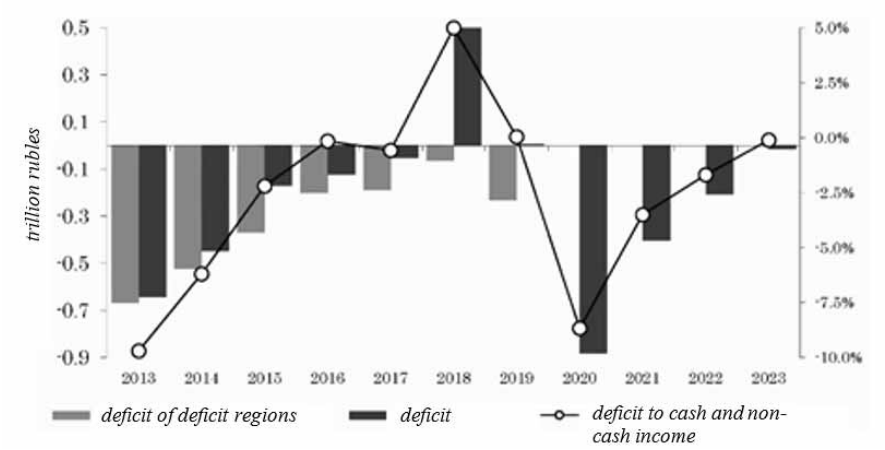
Source: Tirskikh, Galieva, Mitrofanov, 2020.

These regions also include the regions that are donors to the Federal budget, which is even more alarming in relation to the current economic situation. In order to contain the rapid growth of the debt burden and maintain financial stability, the government released the constituent entities from repaying budget loans until the end of this year and extended the program of restructuring budget loans until 2029, and also increased the term for granting Treasury loans from 90 to 180 days. In 2020, the difference between the volumes of industrial output between the regions reached 20 times, without taking into account Moscow, the difference in production remains nine times. *The crisis caused by Covid-19 is very dangerous for the social and economic stability of the regions of the Russian Federation. But no less dangerous is the artificial financial alignment of the regions, which can create a dependent mood in weak regions and deprive the incentive to develop strong regions (Solovyova, 2020).* According to the information of the Ministry of Finance of the Russian Federation dated October 1, 2020, "Main directions of the budget, tax and customs tariff policy for 2021 and for the planning period of 2022 and 2023", one can observe the following dynamics of the budget deficit of the constituent entities of the Russian Federation (Figure 3), from which the unfavourable picture that was developed in 2020 is obvious. At the same time, to mitigate it, the Government of the Russian Federation is planning to provide non-targeted financial

support to the budgets of the constituent entities of the Russian Federation, while maintaining the existing approaches to the distribution of subsidies for equalization.

Figure 3

Dynamics of the budget deficit of the constituent entities of the Russian Federation: light grey – a deficit of deficit regions; dark grey – deficit; line – deficit to cash and non-cash income, trillion rubles



Source: http://www.garant.ru.

According to the meeting of the Government of the Russian Federation dated November 2020: 130 billion rubles from the Federal budget in 2021 will be allocated to support the regions. The increase by 100 billion rubles is due to the deterioration of the economic situation and a decrease in regional revenues. A number of economists believe that even these increased transfers from the Federal budget next year will be clearly insufficient to cover regional budget deficits and fulfil all social obligations *(Shokhina, 2020)*. In addition, the Government of the Russian Federation has submitted a bill on granting the right to one region to lend to others (horizontal loans) to the State Duma. The new rules are expected to take effect from 2021. The restrictions on the issuance of debt securities by regions and municipalities that do not have a sufficient credit rating are also lifted. These measures, according to the Chairman of the Government of the Russian Federation Mishustin M., will give the regions "more manoeuvre in finding resources" for the development of the economy and improving the population standard of living *(https://www.kommersant.ru)*.

The measures of the Government of the Russian Federation are aimed at smoothing the territorial financial imbalance between the regions of the country through cash injections from the Federal budget to the regions. In addition, the donor regions will be able to become creditors of the subsidized regions. This financial dependence of most regions on the Federal budget is very dangerous from a strategic, long-term perspective. In our opinion, horizontal loans will probably not find a lively response among the constituent entities of the Russian Federation. In the context of a slow economic recovery, it will be a priority for the regions to

accumulate funds as much as possible to support their economy, rather than allocate them to help other regions.

Regions should find alternative sources of financing for their projects, including through "people's financing" and the activation of the territorial self-government development based on the crowdfunding mechanism and its use in building an effective network of interaction between business structures and local self-government bodies. This interaction became possible only in the conditions of active development of the distributed use economy.

In economics, a network is a way of regulating the interdependence of participants in a single technological process, based on a cooperative "game" and special relationships. Combining the efforts of management bodies and business entities in a certain territory gives significant advantages in competition and production and market processes rationalization. Such a combination of efforts has proved quite effective in terms of implementing programs for the economic development of regions, and sometimes even national systems in some countries (Srivardhini, 2018; Sumita, Sanwar, 2017; Rosen, Olsson, 2013; Rui Shu, Shenggang Ren, Yi Zheng, 2018; Noelia, Rosalia, 2020; Muñoz, Kibler, Mandakovic, Amorós, 2020).

We set the following research purpose*: to justify the possibility and necessity of developing territorial self-government in Russia based on crowdfunding network interaction between business structures and local self-government bodies in the context of the Covid-19 pandemic, which exacerbates the economic problems of regional financing.* To achieve this goal, the study will consistently solve the following tasks:

1. Analyzing how such financial instruments of "people's financing" as initiative budgeting and self-taxation are currently used in Russia.
2. Developing the current scheme of financial participation of citizens in territorial development based on the self-taxation mechanism, indicating its shortcomings in implementation.
3. Determining whether there are examples of projects already implemented on crowdfunding platforms for territorial development. First of all, we are talking about projects for small Russian cities, towns and villages.
4. Identifying crowd platforms in the Russian Federation that allow to influence the process of territorial self-government.
5. Developing a scheme of network interaction between business structures and local governments based on crowdfunding IT platforms. Indicating its advantages in comparison with the current scheme of citizens` self-taxation.
6. Offering methodological recommendations for the implementation of this scheme in the Russian Federation.

2. Materials and Methods

Logical research methods, both quantitative and qualitative, were used to solve the tasks set. The quantitative research methods include the collection, analysis and use of statistical data

on: the dynamics of subsidies provided from the Federal budget to the regions of the country; the dynamics of "people's financing" tools used in Russia; implemented regional development crowd projects. Such qualitative research methods, as observation and survey, were used in the study of Russian crowdsourcing platforms.

The sources of information were the regulatory legal acts of the Russian Federation on the issues: provision of public subsidies to the regions of the country; proactive budgeting and self-taxation of citizens; implementation of crowdfunding in Russia; national development programs; and information and research published in open sources on the research topic.

3. Results

3.1 Practice of using "people's financing" instruments in the Russian Federation: dynamics, problems, development prospects

The lack of financial resources to resolve issues of local importance is one of the main problems of local government. An alternative way to co-finance local expenses is to use self-taxation mechanisms of citizens, the practice of which has been developed in our country for a long time. In the Decree "On the self-taxation of the population to satisfy local public needs" of 1924, it is noted that the self-taxation of the population was established to satisfy all kinds of local public needs (the maintenance of educational, medical, social welfare institutions, as well as the satisfaction of the needs of local improvement, etc.) and was allowed solely on the basis of a voluntary agreement of citizens *(Resolution of the Central Executive Committee of the USSR, Council of People's Commissars of the USSR of August 29, 1924)*. It should be noted that initially, there were no legislatively established forms of control over the expenditure of these funds. Subsequently, in the period 1927-1930, documents were adopted *(Resolution of the Central Executive Committee and the Council of People's Commissars dd. August 16, 1930)* introducing mandatory self-taxation and monitoring the use of funds, as well as providing for control over the payment of funds by the population. The order of use became legislatively regulated; proceeds were directed to the development of local social institutions.

Under the current legislation and in accordance with federal law No. 131-FZ "On General Principles of the Organization of Local Self-Government in the Russian Federation" (*Federal Law dd. 06.10.2003 N 131-FZ*), self-taxation means one-off payments by citizens made to resolve specific issues of local importance. The decision to introduce self-taxation and the use of these funds is made based on the results of a local referendum or at a gathering of citizens. The size of payments, with a few exceptions, was set the same for all residents of a municipal entity, with the exception of certain categories of citizens, the number of which cannot exceed 30 percent of the total number of residents of the municipal entity. At present, the principle of voluntary payment of these payments is valid, which is also confirmed by court decisions.

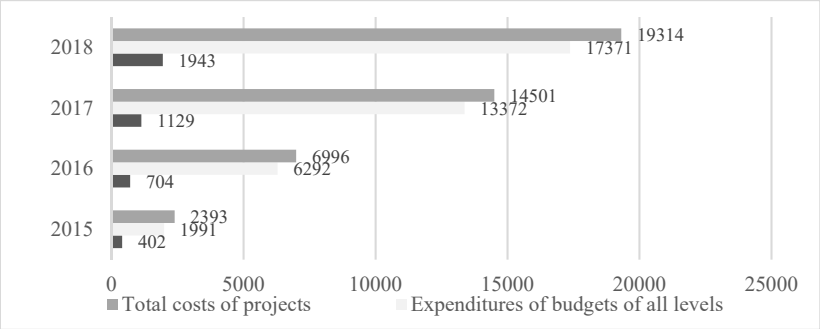
Federal law No. 131-FZ regulates the concept of "territorial public self-government", which refers to the self-organization of citizens at their place of residence on the territory of a settlement, the inner city territory of a city of federal significance, the municipal district,

urban district, intracity district, as well as settlements located on inter-settlement territory (or part of their territory) for independent implementation under their own responsibility of their own initiatives on issues of local importance. Territorial public self-government is carried out directly by the population through holding meetings and conferences of citizens, as well as through the creation of bodies of the territorial public self-governments (TPSG). In accordance with its charter, the territorial public self-government may be a legal entity and is subject to state registration in the legal form of a non-profit organization. Now there are about 30 thousand of such organizations in Russia, and the regions have left the capitals far behind in terms of self-organization; almost as many territorial public self-government bodies have been created in rural areas as in cities. However, less than ten per cents of the territorial public self-government bodies have the legal entity status. The majority is registered in the form of a public organization that does not give enough authority for active interaction with local governments *(Mislivskaya, 2018)*.

In 2018, the Russian Federation began the implementation of the Initiative Budgeting (IB) Development Program, the activities of which were included in the state program "Public Finance Management and Regulation of Financial Markets". An important component of information security is the possibility of participation for a wide range of citizens in putting forward ideas, discussing and choosing projects, various forms of voting and competitive selection of projects. As a rule, this is ensured through various intramural and extramural mechanisms provided for at different stages of the practice; statistics on citizen participation in such procedures are not systematic. In a number of practices, the need for counting participants in procedures at different stages is regulated in normative legal acts, as it is a way of confirming the participation of citizens. The dynamics of financial support indicators for IB projects for 2015-2018 is presented in Figure 4.

Figure 4

Dynamics of financial support indicators for initiative budgeting projects, 2015–2018, million roubles



Source: https://www.minfin.ru.

Transfers are provided from the regional budget to resolve local issues with the mandatory attraction of self-taxation funds in parallel with the practices of proactive budgeting in the Kirov and Vladimir regions and the Republic of Tatarstan. In the Kirov region, this proportion is 60/40, in the Vladimir region – 50/50; in Tatarstan, the ratio is 80/20 (4 roubles

from the republican budget for each rouble from citizens). In addition, a new bill initiated by the Tatarstan parliament proposes to introduce the possibility of "self-taxing in parts", that is, to hold citizens' meetings on self-taxation in part of the territory of a settlement; for example, it can be an individual residential area in a city or even a group of multi-apartment residential buildings. This initiative is dictated by the need to solve the problem of compliance with federal law No. 131-FZ, according to which the decision to impose self-taxation and use of these funds is made based on the results of a local referendum or at a gathering of citizens. It turns out that residents of large cities have no incentive to go to a referendum, since residents of one district or village are not interested in spending their money on resolving issues in another. As follows from the report of the All-Russian Congress of Municipalities, Tatarstan is a leader in self-taxation in the Russian Federation. In 2018, 266.5 million roubles were collected for self-taxation in Russia in total, of which 223 million roubles were in Tatarstan *(Goloburdova, Kirilov, 2019).*

The current practice of applying the self-taxation mechanisms of citizens is rather ambiguous. Measures to stimulate self-taxation undertaken in the constituent entities of the Russian Federation lead to very different results. In some regions, the experience of developing self-taxation was recognized as successful, in others, the introduction of this mechanism did not lead to the expected results and the collected funds of the population did not exceed the costs of holding a referendum, and thirdly, opposition to the implemented practices by the population remains. Obviously, the most successful is the experience of territories where co-financing from the regional budget is used to activate self-taxation. Since 2015, the development of initiative budgeting practices in the constituent entities of the Russian Federation has been supported as part of the direction to increase the transparency of public and municipal finance management *(Zentsova, 2019).* The development of proactive budgeting practices is included in the number of tasks to be addressed within the framework of the implementation of the "Concept for improving the efficiency of budget expenditures in 2019–2024" approved by the Government of the Russian Federation dated January 31, 2019 No. 117 - r. *(http://static.government.ru)* These approaches are implemented at the federal level by including civil participation practices in the number of measures provided for by the state program of the Russian Federation "Management of public finances and regulation of financial markets" *(https://www.minfin.ru).*

On July 20, 2020, the President of the Russian Federation signed Federal law No. 216-FZ "On amendments to the Budget Code of the Russian Federation" (*Federal law dd. July 20, 2020, No. 216-FZ*) and Federal law No. 236-FZ "On amendments to the Federal law "On general principles of organization of local self-government in the Russian Federation" (*Federal law dd. June 20, 2020, No. 236-FZ*). These Federal laws are aimed at consolidating the legal foundations of initiative budgeting in the Russian Federation. The laws regulate the mechanism of citizens' participation in the financial support of initiative budgeting projects. The specified mechanism allows to provide the direction of funds (initiative payments) of residents interested in the implementation of the initiative project for projects to address specific issues of local importance, as well as the citizens` ability to control each stage of the initiative project implementation.

The amendments also defined the powers of the Ministry of Finance of the Russian Federation for the provision of regional and municipal financial authorities with methodological support in the implementation of local initiatives with the citizens` participation, as well as planning and execution of expenditures of the budgets of the RF constituent entities and municipalities to implement initiatives. The adopted innovations will ensure the formation of unified approaches to the methodological support of initiative budgeting practices. The growth of interest in these practices is also evidenced by the results of 2019. The number of the constituent entities of the Russian Federation that have announced the implementation of initiative budgeting practices on their territory reached 69 regions, and some of them are implementing two or more initiative budgeting practices at the same time. For the first time, the number of implemented initiative projects exceeded 20 thousand (21.8 thousand or +13% by 2018), and the total amount of funding for such projects amounted to 24.1 billion rubles (+25% by 2018) (*https://pravitelstvo.kbr.ru*). A comparative analysis of the features of citizens` self-taxation and initiative budgeting is presented in Table 2.

Table 2

Comparative analysis

Comparison criterion	Citizens` self-taxation	Proactive budgeting (including the conclusion of donation agreements with residents and sponsors)
Making a decision on raising funds	Referendum	Individually
Population coverage	All residents of the municipality	Only interested parties. The number of participants is not limited
Amount of payments	It is set in absolute value equal for all residents of the municipality, with the exception of certain categories of citizens whose number cannot exceed 30% of the total number of residents and for whom the amount of payments can be reduced	It may be different for each of the benefactors
Reflection in the budget	Non-tax income	Gratuitous receipts
Legal regulation	Article 56 of Federal Law No. 131-FZ dated 06.10.2003 “On General Principles of the Organization of Local Self-Government in the Russian Federation”	There are no special rules. Separate provisions of the Civil Code of the Russian Federation, the Budget Code of the Russian Federation and Federal Law No. 135-FZ dated 11.08.95 “On Charitable Activities and Charitable Organizations”

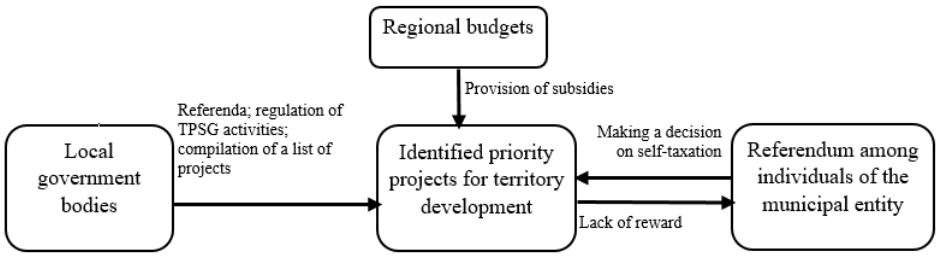
It is worth noting that both technologies are implemented in Russian practice with the support of the regional authorities, since the main amount of funds is provided from the budgets of the constituent entities of the Russian Federation.

3.2 Development of a scheme of financial participation of citizens in territorial development based on the self-taxation mechanism

To date, the Russian Federation legislatively dictates the following scheme of financial participation of citizens in the development of certain territories based on the self-taxation mechanism (Figure 5).

Figure 5

Scheme of financial participation of citizens in the territorial development based on the self-taxation mechanism



Source: own research.

However, this participation scheme can be characterized by a number of disadvantages:

- the need for a referendum in the municipal entity to address self-taxation for a specific project;
- participation in the referendum is provided only for individuals residing in the given territory;
- the lack of financial rewards for citizens from a project for the implementation of which the self-taxation funds have been allocated.

However, there are many problematic issues for the solution of which it is possible to use completely different approaches, each of which can have a positive effect. *We propose to look at the problem of the possibility and financial interest of participation of both individuals and legal entities in the territorial self-government of regions based on the crowdfunding mechanism.* Crowdfunding is one of the sectors of the sharing economy. Platforms of the sharing economy transform traditional systems of production and consumption in cities around the world. While the sharing economy can be aimed at increasing the sustainability of various economic systems, its actual economic, social and environmental effects remain poorly understood. In the era of Covid-19, climatic and economic crises, and growing uncertainty, including the territorial development of single-industry towns, it is becoming increasingly important to promote more sustainable and promising forms of joint (distributed) use of various resources, and, above all, financial ones. Ways to capitalize on the strengths of a sharing economy despite a significant number of both Russian and foreign publications are still poorly understood, many of them are aimed at developing theoretical aspects of this issue. For example, the main aspects of the functioning of the sharing economy are presented and described in the work by Sadovskaya A. *(Sadovskaya, 2018)*; co-authors

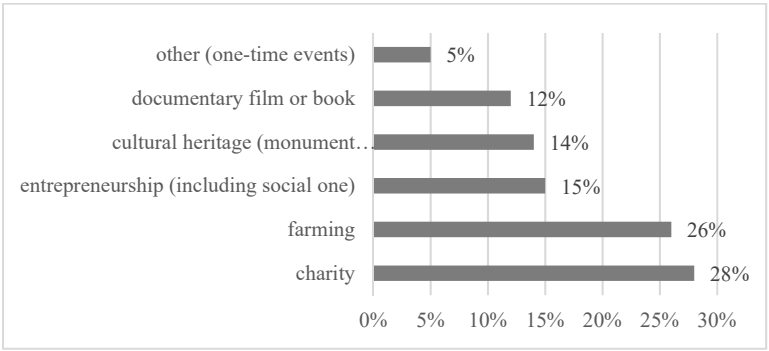
of the work Adaktilos A., Chaus M., Moldovan A. *(Adaktilos, Chaus, Moldovan, 2018)*, consider two sides of the sharing economy model: the positive one is expressed in minimizing the environmental crisis and reducing the consumption of resources that are limited in the world, and the negative one presents itself when the model is based only on people's trust in each other. According to Glukhov V. and Glukhova Z. *(Glukhov, Glukhova, 2019)*, the sharing economy received a new impetus for its development and changed the structure of relations between consumers of goods (services). At the moment, it is extremely important to study the roles, prospects and effects of both resource owners, users, local governments, and the sharing platforms themselves in Russia in the direction of territorial development of regions.

3.3 Identified examples of projects implemented on crowdfunding platforms for the development of territories (including small towns in Russia, rural settlements and villages)

Two sources of information were used to study this issue. Firstly, this is the work by Latysheva A. (*Latysheva, 2020*), in which more than two hundred projects were selected, which started from 2012 to 2017 on two of the most famous Russian platforms Planeta.ru and Boomstarter, the search was carried out by keywords: "rural settlement", "rural", "village", "country". The selection criterion for the final sample was the goal of the project – improving the life and development of a rural settlement or village on the territory of Russia. The final sample included 202 projects, including 169 on the Planeta.ru crowd platform and 33 on the Boomstarter platform, launched between 2012 and 2017. Of the 202 selected projects, 40% were successful at the time of the analysis, 50% were unsuccessful and 10% were not yet completed. If we analyze only completed projects, the percentage of successful projects will grow to 44%, which is higher than the average figures for sites. These data refute the claim that "rural" projects have a localized nature of the interest of crowd platform participants. The selected projects are divided into several thematic groups Figure 6): charity, farming, entrepreneurship (including social one), cultural heritage (monument restoration, creation of a local museum, etc.), documentary film or book, other (one-time events).

Figure 6

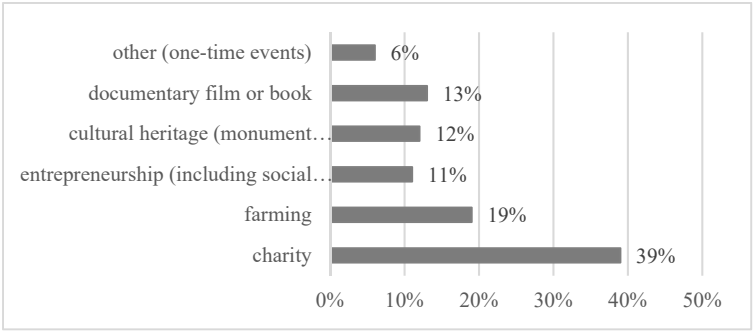
Topics of crowd projects selected in the sample



Topics of only successful projects are shown in Figure 7.

Figure 7

Topics of successful crowd projects



This analysis of crowdfunding projects has shown that in conditions of local budget deficits and expensive lending, crowdfunding helps to successfully solve problems related to various aspects of the life of the population in the regions – from entrepreneurship to social initiatives. Crowdfunding acts as a tool to compensate for the shortcomings of financing social projects.

The second source of information for this issue analysis was the statistical data provided by the Planeta.ru crowd platform for the period 2016-2020. The ratio of the total number of projects (with the key search words "village", "settlement", "town", "region" and their derivatives in the name of the project) to successful projects (for which the amount requested by the Initiator of the project was raised) for 2016-2020 looks differently compared to 2012-2017:

2016: 34 / 12;

2017: 49 / 9;

2018: 49 / 5;

2019: 54 / 10;

2020: 23 / 7.

Thus, from 2012 to 2017, the total number of such projects on the Planeta.ru crowd platform was 169 (of which 40% were successful), and 209 from 2016 to 2020 (of which 21% were successful). With the growing number of such projects per year, their success rate decreases. The reasons for this dynamic may be quite different, but it is obvious that the initiative in applying for raising "public financing" of projects is growing, however, without the appropriate support of local governments in informing the population interested in the implementation of these projects and the possibility of subsidizing part of the project costs from the budget, the success of projects falls. The geography of these projects on the platform is represented by almost all regions of the country, the ratio of project Initiators is as follows: individuals 71%; NPOs (non-profit organizations), ANO (autonomous non-profit

organizations) 12%; IE (individual entrepreneurs) 4%; administrations and municipal bodies 3%; other legal entities 10%.

This ratio is characterized by a certain error, since the search was performed by the name of the projects and there is no type of counterparty on the platform, but only its name. At the same time, it is obvious that currently, the initiative in developing, placing on the platform and implementing such projects belongs entirely to individuals. Local self-government bodies are practically not involved in this activity, although the implementation of social projects and the creation of conditions for the development of small and medium-sized businesses is their direct function.

3.4 Identification of crowd platforms in Russia, which allow to influence the process of territorial self-government in the regions

In January 2018, the crowd platform "100 urban leaders" was launched in Russia (Figure 8). The crowd platform was created as part of the program of the Center for urban competencies of the Agency for strategic initiatives and the "Rosatom" Russian state corporation and is aimed at developing urban communities for their active involvement in the process of changing cities for the better. This crowd platform gives an opportunity to: conduct voting and questionnaires; create surveys; collect the best proposals for improving the project; use educational materials, lectures and instructions; learn from the experience of leaders who have implemented similar projects. At the same time, it is important that the project posted on the crowd platform is aimed at meeting the needs and requests of city residents. The platform is crowdsourcing, that is, it is a way that allows to gather like-minded people in one place to create projects, exchange ideas and experience in order to solve problems facing business, government and society. The platform does not collect funds for specific regional development projects, but only discusses opportunities for implementing and improving the effectiveness of a particular project that is important for a particular territory.

Figure 8

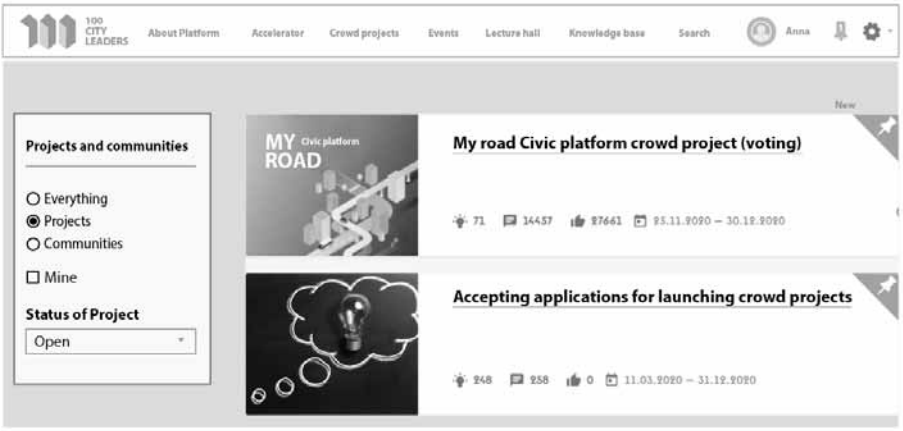
"100 city leaders" crowd platform

Source: *https://100gorodov.ru/.*

Let`s consider the two crowd projects currently open on the platform: "My road Civic platform" and "Accepting applications for launching crowd projects" (Figure 9).

Figure 9

Two open crowd projects on the "100 city leaders" platform



Within the "My Civic road platform" crowd project (implemented from November 25 to December 31, 2020), a vote is being held for a city to pilot design solutions for adapting international urban road design practices. The "Accepting applications for launching crowd projects" crowd project (implemented from March 11 to December 31, 2020) is aimed at collecting applications to attract ideas for implementing projects that are important for the development of certain territories of Russia. As of December 22, 2020, 248 applications were submitted under this project. As an example, we will consider only 4 applications to describe the range of problems of projects proposed for implementation in completely different regions of Russia.

Application 7999: Pskov region. The goal of the project is to create a unique Data processing centre in Russia with the use of distributed registry technologies and quantum encryption, power supply from 80 MW of Pskov GRES and the possibility of further increasing consumption to 440 MW. Heating the Pskov region facilities at the expense of waste heat.

Application 7911: Pskov region. The goal of the project is to overhaul the road from the district centre of Pallasovka to the village of Romashki.

Application 7188: Arkhangelsk. The goal of the project is to restore the estate of Vikulov I., built in 1905-1906.

Application 7168: Moscow region town of Mozhaisk. The goal of the project is to stop cutting down adult fir trees and take care of nature.

It is obvious that Russians from different regions of Russia are primarily concerned with social aspects of the quality of life: roads, ecology, transport. If we consider other applications, we will see the projects associated with supporting the disabled, pensioners,

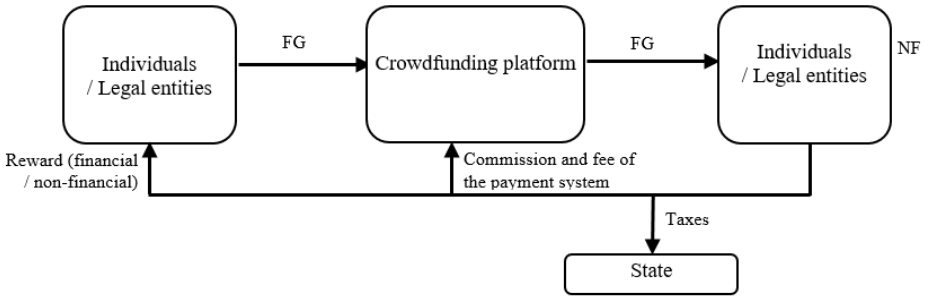
children – that is, socially significant groups; projects in the field of improving the quality of construction and maintenance of housing; the landscaping areas (development and improvement of parks); projects for creating cultural objects. Thus, today a crowdsourcing platform aimed at activating the presentation and discussion of public ideas for the development of socially significant projects important for the regions of the Russian Federation is successfully operating in Russia. *The main drawback of this platform is that it is not crowdfunding, that is, citizens or legal entities who want to financially support a particular project in the Russian region do not technically have such an opportunity with the help of the platform.*

3.5 Development of a scheme of network interaction between business structures and local governments, based on crowdfunding IT platforms. Indicating its advantages in comparison with the current scheme of citizens` self-taxation.

On January 1, 2020, the Federal Law dated August 2, 2019, No. 259-FZ "On attracting investments using investment platforms and amending certain legislative acts of the Russian Federation" *(Federal Law dd. August 2, 2019, No 259-FZ)*, entered into force in the Russian Federation and also called the "crowdfunding law". According to the law, the movement of non-cash funds in the form of investments occurs within the framework of special investment platforms on the Internet on the basis of relevant agreements *(Andreev, 2020)*. Investing with the use of the investment platform can be carried out in the following ways: by providing loans; by acquiring equity securities placed using the investment platform, with the exception of securities of credit institutions, non-credit financial institutions, as well as structural bonds and securities intended for qualified investors; by acquiring utilitarian digital rights. The classic crowdfunding financing scheme is presented in Figure 10.

Figure 10

Organization of crowdfunding financing



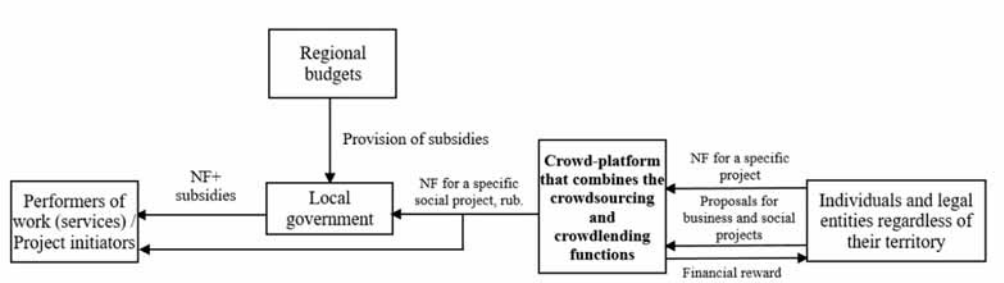
FG – financeal goal, roubles; NF – the necessary funds for the implementation of the project, roubles
Source: Nekrasova, Shumeyko, 2017.

Thus, it is necessary to collect such an amount of funds on a crowdfunding platform that, after the deduction from it of a crowdfunding platform commission, a payment system fee and tax, the amount of funds would remain, which are necessary directly for the implementation of the project. Crowdfunding business models can be divided into financial and non-financial *(Golikova, 2019)*. The practice of the investment platform activity in

Russia indicates that the non-financial crowdfunding models have gained the most and predominant development; however. Taking into account the previously described scheme of financial participation of citizens in the territorial development of the country on the basis of the self-taxation mechanism, an alternative scheme is proposed for the participation of not only citizens, but also legal entities in the development of specific territories or the implementation of projects (Figure 11).

Figure 11

Scheme of network interaction of business structures and local governments based on crowdfunding IT platforms



FG – financial goal, roubles; NF – the necessary funds for the implementation of the project, roubles

Source: own research.

This scheme proposes the creation of a crowd-platform that combines crowdsourcing and crowdlending functions. This crowd-platform would allow not only to conduct voting and questionnaires; create surveys; collect the best proposals for improving the project; use educational materials, lectures and instructions; learn from the experience of leaders who have implemented similar projects, but also raise funds for implementing both entrepreneurial and social projects of the territories. There are a number of crowdlending platforms, there are also crowdsourcing platforms ("Active Citizen", "100 urban leaders") in Russia, but there are no platforms that would combine these functions to develop certain business projects in specific territories. The proposed financing scheme has several advantages in comparison with the currently used:

- participation in the financing of both individuals and legal entities;
- the opportunity to participate, regardless of the territory of residence or activity;
- there is no need for a referendum to decide on self-taxation;
- the possibility of obtaining financial rewards for investing in the project.

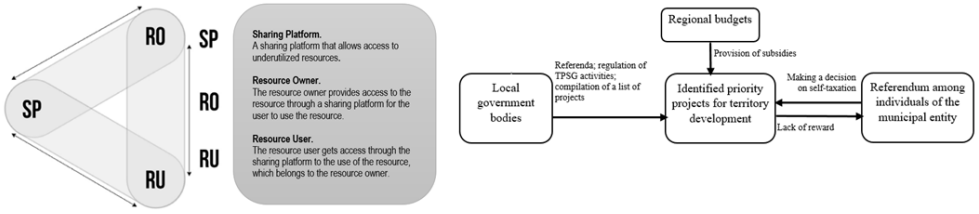
Based on all of the above, we can conclude that crowdfunding can act as a voluntary financial alternative to the self-taxation of citizens and initiative budgeting or supplement them. Unlike the self-taxation mechanism, crowdfunding does not imply that citizens who finance the project must permanently or predominantly reside in the territory of a particular municipality. Anyone can donate money wherever they are, which allows to expand the number of participants and raise more money. A team of project authors can be formed from people

who are also located in different cities or towns. This makes it possible to implement inter-municipal projects. The implementation procedure itself is simpler than self-taxation: there is no need to hold a referendum. In addition, crowdfunding can also serve as a preliminary stage of initiative budgeting, where you need to identify the most significant needs of the local community. In this case, the funds that were raised through the crowdfunding platform complement the funding from the local budget.

The use of crowd platforms for the implementation of projects in the country's regions is not completely new for Russia, as we have seen in paragraph 3.3 of the "Research results". What is the novelty of our approach? In the traditional scheme of using sharing platforms (including crowd platforms), the main focus is on the initiator (owner/project manager). As it was revealed during the analysis of crowd projects on the most famous crowd platform in Russia Planeta.ru (paragraph 3.3 of the "Research results"), they are most often individuals who live in a particular locality for the development or solution of problems of which they create a project to raise funds. That is, it is the citizens of a certain territory who take responsibility for solving its problems. The main task of the proposed scheme is to transfer the "gravity centre" for the development of territories to the local governments. The main practical value of the implementation of the proposed scheme is to move away from the "needle" of permanent Federal subsidies to the regions to increase the financial responsibility of local governments. They are the initiators of projects on crowd platforms in our scheme. Of course, to determine the "rating" of the territory's problems, it is possible to use crowdsourcing platforms by analogy with the already existing "100 city leaders" in Russia, which was discussed earlier. In our scheme, we combine the scheme of "Participants and their actions of the sharing economy" (Figure 12a) and "Scheme of financial participation of citizens in territorial development based on the self-taxation mechanism" (Figure 12b) with the transfer of the area of responsibility for the placement of projects to local governments in the regions of the Russian Federation, but with active cooperation both in identifying problems and attracting financial resources from both individuals and enterprises of these regions, and all other interested in the implementation of the project.

Figure 12

"Participants and their key actions in the sharing economy" (a)
"Scheme of financial participation of citizens in territorial development based on the self-taxation mechanism" (b)



In other words, a mechanism for crowdfunding network interaction between business structures, local self-government bodies and the population of the territories is being created. Thus, our scheme is a new tool of territorial self-government in the regions of the Russian Federation.

3.6 Methodological recommendations for this scheme implementation in the Russian Federation

Let`s formulate recommendations for the implementation of the proposed «Scheme of network interaction of business structures and local governments based on crowdfunding IT platforms». It is possible to allocate five basic stages of this scheme implementation.

Stage 1. Training the municipal employees in the methods of placement and management of crowd projects. It`s possible to use the training materials of the platforms themselves. In the future, territorial crowd platforms that place projects directly in their region can be organized.

Stage 2. Placing the project information on the crowd platform website. At this stage, the project initiator (municipality) registers on the site and enters information about the project. Software most platforms offer consistently specify all the project parameters: title, duration of the campaign to raise funds, necessary amount, idea description, duration of implementation, compensation to participants. It is important not only to describe and justify the idea, but also to indicate the mechanism of its implementation. The platform's functionality allows to upload videos, photos, and drawings.

Stage 3. Moderation and agreement. The author of the project (municipality) sends the finished materials for moderation - checking that the project complies with the platform's rules. After moderation, the author of the project enters into an agreement with the platform, which sets out the rights and obligations of the parties, including the terms of provision and payment for services. Then the platform specialist launches the project, and information about it becomes publicly available.

Step 4. Fundraising. At this stage, any user can transfer funds, post information about the project in social networks, make comments on it, and ask questions to the initiator. The initiator (municipality) can post information about rewards, talk about the project on the Internet and offline, and view statistics of visits to the project page. The municipality reflects the collected funds according to article 150 of the CPASO (classification of the public administration sector operations) "Gratuitous cash receipts". After the deadline for collecting funds for the project implementation, the parties draw up a certificate of acceptance of the services rendered. The platform then transfers funds to the project initiator. It is extremely important to draw the attention of the public of the project territory to the ongoing fundraising at this stage.

It is worth noting that at the initial stage of this scheme implementation, a negative reaction to the offer to participate in the project through crowdfunding is not excluded. The population may express distrust, unwillingness to pay for the benefits that, in their opinion, need to be financed from the budget. To minimize scepticism, it is necessary to convey to the population the idea that crowdfunding will allow them to implement projects for which there are not enough funds in the budget.

Stage 5. Municipality`s reporting on the progress of the project and costs. The undoubted advantage of using crowdfunding in territorial self-government is its transparency. The municipality publishes the budget and estimates on the project page. The agreement can provide for the obligation of the initiator to post a report on the project implementation. Then

everyone who supported them financially will be able to see what the initiator spends money on. In the "project news" section, they can inform project participants about important events through the project profile and social networks. To discuss issues and get feedback, the users should be encouraged to leave comments (*Burilichev, 2019*).

We should separately point out that in order to receive a budget subsidy for the implementation of crowd projects of territorial self-government, it is necessary to make appropriate amendments to the normative legal acts regulating the process of self-taxation of citizens. These amendments should allow the use of the mechanism of fundraising through the crowd platform along with the mechanism of self-taxation of citizens to receive subsidies from the regional budget. *It is obvious that today citizens take responsibility for initiating crowd projects, raising funds, implementing the project and reporting on it to all participants.*

4. Conclusion

The main purpose of this article was *to substantiate the possibility and necessity of developing territorial self-government in Russia based on crowdfunding network interaction between business structures and local self-government bodies.*

To achieve this goal, the following tasks were solved:

- dynamics, problems and prospects of development in Russia of such instruments of "people`s financing" as initiative budgeting and self-taxation was analyzed. The current scheme of self-taxation of citizens in the country was developed with a list of its shortcomings in implementation;
- examples of implemented crowd projects for the development of the territories of the Russian Federation, primarily in the field of public initiatives, were considered;
- crowdsourcing platform "100 city leaders", which allowed to influence the process of territorial self-government in Russia since 2018, was identified and described;
- scheme of network interaction between business structures and local governments based on crowdfunding IT platforms is proposed; its advantages in comparison with the current self-taxation scheme of citizens in the Russian Federation are formulated. Methodological recommendations for the implementation of this scheme are given.

The use of the crowdfunding mechanism in the territorial self-government of regions can help in solving the tasks set out in the state programs of the Russian Federation (*Kutepov et al., 2018*), namely:

- "Development of science and technology" (*Resolution of the Government of the RF dd. 15.04.2014 No. 301*). The use of the crowdfunding mechanism in the territorial self-government will ensure the influx of new categories of investors who previously had no opportunity to participate in the investment process. Regional projects will receive a new source of funding, which will have a positive impact on the quality of life of the population;

- "Digital economy" (*Order of the Government of the Russian Federation dd. 28.07.2017 No. 1632-R*). Crowd platforms can become one of the most important elements of the investment infrastructure of the digital economy. The decentralized framework of the "new finance of the regions" will facilitate the emergence of new horizontal links in the innovation ecosystem and attract new participants through informal social channels;
- "Industry development and increase of its competitiveness" (*Resolution of the Government of the R. Federation dd. 15.04.2014 No. 328*). The use of the crowdfunding mechanism in the territorial self-government of regions can become an important catalyst for the diversification of sources of financing for Russian industry;
- "Information society" (*Resolution of the Government of the RF dd. 15.04.2014 No. 313*). Crowd technology can promote the intensification of the information environment for regional development. The communities formed around the crowd platform, will be the basis for public discussion of key issues of regional development.

Thus, the use of the crowdfunding mechanism in territorial self-government provides an additional opportunity for solving the tasks facing Russia in the development of science and technology, increasing the level of technological development of the economy of the regions and the country.

The proposed project financing scheme is aimed at developing network interaction between individuals and legal entities interested in implementing certain regional business and social projects and local governments based on crowdfunding IT platforms. This scheme is characterized by: a single goal for the development of projects and territories; a clear structure of organizational and financial relations; a high degree of the interconnection of the structural elements. The elements included in this scheme retain their autonomy, but through their entry, the emergence of new management ideas and decisions is activated and the restraining influence of inter-organizational and interpersonal subordination is weakened.

Entering into this scheme of project financing for both individuals, business entities, and local governments allows optimizing the economic potential of all participants in this network, and obtaining a synergistic effect from combining their resources.

References

Adaktilos, A. D., Chaus, M. S., Moldovan, A. A. (2018). Sharing economy. – Economics, N 4 (36), pp. 95-100.

Andreev, F. (2020), National investment platforms can attract trillions of roubles into the country's economy. Available at: https://rg.ru/2020/01/16/nacionalnye-investicionnye-platformy-sposobny-privlech-v-ekonomiku-strany-trilliony-rublej.html.

Burilichev, A. (2019), Crowdfunding will help to finance a project and save budget funds. Available at: http://cmokhv.ru/materials/mat20191204/.

Crowd platform "100 city leaders". Available at: https://100gorodov.ru/.

Federal Law dd. 06.10.2003 N 131-FZ "On General Principles of the Organization of Local Self-Government in the Russian Federation" (as amended on May 23, 2020). Available at: http://www.consultant.ru/document/cons_doc_LAW_44571/.

Federal Law dd. August 2, 2019 No 259-FZ "On attracting investments using investment platforms and on amending certain legislative acts of the Russian Federation". Available at: http://www.consultant.ru/cons/cgi/

online.cgi ? req = doc & base = LAW & n = 330652 & fld = 134 & dst = 1000000001.0 & rnd = 0.7024629357880219 # 0026366072501536886.

Federal law No. 216-FZ "On amendments to the Budget code of the Russian Federation" dd July 20, 2020. Available at: https://rg.ru/2020/07/24/budzhet-dok.html.

Federal law No. 236-FZ "On amendments to the Federal law "On general principles of organization of local self-government in the Russian Federation" dd June 20, 2020. Available at: https://rg.ru/2020/07/24/o-principah-organizacii-samoupravlenija-dok.html.

Franco-Leal, N., Diaz-Carrion, R. (2020). A dynamic analysis of the role of entrepreneurial ecosystems in reducing innovation obstacles for startups. – Journal of Business Venturing Insights, Vol. 14, November 2020, e00192. Available at: https://doi.org/10.1016/j.jbvi.2020.e00192.

Glukhov, V. V., Glukhova, Z. V. (2019). Sharing economy as a new form of economic relations. – Waste and resources. Vol. 6, N 4, p. 10.

Golikova, A. (2019). Key aspects of the crowdfunding functioning. – Bank Bulletin, N 9 (674), pp. 33-43.

Goloburdova, N., Kirilov, M. (2019). Tatarstan lobbying for self-taxation for citizens in the Duma. Available at: https://www.business-gazeta.ru/article/449857.

Kutepov, I. A., Lyakisheva, L. I., Privalova, E. N., Rozhkova, E. S., et al. (2018). New tools for attracting financing for the development of technology companies: practice of using and prospects for development in Russia. Analytical report. Available at: https://www.csr.ru/upload/iblock/d43/d43abe96c5e5a9cc5dea8c673f5028e1.pdf.

Latysheva, A. (2020), Using crowdfunding in solving social and cultural problems of rural areas. Available at: https://cyberleninka.ru/article/n/ispolzovanie-kraudfandingav-reshenii-sotsialnyh-i-kulturnyhproblem-selskih-territoriy-rossii.

Ministry of Finance of the Russian Federation. Information from October 1, 2020 "Main directions of the budget, tax and customs tariff policy for 2021 and for the planning period of 2022 and 2023". Available at: http://www.garant.ru/products/ipo/prime/doc/74626236/.

Ministry of Finance of the Russian Federation. Press center. Anton Siluanov: achievement of national goals largely depends on the regions. Available at: https://minfin.gov.ru/ru/press-center/?id_4=37335-anton_siluanov_dostizhenie_ natsionalnykh_tselei_vo_mnogom_zavisit_ot_regionov.

Ministry of Finance will ensure the implementation and unified methodology for the application of the laws on initiative budgeting signed by the President. Available at: https://pravitelstvo.kbr.ru/oigv/minfin/index.php?ELEMENT_ID=30820.

Mislivskaya, G. (2018). Closer to life. The authorities will support the organization of citizens at the place of residence. Available at: https://rg.ru/2018/07/10/miniust-utochnil-status-organizacij-tos.html.

Muñoz, P., Kibler, E., Mandakovic, V., Amorós, J. E. (2020). Local entrepreneurial ecosystems as configural narratives: A new way of seeing and evaluating antecedents and outcomes. Research Policy. Available online July 19 2020, 104065. Available at: https://doi.org/10.1016/j.respol.2020.104065.

Nekrasova, E. V., Shumeyko, E. V. (2017). Economic evaluation of crowdfunding as a method of attracting investment. – Scientific and Technical Journal of St. Petersburg State Polytechnical University. Economic sciences. Vol. 10, N 5, pp. 114-124. Available at: https://economy.spbstu.ru/userfiles/files/volume/e10.5.2017.pdf.

Order of the Government of the Russian Federation No. 1632-R dd 28.07.2017 "On approval of the program "Digital economy of the Russian Federation". Available at: http://base.garant.ru/71734878/.

Regions could be allowed to lend to each other from 2021. Available at: https://www.kommersant.ru/doc/4323425.

Report on best practices for the development of initiative budgeting in the constituent entities of the Russian Federation and municipal entities. Ministry of the Russian Federation. Available at: https://www.minfin.ru/common/upload/library/2019/10/main/1070_ Doklad.pdf.

Resolution of the Central Executive Committee and the Council of People's Commissars dd. August 16, 1930 «About the self-taxation of the population». Available at: http://istmat.info/node/50020.

Resolution of the Central Executive Committee of the USSR, Council of People's Commissars of the USSR of August 29, 1924 «On the self-assessment of the population to meet local public needs». Available at: http://www.libussr.ru/doc_ussr/ussr_2146.htm.

Resolution of the Government of the Russian Federation dd 15.04.2014 No. 301 "On approval of the state program of the Russian Federation "Development of science and technology" for 2013-2020. Available at: http://base.garant.ru/70643478/.

Resolution of the Government of the Russian Federation dd 15.04.2014 No. 328 "On approval of the state program of the Russian Federation "Industry development and increase of its competitiveness". Available at: http://base.garant.ru/70643464/.

Resolution of the Government of the Russian Federation dd15.04.2014 No. 313 "On approval of the state program of the Russian Federation "Information society (2011-2020). Available at: http://publication.pravo.gov.ru/Document/View/0001201404240017.

Rosen, F., Olsson, P. (2013). Institutional entrepreneurs, global networks, and the emergence of international institutions for ecosystem-based management: The Coral Triangle Initiative. – Marine Policy, Vol. 38, March 2013, pp. 195-204. Available at: https://doi.org/10.1016/j.marpol.2012.05.036.

Rui Shu, Shenggang Ren, Yi Zheng. (2018). Building networks into discovery: The link between entrepreneur network capability and entrepreneurial opportunity discovery. – Journal of Business Research, Vol. 85, April 2018, pp. 197-208. Available at: https://doi.org/10.1016/j.jbusres.2017.12.048.

Sadovskaya, A. G. (2018). The main aspects of the functioning of the sharing economy. – Bulletin of modern research, Vol. 9.4 (24), pp. 252-254.

Shokhina, E. (2020). Regions have caught in a debt loop. Available at: https://www.vedomosti.ru/economics/articles/2020/11/05/845984-regioni-popali.

Sochina, A. (2019). "Moscow is not Russia". Who is to blame for the different living standards of our towns and cities? Available at: https://nts-tv.com/articles/moskva-ne-rossiya-kto-vinovat-v-raznom-urovne-zhiz-13216/.

Solovyova, O. (2020). The crisis has reinforced the inequality of regions. It will be necessary to extinguish social discontent in the constituent entities of Russia with Federal money. Available at: https://www.ng.ru/economics/2020-08-16/1_7938_ regions.html.

Srivardhini, K. Jha. (2018). Entrepreneurial ecosystem in India: Taking stock and looking ahead. – IIMB Management Review, Vol. 30, N 2, June 2018, pp. 179-188. Available at: https://doi.org/10.1016/j.iimb.2018.04.002.

Subsidies to the regions of the Russian Federation in 2020. Available at: https://vybory-91.livejournal.com/2344267.html.

Subsidized regions in Russia and their rating. Available at: https://rosinfostat.ru/dotatsionnye-regiony/.

Sumita Sarma, Sanwar A. (2017). Sunny. Civic entrepreneurial ecosystems: Smart city emergence in Kansas City. – Business Horizons, Vol. 60, N 6, November-December 2017, pp. 843-853. Available at: https://doi.org/10.1016/j.bushor.2017.07.010.

The concept of improving the efficiency of budget expenditures in 2019-2014. Approved by order of the Government of the Russian Federation dd. January 31, 2019 No. 117-r. Available at: http://static.government.ru/media/files/oPbFFY1nPoRrQGx7Q7tfZrV5 JGTUuTOR.pdf.

The state program of the Russian Federation "Management of public finances and regulation of financial markets." Approved by Decree of the Government of the Russian Federation dated April 15, 2014 No. 320 (as amended on March 29, 2019 No. 370; March 31, 2020 No. 389). Available at: https://www.minfin.ru/common/upload/ library/2020/04 /main/N_320.pdf.

Tirskikh, T., Galieva, G., Mitrofanov, P. (2020). COVID-19 struck the incomes of the regions. Available at: https://raexpert.ru/researches/regions/income2020/.

Zentsova, E. V. (2019). The development of mechanisms for the financial participation of citizens in resolving issues of local importance. Available at: http://bujet.ru/article/382189.php.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THEORETICAL UNDERPINNINGS OF LIBERIA'S POST-CONFLICT RECOVERY: PERTINENT LESSONS FOR DEVELOPING COUNTRIES[3]

Post-conflict recovery in underdeveloped and developing countries is always a challenge for political leadership. Liberia has been the victim of 14 years of civil war, due to which GDP experienced a downfall by over 90% making the economic growth process halted. This paper traces the extent of Liberia's collapse and examines the patterns of post-conflict recovery as an application complexity theory and a model which can be followed by other conflict confronting developing countries. The Paper explores challenges faced by Liberia in strengthening rapid, inclusive, and sustained economic growth and how these challenges were converted into opportunities through dynamic leadership and institutional process that had roots in complexity theory. It examines the policy framework and institutional reforms which set the pace for sustainable economic growth in Liberia. Because of visionary steps by leadership, the economic growth, which was very low before 1999, showed positive improvement after the election in 2005. It was concluded that from 2005 to 2014, the per capita GDP growth rate had been approximately 63% which indicated the remarkable performance of the Liberian Government. Paper presents theoretical perspective to understand challenges of socioeconomic growth and mechanism for its revival in poor conflict-hit underdeveloped and developing countries.
Keywords: leadership; post-conflict; policy; challenges; political; institutional reforms; complexity theory
JEL: O21; O43; O55

1. Introduction

Liberia was decimated by 25 years of economic mishandling and 14 years of civil war. The devastation resulted in the displacement of over 500,000 individuals, who fled their homes as either internally displaced persons (IDPs) or refugees in neighbouring countries (Gul, 2013). Families were shattered and communities were uprooted. The Social, political,

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economic, and governance systems of the country were collapsed. Commercial and productive activities were destroyed due to terrible law and order situation. GDP fell by over 90% in less than two decades which has been termed as one of the largest economic collapses in the world since World War II (Radelet, 2008). However, after the election in 2005 and the restoration of the democratic process, Liberia's devastation was relatively over (Gul, Ghazali, 2020). Using constituents of complexity theory, the newly elected leadership introduced a broad set of people-centric policies to foster peace, launch reconstruction and development, and build strong systems for governance. One of the most critical issues for Liberia's recovery was to establish the foundation for rapid, inclusive, and sustainable economic growth. The post-conflict socioeconomic recovery was a challenge for political leadership that could not be handled with conventional leadership approaches. It demanded a new innovative approach based on complexity leadership and socio-economic theory. This paper examines Liberia's journey towards socioeconomic growth, its patterns, key issues, and the most important policy steps towards post-conflict recovery. The complexity leadership approach that was adopted by the Liberian government has many lessons for underdeveloped and developing countries suffering from conflicts and desirous for early recovery.

2. Survey and Appraisal of Literature on Post Conflict Recovery

Liberia is Africa's oldest republic in West Africa; it became better known in the 1990s for its long-running, ruinous civil war. Liberia' landscape is characterised by mostly flat to rolling coastal plains that contain mangroves and swamps. The equatorial climate is hot year-round with heavy rainfall from May to October, with a short interlude in July to August. As indicated by the World Development Indicators 2015, the population of Liberia is 5.503 million as per statistics of 2015 and its GDP per capita is 458.87 (World Development Indicators, 2015). Many researchers have investigated conflicts and post-conflict recoveries in different regions. A review of few prominent studies has been elucidated below.

2.1. Growth process in African countries

Basu et al. have carried out extensive work on the growth process in Sub Saharan Africa in 2001 and highlighted that owing to effective leadership and institutional measures, many countries of sub-Saharan Africa have shown signs of growth amid challenges. Many developing countries have recovered from their conflicts. There are many lessons that can be learnt by the rest of the world from the successful leadership and institutional strategies of underdeveloped and developing African countries (Basu et al., 2001). Binswanger et al. have investigated the structural transformation of African societies in 2010. It was concluded that the revival and modernisation of agriculture played an important role in the structural transformation of Liberia and other African societies (Binswanger et al., 2010). In 2000, Burnside and Dollar have elucidated a strategy for immediate post-conflict recovery in poor countries. It was indicated in the study that financial aid and initiation of incentives regime for work are effective post-conflict strategies to reduce poverty in conflict-hit countries (Burnside, Dollar, 2000).

Cuesta and Abras have elucidated the conflict-induced socio-economic devastation of Liberia in 2013. He explained that there were less than 50 Liberian physicians to cover the nation's public health needs, equal to one for every 70,000 Liberians. About 70% of school buildings were partially or wholly destroyed. A whole generation of Liberians has spent more time at war than at school. It was indicated in the study that the situation after 2005's election had a striking contrast with the previous decade as equal education opportunities to Liberian children were provided after the election of 2005 that had converted the mindset of society from conflict to development (Cuesta, Abras, 2013). Fosu, in his extensive work, indicated in 1992 that the main reason for low economic growth in Sub Saharan Africa was political instability and weak institutions. Economic prosperity in these countries can be achieved by restoration of a stable democratic process and by strengthening the institutions (Fosu, 1992). In 2012, Enuka investigated the effects of conflicts and arms proliferation on socio-economic growth. It was highlighted in the study that arms proliferation in poor conflict-hit countries has increased and that has damaged the socioeconomic life of the population in these countries. For long-lasting sustainable socioeconomic growth, conflicts in poor countries need to be resolved and arms proliferation is required to be strictly controlled (Enuka, 2012).

Reviewing the World Bank's survey of the African crisis referred to as Berg's Report, Gerhart elucidated in 1997 that for the acceleration of sustainable long term development in Sub Saharan Africa, external factors like trade and aid policies cannot be ignored (Gerhart, 1997). Ghura investigated the effects of macroeconomic policies and institutional measures on economic growth in Sub Saharan Africa in 1995. It was concluded in the study that effective institutional actions were essentially required to have an accelerated economic growth rate in Sub Saharan African countries (Ghura, 1995). In another study of 1998, Ghura also indicated that revenue collected through taxes in most of the countries of sub-Saharan Africa gets wasted due to widespread corruption (Ghura, 1998). Particularly indicating Liberia's financial crisis and failure of monetary policies, Gonpu has indicated in 2014 that the banking and monetary crisis in Liberia was from 1986 to 1999 was due to bad governance of the Liberian government that rendered the National Bank of Liberia ineffective (Gonpu, 2014).

Gul conducted extensive investigations on socioeconomic growth in Liberia in 2013. He explained that Liberia's GDP began to decline after 1980 and collapsed after the beginning of the war in 1989. GDP dropped by 90% between 1987 and 1995. The violence reached extreme levels in 2002 and 2003 until the UN peacekeepers arrived in 2003. As the Liberian economy imploded, poverty increased sharply, and more than 75% of Liberians lived below the poverty line of $1 per day. Unemployment was high as returning refugees and internally displaced persons were struggling to find work. Refugees returning to their farms faced a lack of seeds, fertilisers and modern agriculture tools. Schools, hospitals, and clinics were badly damaged, and most government buildings were left in shambles. The war left basic infrastructure in ruins. There was no electricity or piped water supply anywhere in the country for 15 years after 1991. Many roads became impassable, which weakened economic activity and undermined the delivery of basic health and education services. Exports ceased entirely, dropping to about $10 million in 2004. Government revenue fell to less than US$85 million a year between 2000 and 2005, translating into public spending of only about US$25 per person per year; one of the lowest levels in the world. Agricultural production dropped as people fled their farms. Production of iron ore, timber, and mining ceased completely.

Electricity and water supply fell by 85%. Transportation, communication, trade and construction all fell by approximately 70%. He further explained that fast socio-economic growth in Liberia after 2005 was due to the restoration of democracy and strong institutional measures (Gul, 2013).

In 2006, Hausmann et al. indicated that an increase in exports and ensuring export diversification could lead to fast economic growth and this can be one of the effective tools to accelerate growth and development in poor countries (Hausmann et al., 2006). Jones indicated in 2000 that foreign aid was an essential tool to foster economic growth in developing and underdeveloped countries of Africa as they lacked the indigenous capability to restore their economic prosperity. Statistical data has indicated that increasing aid has increased economic growth in poor African countries (Jones, 2000).

McIntire carried out research on agriculture in African countries in 2014. It was concluded in the study that for sustainable economic growth in African countries, agriculture needs to be modernised and transformed into a technologically advanced production process (McIntire, 2014). Particularly indicating woman empowerment issues in Liberia, Moran elucidated in 1989 that empowerment of women was an essential requirement for socioeconomic and socio-cultural growth in Liberia and other developing and underdeveloped African economies. Without woman empowerment, sustainable long term growth is difficult to be achieved (Moran, 1989). Rodrik explained in 2004 that for sustainable development, industrial policies are required to be reconfigured and reoriented so as to make it modernised and ensure efficiency in the production process. It was highlighted that poor countries need to be assisted in policy formulation to achieve the goal of sustainable development (Rodrik, 2004). Sonobe and Otsuka, in their research on industrial policies, elucidated in 2010 that in developing countries cluster based industrial development should be promoted as this could be an effective strategy for economic development in developing countries (Sonobe & Otsuka, 2010).

2.2. Relationship between complexity theory and socioeconomic recovery

It may be known to a small number of social researchers that post-conflict socioeconomic recovery of Liberia is an excellent case study of complexity leadership and economics theory. It is not surprising to know that even the Liberian government did not know that the leadership approach they are following for post-conflict recovery had roots in complexity theory. Few researchers have investigated the relationship between complexity theory and socioeconomic conditions in different regions of the world.

In 1999, Arthur carried out extensive research on complexity theory and economy. In fact, he came out with the idea of complexity economics. It was established in the study that complexity economics is based on networks of heterogeneous agents and these networks are influenced by many surrounding systems. Thus, the economy remains in consistent dynamic conditions instead of being in equilibrium at a single point (Arthur, 1999). The same year, Fogel worked on inductive reasoning and bounded rationality in the context of social networks. It was indicated in the study that agents in networks are bounded rationale and they do not have complete information. They contribute based on changing dynamic situations

(Fogel, 1999). Again, the same year Goldstein brought out the fact that socioeconomic emergence is the logical result of the interaction of agents in networks (Goldstein, 1999).

In 2001, Holling carried out research on the influence of ecological, social and environmental systems on economic growth in complexity economics scenario. He elucidated that in complexity economics, the economy is closely netted to other surrounding systems and it works as an open system (Holling, 2001). The same year, Mikulecky carried out analytical research on the emergence of complexity theory. The study analysed emergence as modern science that has relevance to all fields of social life (Mikulecky, 2001).

In 2013, Moersch carried out research on complexity economics as a different framework for economic thought. It was highlighted in the study that the framework of complexity economics is different than conventional economics. Complexity economics framework is an alternative paradigm within the subject of economics, based on complex theory and non-linear models. In this framework, the economy operates as an open system composed of heterogeneous agents, with bounded rationality, that interacts in networks. The economy remains in non-equilibrium state and it remains in constant change driven by internal dynamics (Moersch, 2013).

3. Complexity Theory, Leadership and Socioeconomics Framework

The deep economic crisis in Liberia and desired post-war economic recovery by the newly elected government called for the application of unconventional non-linear complexity economics framework. There were two reasons for adopting this strategy. One, post-war economic recovery was not a normal case. There were many external systems that were influencing economic growth and the influence of those systems had to be considered for long term sustainability and growth. This aspect is indicated in Figure 1 that shows a dynamic open economy model followed for post-conflict economic recovery by the government of Liberia. As can be seen in the figure, the economy was made to function as an open system interacting with other systems such as social, cultural, financial, environmental, technological and ecological. The influence of security situation and global linkages in post-conflict democratic era were also considered. By adopting such a framework, the economy was allowed to take in resources from other systems such as social capital from the social system and ecological capital from the ecological system so as to generate an output of higher value with entropic residuals.

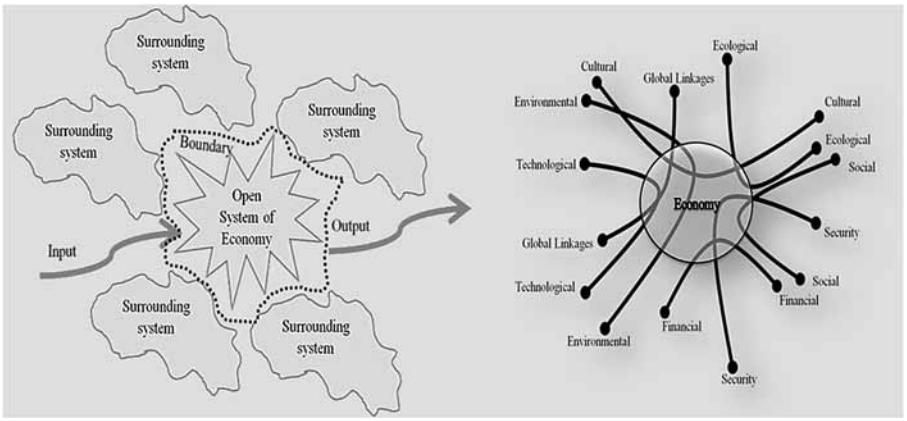
Second, in the case of post-war economic recovery, synthesis was considered more pertinent than analysis as economic institutions were destroyed and it had to be built afresh. Therefore, an open system composed of heterogeneous agents with bounded rationality was more pertinent than the top-down, tightly closed economic system. This approach generated crisscrossed networks of interactions between agents of different systems. These networks were a replica of institutions in conventional economics but more diverse and stronger. This arrangement is shown in Figure 2.

One peculiar characteristic of this approach was that economy was not considered in equilibrium; rather, it was considered in a dynamic state of disequilibrium, constantly

changing, evolving and moving towards multiple points of equilibrium between different systems represented by networks of heterogeneous agents.

Figure 1

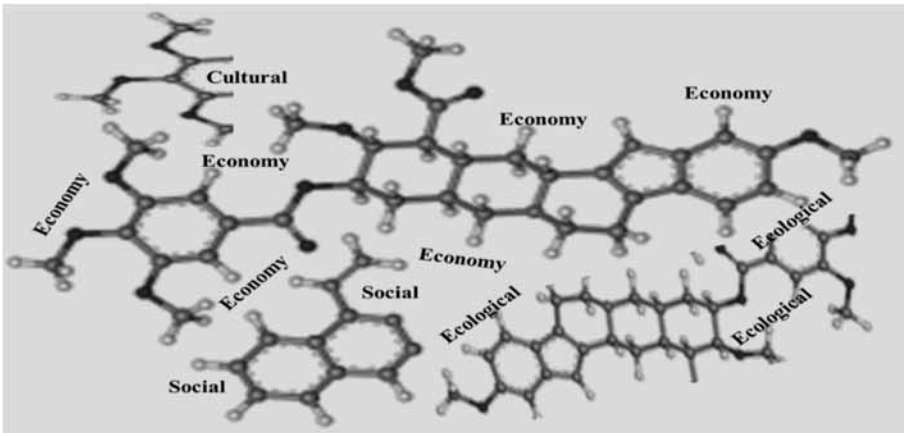
Open economy model showing economy interacting with other systems



Source: author's own work.

Figure 2

A glimpse of complexity economy ic system composed of heterogeneous agents of different systems interacting through networks



Source: author's own work.

Economic system was governed by algorithms that were instructions to govern the process of interaction between agents of different systems and conversion of input into output after flowing through networks. These instructions generated cohesion between networks of heterogeneous agents with heterogeneous expectations and created a realistic economic structure that guaranteed exponential economic growth with long term sustainability. Agents were embedded within many cross-connected networks such as social, cultural, technological

etc. These networks were so netted that success or failure was determined by many different interacting socioeconomic variables across different networks. Sustainable socio-economic growth was a natural emergence of such a system.

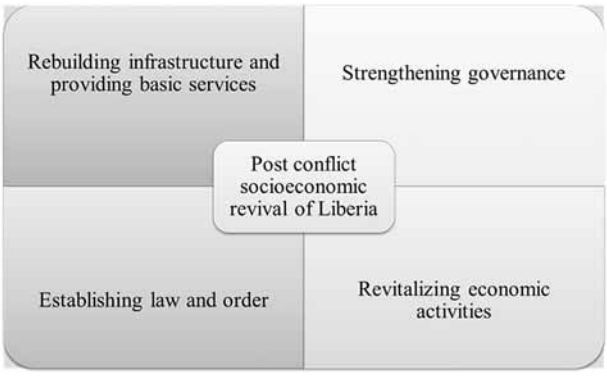
It is worth mentioning here that the new government in 2005 did not deliberately adopt complexity economics and leadership model. The government developed a people's centric strategy to revive socio-economic growth. Later, when strategy and the consequent system was studied in depth, it revealed that the government unintentionally followed a complexity framework which worked successfully.

4. Conceptual Contours of Four Pillars Model Through Lens of Complexity

The democratic political process was restored in 2005 when national elections were held under the umbrella of the United Nations Organization. These elections provided direction to the people of Liberia. The new government faced the daunting task of socioeconomic rebuilding Liberia from the ashes of war. New leadership had to handle a complex social system in a complex environment. The national static mindset was to be converted into a dynamic progressive approach that constantly brought forth new ideas and resulted in the emergence of socioeconomic growth and, in fact, a new nation. Static and conventional mindset was converted into a progressive behaviour fundamentally defined by change. This was a typical complexity leadership scenario. The traditional leadership approach was not valid as a bureaucratic framework with top-down rigid organisational alignment was of no use in such a scenario. Many tasks pertaining to different systems were to be handled simultaneously, which was not possible through a traditional control mechanism. Therefore, a focused and coherent innovative approach was required to tackle essential core issues of socioeconomic rebuilding. To handle this challenging task, a simple and straightforward prioritisation was done by the government through the involvement of social stakeholders from different systems through networks of interactive heterogeneous agents. This logically resulted in the orchestration of an all-encompassing strategy organised around a framework with four basic pillars, as shown in Figure 3.

Figure 3

Four pillar model for post-conflict socio-economic revival of Liberia



Source: author's own work.

Achievement of progress in these four pillars was possible through reconfiguration of society on lines of a complex adaptive system comprising networks of interactive, interdependent agents who are willingly bounded by common goals defined by these four pillars for socio-economic revival. Re-orientation and re-configuration were required due to people-centric approach of the newly elected democratic government. In line with the requirement of a complex system, a decentralised control mechanism was adopted for the implementation of all four pillars of socioeconomic restoration. A separate action group (network) was formed for each pillar which consisted of agents from relevant government ministries and departments, key donors and investors, relevant UN agencies, experts, academia, researchers and commoners from all walks of life. Agents were not having complete information about different dimensions emanating from different systems. They were contributing based on changing situations and internal dynamics. Specifically, commoners were not completely rationale in their decision making, neither they were aware of the computation involved in such processes. This was a real scenario with simple agents and a complex situation; the real situation when agents with bounded rationality limited by available information had to make decisions within the time available with the consent of agents from other systems. So, these agents were contributing in real-world scenarios within the multiplicity of different networks, each exerting its own force on the agent's behaviour and conventional linear causality was not valid in such situation.

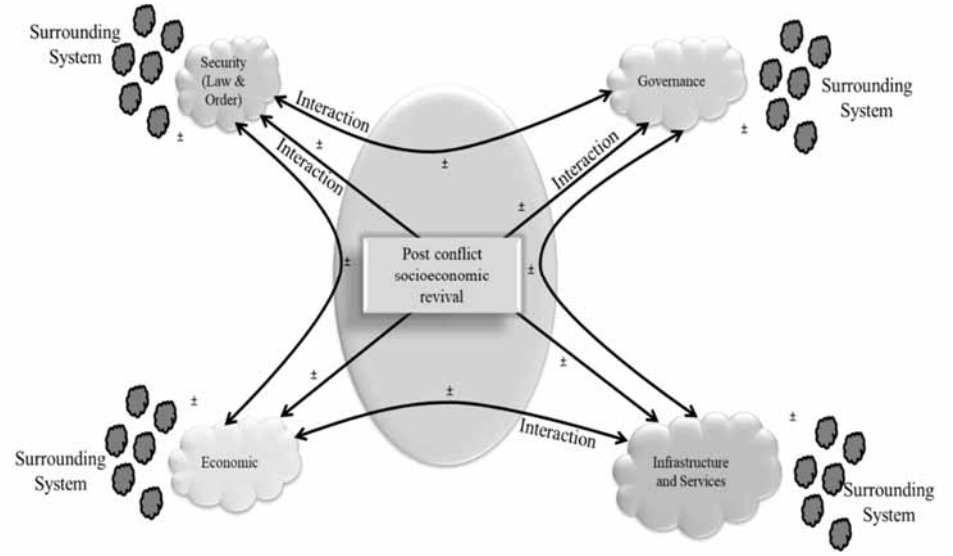
Each group worked with specific mandate and goals to achieve through a participative and interactive process with feedback loops and corrective mechanism. Monitoring of progress of each pillar group was inbuilt in the working mechanism. Agents of networks for different pillars of socioeconomic revival had inter- and intra-pillar interactions which were non-zero sum, unlike the conventional approach. These interactions could add or subtract value to a particular pillar but were not always additive, as is the case in conventional socioeconomics to get equilibrium. These pillars networks evolved their own internal dynamics and structures over time and acted like institutions. The ultimate contribution of each pillar network was the emergence of socioeconomic growth. The functional model is shown in Figure 4. A look at the figure clearly indicates that the network of each pillar was further connected to other systems such as social, environmental, institutional, ecological and technological systems, which were prevailing in Liberia. Resources required for socio-economic development were acquired from the surrounding systems, were processed through internal dynamics of the network and converted into output. Because the system was open and the flow of resources as input and output was interlinked with other systems as well, there were temporal variations in the inputs, outputs and associated processes. Thus, each pillar system was in a state of dynamics.

Each group achieved progress by capitalising on intrinsic and extrinsic values of socioeconomic variables involved in the process. These variables were assessed by social agents under the influence of many different motives and value systems like social capital, cultural capital, and environmental capital. Quantification of socioeconomic variables was done through networks of different interacting variables embedded in the non-zero sum, non-linear interactions between agents.

Cumulative progress of all groups (networks) reflected a great improvement in the shape of socioeconomic emergence within a short period of time. The summarised post-implementation progress of four-pillar groups is indicated on Figure 5.

Figure 4

Functional model of pillars' networks for socioeconomic revival of Liberia



Source: author's own work.

Figure 5

Post implementation progress of four pillar groups

Establishing law and order	• In 2006, approximately 15,000 UN peacekeepers were deployed. • Government demobilized and reintegrated over 75,000 ex-combatants through reintegration programs, including enrolment of 36,000 ex-combatants in three years formal education programs. • Over 50,000 internally displaced persons returned their homes.
Revitalizing economic activity	• Priority was given to agricultural production. The natural resource based activities were revived such as rubber, timber, mining and crops. • Sufficient jobs were created for ex-combatants, refugees, and unemployed youth which accelerated the economic growth.
Strengthening governance	• Government introduced systems that guard against corruption and ensure transparency and accountability. • An important piece was to strengthen both parliament and judiciary to move away from system of supreme executive powers.
Rebuilding infrastructure and providing basic services	• Initiatives were introduced to increase employment through community development projects, food for work programs, urban clean-up projects, and revitalization of agriculture. • All tuition and fees for primary school were abolished, which led to a 50% increase in school enrolments. • Scholarships were awarded to students. • Restored over 350 health facilities and rehabilitated clinics and hospitals.

Source: author's own work.

5. Patterns of Complexity Leadership Approach and Post Conflict Recovery

The most important issue for Liberia was to achieve rapid, inclusive, and sustainable growth. To achieve this goal complexity leadership approach was adopted instead of the traditional leadership approach. Leadership in Liberia did not attempt to control organisations and institutions forcefully. Instead, it focused to influence organisational, institutional and social behaviour through progressive vision so as to ensure a prosper future. Controls were provided by inbuilt internal mechanisms of competition and coordination between agents in the networks.

Patterns of post-conflict recovery in other African countries were examined and analysed in depth. Experiences of Uganda after 1986, Ethiopia after 1991, Mozambique after 1992, and Rwanda after 1994 provide case studies for comparative analysis. Sierra Leone after 2000 and the Democratic Republic of Congo provide more recent examples of recovery. While the revival pattern of each country is different, some glaring trends were identified, which are enumerated below.

- First, GDP contracted sharply in the final years of the crisis in each country.
- Second, once the conflict ended, growth rebounded relatively quickly within two years in Liberia compared to other African countries. This rebound is mainly due to influential leadership to reap the significant idle capacity at the end of conflict, such as unused farm land, industries and other formal and informal trade activities.
- Third, due to an innovative approach based on the theory of a complex adaptive system, Liberia had a fast journey towards prosperity compared to other African countries. It was able to sustain relatively rapid growth for more than ten years, generally fluctuating between 6 to 9% per year.
- Recovery depends greatly on the leadership approach. Other African countries adopted a traditional leadership approach with a top-down control mechanism in the post-conflict period resulting into the sluggish progress. On the other hand, democratic leadership in Liberia adopted complexity leadership approach that was influential and visionary. It allowed the institutions to works independently through internal dynamics.

Therefore, patterns and timing of recovery differed across various sectors of the economy. Compared to other African countries, the complexity leadership pattern in Liberia did not suppress or aligned the informal network dynamics; rather it was efficiently enabled. Leadership was not only charismatic with strategic vision; it was also people-centric. It fostered conditions to develop institutional and organisational capacity concentrating on a pattern of complexity focusing on people-centric methodology. In essence, leadership created conditions for bottom-up social dynamics, which created positive emergence of sustainable socio-economic growth and, in fact, a new nation. As a result of people-centric policies, services were first to recover in Liberia, with growth jumping to an average of 6% after the end of the conflict, led by construction, hotels, and restaurants. Much of the recovery in services was spurred directly or indirectly by donor funds as foreign investors and donors had confidence in the institutional framework and leadership priorities. Average growth rates in services typically remained at around 5 to 6%. Agricultural growth started somewhat

slower, but continued to accelerate, reaching an average of 4%. Manufacturing was the slowest to rebound but generated the fastest growth over the medium term. The manufacturing sector continued at 11% for most of the years.

6. Challenges of Sustainable Socioeconomic Growth and Complexity Framework

Liberia was to capitalise on its peace to build a positive, reinforcing cycle between peace, stability, investment, and growth. In post-conflict scenario, it faced daunting challenges for socio-economic restoration. Restoration of sustainable economic growth was not possible with the traditional leadership approach in a volatile, changing and uncertain environment that was prevailing in Liberia. It required a more innovative leadership approach that could fix issues at hand. New leadership in 2005, adopted a complex leadership and people-centric approach to handle challenges of sustainable socio-economic growth and liberate Liberia from clutches of the war era. For new leadership after the election in 2005, social agents (masses) were the priority and they were fully involved in decision making and monitoring through networks and groups, thus the informal network dynamics were efficiently enabled.

Challenge for Liberia was to rapidly revitalise sustainable socio-economic growth. Liberia could not depend on economic and political structures of the past that led to widespread income disparities, economic and political marginalisation, and deep social cleavages. Liberia's was required to create much more equitable and inclusive economic and political opportunities for Liberians and not for a small elite class. This challenge was met effectively by activating bottom-up dynamics in the socio-political landscape and by letting the complex adaptive system to work on its own. The core of this system was the achievement of macro-level sustainability as emergent properties of micro-level interactions of heterogeneous agents in socioeconomic networks. The result was strong positive socioeconomic emergence with no bias or disparities. This complexity leadership approach created healthy conditions for people to have interactions and self-organise around the core issue of sustainable socioeconomic growth of Liberia.

The network-based complex dynamic system realised that economically more equitable and inclusive growth required a more robust agricultural sector and eventually labours intensive manufactured and service exports that created large numbers of jobs for low skilled workers. People were interconnected within networks of production and consumption. Creating jobs for low skilled workers, especially youth, through new private-sector opportunities or employment programs was the central strand of the whole strategy that emerged from the complex interactions of social agents in socioeconomic networks.

Emergent result from political dialogue in social networks was that Liberia built transparency and accountability into government decision making and created stronger systems of checks and balances across all branches of government by adopting a bottom-up approach in the organisations and government setups. People were allowed to have a say in the policy affairs and suggest policy alignment useful for the whole society. Strict controls on decision making were finished and the social system was allowed to have consented decision mechanism through internal dynamics of networks.

Growth was required to be sustainable. Liberia has a rich resource base, including timber, ore, rubber, and diamonds, fertile lands for agriculture, and ocean and coastal areas. Agriculture was particularly focused given the large number of people involved, its share in the economy, and the importance of food security in ensuring sustained development. As a starting point, these sectors had a potential to create significant numbers of jobs relatively quickly, help rebuild infrastructure, and provide substantial budget revenues. Agriculture was taken as input from the ecological system and processed through the internal dynamics of the economic network. The output was that it created employment for people and productivity gains in agriculture typically provided the foundation for successfully shifting workers to manufacturing and services.

But, Liberia could not rely solely on these activities, since very few developing countries that relied heavily on natural resource exports and extractive industries have achieved sustained economic growth. The most successful developing countries have relied heavily on labour-intensive manufactured exports such as Indonesia, Malaysia, Mauritius, and Thailand as they diversified their exports. Diversification provided a basis for generating sustained growth in productivity, skill levels, wages, and income over time. Manufactured products have much greater potential relative to unprocessed natural resource products for nearly continuous upgrading in product quality as the skills of the workforce improve, allowing for steady growth in productivity and wages over a long time. Labour intensive manufactured exports have been the foundation for long term income growth and poverty reduction in nearly all of the successful developing countries of the last several decades, including China, Indonesia, Thailand, Malaysia, and Korea. Liberia had the potential to create a similar diversified economy and ensure rapid and sustained growth. The diversified economy created a large number of jobs throughout the country for low skilled workers, which turned out to be the most effective economic emergence for Liberia to fight poverty over the long term.

7. Phases of Liberia's Post Conflict Recovery

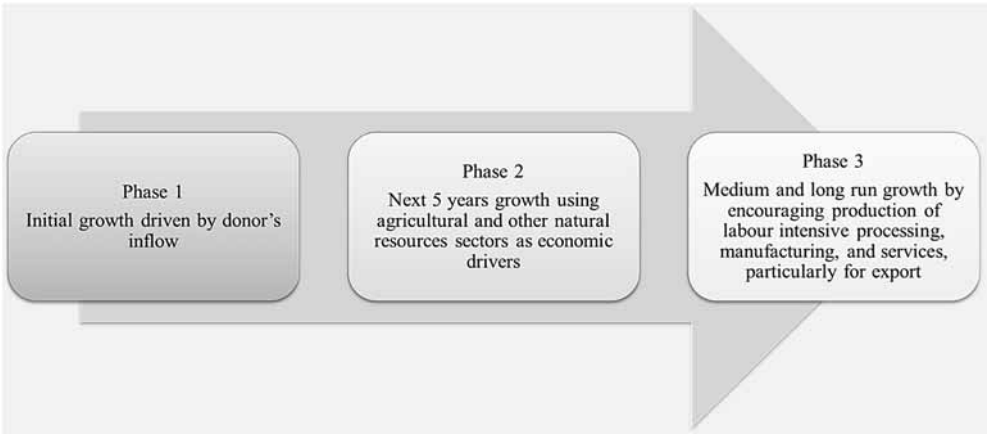
These complex challenges could not be handled abruptly. A comprehensive roadmap was crafted to tackle them. This road map was rooted in the accumulation of synergies of different components of the economy. These component systems interacted, influenced and interfered with each other. Heterogeneous agents of each constituent network had agreements and disagreements both. These networks had strong internal dynamics. Synergies of these networks formed the basis of the emergence of a strong and diverse socioeconomic structure that accelerated sustainable growth. The Challenge of restoring economic growth in Liberia was handled skilfully in three broad phases, which are shown in Figure 6.

As explained earlier, the complexity economics framework that was followed by the Liberian government envisioned the economy as a complex adaptive system that evolves through people's-centric strategy transforming the economy from within. In such a system, the evolutionary process of diversification and augmentation provided qualitative change within the economy and ensured sustainable growth. Changes in one system led to opportunities in the other. This co-evolution led to the interdependency between industries, agriculture and other sectors as self-organised entities. Functional progress of this complex adaptive system

was paved by consistent revision of behaviours, actions, strategies, and products as the heterogeneous agents' accumulated experience. Sustainable economic growth was the natural result of such interdependencies and co-evolution.

Figure 6

Three phases of Liberian economic growth



Source: author's own work.

For the purpose of clarity, steps taken in each phase are required to be elucidated. This elucidation is covered in succeeding lines.

Growth in phase 1 was driven mainly by *donor inflows* and a rebound in urban services. An initial revival in agriculture along with some limited manufacturing and programs aimed at direct employment creation (e.g., small public works projects) was emphasised. In services, construction has been a key driver of growth and is likely to continue to be in the near future as buildings, roads, and other infrastructures are repaired and rebuilt. Within manufacturing, the production of beverages has rebounded quickly. Production of cement increased in 2005. Making cement widely and easily available, was critical to ensuring continued rapid reconstruction in the next several years. Agricultural production was expanded. Rubber production (which accounts for 10% of GDP) showed signs of recovery. Agricultural production remains constrained by poor roads and the uneven availability of key inputs. The International Monetary Fund study estimated growth in 2006 at 7.8% and was projecting 9.4% growth for 2012.

The primary economic drivers of growth in phase 2 were *agricultural and other natural resources sectors*, supported by continued growth in urban services. Construction played a key role, both in terms of immediate growth and to help lay the foundation for sustained growth thereafter. Manufacturing activities accelerated, particularly those based on natural resource products. UN peacekeepers helped maintain security and boosted the economy. Rice, cassava, and other food production could continue to expand rapidly for several years, although the rebound was limited by poor roads that inhibit the availability of inputs and marketing options. Rubber, oil palm, and other plantation agriculture activities, along with timber, forest products, and biomass fuels, had the potential to accelerate very quickly as new

concession agreements were signed. However, growth in these sectors was also constrained by poor roads and other infrastructure. Iron ore, diamonds, and other mining activities were expanded, led by the Arcelor Mittal ore mine concession and other mining concessions, augmented by a range of supporting activities. Services continued to expand, especially construction, retail trade, communications, hotels, and restaurants.

The key to sustainable and equitable economic growth in phase 3 was to encourage the *production of labour-intensive processing*, other manufacturing, and services, particularly for export. Liberia converted to a vibrant, diversified economy with the production of a wide range of manufactured goods, particularly those based on the processing of natural resource products, including furniture, wood products, agro-processing, horticulture, rubber products, tourism, toys, and simple jewellery. With the right environment, Liberian firms could compete on world markets for export to the region, Europe, and the United States. These activities created jobs for a large number of low skilled workers. As such, they were the foundation for widespread poverty reduction and more equitable distribution of income. This helped in diversifying the economy away from dependence on natural resources and overcoming the income disparities of the past.

8. Significant Steps of Governance Policy Through Prism of Complexity

To meet the challenges of achieving rapid, inclusive, and sustained socioeconomic growth, Liberia took advantage of the near term opportunities from agriculture and natural resource-based activities and established a foundation for diversification into downstream processing products, other manufacturing and service exports over time. Doing this was not easy in the backdrop of destroyed infrastructure, a legacy of deep social divisions, limited finances, and weak implementation capacity. Success was achieved through clear prioritisation, getting some basic choices right, and strong support from the international community. Government and donors avoided the temptation of trying to fix every problem and concentrated on a small number of key issues to create jobs and generate opportunities for large numbers of people. Four sets of actions stood out as key priorities for accelerating economic growth, as shown in Figure 7.

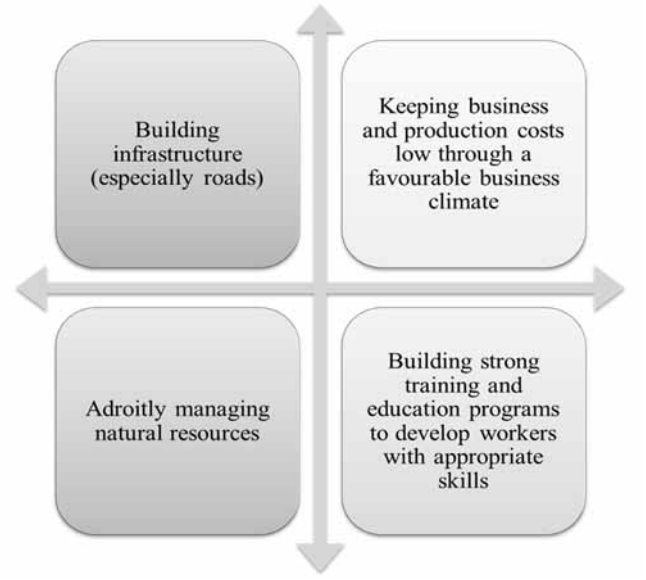
For the purpose of clarity, Figure 7 needs in-depth elucidation, which is covered in succeeding lines.

Building infrastructure was the most important action to stimulate equitable growth in agriculture, natural resource products, processing, manufacturing, and services. Roads throughout the country were in very poor condition. Only about 6% of Liberia's 10,000 kilometres were paved, and most of those were full of potholes. Roads were crucial to nearly every aspect of Liberia's recovery, such as maintaining security, connecting farmers to markets, creating jobs, reducing costs for manufacturing and effectively delivering basic health and education services. Roads were essential for reducing rural poverty, as they allow rural consumers to buy goods more cheaply and open new markets and economic opportunities for farmers and other rural producers. In addition, a strong road network enabled a more decentralised governance structure, with stronger county and local governments that could deliver services and attract skilled personnel. There were key choices

to be made regarding which roads to build and repair first, how to finance them, and how to establish a system that ensures repair and upkeep over time. While the main urban roads needed to be repaired quickly since they carried huge amounts of traffic and connect ports, inclusive growth required building roads to connect rural areas and create opportunities for historically excluded groups. The government created that balance with its efforts by building roads in rural areas across the country. Ports were as central as roads, since they are a connection between Liberian markets and the rest of the world. Other infrastructures such as electricity and water were also crucial. Reliable and low-priced electricity was an important ingredient in making manufacturing and services competitive over time. Markets were also constructed for the facilitation of the public (Gul, 2012).

Figure 7

Key priorities for accelerating the economic growth



Source: author's own work.

Liberia's *natural resource-based activities* provided significant revenues for the government and created new job opportunities for many Liberians, which was a critical first step towards poverty reduction. Two steps were taken to ensure the gains from these activities were widely shared and to lay the foundation for a more diversified economy going forward. First, the effective management of the macroeconomy to mitigate potential negative incentive effects from natural resource exports. In other words, a real exchange rate was maintained that allowed firms to be competitive in world markets. Towards that end, funds generated by natural resource exports were used to finance infrastructure and other investments that reduced the production costs for manufactures and allowed them to be competitive in world markets. Second, models were implemented that encouraged rubber, palm oil, coffee and cocoa production in small and medium-size factories. Moving in this direction was critical to create jobs and build a more inclusive rural economy.

A third important action was to establish a *business environment* that kept production costs low and did not inhibit production. It was critical to establish a climate for investment in manufacturing and services over the medium term. One important way to keep manufactured exports competitive was to aggressively reduce unnecessary regulation. Unnecessary restrictions on imports or price controls were also removed. In addition, outdated tax and investment codes were revised so as to balance the need for revenues with the need for economic efficiency, vibrant private sector growth, and competitiveness. Thus, Liberia moved over time towards lower income tax and duty rates with a wider tax base, combined with strong and fair tax administration. The structure of import duties and taxes was reviewed and appropriately revised. The tariff rates on imported capital goods were lowered.

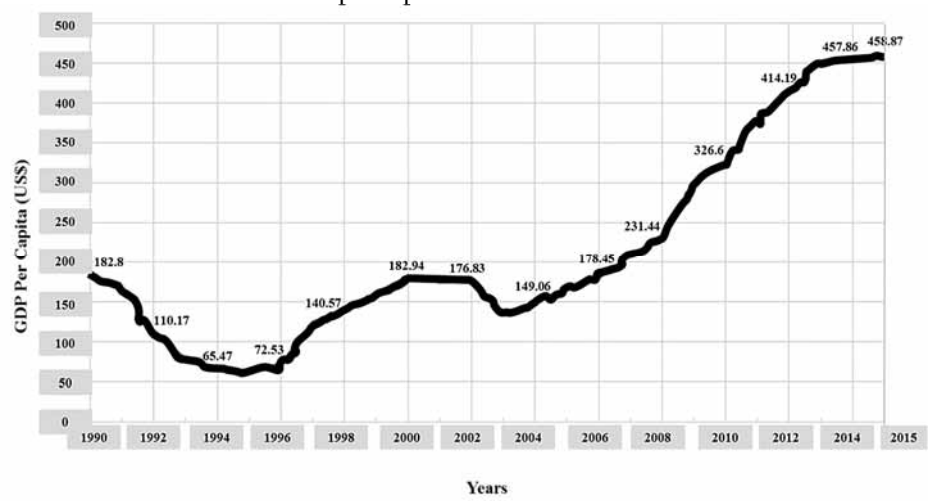
An entire generation of Liberians spent more time at war than in a classroom. Over the medium and long term, Liberia rebuilt its *education and training programs* to provide today's workers and future graduates with the skills they need to become productive members of the workforce. This required a combination of literacy training, technical training for skills in specific sectors, and rebuilding the formal education system. The government took a strong start by reopening schools and substantially increasing school enrolments.

9. Socioeconomic Ambience of Post Conflict Recovery

With four-pillar strategy and key policy actions through interconnected networks of heterogeneous agents of different systems, Liberia's economy was recovered from the global economic downturn. A trend of per capita GDP from 1990 to 2015 is indicated in Figure 8. This trend shows the performance of the Liberian Government after the election in 2005. There has been a sharp increase in GDP per capita from 2005 onwards, which is clearly visible in the graph.

Figure 8

GDP per capita from 1990 to 2015

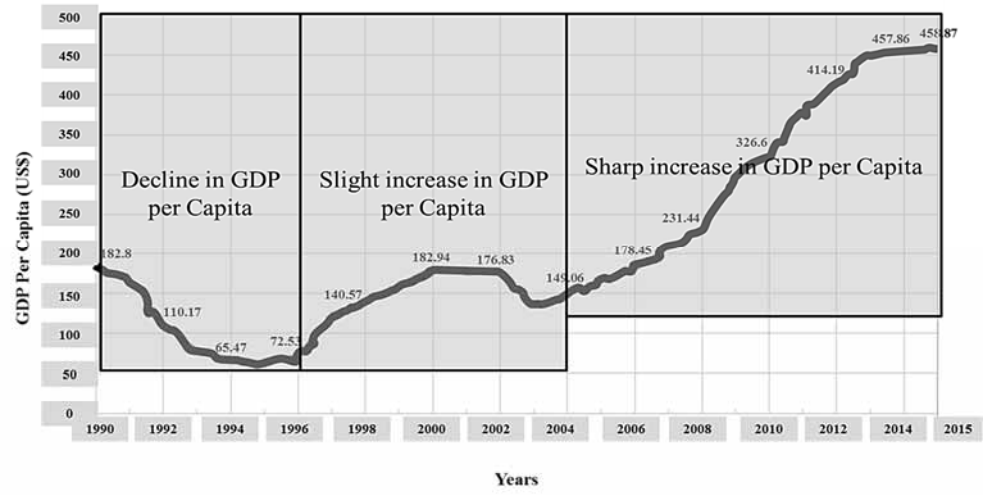


Source: author's own work.

To exactly understand the performance of institutional measures taken by the Liberian Government, the graph of GDP per capita was segmented. The resultant view is shown in Figure 9. Segmentation showed that there was a decline in the GDP per capita from 1990 to 1996.

Figure 9

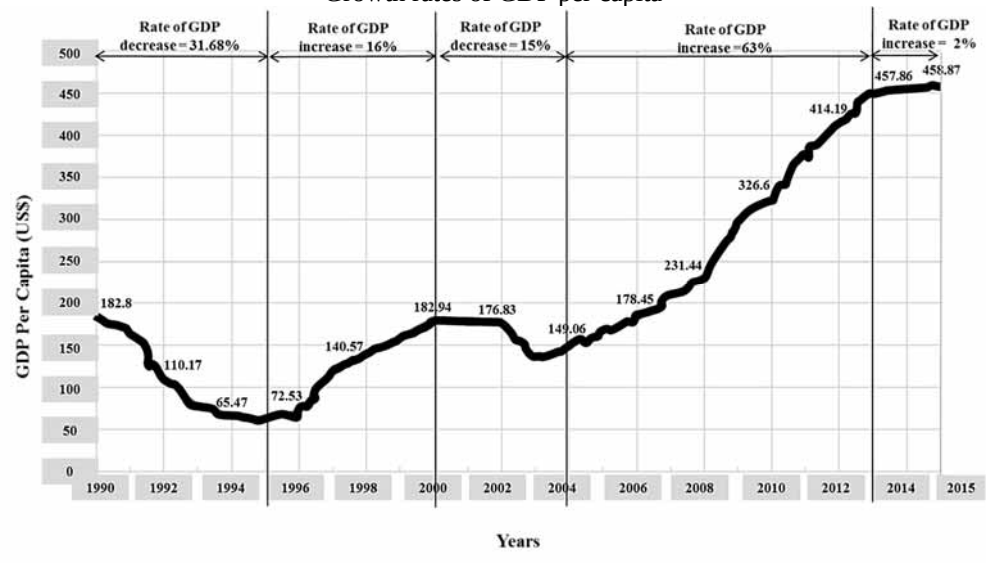
Segmentation of GDP performance



Source: author's own work.

Figure 10

Growth rates of GDP per capita



Source: author's own work.

There was a slight increase in the GDP per capita from 1997 to 2004. However, there was a sharp increase in the GDP per capita from 2005 onwards. As soon as the democratic process was restored and the elected government took charge of the state affairs, the GDP per capita boosted up. To further validate the point, growth rates for GDP per capita were calculated for different segments, which are shown in Figure 10. There was a decrease of 31.68 % in the GDP growth rate from 1990 to 1995. From 1996 to 2000, the growth rate increased by 16%. A decrease of 15% in the growth rate of GDP was noticed from 2000 to 2004.

10. Conclusions and Policy Recommendations

There is no doubt that complexity leadership and economics approach with associated institutional steps taken by the Liberian Government has initiated fast-paced sustainable socioeconomic growth from 2005 to 2014. This process of a fast journey on the road to prosperity has lessons for the underdeveloped and developing countries confronting insurgencies, wars and conflict situations. After a detailed analysis of Liberia's fast socio-economic growth, the following conclusions were drawn.

- For post-conflict socioeconomic recovery, conventional leadership and economics approaches are less valid owing to the complex situation with multifarious tasks. In such a scenario, complexity leadership and economics approach will work. This has been demonstrated by the Liberian government.
- People-centric policies with the bottom-top alignment of decisions are the best institutional model for post-conflict socioeconomic rebuilding. Heterogeneous agents (people) should have a say in the institutional process.
- Improved law and order situation, democratic process, efficient governance and enhanced institutional strength have helped Liberia to revitalise and accelerate its socio-economic growth.
- Institutional measures to curb corruption and ensure transparency has boosted economic growth in Liberia. These stringent institutional measures are very essential for underdeveloped and developing countries suffering deeply from corruption and lack of transparency in governance.
- Increased employment opportunities and community development programmes ensured households' wellbeing and participatory socio-economic development.
- Promotion of agriculture activities, judicious and sustainable utilisation of natural resources, up-gradation of manufacturing sectors have put Liberia on the track of long term sustainable development.
- The uplifting of infrastructure and services has accelerated socioeconomic development manifold.
- As a result of strong institutional and governance measures rooted in complexity theory, post-conflict growth rate of GDP per capita from 2005 to 2014 has been 63%.

Modus operandi adopted by the Liberian government for revitalising its economy can serve as a model for underdeveloped and developing countries, especially those fronting conflicts. From a policy point of view, strengthening institutions and effective governance is the key to long-lasting socio-economic development. Sustainable use of natural resources and diversification leads to an increase in export revenue. In the wake of the improved security situation, many investors from different countries of the globe are now investing in Liberia. The Challenge of transition from a period of post-conflict reconstruction to sustainable development has been skilfully handled by Liberian institutions. These institutions have been strengthened through a consistent democratic process from 2005 onwards. The institutional strength is reflected in the long term development vision of Liberia named '*Rising 2030'*. Liberia is now a strong exponent of regional integration. A well-articulated export policy exploring regional markets and shared regional infrastructure projects have boosted the development for the last few years. Non-African and African emerging partners are active in Liberia. In short, the Liberian model of socio-economic development is valid for many developing and underdeveloped countries of the globe.

References

Arthur, W. B. (1999). Complexity and the Economy. – Science, 284(5411), pp. 107-109, doi:10.1126/science.284.5411.107.

Basu, A., Calamitsis, E., Ghura, D. (2001). Promoting growth in sub-Saharan Africa: Learning what works. – Economic Issues, https://doi.org/10.5089/9781557759863.051.

Binswanger-Mkhize, H. P., McCalla, A. F., Patel, P. (2010). Structural transformation and African agriculture. – Global Journal of Emerging Market Economies, 2(2), pp. 113-152. https://doi.org/10.1177/097491011000200203.

Burnside, C., Dollar, D. (2000). Aid, growth, the incentive regime and poverty reduction. – The World Bank, 210-227, https://doi.org/10.1017/cbo9780511560002.009.

Cuesta, J., Abras, A. (2013). Education and equal opportunities among Liberian children. – Journal of Economic Policy Reform, 16(3), pp. 237-258, https://doi.org/10.1080/17487870.2013.816631.

Enuka, C. (2012). Small arms proliferation and armed conflicts in Africa: The case of Rwandan conflict. – Khazar Journal of Humanities and Social Sciences, 15(4), pp. 21-33.

Fogel, D. C., Chellapilla, K., Angeline, P. (1999). Inductive reasoning and bounded rationality reconsidered. – IEEE Transactions on Evolutionary Computation, 3(2), pp. 142-146.

Fosu, A. K. (1992). Political instability and economic growth: Evidence from sub-Saharan Africa. – Economic Development and Cultural Change, 40(4), pp. 829-841.

Gerhart, G. M. (1997). Accelerated development in sub-Saharan Africa: An agenda for action. – Foreign Affairs, 76(5), p. 237, https://doi.org/10.2307/20048266.

Ghura, D. (1995). Macro Policies, External Forces, and Economic Growth in Sub-Saharan Africa, Economic Development and Cultural Change, pp. 759-778. doi:10.1086/452185.

Ghura, D. (1998). Tax revenue in sub-Saharan Africa: Effects of economic policies and corruption. – IMF Working Papers, 98(135), p. 1, https://doi.org/10.5089/9781451855685.001.

Goldstein, J. (1999). Emergence as a construct: History and issues. – Emergence, 1(1), pp. 49-72.

Gonpu, G. P. (2014). Governance, budget deficits and financial crisis: An analysis of governments role in the Liberian banking crisis. – International Business & Economics Research Journal (IBER), 13(5), p. 1107, https://doi.org/10.19030/iber.v13i5.8776.

Gul, E. (2012). Economic Evaluation of Project Site Using Cardinal Numbers Approach. – Pakistan Journal of Social Sciences, Vol. 32, pp. 485-495.

Gul, E., Ghazali, S. (2020). Return to schools and work in a war hit city: Impact of socio-cultural events. – International Journal of Education Economics and Development, 11(3), p. 314, https://doi.org/10.1504/ijeed.2020.10029586.

Gul, E. (2013). Case Study of Liberian Economic Growth: Pertinent Lessons for Developing Countries. – MPRA Paper 48462, University Library of Munich, Germany, pp. 1-13.

Hausmann, R., Hwang, J., & Rodrik, D. (2006). What you export matters. – Journal of Economic Growth, 12(1), pp. 1-25, https://doi.org/10.1007/s10887-006-9009-4.

Holling, C. S. (2001). Understanding the complexity of economic, ecological, and social systems. – Ecosystems, 4(5), pp. 390-405, https://doi.org/10.1007/s10021-001-0101-5.

Jones, S. (2000). Increasing aid effectiveness in Africa? The World Bank and sector investment programmes. The World Bank, pp. 266-281, https://doi.org/10.1017/cbo9780511560002.011.

McIntire, J. M. (2014). Transforming African agriculture. – Global Journal of Emerging Market Economies, 6(2), pp. 145-179, https://doi.org/10.1177/0974910114525697.

Mikulecky, D. C. (2001). The emergence of complexity: science coming of age or science growing old?. – Computers & Chemistry, 25(4), pp. 341-348, doi:10.1016/s0097-8485(01)00070-5.

Moersch, M. (2013). Complexity Economics: A Different Framework for Economic Thought. – CFA Digest, 43(4), doi:10.2469/dig. v43.n4.70.

Moran, M. H. (1989). Collective action and the "Representation" of African women: A Liberian case study. – Feminist Studies, 15(3), p. 443, https://doi.org/10.2307/3177939.

Radelet, S. (2008). Reviving economic growth in Liberia. – SSRN Electronic Journal, https://doi.org/10.2139/ssrn.1101496.

Rodrik, D. (2004). Industrial policy for the twenty-first century. – SSRN Electronic Journal.

Sonobe, T., Otsuka, K. (2010). Cluster-based industrial development: A comparative study of Asia and Africa. Palgrave Macmillan, pp. 366-369.

World Development Indicators. (2015). Google Public Data Explorer is available at https://www.google.com.pk/publicdata/explore.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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SUSTAINABLE DEVELOPMENT MODEL FOR MOUNTAIN TOURIST TERRITORIES IN BULGARIA AFTER THE CRISIS PERIOD[3]

In the study, we propose a model for the sustainable development of the Bulgarian mountain tourism resorts. The model is developed based on the limitation of the seasonality in their supply and overcoming the results of the pandemic. The winter tourism is the second most competitive and meaningful type of tourism in Bulgaria after the recreational sea tourism. The country has significant natural resources in the mountainous territory, however, the quality of tourism supply in the mountain regions is significantly restricted due to the seasonality factor. The problems have deepened after the closure of the biggest winter resort in the country, Bansko, at the beginning of 2020 due to the pandemic crisis. In the current situation, not only seasonality is a limiting factor for the development of tourism. This requires the use of various research techniques to provide new solutions for the organisation of the tourism process. In the publication, we have used quantitative and qualitative methods, induction, deduction, expert and consumer studies, brainstorming, logic methods, modelling and idealisation to identify the causes of the problems in tourism and find adequate solutions to deal with them. The purpose is to find opportunities for extending the season and overcoming the decline of journeys and visits of mountain resorts. The proposed method does not cover all the possibilities for mountain regions development in Bulgaria but is a relevant solution for the current situation. It can be used as a possibility for sustainable development in other tourism resorts limited by seasonality or crisis.
Keywords: seasonality; extension of the tourist season; consequences of seasonality; strategies for limiting the seasonality; crisis; sustainable development
JEL: Z32; Q01

Introduction

Tourism is a sector that has been strongly affected by the processes, happening in the last decades. A big part of those processes has a positive influence on its development, for

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[3] This paper should be cited as: *Velikova, E., Dimitrova, S. (2021). Sustainable Development Model for Mountain Tourist Territories in Bulgaria after the Crisis Period. – Economic Studies Journal (Ikonomicheski Izsledvania), 30 (7), pp. 221-242.*

example the appearance of new entertainment activities or healing methods. As we witnessed, the other side can be deadly to the current reality related to the travel limitations on a world scale as a result of the COVID-19 pandemic. Since the beginning of tourism statistic data, there has never been a similar drastic drop in journeys and income from tourism. The data shows that it was almost 70% down in 2000. However, the current experience tells us that the sector overcomes very quickly after any upheavals that have ever occurred in human history. Most probably, the current situation will develop in the same way. Nevertheless, the situation in Bulgaria remains worrisome. Despite all efforts to save tourism businesses through intensive marketing activities to attract domestic tourists and a targeted government policy of subsidising the sector, many of them barely survive.

The sustainable development of destinations has been a topic of interest to experts for decades. In the study, we look at seasonality and the decreased number of travels as a result of the crisis. Taken as factors, they both are restricting the sustainable development of the industry. We do not discuss the term sustainable development in the theoretical meaning because its concept is the subject of many scientific researches. However, we accept that sustainable tourism development requires management not only of human, physical and financial capital, but also of environmental assets that are not substitutable, are not unlimited and without which the application of others would lose its meaning. Sustainable tourism should seek to benefit from natural resources in a way that meets human needs while preserving the natural balance in the environment. These needs must be able to be satisfied in the future in the way we satisfy them today. Sustainable tourism evolves on the basis of harmony between resource use and conservation through the integration of the local community. In all definitions of sustainable development and sustainable tourism, the issue of preserving the ecological balance is a main subject (Velikova, 2019).

In the literature sources so far, the seasonality in tourism is pointed as a problem due to many reasons. Today, however, the crisis is a reason to look at seasonality not as such a big problem because seasonal tourism companies can afford to have a weaker season. The nature of the job and its cyclical nature is a reason for the fast adaptability of all its aspects that offer seasonal tourism services. Despite all of this, the goal of tourism entrepreneurs is prolonging and rethinking the tourist services as a result of the contemporary phenomenon as well as traditional activities.

In the present study, we define possibilities for extending the tourist season for one of the competitive and promising tourist products development in Bulgaria. The opportunities for extending the summer tourist season have been researched on a world scale; this is the reason that focuses on prolonging the winter tourist season. Tre perspectives for the summer season are very favourable as a result of global warming. In comparing to it, the winter season is expected to be really harmed by the climate changes. Winter tourism becomes a priority and important sector for the development of Bulgarian tourism, on whose statement depends the competitiveness and the economy's growth. Also, the mountain territories occupy most of the territory of the country, which is a prerequisite for intensive progress of tourism not only in the limited coastline along the Bulgarian Black Sea coast.

This is the reason why the object of the research in this publication are the mountainous areas in Bulgaria. The subject is the measures for their sustainable development by overcoming the

seasonal effects and the drastic decline in tourist holidays as a result of the crisis. The increase of tourist visits in mountain resorts in Bulgaria on a year-round basis must be carried out sustainably, as one of the advantages of seasonality in tourism is precisely the regenerative capacity of resources during the weaker season.

The relevance of the research problem is defined by the fact that tourism is one of the most significant sectors of the Bulgarian economy. Finding solutions for overcoming seasonality will contribute to increasing its economic significance. The current statements were confirmed even in the world economic crisis that we were already faced in 2020. Because of travel limitations, a lot of people lost their jobs and the closing of functioning tourist sites led to troubles in other sectors of the economy. The multiplier effect of tourism in other sectors of the economy is a prerequisite for the serious effects of the crisis everywhere.

In order to create a model for sustainable development of the mountains resorts in Bulgaria, we try to solve the following research problems:

- analysis of the state of Bulgarian tourism,
- defining the advantages and disadvantages of the seasonality and finding strategies for overcoming it,
- research of consumer opinion on the preferences for extending the stay and the reasons for revisiting the winter tourist resorts in Bulgaria through a questionnaire developed on the basis of interviews with experts,
- presenting a model for sustainable development of Bulgarian mountain resorts and defining the trends in their development after the COVID-19 crisis.

In this way, we define different possibilities for prolonging the season in the mountain regions, the most significant of which are offering year round, alternative types of tourism and the organisation of events relevant to the tourism demand.

The search for new models of supply in tourism will have a special value after the current crisis is over. A lot of the problems can be prevented if they are pledged in the planning stage. The sustainable planning is going to lead to a sustainable development of the resorts, which is a main goal for the development of society after the conference in Rio in 1992 (Velikova, 2020). Planning is the basis for achieving sustainable development in the long run.

In the contemporary conditions for achieving sustainability, we need to rethink the tourism planning, operation and the perception we have of it as a process. As part of this process, many of the interested sides, represented by locals, the municipality, the tourism industry and the environment, must work together for achieving their common goals. The systematic and integrative strategic planning, based on joint cooperation, can be turned into the foundation of defining the goals and the sustainable management of tourism.

The research goal of the authors is to propose a model on the bases of which the mountain tourism territories can be developed sustainably while overcoming the problems related to global warming, pandemic situations, seasons and climate effects and territory limitations. The created model is relevant and applicable to the Bulgarian mountain resorts and would contribute to increasing their economic efficiency.

Problem Statement and Literature Review

Tourism is a very important part of the economy in Bulgaria, with significant benefits towards the gross domestic product (GDP) and employment in the country. According to the World Travel and Tourism Council, the contribution of tourism to the GDP is 11.7% of the economy, workers in the sector are 346 800 (11% of the employment), 8 370.3 million leva are being made from travels which represent 12.3% of the total export of the country (WTTC, 2019).

Researchers argue, that since the dawn of Bulgaria's transition to a market economy in the early 1990s of the 20th century, tourism, along with agriculture, is one of the sectors which could and should be relied upon for the prosperity of the Bulgarian nation in its transition to a market economy and beyond (Dimitrov at all., 2018). The tourism in Bulgaria is a big part of the GDP and the most developed is the summer recreational tourism practised on the Bulgarian Black sea coast. The second significant type of tourism is the winter one which is also facing serious problems due to global warming and today's challenges with the pandemic situation. The available mountain tourist resorts in Bulgaria risk losing their traditional appearance of ski destinations which leads to a rethinking of their product concept. These changes must be based on existing potential and customer preferences. This is the reason for the inclusion of basic methods of research and consumer research in the current study.

Analysis of the Bulgarian mountain tourist product

Tourism in Bulgaria can be traced back to the end of the XIX century when beaches and beach infrastructure around the city of Varna have been built, the creation of Borovets mountain resort and the foundation of the Bulgarian tourist union. International tourism marks incensement in the 1960s when Bulgaria appears on the international market as a typical destination offering sun, sand and sea (Vodenska, Gösling, 2017). In the following years, tourism is making its way to becoming an important part of the Bulgarian economy.

The development of modern, global tourism, the introduction of new technologies, providing opportunities for virtual travel and the emergence of new and unique destinations, affect the overall culture of the individual, contribute to the formation of aesthetic attitude, sense, taste for beauty and appropriate and at the same time it is one of the new directions in the competition to attract as many visitors as possible. Planning and construction of contemporary tourist destinations require a focus on innovations and keeping up with trends that are present in the industry.

Bulgarian mountains as morphological structures cover about 48% of the country's territory (Mikhaĭlov, 1989), and mountainous areas over 600 m occupy about 28% of its territory. Three national parks are established on the mountain territories – the Pirin, Central Balkan and Rila (Hristova, 2018). The middle and high mountains (above 1000 m) represent around 12.5% of Bulgarian territory. In the main mountains of the country – Rila, Pirin, Vitosha and West Rodopa the regions with an altitude above 1000 m are between 60 to 70% (Evrev, 1987). Due to their big territorial scope, the mountain regions are the main "territorial

reserve" for expanding the tourist absorption in the natural environment after the sea coast. Their surface is around 10 times bigger than the Black sea municipalities and their tourist capacity is 50% bigger than that of the Black sea coast (Evrev, 1999). The presence of this important resource is a premise for developing and offering many diverse types of tourism which can be practised there. However, the sustainable development of mountain areas is important. According to Wang at al. (2019), moving towards sustainability is a societal challenge that involves national and international legislation, urban and regional development, transport and other sectors, and that equally involves engagement with local and individual ways of life, and, especially in an increasingly urban world, positive choices to promote more ethical consumerism.

When compared with the seaside another important advantage of the mountain regions is the possibility of year-round (or at least dual season) usage. Seasonality is recognised as one of the main problems of Bulgarian tourism. In the past years, more than 40% of the overnight stays were made during only two months (July and August) and around 70% in four months (June- September). At the same time, the durability of the season with favourable climate conditions in the mountain regions is 8-9 months in a year (Marinov, Asenova, 2016). The larger area of the mountains in Bulgaria and the possibility to use them for a longer period of time became a prerequisite for their inclusion in this publication.

Despite all of this the seasonality in the country is well defined, it is connected with sea tourism and the winter season still cannot outline itself as a strong season and it still fails to bring significant visitations. Overcoming seasonality, according to the authors, is also a step in the sustainable planning and development of the Bulgarian mountain destinations. This is also supported by Dunets at all. (2019), which state that the sustainable development of tourism ensures the unity of the three components: development of tourism in conjunction with the main environmental processes; economic sustainability is achieved by the role of tourism as one of the ways to develop the local economy through balanced resource management; socio-cultural sustainability allows increasing employment and incomes of the population, preserve historical and cultural monuments, strengthen local identity and the established way of life.

Bulgarian mountains have perfect conditions for tourism. However, there are few functioning resorts that welcome international tourists. The most famous ones are Bansko, Borovets and Pamporovo. The other mountain resorts are small, not well known and poorly developed, with significant potential for the development of alternative types of tourism. The economic improvement of mountain areas in the future can be based on their potential to offer activities other than winter sports.

Positive and negative consequences of seasonality

The consequences of seasonality still cannot be put under the same denominator. They can be positive and negative, but the ratio between them is strongly defined and the burden of the negative impacts is definitely bigger. Because of this reason, we are also going to stick to the dominant position that seasonality is a limiting factor for tourism and the economy, and thus, we need to seek opportunities for overcoming it. Besides that, as Bogomilova (2020) points

out, unexpected situations force countries, companies and individuals to be in different situations and uncertain environment, which are accompanied by different obstacles and ~~are~~ characterised by complexity and dynamism; hence they need a systematisation.

In the train of seasonality in tourism, two very distinctive differences are being formed when talking about the usage of the material and technical base. We observe the accumulation of huge tourist masses in a short period of time and the unusability of the sites and facilities during the rest of the year. Thus the resources are largely worn out. During the high season, the facilities logically are ageing. But even during the off-season, there is depreciation, which requires constant investment of funds for renovation, repairs and maintenance (Velikova, 2020a).

The results for the seasonality of the transport services are essentially the same as for the material and technical base. The high usage of transportation services, during the main season, influences the depreciation of the vehicles. The costs for it is high during the pre-season and the inactive season, when transportation is used less frequently, some are not being used at all (which leads to additional losses) and they barely bring any profits.

Seasonality affects all sides of the tourist process. The fluidity of workers, the interrupted working process during the year lead to worse coordination between the different links of the personnel and thus worsens the overall services provided. It is not always possible to form a good team and that often leads to problems in management and inhibits the activities. The absence of constant contact between people, the lack of match process of characters and the way of work suggests that, a little time is needed for synchronisation between different personalities. Each season is turned into a new beginning and the whole cycle of the employment process starts from the begging. The short work period, the difference in characters and the specifics of the job themselves add to the complex organisation of services (Lee et al., 2008). The problem of employment leads to population migration and other negative economic consequences (Mintchev, 2016). The assessments of return migration in Bulgaria are based on sample surveys attesting the increase of the relative share of households having a return migrant. Nevertheless, the capacity of the local labour market to attract migrants back into the country can be evaluated as humble (Mintchev, Boshnakov, 2018).

To a certain degree, seasonality also influences the quality of the tourist product. A tourist site that is influenced by seasonality cannot be very competitive. Its good quality is achieved gradually, step by step, through uninterrupted analysis of received data, the disadvantages and measures required for their removal. This is a process of constant upgrades until it finally reaches its highest point. There is a tear in the process when talking about seasonal tourism. Each season is a new start, so it is impossible that in a month, the level of tourists generated will be the same one as it is with congress or business tourism, which are categorised with constant development (Baum, Lundtorp, 2001).

The main concern about seasonality is focused on the effective planning and the usage of the resources in the pre-season and off-season. The high season also needs special care since the sites and the facilities can become overflowing with tourists, who can lead to problems in service quality and tourist satisfaction.

Seasonality is considered as a global problem for the tourist industry and the main negative result of it, is the profit reduction of businesses since the local entrepreneurs, especially the owners of accommodation facilities, suffer during the pre-season and the off-season when the demand for products and services declines or completely disappears (Velikova, 2020a).

Most commonly, the negative effect of seasonality in tourism is related to the economic influences from inefficient utilisation of resources by the tourist companies. The negative economic outcomes are related to: receiving of seasonal income; low return on capital investments; problems with accumulation of annual fixed costs; difficulty to attract investors; lack of capacity in the active season; insufficient use of facilities and resources in the off-season (Baum, Lundtorp, 2001).

Positive effects and advantages of seasonality also exist. The time out of the main seasons is a chance for recovery of the destinations and their resources. Maintenance and renovations of buildings, landmarks, facilities and marketing are typical activities for the periods of pre-season and off-season. During those times, the host territories have the opportunity to be relieved from the tension that has been built during the high season, to recover completely and keep their identity of a traditional functioning model of their social and ecological environments.

From economy point of view during the off-season, the conditions of buildings and facilities is being stabilised or can improve. Seasonality allows employment of students and housewives, and part-time working opportunities as an extra income for the locals, etc. In terms of natural environment, the chance for resource and bioderversive recovery, at the tourist destinations, is present. Depending on the degree of sensitivity of the community to the ecology and its dependence on the preservation of the attractiveness of the tourist destination, there are positive effects of seasonality, the most important being the conservation of biodiversity and natural species (Velikova, 2019a).

The positive socio-cultural consequences for the community are that the local people can go back to their everyday life, they can use the commodities and the facilities and are stress free. The initiatives to attract more visitors during the pre- and off-season at the tourist destinations are a favourable perspective for the active participation of the local communities in the strategies fulfilment of extending the tourist season (Hartmann, 1986).

All of the above mentioned imposes a rethinking of strategies for tourist product offerings in the seasonal tourism destinations and the search for opportunities for overcoming seasonality. As a conclusion of the analyses, we can utter that the negative consequences dominate; hence the seasonality in tourism is viewed as macroeconomic loss – mainly because of the seasonal employment characteristics. To overcome it, it is necessary to achieve equally common distributed visits to the tourist place over time. This can be accomplished through impacting on the seasonality factors – stimulating travels during the off- and pre-season, diversity of the types and forms of tourism in the destination, increment of the quality and the assortment of the offered services.

Strategies for seasonality restrictions

The strategies that are typical for overcoming seasonality in tourist destinations are classified mainly by geographical placements and the effects of the climate (the weather seasons). The potentiality for extending the tourist season or the establishment of a second one depends mainly of the destination and the competitiveness. Although seasonality will not disappear completely, there are few ways of evenly spread visits all year-round during the high and low season of travels.

Three successful strategies are applicable and we can use them for reducing the negative seasonality results: increasing tourist demand during the off-season, reduction and redistribution of tourist seeking during the high season (Corluka, 2014). The success and the constructiveness of strategies and policies, have to be related to the geographical (specific spatial characteristics of location) and to the socio-economic patterns of destinations (Cannas, 2012).

The approach for increasing the tourist gest during the low season can be accomplished in several basic ways. On a company level, few common sets of tactics exist, as well as on a destination level, are being used. In those plans are included the following:

- Differentiated pricing;
- Differentiated attractions (change of the product mix);
- Market diversification;
- Selective forms of tourism;
- State support/ facilitation (Lee et al., 2008).

Modified pricing can include offers for group reservations on promotional prices (for example, for retired people) and seasonal or promotional pricing (for example, discount) in the off-season, while the higher price is offered during the active season (Corluka, 2019). Price diversifications are a significant factor, and income is particularly important. Economic growth is associated with this reduction in concentration, while times of crisis increase it. Economic crises do not just reduce the level of annual demand, but also increase seasonal concentration (Turrión-Prats, Duro, 2018).

The purpose of the differentiated attractions (change of product mix) is to popularise the tourist products based on their seasonal characteristics. To a large extent, this strategy is close to the concept of event tourism as a tool for overcoming seasonality.

Market diversification consists of:

- Intensified marketing campaigns to attract different target markets during the inactive tourist seasons (multi-segment approach).
- New or alternative sources of demand of already existing products and sites, for example, middle-aged people (retirees), business tourists and visitors that prefer short vacations (weekend tourism) because those groups are most capable and ready to travel during the mid-season (the wings of the season/ March-June and September-November).

- Need to determine the optimal combination of segments (Corluka, 2019).

The other strategy is related to reducing the tourist demand during the high season. From an environmental point of view, extreme tourism seasonality increases the pressure on ecosystems due to the peaks in tourist arrivals (Koenig, Bischoff, 2005). This can be necessary if the number of tourists exceeds the destination's capacity, which can lead to lower satisfaction of the visitors and receiving lower services during their stay (crowded streets, lines for attractions, etc.). Similar measures are needed, especially when the negative consequences significantly exceed the positive ones. Systematic demand fluctuations are considered as a problem, which has to be counteracting in order to reduce and modify the effects. Lower quality standards and services in the peak months and overcrowding at beaches, mountains and airports, can be considered as social and personal costs of seasonality (Bar On, 1975 in Cannas, 2012). The strategies for surmounting this problem include increasing prices for all tourist places, facilities and attractions during the active season. That way, a big part of the tourists in the destination would prefer to vacation during the off-season in the years to follow, due to bad characteristics of the active season, which consist of overcrowding of streets, sites and attractions and high prices (Corluka, 2019).

The redistribution of tourist demand includes, on the one hand, the shift of peak demand to the period of weak demand and, on the other hand, the spatial distribution of demand during the peak period. It can be achieved in several ways.

The spatial redistribution of tourist demand during the peak period can also reduce the negative impact of overcrowding in destinations. Strategies include techniques for managing visitors to the places and more efficient transport measures, such as developing and publishing alternative routes to tourist objects or promoting alternative transport options to avoid congestion, accidents, incidents, etc. (Corluka, 2019). The boundaries between demand and supply-side strategies appear blurry. For example, the events and festivals are strategies that aim to attract demand, but, at the same time, these aim to provide services and organisation in supply patterns. In fact, these future plans can require increasing the number of the service and facilities, or providing new services (Cannas, 2012).

Optional ways for overcoming seasonality in tourism are well-known techniques applied and established over the years in tourism practice. However, a complete solution to the problem has not yet been found. Mountain tourist areas continue to operate in great dependence on seasonality and climate change.

Research Methodology

In the present study, the Bulgarian mountain resorts are included with the availability of offering and practising tourism. A set of methods was used to achieve the main goal of the article. In the first place, expert analysis based on data, observation and personal experience is applied. This made it possible to determine the basic structure of the study and the main sequence of its conduct. The research methods are based on scientific principles and basic achievements of the economic theory, global regionalism and modelling of economic processes that take place in the field of research and tourism. The methodological basis of

the research includes the methods of abstraction, dialectics, logic, structural and systematic approach to analysis, expert and questionnaire research and modelling. The main research thesis is related to the statement that the organisation and holding of events relevant to the territory and consumer interest is a necessary condition for extending the tourist stay, searching for holiday destinations outside the main season and reviving demand in the post-crisis period. For this reason, consumer preferences are also included in the survey.

In Bulgaria, three mountain resorts develop international tourism, based mainly on winter ski tourism. These are Bansko, Borovets and Pamporovo. There is significant potential for expanding and increasing attendance in mountain sites. The country has many small settlements located in the mountains, with the potential for the development of varied types of tourism.

Model of research work

When we characterise winter resorts in Bulgaria and their chances for attracting tourists during the summer months of the year, we can define few strong sides, in particular: strategic location, relatively good tourist infrastructure (for ski and mountain tourism, eco paths), unique and conserved nature and climate, presence of protected territories, rich natural and culture-historical heritage, famous local lifestyle and culinary products, strategic location of the country, low level of living density and developing material and technical bases which can receive a big number of incoming tourists.

Along with the strengths of the Bulgarian mountain regions, a number of weaknesses can be noticed as well. The ones with special attention are: lagging behind in the development of the technical infrastructure compared to the pace of construction of the new tourism zones, undeveloped transport infrastructure, lack of common marketing strategy and complex tourist product which can promote the whole region, lack of access to services in the small towns – medical, social, informative, communicative, and last but not least defined seasonality and significant problems as a result of the COVID-19 pandemic.

The research and experimental work in this publication use an adapted model for the study of winter resorts, developed by Wilson (Wilson, 1952). The structured interview method was used to conduct qualitative research. Following were the identification of specialists in the field of tourism and pursued interviews. Where the method of the structured interview identifies gaps, as well as to answer specific scientific questions and study the behaviour of tourists in the region, the method of the questionnaire study is used.

Based on a summary of the answers given by the experts to the asked questions, we can derive the following basic information. In the mountainous regions of Bulgaria is developed mainly winter tourism based on skiing. Contrary to expectations, many people prefer to visit mountain places outside the winter season. The possibilities for a holiday during the summer months create conditions for attracting a bigger number of tourists, and the material and technical base in the mountains, gives the opportunity for organising different events. It is a premise for attracting tourists outside the high season and offers unique experiences. Among the possible reasons for extending the tourist stay, experts identify the host destination,

attendance of cultural events, discounts of per night stays and SPA procedures (Dimitrova, 2018).

The purpose of our model is to structure and present in a more visual way the algorithm of our research work.

Figure 1

Model of research work

Source: a systematisation of authors.

To surmount the seasonality in tourism and the pandemic crisis in the mountain regions, the interviewees noted the need for the transport infrastructure, improvements of the destinations in their entirety with all the main and accompanying types of tourism, and various advertising campaigns on social networks, emphasising compliance with the full pack of safety measures. Emphasising the opportunities for providing health services in the Bulgarian mountains is also important. In order to change the direction for the development of tourism in the mountainous regions out of season, they indicate renovation of the existing material and technical base, provision of lower prices and organisation of various events during the summer, autumn and spring seasons. In addition, according to them, the events can be used to promote the offer in the resorts as a safe and secure place. The greater the response to an event, the better. For this reason, as a result of the interviews with the experts, a survey of tourists was developed. The questions were about the significance and demand for the events as a motive for visiting the mountain areas outside the main season.

Survey results

The research question in the survey is: "Can the organisation of events in the mountainous regions be a factor for overcoming seasonality in tourism and overcoming the consequences of COVID-19?".

In the search for answers of this question the following working hypotheses can be formulated:

Hypothesis 1 – In the winter, tourist resorts is more expedient to look for ways to extend the season than offering-year-round alternative types of tourism.

Hypothesis 2 – The organisation and the supply of differentiated events product in the winter tourist resorts is a premise for extending the visits of tourists, practising winter ski tourism.

It turns out that the modern tourist is well educated, receives a high monthly salary and based on that he travels more often for a shorter period of time. He is distinguished by responsibility and environmental consciousness. The majority of them prefer to travel out of the high season, which is an excellent premise for overcoming seasonality in mountainous tourism by organising events. Besides that, the tourists are less inclined to cancel trips because of fears of catching a disease.

The biggest part of the respondents thinks that participating in an event is a reason for the visitation of a mountains region as a tourist destination. The major reason for travel is the holiday purpose and with opportunities/options for some activities during their stay. The need for socialising, entertainment and cultural enrichment have a reflection on the answers given by the respondents.

For example, we will examine the answers to question number 6: "Which of the following you think is a strength for the region?" (Table 1).

Table 1

Uniform distribution of the strengths of the region indicated by the respondents (x6)

6. Total frequency			
Advantages	Answers		%
	N	%	
Culture	11	3.35	11.0
Nature	102	31.10	102.0
History	5	1.52	50.0
Infrastructure	12	3.66	12.0
Industry	9	2.74	9.0
Location	36	10.98	36.0
Sport events	89	27.13	89.0
Entertainment	64	19.52	64.0
Total	328	100.0	328.0

a. Dichotomous group, distinguished by value
Source: author's research

The results prove the high potential of organising events in the Bulgarian mountain resorts and their ability to attract a large number of tourists outside the peak seasons and after overcoming the crisis. It is these events that should be successful among Bulgarian and foreign tourists. Due to the relatively small percentage that infrastructure has, there is a necessary change of the ways, resorts can be accessed.

More than 50% of the respondents identify nature as a key component when choosing a strong side of the hosting destination; entertainment also takes an important part of the

answers. In order to preserve nature as one of the leading reasons for visiting the host region, it is necessary for the uncontrolled redevelopment in the area of the resorts to stop and the capacity of the already existing infrastructure to be optimised. Sports events must be optimised, which includes practising different types of sports during the summer, thus extending the tourist season through the creation of new facilities, the development of already existing ones and the connection between them, as well as the natural resources of the environment. Another possible measure is the elaboration of detailed plans for the organisation of various types of events such as festivals, seminars, music and culture events and the attraction of a big number of investments which can cover the costs of their organisation. In addition, the road infrastructure needs to be significantly improved and the usage of installations for the production of artificial snow during the winter season in the zones, needs to be reduced because it represents a potential risk for lack or deterioration of the drinking water for the needs of locals (Dimitrova, 2018).

Reviewing the guests' preferences when talking about entertainment at a destination, we can say that SPA and wellness tourism is still the most preferred ways of spending guests own free time. Attendance of a cultural event, sporting event and conference for training are also very close. This comes from the fact that more and more tourists prefer to attend a cultural or sports event instead of a traditional holiday. The forecasts are that this tendency will grow more and more and the organisation of events as a form of entertainment, will gain popularity, with which it will lead to raising the number of visitors outside the high season.

A presence of a sporting event comes second in the answers given by the respondents (56 of the participants have identified it as a preferred form of entertainment or 28% of all respondents).

Question number 10 refers to the type of tourism that can be of interest for potential visitation in the respondents: "What type of event can make interested of visitation?".

This question has multiple answers. After analysis, we gain the following results (Table 2):

Table 2

One-dimensional distribution of the types of events that would be interesting to visit (x10)

10. Total frequency			
Event	Answers		%
	N	%	
Cultural event	47	8.97	8.97
Musical event	125	23.85	23.85
Sports event	167	31.87	31.87
Festival/ carnival	133	25.38	25.38
Event related to art	11	2.10	2.10
Socio-political event	15	2.86	2.86
Natural event	26	4.96	4.96
Total	524	100.0	524.0

a. Dichotomous group, distinguished by value
Source: author's research.

From the table above is visible, that the biggest interest for visitation comes from the organisation of a sportive events (31.87%), followed by festival/carnival (25.38%), musical

event (23.85%), cultural event (8.97%), natural event (4.96%), socio-political event (2.86%) and last, event related to art (2.10%). The big interest for sports events facilitates outlines the need of organisation of ones for attracting more tourists in Bulgarian mountain regions.

The results of the research allow us to conclude that sport events can be the main possibility for prolonging the season. Reasons for it are opportunities that mountain resorts offer are endless and we can give examples with mountain hikes or "off-road" safari in Borovets, sport fishing, shooting or horseback riding, etc.

Question 15 from the survey "Identify the reason for revisiting a destination" gives us the following results (Table 3):

Table 3

Uniform distribution of the reasons for revisit given by the respondents (x15)

15. Reasons for revisit of a destination				
Validity	Frequency	%	Valid %	Accumulated %
Deeper exploring of the region as a tourist destination	38	19.0	19.0	19.0
Attendance of an organised event which is important and interesting	106	53.0	53.0	53.0
Holiday	47	23.5	23.5	23.5
I would not re-visit a destination	9	4.5	4.5	4.5
Total	200	100.0	100.0	

Source: author's research.

It turns out that the attendance of an organised event would be the main reason for visiting a tourist destination. This answer is given by 53% of the respondents. Followed by holiday as a reason for a revisit (23.5%) and deeper exploring of the region as a tourist destination (19%).

The motives for revisiting a destination led us to the possibilities of turning the Bulgarian mountain regions into a year-round destination. The development of unpopular specialised types of tourism, including the events tourism, is very limited mainly due to the lack of information. It would be good to look for a way to organise various events for the development of mountain regions as a destination for "non-mass" tourism. The most distinguishing characteristics for attending an organised event, we can point out, are exactly the possibility for people of all age groups to take part in it during any season of the year, the created conditions for rest in the area and the popularity of the product/service (Dimitrova, 2018).

One of the other questions in the survey is closely related to identifying possible reasons for extending the tourist stay. The question asks: "Identify a possible reason for prolonging your stay at a destination". The goal is to check if it is possible for the attendance of an organised event or business skills development event to be a reason enough that tourists extend their stay at a destination. With this question, we can check the research hypotheses and obtain the following table:

Table 4

Test statistics

	Group
Mann-Whitney U	10.000
Wilcoxon W	25.000
Z	-1.767
Asymp. Sig. (2-tailed)	.047
Exact Sig. [2*(1-tailed Sig.)]	.112[a]

a. Uncorrected links.
b. Variable group: Possible reason for extending the tourist stay
Source: author's research.

Asymp. Sig. (2-tailed) = 0,047< α = 0,05 →H1 – According to data from this sample and with a 5% chance of error, we have reason to prove the two hypotheses in support of the thesis, i.e. in the winter tourist resorts, the search for alternatives for extending the season is more appropriate than offering year-round types of tourism. The organisation and the offers for diversified events products in the winter tourist resorts is a premise for extending the stay of tourists that practice winter ski tourism.

The two hypotheses were made based on the correlation between seasonality and events tourism. With the help of statistics methods of proving a hypothesis, we figure out that the organisation of some sort of event would inspire interest in the travellers and it is a premise for limiting and overcoming seasonality in the mountain regions of Bulgaria. It is necessary to underline that the analysis of the results reveals not only the correlation between the two phenomenons but also the overcoming of seasonality would have positive benefits on the local economy and in that sense, the hypotheses are being proved.

As of the present moment, we can identify the tourist activity in the mountain resorts in Bulgaria as one way, oriented mainly towards the development of winter ski tourism. In most cases, however, the possibilities for overcoming seasonality are limited because of the high demands the destinations have towards secondary resources, secondary supply and the necessity of long term investments in a specialised material and technical bases and professional services.

Through the development of accompanying tourism activities and services and the attracting of tourists outside the high season – mostly during the summer and less during the fall and spring, the consequences of the financial and economic crises can be reduced. There is a potential both for an increase in overnight stays during the winter period and for the formation of a second, albeit weaker, summer season, and why not for even and sustainable year-round employment. So far, only in Bansko, there are signs of the formation of a second weaker summer season, which will provide additional employment to the tourist base.

The conclusions of the survey are used as a basis for further growth in mountain resorts in Bulgaria. Due to the dynamic nature of consumer preferences, research should be confirmed by expert analysis for greater reliability of the results.

Results and Vision for Development

Bulgaria has potential for developing year-round types of tourism such as cultural and SPA tourism but is still competitive only in the sea tourism and partly the winter one (Velikova, Anev, 2019). The transformation of mountain resorts into year-round, sustainable destinations requires the efforts of all stakeholders and the maximum use of the available potential in a responsible and environmentally friendly way.

In our view, the achieving of the three main pillars of sustainable planning requires close cooperation between the private and public sectors in the face of institutions and public authorities. This will increase the competitiveness of Bulgarian tourism, the efficiency of tourism companies and will improve employment and wages in the sector. This, in turn, will support government policy in the field of tourism and successful business development. This is also confirmed in the study of Dunets et al. (2019). They find that sustainable tourism development is a combination of processes characterised by spatial heterogeneity and controllability. Only with the help of conscious regulation, one can come closer to a balanced combination of compromises between objects and subjects of tourist activity.

The travelling industry in Bulgaria is quite dependent on the meteorological conditions and it is extremely seasonal. The two most developed types of tourism are particularly vulnerable – a rainy summer would affect the sea, sun, sand tourism and the level of employment in the accommodation sector of the seaside resorts, while the lack of snow could have a serious negative effect on the income of the ski tourism (Vodenska, Gösling, 2017). Experts say that the results of global climate warming are due to contamination (Bogomilova, 2017). Although they were significantly reduced during the pandemic, the risk still exists to a big degree. During the past few years, a lot of cities in Western Europe clearly stated that they are determined to reduce their negative influence on the environment. They confirmed this by joining the created in 2008 European Commission's initiative that requires the local governments to take the responsibility to reduce carbon emissions by 20% by 2020 (Tzvetkova, 2019). The measures taken already give results but the forecasts for the winter vocational period are not exactly promising.

Thus for Bulgaria is really important to think of future plans to overcome seasonality in the mountain regions, especially once the COVID-19 pandemic is over. A big part of those strategies, according to us, should be intended towards resifting the main tourist offers of winter tourism to alternative tourist packages. This is particularly important for the lowland areas where the consequences of the climate change are expected to be huge.

A significant competitive advantage for mountain destinations is their ability to offer a wide spectrum of services. During the winter season, the tourists in the mountain destinations can enjoy different sports and activities such as: skiing, snowboarding, snowmobiles, hockey, ice skating and others. During the summer season, tourists can practice rafting, kayaking, rock climbing, mountain biking, bungee jumping, paragliding, berry and herb picking and so on. All of these activities attract tourists from all over the world. At the same time, mountain tourism and its related mountain activities depend to a degree on the weather and the local climate (Velikova, 2020).

The weather forecasts in Bulgaria show a continuous decline of snowfall and earlier snow melting. Rainfall can have negative effects on the quality of the snow and the expectations of holiday goers. This will have a significant negative consequence for the ski resorts, especially the ones situated at a lower altitude (Vodenska, Gösling, 2017). While the summer season could benefit from climate changes, the winter one can suffer terrible consequences.

Strategies that are characteristic of overcoming seasonality in tourist destinations arise mainly from geographical location and climate effects (i.e. seasonal changes in time). The possibility for extending the tourist season or the inclusion of a second season depend strongly on the location and the competitiveness of the destination. For example, isolated or peripheral areas can face difficulties when they try to develop similar tourist products. This was proved by Dimitrov and Stoilova (2014).

Moreno-Gené at all. (2018) state that the smaller resorts are the ones with a more uncertain future. Their sustainability will therefore need to be assessed, as resorts are not only profitable for themselves, but also have influence in the surrounding territory. They promote the profitability of other local businesses, such as restaurants, commerce, hotels, training companies, and complementary activities, generating jobs and acting as economic engines. However, these complementary activities can only exist if the winter seasons are long and allow the practice of winter sports.

Despite the fact that seasonality would never be completely eliminated, there are a lot of ways to equalise the high and low periods of tourist visitations throughout the year. The positive effects from the efforts to reduce them are present in some tourist destinations, due to applied strategies and the fast growth of tourism in the last four-five years. All of the efforts are pointed at resifting the tourist visitations towards the calmer periods of the year, i.e. outside the high season.

The mountainous region can become the largest centre of international eco-tourism, scientific research, cultural relations and rational use of resources. Tourism makes a significant contribution to the sustainable development of mountain regions (Dunets et al., 2019).

According to the authors of this publication, the sustainable planning for sustainable development of the Bulgarian mountain resorts can be secured with the application of the following development model (Figure 2).

To ensure the current model, coordination and cooperation of the public and private sector efforts are expected. For the purposeful development of the following types of tourism are needed:

- Winter ski tourism and ski sports (during the months from December to March) – currently available and provided mainly on a private-sector basis. The public sector participates by giving a concession of ski slopes. It is possible to enrich the offer through SPA and wellness packages and cultural experiences;
- Transit, shopping and event tourism (in October-November and April-May) – are showing the potential for a significant increase in tourist visits and revenues. Bulgaria's geographical location guarantees a significant transit flow during all seasons of the year. In 2019 according to the NSI (National Statistical Institute), 4 930 515 tourists had visited

Bulgaria with the purpose of guests or transit. This is a remarkable reserve, which is not yet covered by the leisure industry – no overnight stays are realised in the licensed means of accommodation. In our opinion, it is possible to implement a strategy to stimulate the stay of transit tourists by increasing and promoting the opportunities for shopping and organising events. These types of tourism are very poorly developed or completely absent. For this reason, there is a need for a clear strategy and close cooperation of all stakeholders at each level;

Figure 2

Model for sustainable development of mountain resorts in Bulgaria

Source: Velikova, 2020.

- Summer mountain tourism (from June to September) – poorly developed. The increase in visits can be stimulated through the development of outdoor activities, events, spa and wellness offers and visits cultural sites – activities that will become especially popular after the pandemic. Here again, a clear strategy and close cooperation of all stakeholders is needed in order to stimulate visits to the mountains during the summer months. Diversification of the stay and the increasing of activities related to the preservation of the health condition, for example, spa and wellness offers and sports proposals, conceal serious potential for increasing summer vacations. In this regard, the targeted use of the available mineral water resources in Bulgaria, which are also significant in the mountainous areas, also need serious investments, popularisation of the possibilities for developing a strategy for including them in the tourist turnover (Velikova, 2020).

These options will improve the supply in the Bulgarian mountain resorts, which significantly exceed as a territory those for the offer of sea tourism. Close cooperation of municipalities with the private sector can be achieved through the building of alliances. This is a form of cooperation that allows the conservation of independence between the different participants

and their cooperation for achieving a common goal (Velikova, 2012). Once the goal is achieved, the alliance can cease to exist or build a new strategy for action.

The implementation of the current model will provide a significant competitive advantage to Bulgarian mountain tourism and will help it to establish itself even more on the international stage. Authors prove that mountain tourism can provide an alternative, environmentally friendly employment opportunities for local communities and contribute positively to their socio-economic wellbeing. In most of the region, however, tourism development is poorly planned, often even unplanned, and the development of infrastructures such as recreational facilities, guest houses, camping sites, and restaurants often have significant negative impacts on the mountain environment (Wang at al., 2019). This requires careful planning and zoning of each part of the tourist area.

It is important for the future development of tourism in Bulgaria to observe the trends that will dominate tourist travel after overcoming the crisis with COVID-19. We believe that their combination with strategies for ensuring sustainable development is a guarantee for future prosperity. In our opinion, they can be summarised as follows:

- Tourists would avoid the visitation of big hotels, "all-inclusive" resorts and loud mainstream resorts. This would be a "fresh air" for the small tourist organisations. In our opinion, this type of places would be avoided not because of their inability to maintain high hygiene but because of the accumulation of more people. In the short period, this would be the main psychological effect of influence from the measure taken to fight the pandemic. More and more small accommodation with "green" certificates will be sought. The service "all-inclusive" has been under attack for a long time from supporters of sustainable development because of the generated food waste, offering it from common buffers and limiting the access of the local population to the benefits of tourism;

- The concepts for sustainable development of tourist resorts rely on the establishment of ecological modes of transport. Ecological self-awareness presupposes a preference for the train over the personal car and the bus. The railway transport is cheap, ecological but not very practical. In Bulgaria, there is a need to improve the transport infrastructure in this regard and increase its usability. To this end, targeted efforts are again needed from all stakeholders;

- Outdoor activities will be necessary to a large extent – walks, outdoor sports, rock climbing, hiking, etc. In this regard, the mountains have to offer excellent possibilities. Personal responsibility and self-awareness after the crisis will increasingly promote lifestyles striving for a healthy and environmentally friendly way of life. This means that many sports activities and "healthy" foods will be sought;

- Technologies and innovations also can help the sustainable development in tourist destinations. Increasing the possibilities for using electric vehicles, including car rental, is just one example in this regard. The modern tourist environment needs new technological solutions to support it. Artificial intelligence will create many new opportunities in tourism and this is still to come.;

- Epidemiological measures will establish the pools as a preferred and sought form for sports, healing and recreation after the COVID-19 crisis. In this regard, the entire territory

of the country has an indisputable competitive advantage - the presence of over 550 deposits of mineral springs and peloid resources with an extremely wide range of prevention and treatment. With small investments and targeted policy, this resource can be used effectively;

- Corporate social responsibility will be established through the search for "eco-friendly" travel companies. New models of tourist accommodation and catering will be established, providing greater independence and isolation (Velikova, 2020).

These trends can also be significantly supported by the creation of the aforementioned alliance between the private and public sectors. In our opinion, even the new consumer requirements will inevitably impose this cooperation in response to the new socio-economic needs.

Conclusion

We can emphasise overcoming seasonality at the tourist ski resorts as a main conclusion, special attention must be paid at the ways of minimising their weaknesses. They should be limited by improving the interaction between the suppliers of tourist products in the country with the leading incoming tour operators. They have access to many emitting markets to which they can offer destination Bulgaria.

The present study, along with determining the positive and negative consequences that seasonality has on tourism and the analysis of the Bulgarian mountainous tourist resorts manages to create foundations of a strategic plan for action and optimisation of tourist development in the Bulgarian mountain areas. The results of the empirical research, together with the conclusions of the theoretical settings related to specifics of the organisation of events with the purpose of extending the tourist season, could be practically reduced to the possibilities for promotion of event tourism at a tourist destination.

In Bulgaria, there are opportunities for practising many other types of tourism besides summer sea and winter ski tourism. We have many mineral springs and hundreds of cultural resources. The strategies for the development of the tourist products should be developed in the context of the whole strategy for sustainable development of a destination; thus, the new products can complete and support one another.

The possibilities for turning the Bulgarian mountain regions into sustainable destinations that can be visited throughout the whole year are good. The development of the less popular specialised types of tourism, incl., and event tourism, is slightly limited, mainly due to lack of information. It would be appropriate to look for options for organising various events to build a vision of the mountain regions in Bulgaria as destinations for "non-mass" tourism.

The authors of this publication consider seasonality as a barrier that reduces the economic benefits of tourism in mountainous areas. They defend the thesis that finding opportunities for year-round use of the tourist base is a prerequisite for sustainable development of the territory, only when the proposed types of tourism are not mass, develop regularly and according to environmental principles. These types of tourism can be transit, shopping, event,

cultural, spa and wellness tourism. By carefully planning and offering them at certain times of the year, the tourist potential of the mountains can be greatly increased.

The current development of tourism in the mountainous territories of Bulgaria shows that it is more profitable for entrepreneurs to focus on extending the existing winter season. Despite the severe consequences of the pandemic, consumers continue to seek tourist services and the change in their behaviour is minimal. As soon as the borders are opened and travel is allowed, tourist travel will regain its pre-crisis values. The proposed model for year-round visits to mountain resorts can significantly increase the tourist potential of the mountains in Bulgaria. The aim of the model is not to make the proposed types of tourism mass. By attracting a number of visitors, acceptable to the capacity of the mountains, such a sustainable development of the resorts can be ensured that can combine economic, social and environmental components for development.

Rising temperatures and climate change will cause more changes in the tourist offer of mountain resorts. Of interest for future research may be the search for alternatives to ski tourism. This means a radical change in supply. Reconceptualising the tourist profile of a resort is a long and complex process that requires significant effort and strategic decisions. It should not be forgotten; however, that planning for future development must be based on the principles of sustainability.

References

Bar On, R. V. (1975). Seasonality in Tourism. A Guide to the Analysis of Seasonality and Trends for Policy Making. London: The Economist Intelligence Unit Ltd., Technical Series N. 2.

Baum, T., Lundtorp, S. (2001). Seasonality in Tourism. Oxford.

Bogomilova, E. (2017). Upravlenie na izvŭnrednite situatsii (prirodni bedstviya i ekologichni katastrofi). Chast I. Sofiya: IK-UNSS.

Bogomilova, E. (2020). Upravlenie v usloviyata na izvŭnredna situatsiya. – Biznes posoki, 27/2020, pp. 9-13.

Cannas, R. (2012). An overview of tourism seasonality: Key concepts and policies. – Almatourism: Journal of Tourism, Culture and Territorial Development, 3 (5) (2012), pp. 40-58.

Corluka, V. K. (2019). Tourism Seasonality – an Overview. – Journal of Business Paradigms, Vol. 4, N 1, pp. 21-43.

Corluka, V. K. (2014). Seasonality in Tourism – causes, implications and strategies. Available at: https://www.academia.edu/8670280/SEASONALITY_IN_TOURISM_causes_implications_and_strategies. [Accessed 6/2020].

Dimitrova, S. (2018). Analysis of the potential of the events for turning the winter resorts of Bulgaria into year-round tourist destinations. – Economic Alternatives, UNWE, N 4, pp. 566-577.

Dimitrov, P., Stoilova, D. (2014). The project "Local products festivals and tourism development in cross – border cooperation Greece – Bulgaria (the LOFT project) funded under the European Cooperation Programme "Greece-Bulgaria 2007-2013". – Contemporary issues in tourism and management studies, pp. 221-233.

Dimitrov, P., Kraseta, R., Dimitrov, B., Parvanov, P. (2018). Bulgarian tourism and the problem of poverty alleviation in Bulgaria. – Tourism & Management Studies, 14(2), pp. 45-52, DOI: 10.18089/tms.2018.14205.

Dunets, A., Vakhrushev, I., Sukhova, M., Sokolov, M., Utkina, K., Shichiyakh, R. (2019). Selection of strategic priorities for sustainable development of tourism in a mountain region: concentration of tourist infrastructure or nature-oriented tourism. – Entrepreneurship and Sustainability Issues, Vol. 7, N 2 (December). http://doi.org/10.9770/jesi.2019.7.2(29).

Evrev, P. (1987). Planinski kurorti. Sofiya: Tekhnika.

Evrev, P. (1999). Teritorialno-ustroĭstveno planirane na otdiha i turizma. Sofiya: SU „Kl. Okhridski".

Hartmann, R. (1986). Tourism, Seasonality and Social Change. – Leisure Studies, Vol. 5.

Hristova, N. (2018). Administrativno-praven rezhim na natsionalnite parkove. Sofiya: Damyan Yakov.

Koenig, N., Bischoff, E. E. (2005). Seasonality: The State of The Art. – International Journal of Tourism Research, 7, pp. 201-219.

Lee, C., Bergin-Seers, S., Galloway, G., O'Mahony, B., McMurray, A. (2008). Seasonality in the Tourism Industry, Impacts and Strategies. CRC Sustainable Tourism Pty Ltd 2008, Gold Coast, Queensland, Australia.

Marinov, V., Asenova, M. (2016). Predizvikatelstva pred ustoĭchivoto razvitie na turizma v planinskite raĭoni na Bŭlgariya. Vtora mezhdunarodna nauchna i biznes konferentsiya „Ustoĭchivo regionalno razvitie na Bŭlgariya". Sofiya: SU „Sv. Kliment Okhridski", Geologo-geografski fakultet, pp. 14-28.

Mikhaĭlov, Ts. (1989). Morfografiya i morfometriya na planinskite oblasti. – V: Prirodniyat i ikonomicheskiyat potentsial na planinite v Bŭlgariya. Tom 1, Priroda i resursi. Sofiya: Izdatelstvo na BAN, pp. 12-18.

Mintchev, V. (2016). Potential and return migrants in Bulgaria – demographic and socio-economic aspects. – Ikonomicheski Izsledvania, 25(5), pp. 91-115.

Mintchev, V., Boshnakov, V. (2018). The choice of Bulgarian migrants – Stay or leave again?. – Ikonomicheski Izsledvania, 27(2), pp. 45-64.

Moreno-Gené, J., Sánchez-Pulido, L., Cristobal-Fransi, E., Daries, N. (2018). The Economic Sustainability of Snow Tourism: The Case of Ski Resorts in Austria, France, and Italy. – Sustainability 2018, 10, 3012. https://doi.org/10.3390/su10093012.

NSI. Natsionalen statisticheski institut (National Statistical Institute). Available at: https://www.nsi.bg/bg/content/1969/%D0%BF%D0%BE%D1%81%D0%B5%D1%89%D0%B5%D0%BD%D0%B8%D1%8F-%D0%BD%D0%B0-%D1%87%D1%83%D0%B6%D0%B4%D0%B5%D0%BD%D1%86%D0% B8-%D0%B2-%D0%B1%D1%8A%D0%BB%D0%B3%D0%B0%D1%80%D0%B8%D1%8F-%D0%BF%D0%BE-%D0%BC%D0%B5%D1%81%D0%B5%D1%86%D0%B8-%D0%B8-%D0%BF%D0%BE-%D1%81%D1%82%D1%80%D0%B0%D0%BD%D0%B8?page=1. [Accessed 6/2020].

Turrión-Prats, J., Duro, J. A. (2018). Tourist seasonality and the role of markets. – Journal of Destination Marketing & Management 8, pp. 23-31.

Economics Department and CREIP, Univ. Rovira i Virgili, Avinguda Uni.

Tsvetkova, S. (2019). Guidelines for the Stable Development of Public Bus Transport in the City of Sofia E3S Web of Conferences; Les Ulis Vol. 101, Les Ulis: EDP Sciences. (2019) DOI:10.1051/e3sconf/201910101003.

Velikova, E. (2019). Methodological guidelines for the sustainable development of the Bulgarian touristic resorts through reducing the harmful impact of transport. E3S Web Conf., 101 (1). 01004. doi: https://doi.org/10.1051/e3sconf/201910101004.

Velikova, E. (2019a). Preodolyavane na sezonnostta v turizma – problemi i resheniya. Sofiya: Avangard Prima.

Velikova, E. (2012). Strategicheski aliansi v turizma. Sofiya: Avangard Prima.

Velikova, E. (2020). Sustainable Planning and Development of the Mountain Resorts in Bulgaria. – Journal of Real Estate Property & Business, Vol 4 (2), pp. 81-90.

Velikova, E. (2020a). Vrŭzki i zavisimosti mezhdu sŭbitiyata i turizma. Sofiya: Avangard Prima.

Velikova, E., Anev, I. (2019). Value Assessment of Mineral Springs Used in Spa Facilities. – Economic Studies, Vol. 28, N 4.

Vodenska, M., Gösling, S. i kol. (2017). Konsultantski uslugi po Natsionalna strategiya i Plan za deĭstvie za adaptatsiya kŭm izmenenieto na klimata Sektorna otsenka za sektor „Turizŭm" [Online]. Available from: www.eufunds.bg (accessed March 2020).

Wang, Y., Wu, N., Kunze, C., Long, R., Perlik, M. (2019). Drivers of Change to Mountain Sustainability in the Hindu Kush Himalaya. – In: Wester P., Mishra A., Mukherji A., Shrestha A. (eds.). The Hindu Kush Himalaya Assessment. Springer, Cham. https://doi.org/10.1007/978-3-319-92288-1_2.

Wilson, E. (1952). An introduction to scientific research. McGraw Hill.

WTTC. (2019). Bulgaria 2019 Annual research: key highlights. Available at: https://wttc.org/Research/Economic-Impact. [Accessed 6/2020].

SUMMARIES

Dzenita Siljak
Sándor Gyula Nagy

THE EFFECTS OF THE CRISIS ON CONVERGENCE BETWEEN THE EASTERN PARTNERSHIP AND EU-15 STATES

This paper aims to investigate the effects of the 2008/2009 financial crisis on the convergence process of the Eastern Partnership (EaP) countries towards the core countries of the European Union (EU-15). To do so, we econometrically test the relationship between the per capita GDP growth rate and selected macroeconomic variables in the period 2004–2018 and three sub-periods: the pre-crisis, the crisis, and the post-crisis period. We hypothesize that the financial crisis had a negative impact on the absolute and conditional convergence process in the analyzed group of countries. The convergence rates are estimated using ordinary least squares (OLS) semi-log regression based on cross-sectional data. The empirical results show that the EaP countries converge towards the EU-15 Member States and that the convergence rates range between 1.6% and 4.3%. Negative effects of the financial crisis on the convergence process are confirmed only for absolute convergence. The two groups of countries form separate clusters, which indicates a considerable heterogeneity of growth. According to the results of this research, the EaP countries should focus on opening their economies to more trade, increase macroeconomic stability and decrease corruption, because improvement in these areas should lead to a faster convergence process.
Keywords: β-convergence; Eastern Partnership; European Union; Financial crisis; Economic growth
JEL: F15; O47; O52

Anna Dimitrova

CAPTURED ENERGY MARKET OPERATION AND LIBERALISATION EFFORTS

The article examines several developments in the energy sector in Bulgaria through the prism of the "capture" theory ("interest groups" theory), and regulatory capture in particular. It argues that captured state interventions or the lack thereof lead to inefficiencies in the utilities and to socially inferior results, especially in a highly concentrated market, intensive public ownership and questionable NRA independence context. They are liable to hinder effective market liberalisation and green transition efforts.
Keywords: regulation; capture; liberalization; energy
JEL: L51; L94; L95

Andrey Kudryavtsev

STOCK PRICE DYNAMICS SURROUNDING COMPANY-SPECIFIC SHOCKS

In this study, I analyze the correlation between stock returns before and after major price shocks. I hypothesize that if a large price move for a given stock takes place after a short period when the stock's price moves in the same direction, then it may indicate that the fundamentals of the company-specific shock are more completely incorporated in the stock price, significantly increasing the probability of subsequent post-event price reversal. In order to test the study's hypothesis, I employ

the price data for all the stocks that made up the S&P 500 Index during the period from 1993 to 2019, and define significant price moves according to a number of alternative proxies referring to both raw and abnormal stock returns. I find that both large price increases and decreases are followed by significant one to three month price reversals (drifts) if they are preceded by the same- (opposite-) sign short-term cumulative abnormal returns. The effect remains significant after accounting for additional relevant company-specific (size, Market Model beta, historical volatility) and event-specific (stock's return and trading volume on the event day) factors.
Keywords: Behavioral Finance; Large Price Changes; Overreaction; Stock Price Reversals
JEL: G11; G14; G19

Dilian Vassilev

A MODEL OF NATURAL INTEREST RATE: THE CASE OF BULGARIA

The proposed model estimation of the natural interest rate for Bulgaria is based on the seminal model of Laubach and Williams (2003), as important modifications are implemented in order to capture the specifics of the Bulgarian economy. As a small and open economy, the real effective exchange rate is included in measurement equations as well as the Eurozone output gap. Second, we incorporate stylised facts and observations about the behaviour of the Bulgarian economy, such as the steady-state growth rates of potential output and initial guidance about the level of natural interest rates. We circumvent the "pile-up" issue by imposing certain assumptions about the level and growth rates of potential output and time preferences of economic agents. In order to validate the consistency and reliability of the assumptions, we counterfactually evaluate the past and present BG monetary conditions by estimating the real rate gap, i.e. compare the observed real interest rate (r) against the natural rate (r*).
We find that, contrary to many advanced economies, the natural real interest rate of the Bulgarian economy does not show a declining trend, i.e. the economy after 2008, i.e. it is not under the precondition of "secular stagnation". This means that BNB's monetary space is far from being exhausted so far. This is due to the fact, that Bulgarian productivity growth (as a catching-up economy) is predominantly exogenous (imported) and the growth rate of productivity proved sustainable even after 2008 and well compensates for the detrimental demographics. The results from the Taylor rule exercise confirm counterfactually, that the Bulgarian short term interest rates are justified, thus the transition to the inflation targeting regime of ECB is expected to be smooth.
Keywords: NIR; secular stagnation; inflation expectations; real interest rate
JEL: B15; N10; E50; O47

Ram Pratap Sinha

PROFIT BENCHMARKING OF INDIAN GENERAL INSURANCE COMPANIES

While there are several studies regarding the efficiency of Indian general insurance companies, the field of profit efficiency remains unexplored till date. In the present paper, a quantity-based ratio form model has been adopted for the estimation of profit efficiency. The profit efficiency scores so derived are then decomposed into revenue and cost efficiency components. Bootstrap-based and bias-corrected lower and upper bounds of profit, revenue and cost efficiency scores have also been estimated. The data set includes information pertaining to fifteen general insurance companies for the period 2011-12 to 2016-17. The outcome shows that the public sector insurers have done well in terms of revenue efficiency but needs to be concerned about cost-efficiency. Further, we have explored the linkage of profit, revenue and cost efficiency with solvency ratio and return on equity

using Tobit regression. The results show that profit, revenue and cost efficiency have a strong linkage with both solvency ratio and return on equity.
Keywords: General insurance; Profit Efficiency; Revenue Efficiency; Cost Efficiency; Return on Equity; Solvency Ratio; Censored Regression
JEL: C61; D21; G22

Kashif Munir
Mehwish Iftikhar

IMPACT OF TRANSPORT AND TECHNOLOGICAL INFRASTRUCTURE IN ATTRACTING FDI IN PAKISTAN

This study analyzes the long run and short-run impact of transportation and technological infrastructure in attracting FDI in Pakistan, while transportation infrastructure is disaggregated into roads, rail, and air transport, and technological infrastructure is disaggregated into telecommunication, oil, and power consumption. The study uses annual time series data of Pakistan from 1973 to 2018 and applies the ARDL bounds testing approach for analysis. Results show that all the indicators of infrastructure, i.e. roads, railways, air transport, telecommunication infrastructure, power and oil consumption, have a positive and statistically significant impact on FDI in the long run. Oil and power consumption shows a greater impact on FDI because foreign investors associate the country's development with its energy consumption. Transport infrastructure needs more improvement and development to facilitate foreign investments in the country. Government, as well as the private sector, has to pay attention to improving infrastructure facilities not only to fetch more FDI but for the economic progress of the country. Investment in infrastructure is required to provide better and efficient transport and technological infrastructure to facilitate the production process.
Keywords: FDI; Infrastructure; Transportation; Technology; Pakistan
JEL: C32; F21; O18

Uzma Tabassum
Munazah Nazeer

DETERMINANTS OF ECONOMIC CITY SIZE

The attraction and economic contribution of cities differ across cities in Pakistan. The purpose of this study is to look into what are the drivers of this difference. A balanced panel data set which has equal number of observations for fourteen cross-sectional units (cities), is used for analyzing determinants of economic city size. In-migration is a major factor in determining the economic as well as the physical size of a city. It not only increases the mass but also alters production by increasing labour supply and demand for production. Amenities also significantly influenced city size. Positive amenities of a city tend to increase city size while the negative ones decrease it. Further, the greater the size of the informal sector in a city, the greater it contributes to national growth and GDP. Imports and exports both tend to raise production and consumption in the city, which eventually boosts the size of the city. Finally, the effect of being a port city is also significant and positively relates to the economic size of the city.
Keywords: City; Economic Size; Fixed effect; Specialization; Amenities
JEL: C1; R0; O1; O4

Burim Gashi

IMPACT OF BANK-SPECIFIC AND MACRO DETERMINANTS ON NON-PERFORMING LOANS OF POLISH BANKING SECTOR

The aim of this paper is to examine the determinants of non-performing loans (NPLs) in Poland. We investigate macroeconomic and bank-specific determinants of NPLs – for a panel of 18 banks from Poland, using annual data for the period 2005-2018. We apply two alternative estimation techniques: fixed-effects model and system Generalised Method of Moments. The results show the bank-specific determinants, with an impact on the amount of NPLs include return on equity and growth of gross loans,, while the most important macroeconomic factors influencing NPLs in Poland are GDP growth, domestic credit to the private sector, public debt and unemployment.
Keywords: Non-performing loans; Macroeconomic determinants; bank-specific determinants; Poland; Generalised Method of Moments
JEL: C23; C51; G21; G2

Igor Matyushenko
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ASSESSMENT OF TECHNOLOGICAL COMPETITIVENESS OF UKRAINE IN TERMS OF ASSOCIATION WITH THE EU

Research background: The paper accounts for the problem of assessing the factors of the formation of Ukraine's technological competitiveness in the face of new challenges for the state in the process of developing relations with the EU.
Purpose of the article: The aim of the report is to assess the level of technological competitiveness of the Ukrainian economy and determine the most important factors for its further development in the conditions of association with the EU.
Methods: The article presents the scheme of research of technological competitiveness of Ukraine on the basis of qualitative and economic-statistical analysis, analysis of comparative advantages, cluster and correlation-regression analysis.
Findings & Value added: The analysis of world rankings has shown that the technological competitiveness of Ukraine determines comparative factor advantages in coverage of higher education, availability of scientific staff, and quality of research institutions, but low state support, lack of stability, and problems in institutional development hamper the country's innovative potential. The identification of competitive advantages in trade in high-tech products demonstrates that Ukraine remains an importer of high-tech products; relatively small comparative competitive advantages among the high-tech products of Ukraine has only products of the aerospace industry. Cluster analysis showed that Ukraine is in the same cluster as Poland. Bulgaria and Romania, which have not yet fully consistent with the level of technological competitiveness of EU leaders; among the strengths of Ukraine are the development of human resources and labour effect. The correlation analysis between the components of the Global Innovation Index and the factors of increasing Ukraine's competitiveness indicates a moderate link between the development of clusters, the ratio of expenditures on R&D to GDP, and the export of ICT services. In order to increase the level of technological competitiveness of Ukraine: to increase both foreign investments and state financing; improvement of regulatory acts, reduction of corruption, institutional improvement; support of

technologies through regional cluster programs or “smart specialisation”; integration into the European Research Area.
Keywords: technological competitiveness; Global Innovation Index; high-tech products; comparative advantages; EU-27 and Ukraine
JEL: C15; F13; F17; O14; O24; O52; O57

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DEVELOPMENT OF TERRITORIAL SELF-GOVERNMENT IN RUSSIA BASED ON CROWDFUNDING NETWORK INTERACTION BETWEEN BUSINESS STRUCTURES AND LOCAL SELF-GOVERNMENT BODIES

The crisis caused by Covid-19 is very dangerous for the social and economic stability of the regions of the Russian Federation. There is a deterioration in the dynamics of the budget deficit of the constituent entities of the Russian Federation in 2020. The Government of the Russian Federation is planning to provide non-targeted financial support to the budgets of the constituent entities of the Russian Federation, while maintaining the existing approaches to the distribution of subsidies for equalization, to mitigate it. The long-term dependence of the majority of the country’s regions on Federal budget subsidies and the implemented policy of artificial financial equalization of the regions can give rise to dependent moods in weak regions and deprive them of an incentive to develop strong regions. In the context of budget deficits at the regional and especially at the local levels, the search for additional sources of funding to solve the tasks that are socially significant for the territories becomes particularly urgent. The most effective way to finance municipal projects is to combine the funds of citizens, businesses, local and regional budgets. Regions should find alternative sources of financing for their projects, including through “people’s financing” and the activation of the territorial self-government development based on the crowdfunding mechanism and its use in building an effective network of interaction between business structures and local self-government bodies.
The article solves the following problems: the dynamics, problems and prospects of development in Russia of such instruments of “people’s financing” as initiative budgeting and self-taxation are analyzed. The current scheme of self-taxation of citizens in the country was developed with a list of its shortcomings in implementation. Examples of implemented crowd projects for the development of territories of the Russian Federation, primarily in the field of public initiatives, are considered. A crowdsourcing platform, which has allowed to influence the process of territorial self-government in Russia since 2018, was identified and described. The scheme of network interaction between business structures and local governments based on crowdfunding IT platforms is proposed. Methodological recommendations for the implementation of this scheme are given. The use of the crowdfunding mechanism in the territorial self-government of regions can help to solve the tasks set out in a number of state programs of the Russian Federation.
Keywords: territorial development; investment mechanisms; crowdfunding; network interaction
JEL: R1

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THEORETICAL UNDERPINNINGS OF LIBERIA'S POST-CONFLICT RECOVERY: PERTINENT LESSONS FOR DEVELOPING COUNTRIES

Post-conflict recovery in underdeveloped and developing countries is always a challenge for political leadership. Liberia has been the victim of 14 years of civil war, due to which GDP experienced a downfall by over 90% making the economic growth process halted. This paper traces the extent of Liberia's collapse and examines the patterns of post-conflict recovery as an application complexity theory and a model which can be followed by other conflict confronting developing countries. The Paper explores challenges faced by Liberia in strengthening rapid, inclusive, and sustained economic growth and how these challenges were converted into opportunities through dynamic leadership and institutional process that had roots in complexity theory. It examines the policy framework and institutional reforms which set the pace for sustainable economic growth in Liberia. Because of visionary steps by leadership, the economic growth, which was very low before 1999, showed positive improvement after the election in 2005. It was concluded that from 2005 to 2014, the per capita GDP growth rate had been approximately 63% which indicated the remarkable performance of the Liberian Government. Paper presents theoretical perspective to understand challenges of socioeconomic growth and mechanism for its revival in poor conflict-hit underdeveloped and developing countries.
Keywords: leadership; post-conflict; policy; challenges; political; institutional reforms; complexity theory
JEL: O21; O43; O55

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SUSTAINABLE DEVELOPMENT MODEL FOR MOUNTAIN TOURIST TERRITORIES IN BULGARIA AFTER THE CRISIS PERIOD

In the study, we propose a model for the sustainable development of the Bulgarian mountain tourism resorts. The model is developed based on the limitation of the seasonality in their supply and overcoming the results of the pandemic. The winter tourism is the second most competitive and meaningful type of tourism in Bulgaria after the recreational sea tourism. The country has significant natural resources in the mountainous territory, however, the quality of tourism supply in the mountain regions is significantly restricted due to the seasonality factor. The problems have deepened after the closure of the biggest winter resort in the country, Bansko, at the beginning of 2020 due to the pandemic crisis. In the current situation, not only seasonality is a limiting factor for the development of tourism. This requires the use of various research techniques to provide new solutions for the organisation of the tourism process. In the publication, we have used quantitative and qualitative methods, induction, deduction, expert and consumer studies, brainstorming, logic methods, modelling and idealisation to identify the causes of the problems in tourism and find adequate solutions to deal with them. The purpose is to find opportunities for extending the season and overcoming the decline of journeys and visits of mountain resorts. The proposed method does not cover all the possibilities for mountain regions development in Bulgaria but is a relevant solution for the current situation. It can be used as a possibility for sustainable development in other tourism resorts limited by seasonality or crisis.
Keywords: seasonality; extension of the tourist season; consequences of seasonality; strategies for limiting the seasonality; crisis; sustainable development
JEL: Z32; Q01