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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Rupal Chowdhary[1]
Isha Joshi[2]

ECONOMIC GROWTH AND TRADE OPENNESS: A CASE OF ASEAN 9[3]

A popular opinion amongst economists is that trade openness leads to the economic growth of a country. However, this relationship is not that straightforward and sometimes inconclusive as well. While the theoretical literature states that opening up an economy increases trade, leading to the country's economic growth, the empirical findings greatly differ in many cases. This paper explores the impact that trade openness has on the economic growth of select ASEAN countries from 2008 to 2019. For this purpose, first, panel unit root tests have been employed to find out the stationarity of data. Then Pedroni and Kao residual cointegration tests are used to examine the long-run relationship between variables such as Gross Domestic Product (GDP), Gross Fixed Capital Formation (GFCF), Labour Force (LF), and Trade Openness (TO). Finally, long-run estimations have been conducted through FMOLS and DOLS and the causality of the panel is studied through the Dumitrescu Hurlin panel causality test. Our results show that trade openness has a positive impact on the economic growth of select ASEAN countries in the long run.
Keywords: Trade Openness; Economic Growth; ASEAN, Panel Cointegration; Granger Causality
JEL: F15; F14; F13

Introduction

The impact of trade openness on the economic growth of countries has been a widely investigated topic both theoretically and empirically. The idea of opening up an economy where businesses would get the freedom to trade in goods, while inviting both domestic as well as foreign competition dates back to Adam Smith's primary thesis on The Wealth of Nations, 1776. Many economists state that opening up of economy benefits the country in various aspects such as an increase in domestic production, international trade, employment opportunities, investment, education, and so on (Semančíková, 2016). However, there are certain factors, when analysed, reveals that in addition to the benefits, costs are also involved. It has been seen in many cases that the positive impact of trade openness on economic growth

[1] *Dr. Rupal Chowdhary, Associate Professor, Prestige Institute of Management and Research, Indore, e-mail: rupal_chowdhary@pimrindore.ac.in.*
[2] *Ms. Isha Joshi, Academic and Research Associate, Prestige Institute of Management and Research, Indore, e-mail: isha_joshi@pimrindore.ac.in.*
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depends upon a country's income, availability of infrastructure and resources, types of goods manufactured, availability of technology, skilled manpower, etc. Karras (2003), Bajwa and Siddiqi (2011), Dao (2014), and Zeren and Ari (2013) established a positive impact between trade openness and economic growth. According to them, the faster an economy opens itself to international trade, the faster the economy will grow.

Dritsakis and Stamatiou (2016) added that when economies open themselves, countries develop a dependency on the foreign market which ultimately leads to an increase in trade. Awokuse (2008) found that an increase in trade due to trade openness can be import-led too. The countries should work towards more export-promotion strategies if they want to reap the benefits of openness for a long period. Dowrick and Golley (2004), Fetahi-Vehapi, Sadiku and Petkovski (2015), Keho (2017) concluded that a positive or negative impact of trade openness on economic growth depends upon various factors such as the level of development, specialisation of trade, income lever (per capita), investment, technology and the period the study is conducted for. It is further elaborated that usually higher income-group countries show a positive impact between openness and economic growth and lower income-group countries may enjoy the benefits for a brief period, but in the long run, it can also hurt the economy.

However beneficial, many empirical studies have found a negative relationship between the two variables. This has been supported by Gries and Redlin (2012), Hye and Lau (2015), and Abbas (2014). The authors found that when reliance on imported products increases, it creates a significant negative impact. Hye, Wizrat and Lau's (2016) study stressed the skills of the manpower. The more skilled the manpower is, would have the capacity to produce good quality products, which would improve global competitiveness.

This paper examines the data of nine member countries of the Association of Southeast Asian Nations (ASEAN) countries throughout 2008-2019. ASEAN is a regional inter-governmental organisation created to address political, security, and economic issues. The agreement on the formation of ASEAN was signed in 1967 in Bangkok, Thailand. It is comprised of ten member states ranging from developed countries to least developed countries. These are Singapore, Brunei Darussalam, Indonesia, Thailand, Malaysia, Philippines, Vietnam, Myanmar, Cambodia, and Lao PDR. The main sectors driving the economy of ASEAN are manufacturing, agriculture and services. As of 2018, the total merchandise trade for ASEAN member states has reached around US$ 2.8 trillion, where there is a positive trade balance as exports exceed imports. With the increase in trade, China (17.2%), European Union (11.2%), and the USA (9.3%) have become the top three trading partners for ASEAN countries. (ASEAN Key Figures, 2019). ASEAN's combined population amounts to 655.9 million. Indonesia is reported to have the highest population among the ten member states and Brunei reports the lowest population statistics.

Education, being an important part of ASEAN's development agenda, stands at tremendous levels. It also depicts the quality of human capital available amongst the member states. The adult Literacy rate was reported to be above 94% in 2018. Singapore recorded its adult literacy rate at 97.3%, followed by Brunei Darussalam (97.1%), the Philippines (96.4%), and Indonesia (95.7%). The poverty incidence of ASEAN has seen some major improvement between 2005-2018. A significant reduction in poverty during this period was observed in Cambodia (19.5%), Thailand (16.9%), and Lao PDR (15.2%). According to the Human

Development Index (HDI) Singapore, Malaysia, and Brunei Darussalam lie in the high index category and the other member states lie in the medium index category. This shows that the countries' population can lead a healthy and long life, there is a decent standard of living and the ability to acquire knowledge through schooling and training and development is of optimum levels. Except for Lao PDR, the labour force participation rate among all other member states is found to be relatively stable from a period of 2005-2017. There have been variations with the changing dynamics of the world, but the results are still fairly stable. (ASEAN Key Figures 2020)

To examine the impact of trade openness on economic growth among ASEAN member states, nine out of ten ASEAN states have been selected, namely, Singapore, Brunei Darussalam, Indonesia, Thailand, Malaysia, Philippines, Vietnam, Myanmar, and Cambodia. Lao PDR has been excluded from the study due to the unavailability of data.

Review of Literature

The literature review comprises mixed results, which leads us to the fact that even if trade openness impacts the economic growth of a country, the result might not always be positive. Some concluded that the impact of trade openness on the economy is not only positive but also substantial. The reasons for such a positive impact depend upon a country's trade specialisation, level of development, technological enhancement, skilled labour force, and the period under consideration, among a few. While other researchers found that there might be a positive impact in the long run, but countries face many troubles in the short run. For some countries which are less economically developed, trade openness proved to create a negative impact on their economy because of low-quality products and services and soaring competition in the market. The focus of this study is only on ASEAN 9, whereas the literature found includes various regions and countries. Like Bajwa and Siddiqi (2011) have taken four SAARC nations, Tahir and Lodhi (2016) focus on a panel of 67 developing countries and Pradhan, Arvin and Hall (2019) have taken 25 countries of the ASEAN Regional Forum. Therefore, an exhaustive analysis is done, and results might vary.

Karras (2013) study concludes that the impact of trade openness on the economy is not only positive but also economically substantial, significant and it is capable of increasing the real GDP rate (per capita) permanently by 0.25 to 0.3% (approx). Dowrick and Golley (2004) find a positive impact of Trade Openness on Economic Growth. The reasons behind the positive impact depend upon the level of development, specialisation of trade, and period is taken into consideration. Two important factors taken into consideration in the study are the onset of the concept of trade openness and the type of product exported. According to the authors, at the onset of relating trade openness with economic growth, benefits reaped by developing economies were greater than the developed economies. The trade also proved to be beneficial for those countries that mainly exported primary products. Due to this, the poor countries faced extreme problems. Awokuse (2008) opined that import-led growth was found in the three selected countries, namely, Argentina, Columbia and Peru, than export-led growth. Results indicate that rather than exports, imports played a major role in affecting

economic growth. The authors suggest that with export promotion, import openness is also important for the positive growth of trade and the economy.

In the study conducted by Yucel (2009), the granger causality test resulted in a bi-causality between trade openness and economic growth and between financial development and economic growth. The changes in Turkish policies such as reduction of tariffs, trade liberalisation (elimination of barriers) have led to an increase in trade openness which ultimately has positively impacted the Turkish economy. Bajwa and Siddiqi's (2011) findings show a short-run unidirectional causality from 1972-85 and bi-directional causality from 1986-07 between growth and openness on four selected SAARC nations – Bangladesh, India, Pakistan and Sri Lanka. The results of Gries and Redlin (2012) indicate that the long-run effect of openness on economic growth has been continuous, but it also depends on income groups. The lower-income countries show a negative impact of openness on economic growth whereas, high-income countries are positively impacted.

Tahir and Ali (2013) analysed an instrumented bilateral trade and an actual bilateral trade among OECD member countries. It is found that there is a significant and positive relationship between trade openness and economic growth in the case of developed nations. The author further states that the labour force and income levels are also impacted by trade openness. Therefore, the policymakers should ensure maximum employment. Investment, however, did not show a significant impact. The reason for this lies in the fact that the investment plan, time of returns, and the amount invested may differ over time. Zeren and Ari's (2013) study conducted on the G7 countries, namely, Germany, France, Canada, Japan, Italy, the United States and the United Kingdom, indicates a bi-directional causality between trade openness and economic growth. Abbas (2014) show a significant negative impact between economic growth and trade openness which means that the share of imports is greater than exports in this case. He further proposes the requirement of significant export promotion strategies. Dao (2014) concludes that there is a positive and significant relationship between openness in trade and economic growth. The author further elaborates that the more open a country is to international trade, the faster will its economy grow.

The Econometrics tests conducted by Jawaid (2014) reveal that there is a positive long-term relationship between exports and economic growth in Pakistan, but the imports have a significant negative impact on the Pakistan economy. The author recommends export promotion strategies, efficient use of capital resources present in the domestic market, and an increase in domestic production to reduce the reliance on imported capital resources. Hye and Lau's (2015) results show that there is a negative impact of trade openness in the long run for India. On the other hand, it shows a positive impact in the short run. Also, the impact of trade openness on the Indian economy has not been stable in the overall period. Fetahi-Vehapi, Sadiku and Petkovski (2015) concluded a significant and positive impact of trade openness on economic growth. This depends on factors such as income level per capita – higher income group countries show a positive impact, higher GDP nations are encouraged to work more towards trade openness which leads to higher GFCF and FDI flows. Dritsakis and Stamatiou's (2016) research shows a positive unidirectional causal relationship between trade openness and economic growth in both the short and long run. This means that with the increase in openness, the countries are more dependent on the foreign markets, which

ultimately leads to an increase in economic growth for the selected thirteen European Union countries.

Hye, Wizarat and Lau (2016) also showed through their research a positive relationship between trade openness and economic growth in the long as well as the short run. Results through the rolling window regression method showed that trade openness harmed economic growth in the years 1986-1988, 1993-1996, and 1999-2000. The authors conclude with certain policy measures indicating the importance of human capital in creating a positive relationship between TO and EG. A substantial focus should be given to imparting education and training. Analysis conducted by Idris, Yusop and Habibullah (2016) concluded that there is a bi-directional causality among the 87 selected countries (OECD and developing countries) between openness, trade, and economic growth. Tahir and Lodhi (2016) conducted a panel fixed effects estimation procedure on 67 developing countries from 1990-2009. The results showed a positive link between trade openness and economic growth. According to the results, a large change in growth in the lower-middle-income countries corresponds to a small change in trade openness. On the other hand, in the case of lower-income countries, small changes in economic growth corresponded to large changes in trade openness.

Keho (2017) shows a positive impact of trade openness on economic growth in Cote d-Ivoire, also highlighting the importance of capital formation in promoting positive economic growth. Huchet, Mouel and Vijil (2018) conclude that to find a relationship between trade openness and economic growth, the quality and variety of export basket is also important. Results indicate that any country with low-quality products will harm trade openness on economic growth. Only countries that have high-quality specialisation will enjoy a positive impact between TO and EG. In the case of export variety, almost all developing countries show a positive impact. The author suggests policy measures with regards to quality creating infrastructure and increase in production capacity. The positive impact of trade openness on economic growth has also been found by Silajdzic and Mehic (2018) while analysing the Central and East European countries (CEECs). It is also found that other than exports, the import of necessary technology from the EU countries to less-developed CEECs has proven to be effective and lead towards a positive relationship. Lastly, Pradhan, Arvin and Hall's (2019) results indicate a difference between the long-run and short-run. In the case of the long run, results show a positive relationship amongst trade openness, stock market, foreign direct investment, and economic growth. In the short run, the dynamics present among the variables change and vary in several cases.

Empirical Methodology

Background

The focus of the paper is to analyse the impact that trade openness has on the economic growth of a country. Over time, many economists have presented theories and argued that trade openness leads to economic growth, which ultimately leads to the overall development of the country. Walt Rostow, in the early 1960s, explained that to reach a certain level of economic growth, a country must go through various development stages. The Harrod-Domar economic growth model gave two important aspects that lead to economic growth.

According to them, the higher savings of a country and the higher capital-output ratio will yield a higher rate of economic growth of the country. The Lewis model in 1955, also known as the two-sector model, emphasised having structural changes in an economy. According to the model, countries should shift from low-labour productivity sectors to higher-labour productivity industrial sectors. A structural shift from agriculture to industrialisation will accumulate capital which would help the labour in increasing their productivity hence leading to a sustainable economic development scenario. Clark-Fisher model focused on developing a tertiary sector, that is, the service industry. The emergence of a large service sector with a productive labour force will act as an indicator of economic development and growth.

Building further on the Harrod-Domar growth model, Robert Solow gave the first neo-classical growth model – the Solow Growth model. This exogenous model postulated that the economic growth of a country depends upon changes in its savings rate, population growth rate, and its technological progress rate. The exogenous growth theory states that the economic growth of a country is influenced by external independent forces rather than internal forces that are interdependent. Here, technological innovation and enhancement has been considered as the main factor in determining the economic growth rate. In contrast, the Endogenous growth theory suggests that a country's economic development and growth depends upon its internal factors and not external forces. Accordingly, the theory states that the emphasis of a country's government should be on developing its internal infrastructure in terms of providing incentives and subsidies to various businesses, investment in research and development to foster innovation, striving for the development of human resources through education and training and development, and so on.

The empirical analysis by many researchers over the years has given differentiated results. Some state that the theoretical literature and the empirical results match and trade openness does lead to economic growth. On the other hand, many empirical studies state that the positive or negative impact of trade openness on economic growth depends upon certain factors and conditions, which also vary from country to country.

To examine the impact of trade openness on economic growth, data of nine ASEAN countries have been selected from 2008 to 2019. The data is gathered from *World Development Indicators, World Bank.* The data is analysed in two segments. First, an overall analysis of all countries has been conducted. In the second segment, the selected countries are divided into three categories, namely *Developed Countries* (Brunei Darussalam and Singapore), *Developing Countries* (Indonesia, Thailand, Malaysia, Philippines, and Vietnam), and *Least Developed Countries* (Myanmar and Cambodia). Due to the unavailability of data, Lao PDR has been excluded from the analysis, which is also the least developed country amongst the ASEAN countries.

Empirical Methodology and Model

Firstly, panel unit root tests such as Augmented-Dickey Fuller (ADF) test and Levin, Lin and Chu (LLC) test have been employed to find out the stationarity of the data. Further, after identifying the stochastic test, Pedroni Panel Co-integration test is used to understand the long-term relationship between several time-series and cross-sections of the data (Yucel

2009, Bajwa and Siddiqi 2011, Gries and Redlin 2012, Dristsakis and Stamatiou 2016, Pradhan, Arvin and Hall 2019) along with Kao Residual Cointegration Test.

Here, the variables used are:

Y – Gross Domestic Product (GDP at current US$)

opn – Trade Openness (calculated as the sum of total exports plus total imports divided by GDP at current US$)

gfcf – Gross Fixed Capital Formation (as a representative for investment at current US$)

The equation of the panel data (1) is written as follows:

$$Y_{i,t} = \beta_{0\,i,t} + y_{1i}\,opn_{i,t} + y_{2i}\,gfcf_{i,t} + y_{3i}\,lf_{i,t} + \varepsilon_{i,t} \quad (1)$$

i = 1 to 9 representing the number of countries

t = time period from 2008 – 2019

$\varepsilon_{i,t}$ = error term

β & y = are coefficients

Further, to estimate the long-run linkage between the select variables, Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) are employed (Tatoglu, 2011; Dritsaki, Dritsaki, 2014; Kirikkaleli, et al., 2018) and finally Dumitrescu Hurlin Panel Causality test has been applied to determine causality in the panel data (Zeren, Ari, 2013).

Hypotheses

Panel Unit Root Test:

H_o = There is a unit root for the series. The series is non-stationary.

H_1 = There is no unit root for the series. The series is stationary.

Panel Cointegration:

H_o = There is no cointegration across the time series and panels

H_1 = There is cointegration across the time series and panels

Results

Panel Unit Root Test – Augmented Dickey-Fuller test and Levin, Lin and Chu test:

The methodology is divided into two steps; in the first step, we examined the stationarity of variables using a unit root test by employing panel unit root tests like the Augmented Dickey-Fuller test and Levin, Lin and Chu test.

Table 1 displays the results of the panel unit root test whereby GDP, GFCF, and TO has been found stationary in the levels, whereas LF has been found stationary in the first difference. Thus it can be said that some of the variables are following the integration of order one, i.e., I(1) processes, but the other variables are having integration of order zero, i.e., I(0). Since some of the variables are having I (1) process, hence the series can be cointegrated.

Panel Cointegration Test:

(I) The result of the **Pedroni Cointegration Test** is given in Table 2:

There are seven statistics for the test of the null hypothesis of no cointegration (Table 2). We have chosen no deterministic and deterministic trend, in which it has been found that in a no-deterministic trend, only two statistics are showing cointegration in data, but when the deterministic trend is observed, five statistics are highlighting the presence of cointegration. Thus, the study shows the presence of cointegration for the group as a whole and within the panel of countries as well. Therefore, the alternative hypothesis is accepted, which states that there is cointegration present across time series and panels.

(II) Kao Residual Cointegration Test:

Kao residual cointegration test (Table 3) has also resulted in accordance with the Pedroni cointegration test. Hence, the alternative hypothesis is accepted in this case, too, which further confirms the presence of cointegration.

Panel FMOLS and DOLS Results:

Table 4 illustrates the results of Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) (Dristsaki and Dritsaki 2014 and Kirikkaleli, Sokri, Candemir and Ertugrul 2018). These tests are used to determine the long-run relationship between GDP, GFCF, LF, and TO. It has been found that except for LF; GFCF and TO are statistically significant and positive. This means that GFCF and TO have a long-run positive impact on the economic growth of select ASEAN countries. On the other hand, LF is found to be statistically insignificant in impacting economic growth. Since the study is using the overall labour force of the country, the effects seem to be insignificant.

Dumitrescu Hurlin Panel Causality Test Results:

The result of the Dumitrescu Hurlin Panel Causality test shown in table 5, are found to be consistent with the results of panel cointegration, FMOLS, and DOLS. According to table 6, all variables show a bi-directional causality relationship among each other except in two cases. Labor Force is found to have a unidirectional relationship with GDP, whereas it can be seen that the labour force has an impact on GDP, but GDP does not impact the labour force. Similarly, Trade Openness has a positive impact on GDP, but GDP does not have an impact on trade openness. Therefore, the null hypothesis is rejected in these two cases.

Conclusion

Trade openness leads to economic growth. A popular yet highly debatable topic amongst various researchers. The literature shows that generally, an increase in trade openness will

lead to an increase in economic growth. This will be backed by an increase in investments as well as a labour force. However, there are various expositions regarding the causality between trade openness and economic growth. Awokuse, 2008 and Yucel 2009 found that if the policy structure is more export-oriented and trade is liberalised with the reduction in tariffs, trade openness and economic growth result in a positive bi-directional relationship. Dao, 2014 added that a country's economy would grow at a faster pace if a country is more open to trade. Huchet, Mouel and Viji, 2018, Silajdzic and Mehic, 2018, and Pradhan, Arvin and Hall, 2019 further elaborate that trade openness is not the only factor that contributes to an increase in the economic growth of a country. With an emphasis on trade openness, the quality of the products and services provided, technology, skilled labour force, quality investments, and specialisation are required to successfully compete in the market.

This paper examined the impact of trade openness on the economic growth of select ASEAN countries from the period of 2008-2019. The dataset was collected from World Development Indicators, World Bank. The data were first analysed for its stationarity using panel unit root tests like Levin, Lin and Chu, and Augmented Dickey-Fuller Test. The result showed that GDP, GFCF, and TO were stationary at levels, whereas, LF was found to be stationary at first difference. As the data was found to be integrated of order one, i.e., I (1), the series was further cointegrated using the Pedroni panel cointegration test. Out of seven statistics for testing the null hypothesis of no cointegration, only two showed the presence of cointegration under no deterministic trend. When the deterministic trend was analysed for the same data set, five out of seven statistics confirmed the presence of cointegration. Therefore, the alternative hypothesis was accepted, stating that cointegration is present across time series and panels. This result was corroborated with the result of the Kao residual panel cointegration test accepting the alternative hypothesis at 0.0238 p-value. FMOLS and DOLS results showed that GFCF and TO are statistically significant and illustrate a long-run positive impact on the economic growth of ASEAN countries. LF, on the other hand was found to be statistically insignificant at p-values of 0.2354 (FMOLS) and 0.2116 (DOLS). Lastly, the Dumitrescu Hurlin panel causality test revealed a bi-directional causal relationship between all variables except in two cases. LF and TO were found to have a unidirectional relationship with the GDP.

The results of all the tests lead to the conclusion that trade openness has a positive long-run impact on the select ASEAN countries. It is further suggested that ASEAN is a mix of developed, developing, and least developed countries. With significant policy and infrastructure reorientation in the least developed nations of ASEAN, the economic growth can further be improved and the group as a whole can become highly competitive in the international markets. This will require meticulous economic and diplomatic engagement from all ASEAN countries with their trading partners. The benefits will lead to increased trade and investment, both within and outside the boundaries of ASEAN. Human Development Index, poverty incidence, and labour engagement have seen major improvements leading to immense business opportunities for ASEAN.

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ANNEXURE

Table 1

Panel Unit Root Results of nine select ASEAN countries

Variable	LLC	ADF-FC	LLC	ADF-FC
	LEVEL			
	Individual Intercept	Individual Intercept	Individual Intercept and Trend	Individual Intercept and Trend
GDP	-0.66722 (0.2523)	26.8311 (0.0822)	-6.95038 (0.0)	53.4870 (0.0)
GFCF	0.57955 (0.7189)	29.0391 (0.0479)	-6.10317 (0.0)	28.2125 (0.0589)
LF	-5.0689 (0.0)	21.8483 (0.2388)	-0.41346 (0.3396)	10.6698 (0.9078)
TO	-0.61669 (0.2687)	40.3966 (0.0019)	-7.5836 (0.0)	37.1203 (0.0051)
Variable	LLC	ADF-FC	LLC	ADF-FC
	FIRST DIFFERENCE			
	Individual Intercept	Individual Intercept	Individual Intercept and Trend	Individual Intercept and Trend
GDP	-4.5790 (0.0)	36.3247 (0.0064)	-0.98263 (0.1629)	23.5116 (0.1717)
GFCF	-2.0944 (0.0181)	20.8839 (0.2853)	-2.09012 (0.0183)	23.4196 (0.1750)
LF	-1.62893 (0.0517)	17.9233 (0.4607)	-3.26009 (0.0006)	26.208 (0.0993)
TO	-3.33983 (0.0004)	39.0730 (0.0028)	-2.1996 (0.0139)	25.3541 (0.1155)

Note: the parenthesised values denote the p-values. GDP = Gross Domestic Product, GFCF – Gross Fixed Capital Formation, LF – Labor Force, TO – Trade Openness.

Table 2

Pedroni Panel Cointegration test results for nine select ASEAN countries

Test Statistics	No Deterministic Trend				Deterministic Trend			
	Panel Cointegration Statistics (within-dimension)							
	Statistic	Probability	Weighted Statistic	Probability	Statistic	Probability	Weighted Statistic	Probability
Pavel v-Statistic	1.018926	0.1541	-0.842396	0.8002	0.067367	0.4731	-2.156811	0.9845
Panel rho-Statistic	0.560876	0.7126	1.821388	0.9657	2.395763	0.9917	2.910552	0.9982
Panel PP-Statistic	-1.034494	0.1505	-0.707545	0.2396	0.114879	0.5457	-1.807992	0.0353
Panel ADF-Statistic	-1.179918	0.1190	-2.386944	0.0085	-1.951729	0.0255	-2.614418	0.0045
	Panel Cointegration Statistics (between-dimension)							
	Statistic	Probability			Statistic	Probability		
Group rho-Statistic	2.947730	0.9984			3.911397	1.0000		
Group PP-Statistic	-0.688012	0.2457			-1.338907	0.0903		
Group ADF-Statistic	-1.801561	0.0358			-1.971731	0.0243		

Table 3

Kao Residual Panel Cointegration test results for nine select ASEAN countries

			t-Statistic	Prob.
ADF			-1.981707	0.0238

Table 4

Panel FMOLS and DOLS test results for nine select ASEAN countries

Dependent Variable: GDP			
Independent Variable		t – statistic	p-value
GFCF	*FMOLS*	11.80577	0.0000
	DOLS	8.647146	0.0000
LF	*FMOLS*	1.194736	0.2354
	DOLS	1.262691	0.2116
TO	*FMOLS*	6.761515	0.0000
	DOLS	3.589364	0.0007

Table 5

Dumitrescu Hurlin Panel Causality test results for nine select ASEAN countries

Null Hypothesis	W-Stat.	Zbar-Stat.	Probability
GFCF does not homogeneously cause GDP	15.5193	4.90476	9.E-07
GDP does not homogeneously cause GFCF	8.41098	2.04371	0.0410
LF does not homogeneously cause GDP	8.57222	2.10861	0.0350
GDP does not homogeneously cause LF	8.00711	1.88116	0.0600
TO does not homogeneously cause GDP	13.7744	4.20244	3.E-05
GDP does not homogeneously cause TO	4.72336	0.55948	0.5758
LF does not homogeneously cause GFCF	10.2846	2.79784	0.0051
GFCF does not homogeneously cause LF	13.6771	4.16328	3.E-05
TO does not homogeneously cause GFCF	9.77669	2.59340	0.0095
GFCF does not homogeneously cause TO	8.68379	2.15352	0.0313
TO does not homogeneously cause LF	9.72388	2.57214	0.0101
LF does not homogeneously cause TO	8.23088	1.97122	0.0487

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Anton A. Gerunov[1]

PERFORMANCE OF 109 MACHINE LEARNING ALGORITHMS ACROSS FIVE FORECASTING TASKS: EMPLOYEE BEHAVIOR MODELING, ONLINE COMMUNICATION, HOUSE PRICING, IT SUPPORT AND DEMAND PLANNING[2]

This article puts the problem of forecasting in economic and business situations under scrutiny. Starting from the premise that accurate forecasting is now a key capability for analyzing problems of business operations and public policy, we investigate the performance of alternative prediction methods that include both traditional econometric approaches as well as novel algorithms from the field of machine learning. The article tests a total of 109 different regression-type algorithms across five pertinent business domains – employee absenteeism, success of online communication, real estate asset pricing, support ticket processing, and demand forecasting. The results indicate that forecasting algorithms tend to produce a set of widely dispersed outcome, with some methods such as random forecast and neural network implementations being able to consistently generate superior performance. We further argue that forecast accuracy is not necessarily predicated upon computational complexity and thus, an optimization decision between the costs and benefits of using a certain algorithm can feasibly be made.
Keywords: forecasting; algorithms; random forest; neural network; regression; machine learning
JEL: C44; C45; C52; D81

I. Introduction

Forecasting economic and business variables of interest has always been a central problem for econometrics. Taking its origin from early attempts in demand planning, this task has now expanded to any conceivable field of application from macroeconomic and financial forecasting, through consumer choice modelling, and into operations research. Yet, the standard econometric toolkit has expanded only at a relatively slow pace, displaying a preoccupation with forecasting problems over time series. While this has produced many

[1] *Anton A. Gerunov, Ph.D., Dr.Econ.Sc., Associate Professor at the Faculty of Economics and Business Administration, Sofia University "St. Kliment Ohridski", e-mail: a.gerunov@feb.uni-sofia.bg.*
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meaningful results and applications, particularly in the field of macroeconomics, growth theory, and financial economics, the non-time series forecasting problems have largely had to contend with leveraging a limited set of standard instruments such as the linear regression and its variations within the general linear model (GLM). New developments in the field of machine learning promise to expand the variety of available forecasting methods that can be fruitfully applied to different business domains. This article thus attempts to test a wide set of 109 alternative methods (or algorithms) by applying them to five different economic problems and compare their forecast performance. A short overview of the forecasting literature follows in the second section, while the third one presents the application of the algorithms under study to five very different problems that call for a regression approach. The fourth section discusses the results, and the fifth one concludes.

II. Literature Review

The issues of accurately forecasting variables of economic interest are hardly novel. Numerous approaches have been proposed, ranging from very simple ones such as exponential smoothing to rather complex such as neural networks (Hyndman, Athanasopoulos, 2014; Friedman, et al., 2001). Due to the specific of each business situation, forecasting research has often focused on a particular application area such as energy (Hong et al., 2016; Debnath, Mourshed, 2018), customer demand (Ferreira et al., 2016, Schaer, et al., 2019), operations research (van der Laan et al., 2016; Whitt, Zhang, 2019), as well as the classic strand of forecasting macroeconomic variables such as the interest rate (Kunze et al., 2017; Hassani et al., 2021), growth (Christensen et al. 2018; Cronin, McQuinn, 2020), and financial market performance (Mei et al., 2017; Chiu et al., 2018).

While enlightening, research that leverages a single or a few forecasting algorithms can hardly serve as guidance to identifying the best available method in terms of forecasting accuracy. To overcome this problem, the discipline has moved towards either comparative research designs, or so-called forecasting competitions such as the M-competitions where different methods compete against each other. Among the former, we should note the large proliferation of comparative studies in diverse domains. For example, Lago et al. (2018) present a comparative study of 27 state-of-the-art methods for forecasting electricity prices, that include both traditional and more advanced ones. The authors (ibid.) find that machine learning methods show overall better results than traditional statistical ones, with the deep learning methods being the best performers. Alawadi et al. (2020) compare 36 alternative machine learning algorithms that can be used to forecast temperature in a smart building. Their (ibid.) research finds that the ExtraTree algorithm (member of the Classification and Regression Trees, CART, family) shows the best performance in terms of forecasting accuracy. Tyralis et al. (2020) investigate 10 machine learning algorithms for streamflow forecasting, finding that neural networks show the best individual performance. Overall, an ensemble algorithm of the methods under investigation (so-called super learner) outperforms individual methods. There are also some smaller scale comparisons such as those by Koller et al. (2019) with seven algorithms, Salotti et al. (2018) with ten algorithms, Shih and Rajendran (2019) with eight algorithms, and a few others.

Forecasting competitions are similar in philosophy but employ a different research strategy and design. While comparative papers select a single or several sources of data and a single team or researcher tests a limited selection of algorithms, the forecasting competitions provide a large but fixed number of databases and challenge participants to find the best forecasting algorithms, crowdsourcing solutions from a potentially very large number of researchers. One of the first major undertakings in this direction is work by Makridakis et al. (1979) in the late nineteen-seventies which seeks to compare the performance of different forecasting methods on 111 datasets (the M-competition).

This approach also underpins later editions of the M-competitions. In the M-2 Competition, Makrdidakis et al. (1982) present results for 1001 time series that are forecasting using a diverse number of predominantly statistical algorithms. The M-3 Competition significantly expanded the sample of time series, bringing the total number of datasets to 3003 (Makridakis et al., 2000). The M-3 competition finds that while most complex methods do not necessarily produce the best forecasting performance, they still present a significant performance improvement over naïve. Those results validate results from other empirical work as well.

Most recently, Makridakis et al. (2020) published the results from the fourth wave of the M-competitions. This is the largest one to date, testing 61 alternative forecasting methods on over 100,000 different time series. Among the most important findings from M-4 are that the best six methods are significantly better than the others and that more complex methods (including ensembles of methods) have the potential to achieve higher predictive accuracy. The series of M-competitions provides a rigorous and robust evaluation on time series approaches but gives only limited insight about what methods to use in other situations where projections are potentially needed.

III. Methodology and Data

1. Business Domains under Study

The endeavour to pick out the most accurate algorithms for forecasting tasks is a multi-faceted problem. On the one hand, it must ensure that a relatively large number of algorithms are rigorously tested to give sufficient representativeness to the results, and on the other, it must not be constrained to a specific type of problem. In particular, time series analysis is amply researched, with the M-4 competition probably being the most recent comprehensive overview of time series forecasting methods (Makridakis et al., 2020). A novel contribution complementing the conclusions therein must focus on pertinent problems of forecasting of non-time series nature and apply a wide range of advanced methods to solve them.

Thus, this article selects five different forecasting tasks across diverse business domains that can be used as a testing ground. These situations are captured in five specific datasets and some initial work is done by the data creators and curators. This research aims to deepen and expand it to reach a set of novel conclusions with both scientific and practical value. Those five decision domains are as follows. First, we take up a task from operational research and model excessive workplace absenteeism using data from Martiniano et al. (2012), trying to project the hours that a given employee will be absent from his or her job leveraging a set of

individual and firm-level explanatory variables. The second situation is a typical problem from digital marketing whereby the analyst must determine what types of online news and communication will be of most interest to a target audience. The challenge here is thus to forecast the number of shares of specific pieces of content, leveraging data from Fernandes et al. (2015).

The third problem is about the valuation of assets with a particular focus on real estate. Given the characteristics of a given unit of real estate, organizations are often interested to evaluate what its actual market price can be in order to facilitate their asset management processes. Again, the challenge here is to forecast the exact price given a dataset of property deals and a number of individual-level estate characteristics (Yeh, Hsu, 2018). The fourth problem under study here is a classic demand forecasting problem. Sharp rises and falls in market demand pose problems for any organization to assign resources and cope adequately. The focus in this situation lies on a logistics company and the volatility of its orders, using data provided by Ferreira et al. (2016). The final business problem under study is how to improve customer support by forecasting the length of the support operation (or open ticket), and use this forecast to minimize it. This is investigated via the dataset provided by Amaral et al. (2018). Table 1 summarizes all situations and sources of data.

Table 1

Types of Forecasting Problems and Data Sources

#	Business Situation	Data Source
1	Excessive absences from work	Martiniano, et al., 2012
2	Online communication	Fernandes, et al., 2015
3	Valuation of asset prices (real estate)	Yeh, Hsu, 2018
4	Sharp changes in market demand	Ferreira, et al., 2016
5	Support ticket processing	Amaral, et al., 2018

The diverse sets of business situations and the associated datasets provide for a wide scope of testing and ensure that the results obtained are sufficiently generalizable to be of use for both academics and practitioners. All the data sets are treated as individual-level data, thus abstracting from their time-series dimensions. This is done as the observations are independent of each other and we only expect a very weak correlation among those. Whenever a time dimensions may be relevant to the forecasting problem (e.g. day of the week for absences or holidays for demand), this is included as a separate explanatory variable.

2. Statistical and Machine Learning Algorithms

Ensuring results generalizability also entails the testing of a wide range of alternative statistical algorithms, some of them hailing from traditional econometrics, and some – from adjacent fields such as machine learning. There is a wide variety of such methods, most of which have not been formally tested on economic problems but for the most common ones such as variants of the linear models family (e.g. the multiple linear regression), support vector machines (SVM), classification and regression trees (CART) and random ensemble

forest (RF) models, clustering (e.g. the k-Nearest Neighbors), as well as the ascendant class of neural network models. This research selects practically all regression methods applicable for the aforementioned types of problems, reaching a total of 109 algorithms, and tests them formally. The environment of choice is the R programming language and its packages (see Kuhn, 2008), and thus the R implementations of the selected methods. Table 2 summarizes the algorithms under study.

Table 2

Regression Algorithms Used for Forecasting

#	Method Name	R Implementation	#	Method Name	R Implementation
1	Model Averaged Neural Network	avNNet	56	Multi-Layer Perceptron, multiple layers	mlpWeight DecayML
2	Bagged MARS	bagEarth	57	Monotone Multi-Layer Perceptron Neural Network	monmlp
3	Bagged MARS using gCV Pruning	bagEarthGCV	58	Multi-Step Adaptive MCP-Net	msaenet
4	Bayesian Additive Regression Trees	bartMachine	59	Neural Network	neuralnet
5	Bayesian Generalized Linear Model	bayesglm	60	Neural Network	nnet
6	Boosted Tree	blackboost	61	Non-Negative Least Squares	nnls
7	The Bayesian lasso	blasso	62	Tree-Based Ensembles	nodeHarvest
8	Bayesian Ridge Regression (Averaged)	blassoAveraged	63	Non-Informative Model	null
9	Bayesian Ridge Regression	bridge	64	Parallel Random Forest	parRF
10	Bayesian Regularized Neural Networks	brnn	65	Neural Networks with Feature Extraction	pcaNNet
11	Boosted Linear Model	BstLm	66	Principal Component Analysis	pcr
12	Boosted Tree	bstTree	67	Penalized Linear Regression	penalized
13	Conditional Inference Random Forest	cforest	68	Partial Least Squares	pls
14	Conditional Inference Tree	ctree	69	Partial Least Squares Generalized Linear Models	plsRglm
15	Conditional Inference Tree	ctree2	70	Projection Pursuit Regression	ppr
16	Cubist	cubist	71	Quantile Random Forest	qrf
17	Stacked AutoEncoder Deep Neural Network	dnn	72	Quantile Regression Neural Network	qrnn
18	Multivariate Adaptive Regression Spline	earth	73	Ensembles of Generalized Linear Models	randomGLM
19	Elasticnet	enet	74	Random Forest	ranger
20	Tree Models from Genetic Algorithms	evtree	75	Radial Basis Function Network	rbfDDA
21	Random Forest by Randomization	extraTrees	76	Relaxed Lasso	relaxo
22	Ridge Regression with Variable Selection	foba	77	Random Forest	rf
23	Generalized Additive Model using LOESS	gamLoess	78	Random Forest Rule-Based Model	rfRules
24	Generalized Additive Model using Splines	gamSpline	79	Ridge Regression	ridge
25	Gaussian Process	gaussprLinear	80	Robust Linear Model	rlm
26	Gaussian Process with Polynomial Kernel	gaussprPoly	81	CART	rpart

#	Method Name	R Implementation	#	Method Name	R Implementation
27	Gaussian Process with Radial Basis Kernel	gaussprRadial	82	CART	rpart1SE
28	Stochastic Gradient Boosting	gbm	83	CART	rpart2
29	Multivariate Adaptive Regression Splines	gcvEarth	84	Quantile Regression with LASSO penalty	rqlasso
30	Fuzzy Rules via MOGUL	GFS.FR.MOGUL	85	Non-Convex Penalized Quantile Regression	rqnc
31	Generalized Linear Model	glm	86	Regularized Random Forest	RRF
32	Negative Binomial Generalized Linear Model	glm.nb	87	Regularized Random Forest	RRFglobal
33	Boosted Generalized Linear Model	glmboost	88	Relevance Vector Machines with Linear Kernel	rvmLinear
34	Elastic Net	glmnet	89	Relevance Vector Machines with Polynomial Kernel	rvmPoly
35	Generalized Linear Model with Stepwise Selection	glmStepAIC	90	Relevance Vector Machines with Radial Basis Function Kernel	rvmRadial
36	Hybrid Neural Fuzzy Inference System	HYFIS	91	Subtractive Clustering and Fuzzy c-Means Rules	SBC
37	Independent Component Regression	icr	92	Partial Least Squares	simpls
38	Partial Least Squares	kernelpls	93	Spike and Slab Regression	spikeslab
39	k-Nearest Neighbors	kknn	94	Sparse Partial Least Squares	spls
40	k-Nearest Neighbors	knn	95	Supervised Principal Component Analysis	superpc
41	Polynomial Kernel Regularized Least Squares	krlsPoly	96	Support Vector Machines with Linear Kernel	svmLinear
42	Radial Basis Function Kernel Regularized Least Squares	krlsRadial	97	Support Vector Machines with Linear Kernel	svmLinear2
43	Least Angle Regression	lars	98	L2 Regularized Support Vector Machine (dual) with Linear Kernel	svmLinear3
44	Least Angle Regression	lars2	99	Support Vector Machines with Polynomial Kernel	svmPoly
45	The lasso	lasso	100	Support Vector Machines with Radial Basis Function Kernel	svmRadial
46	Linear Regression with Backwards Selection	leapBackward	101	Support Vector Machines with Radial Basis Function Kernel	svmRadialCost
47	Linear Regression with Forward Selection	leapForward	102	Support Vector Machines with Radial Basis Function Kernel	svmRadialSigma
48	Linear Regression with Stepwise Selection	leapSeq	103	Bagged CART	treebag
49	Linear Regression	lm	104	Partial Least Squares	widekernelpls
50	Linear Regression with Stepwise Selection	lmStepAIC	105	Wang and Mendel Fuzzy Rules	WM
51	Model Tree	M5	106	eXtreme Gradient Boosting	xgbDART
52	Model Rules	M5Rules	107	eXtreme Gradient Boosting	xgbLinear
53	Multi-Layer Perceptron	mlp	108	eXtreme Gradient Boosting	xgbTree
54	Multi-Layer Perceptron, with multiple layers	mlpML	109	Self-Organizing Maps	xyf
55	Multi-Layer Perceptron	mlpWeightDecay			

It should be kept in mind that some implementations under R may be less efficient than implementations under other languages. To ensure comparability of calculation times, we opt for testing only methods implemented under this statistical programming language that can be accessed via a unified interface package (ibid.).

3. Forecasting Accuracy Metrics

A key strand of research has also focused on what criteria should be used to evaluate forecasting results. There is a wide range of indicators and metrics in the scientific literature for the accuracy of a prediction, and we can summarize four main groups of predictive error measures (Hyndman, 2006; Shcherbakov et al., 2013):

- **Measures that depend on the scale of measurement** – they take into account the difference between the estimated and the realized value reported against the scale of measurement. Examples of such measures are average absolute error or mean absolute deviation;
- **Measures taking into account the percentage deviation** – they do not factor in the scale of measurement, as they take into account the difference between the forecast and the realized value in percentages. For some of them, this can be in absolute value. An example is the average absolute percentage error;
- **Relative error measures** – they compare the average errors of a given test method with the errors of a naive forecasting approach. An example of such a measure is the mean scaled error;
- **Measures that are independent of the scale of measurement** – they express each forecast error in relation to the average error of a basic (naive) approach. Similar is the mean absolute scaled error.

Among the more popular forecast error measures, we will consider the mean error, root mean squared error, mean absolute error, mean absolute error, mean percentage error, mean absolute percentage error, and mean absolute scaled error. With ε_i we denote the error of the i-th observation, this error being equal to the difference between the forecast f_i^m realized observation y_i, or:

$$\varepsilon_i = y_i - f_i^m \tag{1}$$

Mean Error (ME) is thus a measure of the average difference between the forecasted and the actual values. It is defined as follows:

$$ME = \frac{1}{n}\sum_{i=1}^{n} \varepsilon_i \tag{2}$$

This measure is not particularly appropriate as it averages both positive and negative deviations, thus cancelling out some of the variability. Therefore, the average error usually overestimates the predictive accuracy. To address this problem, either the squared error or the absolute error may be considered. Following this logic, we can calculate the following

two measures. The root mean squared error (RMSE) looks at the averaged squares of the errors generated and allows one to obtain a measure on the same scale as the original variables. It is defined as follows:

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\varepsilon_i)^2} \quad (3)$$

Among the measures that use absolute values, it is worth mentioning the mean absolute error (MAE), defined as follows:

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|\varepsilon_i| \quad (4)$$

The error rate can also be presented as proportion or percentage, as it is in the mean percentage error (MPE) and the mean absolute percentage error (MAPE). To calculate them, we define the percentage error of a forecast, p_i as:

$$p_i = \frac{(y_i - f_i^m)}{y_i} \quad (5)$$

The mean percentage error takes into account what is the mathematical expectation of the forecast error, expressed as a percentage, and is defined as follows:

$$MPE = \frac{1}{n}\sum_{i=1}^{n} 100 * p_i \quad (6)$$

Similarly, we also define the average absolute percentage error, using the absolute value of the percentage deviations:

$$MAPE = \frac{1}{n}\sum_{i=1}^{n} 100 * |p_i| \quad (7)$$

The latter two metrics may be problematic in cases when the realized value y_i is equal to zero. On those occasions, the fraction is not defined and the metric cannot be calculated. Apart from these presented measures, there are many others that are popular in the scientific literature and provide different perspectives on the predictive accuracy of a model, such as the mean scaled error, MSE, or the mean absolute scaled error, MASE (Shcherbakov et al., 2013; Prestwich et al., 2014; Mathai et al., 2016). The great challenge in assessing the forecasting accuracy of a forecasting model lies in judging which is the optimal measure for a given type of data in a given situation and for specific research goals. To facilitate comparison of the results presented here, we report the values of three separate forecasting accuracy metrics – the mean error (ME), the root mean squared error (RMSE) and the mean absolute error (MAE). The MPE and the MAPE are omitted as they are undefined in some cases.

4. Research Design

The five data sets are tested sequentially with each of the 109 alternative algorithms applied to them. Each of the sets is divided into two samples – a training set and a test set. The training set consists of 80% of the full dataset and is used for the initial estimation of the model. The test set comprises the remaining 20% and is used for comparing different algorithms. The idea behind this split is to minimize the risk of overfitting to the initial training data and only compare algorithm results based on unfamiliar data. To achieve this, once the model parameters are estimated on the training data, this model is used to forecast a target-dependent variable in the test data, and accuracy metrics are calculated. We report the Mean Error (ME), Root Mean Squared Error (RMSE), and the Mean Absolute Error (MAE). The Mean Percentage Error (MPE) and the Mean Absolute Percentage Error (MAPE) are also appropriate metrics, but in some of the situations, these cannot be calculated as the forecast value goes to zero, thus making the fraction undefined. Therefore, MPE and MAPE are not reported. Usually, accuracy metrics tend to be higher in the training set due to overfitting, and somewhat lower on the test set, which is why only accuracy metrics on the test set are reported.

In addition to accuracy metrics, the program for comparison measures the time needed for model training as a proxy for the computational resources required. The time is standardized with the most resource-intensive algorithm given a value of 100% and the rest – presented as fractions of this. This is how the complexity metric is defined – if a given algorithm has a complexity metric of 5%, this means that it is 20 times faster than the slowest algorithm under study. This additional metric allows one to quantitatively measure the tradeoff between costs of forecast (i.e. the time or resources needed to make it) and its benefits (as measured by accuracy). The introduction of some measure of the cost of forecasting allows the researcher to make an informed optimization decision of what method to use and the practitioner – to appropriately size the necessary infrastructure during operations. These considerations are relatively unimportant when dealing with a small dataset of fewer than 10,000 observations but become increasingly prominent as sizeable datasets (so-called “big data”) are analyzed to generate real-time forecasts on the order of millions or billions of observations. The general trend of economics to leverage ever-larger datasets, particularly for microeconomic problems, necessitates the introduction of additional considerations about the methods used and their computational efficiency.

IV. Results

This section provides a brief overview of the five economic situations under study and the application of all 109 algorithms to each of them. It should be noted that in each one, the value of forecasting lies in the organization’s ability to successfully embed it within its decision-making processes and its operational procedures. Furthermore, the accuracy of the forecast generates more value at large scales – even a small benefit applied over millions of transactions can significantly impact business operations. Thus, the proposed more complicated algorithms will be particularly useful in problems where a large number of

transactions are being processed and are thus of greater interest to problems in microeconomics rather than to macroeconomic issues.

1. Workplace Absenteeism

Excessive absence from the workplace of key employees is one of the classic operational risks faced by the modern organization. This can be either a physical absence at a standard localized office or a refusal to perform work duties with virtual teams. The absence or incapacity of employees can lead to delays in processes, inability to complete operations in a timely manner, problems with management and transfer of organizational knowledge and reduced motivation of other employees in the team. All these effects are adverse and can lead to a general deterioration of the internal environment, lost profits and realized costs and losses for the organization. In this sense, it is essential to model the risk of absence from work and to take action to minimize it by improving motivation, facilitating employees and assisting them in their family and social duties.

Adequately modelling this phenomenon enables adequate measures that can address and minimize its adverse consequences. Absence from work is an indicator that is strongly correlated with a number of behavioural and situational characteristics of employees and is often a leading indicator of change in employee attitudes, including loyalty to the organization (Hassink, 2018). In this sense, management faces two main tasks in managing the risk of absence. The first is to provide the necessary staff to maintain the duration of the processes in the short term, for which the absent hours should be forecasted and managed. The second is to maintain high motivation in the medium term, and here the absence is rather an indicator of the attitude of employees. Thus, predicting absences at the individual level helps to identify potential intervention points.

To address this business problem, we use data from Martiniano et al. (2012), which describe the hours of absence of employees of a Brazilian courier company for the period from July 2007 to July 2010, as well as a wide range of other characteristics. The total number of observations in this database is 740. It contains data on the reasons for absence, time, situational characteristics (distance from work to workplace, workload), performance of work (fulfilment of objectives, disciplinary proceedings), as well as individual characteristics (age, education, height, weight, number of children, etc.) of the employees. The target variable of the task is the number of hours of absence of each employee, recorded as y. Martiniano et al. (2012) used these data to demonstrate the capabilities of a fuzzy neural network model to predict hours of absence, obtaining satisfactory results.

Building upon this, we evaluate the 106 alternative algorithms on the data under consideration, presenting their predictive accuracy, measured by the root of the root mean square error, in Figure 1. We note a significant group of algorithms with predictive accuracy in the vicinity of RMSE = 13, with almost all the alternatives considered having a root mean square errors for this task in the range from RMSE = 12 to RMSE = 14. The best algorithms register RMSE around 12, but there are a few with a particularly weak representation where RMSE > 15. While almost all algorithms produce satisfactory results, the difference between best and average ones is relatively small. The key consideration, in this case, is to avoid using

any of the particularly weak methods, since their results register significantly higher error rates than the average ones.

Figure 1

Histogram of forecast accuracy for workplace absenteeism data

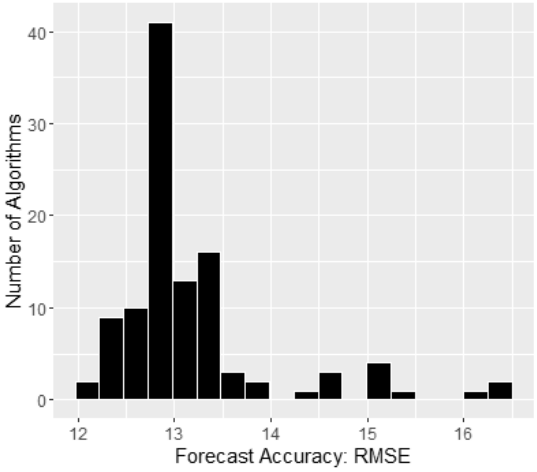


Table 1

Forecast accuracy of the top ten algorithms for workplace absenteeism data

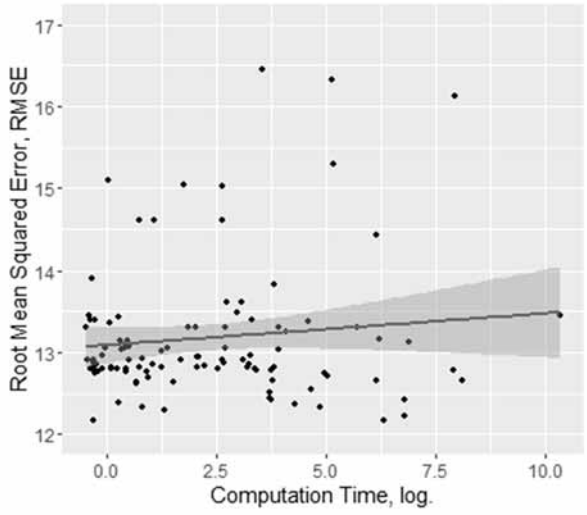
Algorithm	Method	Mean Error, ME	Root Mean Squared Error, RMSE	Mean Absolute Error, MAE	Complexity Measure
CART	rpart2	0.621	12.172	5.376	0.1%
eXtreme Gradient Boosting	xgbDART	0.043	12.174	5.459	1.8%
Random Forest by Randomization	extraTrees	-0.314	12.229	5.418	2.9%
Gaussian Process with Radial Basis Function Kernel	gausspr Radial	0.054	12.287	5.573	0.7%
Bagged CART	treebag	0.205	12.325	5.459	0.4%
Regularized Random Forest	RRFglobal	-0.603	12.330	5.724	0.4%
Conditional Inference Random Forest	cforest	-0.141	12.371	5.581	14.5%
Conditional Inference Tree	ctree	0.798	12.381	5.387	0.3%
Regularized Random Forest	RRF	-0.587	12.424	5.792	2.9%
Random Forest	rf	-0.500	12.430	5.688	8.5%

The methods with the lowest forecast errors are presented in Table 1. We immediately notice that six of the top ten methods are different implementations of the random forest family. The best predictive accuracy is found in a version of the classification and regression trees methods (rpart) with a root mean square error of 12.17 and an average error of 0.62, followed by an algorithm for extreme gradient boosting (xgbDART) with RMSE=12.17 and ME=0.04, respectively.

We note the extremely small difference in predictive accuracy between the top ten methods – it ranges from RMSE=12.17 to RMSE=12.43, which highlights the possibility of choosing a method among this already narrow set based on other considerations – e.g. the required computational resources, organizational experience and other business considerations, interpretability of results and integrate with other systems, etc. From the point of view of the resources used, we recognize that none of the top ten algorithms is particularly demanding from a computational perspective.

Figure 2

Link between forecast accuracy and computation time for workplace absenteeism data



The best method is 1,000 times faster than the slowest alternative and has a computation time commensurate with the multidimensional linear regression. These results are partly due to the popularity of the random forests, which leads to a large number of implementations that are highly optimal in terms of computation time and resources required. Those results can be leveraged by the modern organization to improve staff selection processes and ensure that unexpected drops in productivity due to absenteeism do not threaten business continuity.

2. Online News Sharing

The communication of an organization with its employees, customers, shareholders, regulators and other stakeholders has always been a key management process and an important component of operations to achieve the desired strategic goals. Historically, this communication has been subject to increasing automation, with technological innovation being an important driver of improving the flow of information and knowledge within and outside the structure. Digital transformation brings new channels of communication, and in some of them technological developments fundamentally change the needs of the management process. An example of this is social networks, where there is not a unilateral dissemination of information, but joint creation and active sharing, as organizations are

exposed to a number of network and external effects of their actions. A major issue of communication operations is the extent to which a given information reaches the widest possible range of its identified recipients, and in the context of digital online communication, this is mainly a function of its sharing between different users. In this sense, an important part of the communication operations on the Internet of the modern organization consists in identifying the engines of distribution among users and the drivers of information utilization.

Given the specifics of communication operations, we define the main business problem as the need to identify the factors that make it lead to a high level of popularity of an online material and their use in organizational activities. To this end, it is important to model the engines of high distribution and to use them to the maximum extent to optimize publicity activities on the Internet. The purpose of this management process is to minimize the likelihood of failed communication, thereby reducing the unnecessary waste of resources in this activity. In an online environment, a natural and widely available measure of the reach of reached users is the number of shares of a material. Modern social networks allow users to easily share text, sound, picture or video, which not only evaluates the material, but also becomes channels for the distribution of shared messages. In this sense, the business goal is to ensure the highest possible number of shares of the organization's digital communication.

For this purpose, we use the data provided by Fernandes et al. (2015), which presents structured data on 39,797 news items published on the popular online portal Mashable. The authors (ibid.) have applied methods for analysis in natural language on the text of the provided news and have extracted basic quantitative characteristics of each of the texts, including variables such as word count, hyperlinks to different sources, emotional charge, mood polarization, publication category, day of the week, etc. The total number of provided characteristics is 60. In addition, a variable is available, which takes into account the number of shares of the given article on social networks, which we determine for the target variable of the present task. Fernandes et al. (2015) use this data to demonstrate the operation of a highly automated decision support system (expert system). They also test five different forecasting algorithms, finding that a random forest model led to the best results. Building on their work, we expand the scope of forecasting methods here (adding an additional 104) and show how this approach can be effectively used to identify and assess operational risks.

The target variable is forecasted using over 100 alternative algorithms, with the distribution of their predictive accuracy (RMSE) plotted in Figure 2. The vast majority of the tested algorithms have very good predictive accuracy from RMSE <11,000. We observe a notably shifted distribution, with a large number of approaches generating close to optimal results and a smaller number of algorithms with much lower performance.

The ten approaches with the highest predictive accuracy are presented in Table 2. It is noteworthy that six of them represent different implementations of the random forest method. The best algorithm, in this case, is the *ranger*, which is a highly optimized application of random forest that achieves comparable predictive accuracy at very low computational resource consumption. Its root mean squared error is only RMSE = 10,514, and the other ten algorithms score in close vicinity to this result.

Figure 3

Histogram of forecast accuracy for online news sharing data

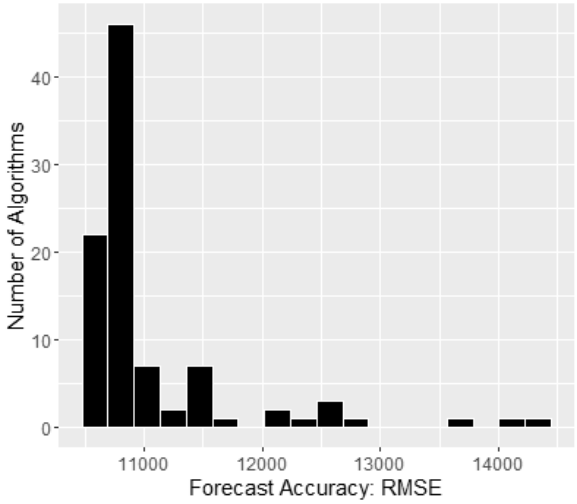


Table 2

Forecast accuracy of the top ten algorithms for online news sharing data

Algorithm	Method	Mean Error, ME	Root Mean Squared Error, RMSE	Mean Absolute Error, MAE	Complexity Measure
Random Forest	ranger	384.52	10514.60	3566.87	0.35%
Regularized Random Forest	RRF	247.73	10532.25	3630.94	9.92%
Regularized Random Forest	RRFglobal	231.90	10533.87	3633.60	1.46%
Random Forest	rf	213.69	10573.80	3662.55	0.52%
Random Forest by Randomization	extraTrees	209.17	10584.73	3639.87	3.33%
Gaussian Process with Radial Basis Function Kernel	gausssprPoly	311.21	10636.78	3703.16	1.42%
Bayesian Ridge Regression	bridge	349.77	10651.67	3637.69	0.30%
Conditional Inference Tree	cforest	366.84	10656.54	3646.23	0.68%
glmnet	glmnet	370.03	10657.97	3607.08	0.00%
Lasso Regression	lasso	369.31	10659.49	3608.71	0.01%

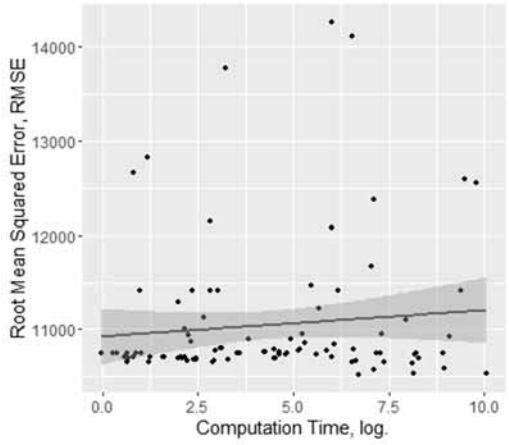
In addition to the random forest calculation methods, we also observe the Gaussian process, Bayesian and lasso regression algorithms, as well as the generalized linear model. From the point of view of all calculated measures of predictive accuracy, the presented top ten algorithms are difficult to distinguish and the choice of the optimal one can be made on the basis of a suitable resource or organizational criterion.

For this purpose, the measure of complexity can be used as an approximation of the resource needs of the given algorithm. With the exception of the regularized random forest, all other algorithms are relatively fast, with *ranger* being 300 times faster than the slowest alternative

considered. In this sense, it is an appropriate choice for a regression algorithm to solve similar forecasting problems. Since ensuring effective communication is now a key capability for businesses, public and non-governmental organizations, the ability to model and predict outreach is an important skill. Leveragin an advanced algorithm such as those presented here enable its users to improve both reach and engagement and thus ensure better results in their public relations and internal communications efforts.

Figure 4

Link between forecast accuracy and computation time for online news sharing data



3. Housing Prices

In addition to the usual business processes of production, supply and maintenance, a number of organizations also have activities for the acquisition and management of tangible fixed assets, including real estate. A key problem in the acquisition and management of the real estate is the determination of the correct price of the property. In standard practice, this often happens with the help of a dedicated expert appraiser, who combines objective market data with subjective judgment and adjustments so as to arrive at a definitive assessment. The main problem with this approach is that it largely depends on human judgment, which makes it relatively expensive, slow and more difficult to scale. These factors require relatively rare or even one-off property valuations, although a dynamic market environment often suggests significant dynamics.

In this sense, it is important to improve the process of real-time assessment and forecasting of the value of a property, which will allow its rational management and the unlocking of maximum business values in operations with it. Such a task is of interest both to organizations involved in the purchase and sale of real estate (construction companies, brokers, etc.) and to organizations involved in the financing and securitization of transactions (banks, non-bank credit institutions, funds, etc.).

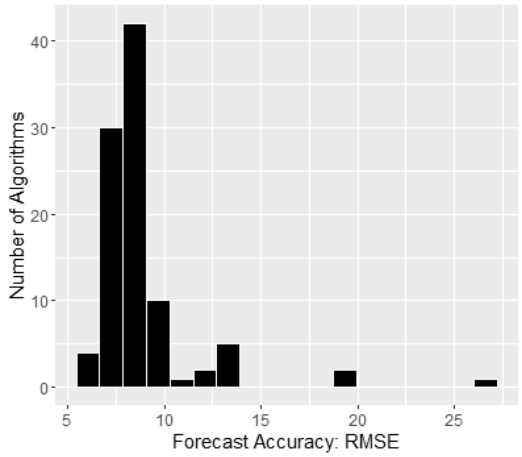
The main business problem is the need to determine and regularly update the correct price of a property, so that the organization can assess the effectiveness of potential disposal

transactions with it (purchase, sale, rental, etc.), as well as to predict future price dynamics in order to minimize the risk of unexpected losses due to unfavourable trends in the real estate market. To tackle this task, we use data provided by Yeh & Hsu (2018). They (ibid.) compared a proposed new approach which they refer to as the comparative quantitative approach with four other alternatives – two hedonic pricing approaches, a multidimensional linear regression algorithm and a neural network model. Yeh and Hsu (2018) show the superiority of this comparative quantitative approach over the investigated alternatives. This study is a useful first step, but we recognize the need to expand the set of potential predictive algorithms and investigate their accuracy.

The database itself consists of 414 observations of real estate transactions in Taipei (Taiwan) against seven different characteristics - date, years of construction of the building, distance to the subway station, number of nearby shops, geographical coordinates (latitude and longitude), unit price area. For convenience in modelling, we divide the date into two components – year and sequence of the transaction within the calendar year (combination of day and month). The target variable is the unit price, and by its nature, it is a continuous numerical variable, whose prediction is of significant business interest. On the basis of real estate data, 106 alternative models from the field of machine learning are evaluated, and their predictive accuracy is investigated through their forecast errors. A histogram of the predictive accuracy as measured by the root mean square errors is presented in Figure 3. It is striking that the vast majority of methods have a realization of RMSE in the range of 7 to about 9. The best algorithms among the subjects have a predictive accuracy of RMSE <6.5. and those with the worst results can reach RMSE values of over 25. It is noteworthy that we notice a significant grouping around the average accuracy, but a few algorithms show extremely weak performance. Few algorithms have a slightly better performance than the average one. In this sense, there is potential business value in testing and selecting the best ones, even if this only allows one to avoid the very worst performers.

Figure 5

Histogram of forecast accuracy for housing prices data



The ten approaches with the lowest root mean squared error are presented in Table 3. It is immediately apparent that seven of them are different applications of the random forest family. They all report extremely good forecasting accuracy, with the root of the squared error of the predictions being in the range of RMSE = 6.46 to RMSE = 7.10. The other three non-random forest algorithms are 2 based on a kernel function and one based on a Gaussian process, whose predictive accuracy is about RMSE = 7.10.

Table 3

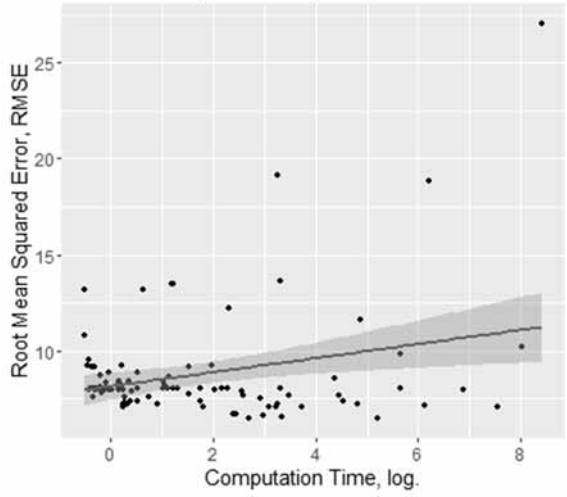
Forecast accuracy of the top ten algorithms for housing prices data

Algorithm	Method	Mean Error, ME	Root Mean Squared Error, RMSE	Mean Absolute Error, MAE	Complexity Measure
Regularized Random Forest	RRF	-0.750	6.459	4.831	64.8%
Quantile Random Forest	qrf	0.001	6.470	4.695	5.2%
Regularized Random Forest	RRFglobal	-0.832	6.568	4.890	9.9%
Random Forest	ranger	-0.878	6.600	4.884	7.0%
Parallel Random Forest	parRF	-0.936	6.689	4.965	3.8%
Random Forest	ranger	-0.943	6.689	4.908	4.0%
Radial Basis Function Kernel Regularized Least Squares	krlsRadial	-0.435	7.068	5.388	14.8%
Bayesian Additive Regression Trees	bartMachine	-0.795	7.076	5.353	11.1%
Random Forest by Randomization	extraTrees	-0.948	7.081	5.137	7.8%
Gaussian Process with Polynomial Kernel	gaussprPoly	-0.501	7.082	5.443	2.1%

The measure of complexity, accounting for the proportional computation time with respect to the most resource-intensive algorithm, also varies within very wide limits. The best method – that of the regularized random forest is only 35% faster than the slowest in the sample.

Figure 6

Link between forecast accuracy and computation time for housing prices data



On the other hand, the second best – the quantile random forest – is nearly 20 times faster than the most resource-intensive, and the difference in predictive accuracy between the two is almost imperceptible. This underlines that even with this type of task, it is possible to find the optimal point between the benefits and the costs of calculating given algorithms. Moreover, the calculation speed of the algorithm underlines the possibility of switching from asynchronous to synchronous operations, i.e. from model calculations and their subsequent use and future updates to real-time analytics that are used and trained simultaneously. On the more practical side, this level of accuracy provides encouraging implications for asset management. It enables organizations to generate up-to-date estimates of the actual value of immobile assets and thus make business decisions on their maintenance and disposal. On the flip-side, it enables individual owners and buyers to get a close approximation of the actual housing prices, thus decreasing the information asymmetry in the housing market.

4. Support Ticket Processing

Within the normal activities of the organization, problems and disturbances sometimes arise, which affect the end customers of its services - both internal and external. For their most effective removal as a good business practice, it is necessary to introduce a system for registration and processing of complaints by users of the service. The effectiveness of this system is essential both in terms of financial resources and as a source of knowledge about the constant evolutionary learning of modern organizations. The incident processing system is a direct link between the organization and the market and the various stakeholders using its products and services. In addition to being a source of information, effective incident processing is important in terms of providing a good level of service, maintaining the organizational reputation and caring for customer loyalty, all of which have potentially direct effects on the financial results of the structure. In this sense, the fast and efficient processing of signals from customers is a key competence for the modern organization and an important part of its usual operations.

The key business task in the processing of incident tickets by customers is ensuring a quick and efficient processing that ultimately leads to a cost-effective solution of the consumer problem. So one of the main indicators to be monitored is the time required from registration to closing of the given incident ticket, avoiding excessively long signal processing before reaching a satisfactory resolution. To this end, it is necessary to identify the main drivers of the potential delay, allowing it to be minimized. In addition, it is important to be able to automatically assess whether a signal is at risk of excessive delay, so as to direct organizational resources and attention to it. Therefore, the target variable for the forecast is the time required to process a given incident ticket.

To investigate this task, we use data from an incident processing information system provided by Amaral et al. (2018). The data contains standard information, including identification numbers of incidents, responsible employees, processors, the request itself, and more. In essence, the information also includes a wide range of characteristics of the incidents themselves – the status of the incident, activity, number of assignments and reopens, reporting channel, symptoms and logical location, the presence of an error message and so

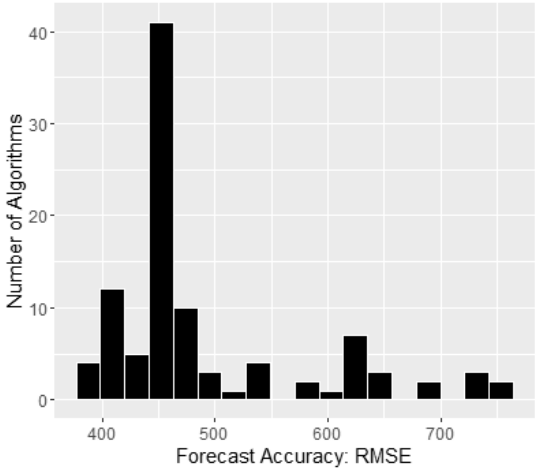
on. Estimates of the severity of the problem are also available – those include effect strength, urgency, priority, double priority check, as well as completion characteristics – date and time, termination code, identifier of the terminating employee. The number of characteristics in the original data set is 36, and the observations are 141,712 in total.

Amaral et al. (2018) focus their work on selecting the appropriate characteristics to include in the forecasting model, leveraging annotated transition systems. They employ three experiments with different selection approaches, finding that peer reviews are better than some, but not all, automated approaches. The authors derive this conclusion using the mean absolute percentage error (MAPE) to measure forecast accuracy, but do not report other metrics for forecast accuracy. We build on the results in this article (ibid.) regarding the choice of characteristics to be included in the model and present a wide range of alternative forecasting approaches, some of which lead to higher prognostic accuracy compared to the approach proposed in the original article.

During information processing, we removed data that simply contains identifiers of various circumstances (agents, randomly generated request numbers, etc.), as they follow either a clearly predetermined sequence or are the result of chance and are thus unlikely to aid forecasting. Additionally, we remove all variables that have a large number of missing observations (over 30%), ending up with removing seven variables. Five of them have more than 98% missing, so their removal does not lead to significant loss of information. Based on the time stamps for the moment of signal registration and the moment of its termination, we construct the target variable – the necessary processing hours. After this, we select the complete set of observations that do not have missing data, which leads to a set of data with 108,247 observations that is used for subsequent analysis. This set contains 1 target and 18 explanatory variables, which is slightly more than the fifteen used by Amaral et al. (2018). Again, we estimate the 109 different algorithms under study on the incident management data. Of them, 102 reach convergence and can be used to generate forecasts.

Figure 7

Histogram of forecast accuracy for incident processing data



The distribution of forecast accuracy measured by the root mean squared error (RMSE) is visually displayed by the histogram in Figure 5. The vast majority of algorithms register an RMSE of about 450, but we also observe the long tail of the distribution. It shows the presence of a small number of algorithms with particularly poor performance. Under specific circumstances, it is possible to observe the tendency of certain algorithms to do particularly well with some tasks, which is offset by a particularly poor performance of others, which is known as the "No Free Lunch Theorem" of optimization, and we probably observe exactly those effects here.

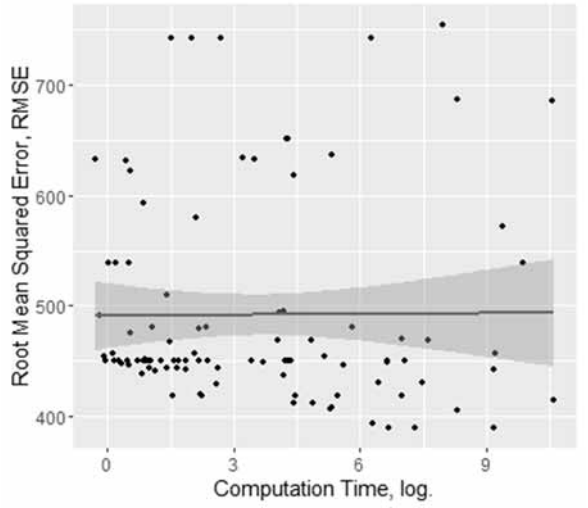
Table 4

Forecast accuracy of the top ten algorithms for incident processing data

Algorithm	Method	Mean Error, ME	Root Mean Squared Error, RMSE	Mean Absolute Error, MAE	Complexity Measure
Regularized Random Forest	RRFglobal	-23.95	388.82	183.81	2.0%
Regularized Random Forest	RRF	-24.22	389.64	184.59	13.2%
Random Forest	rf	-24.30	389.75	184.61	1.1%
Parallel Random Forest	parRF	-28.04	393.42	188.02	0.7%
Random Forest by Randomization	extraTrees	-23.79	405.33	187.67	5.6%
Random Forest	ranger	-24.27	406.17	188.66	0.3%
eXtreme Gradient Boosting	xgbLinear	-17.56	407.67	188.13	0.3%
eXtreme Gradient Boosting	xgbTree	-10.43	411.34	191.64	0.2%
Boosted Tree	bstTree	-8.33	412.05	185.00	0.1%
Bayesian Additive Regression Trees	bartMachine	-7.16	414.76	196.90	55.5%

Figure 8

Link between forecast accuracy and computation time for incident processing data



The ten methods with the highest predictive accuracy are summarized in Table 5. Eight of the ten methods are varieties of the random forest algorithm. The *RRFglobal* method achieves the highest forecast accuracy, with its RMSE = 388.8, followed by five other random forest implementations with comparable error rates.

The list of the ten most accurate algorithms also includes two methods for extreme gradient boosting. In terms of the complexity measure, the most accurate method has relatively good levels of resource intensity, being 50 times faster than the slowest alternative. If computational optimization is required, it is also possible to choose a method with comparatively high accuracy and lower computational needs.

This application of machine learning algorithms leverages a new type of data coming from the so-called process-aware information systems. This data enables an organization to fully map its business process – in this case, IT support – using information from its transactional data systems. The combination of process-aware data and advanced algorithmic modelling allows for a very precise business process management and control. This, in turn, enables gains in productivity and profitability.

5. Logistics Demand

One of the main operational concerns for the modern organization are the unexpected changes in the market environment, which can lead to excess or insufficient resources to meet demand. Many business activities are characterized by significant demand dynamics, and the main task consists of being able to meet the peak moments, minimize costs at low points and smooth the internal work process. Thus, it is especially important to be able to forecast demand and in the presence of significant deviations from its usual level – to take appropriate management action. The risk, in this case, is twofold. On the one hand, an excessively high level of demand can lead to an inability to serve potential customers and hence – lost revenue. On the other hand, excessively low levels of demand lead to unused resources such as employees and equipment and thus generate costs for the organization. Effective demand forecasting and management is also key to applying a flexible approach to resource allocation and helps to implement good management practices such as timely delivery (JIT), minimum product development and the application of the principles of flexible management (Agile).

The business problem in demand analysis is the accurate forecasting of expected demand levels, which allows for taking the relevant measures should excessive deviations from the usual or expected load occur. The key goal is to correctly predict the peaks and troughs at which the organization should take appropriate action. To study this task, we use data from a large Brazilian logistics company provided by Ferreira et al. (2016). The database contains information for the orders received from the given company for a period of 60 days, and some of the variables are not described in detail in order to preserve sensitive business information. Data are available for the week and day of the order, for what part of the orders are defined as priority ones, how many of them are of a certain type (A, B, C), what part comes from the public sector, from the banking sector or from a traffic control centre. The total number of explanatory variables is 12. The array also contains information on the total

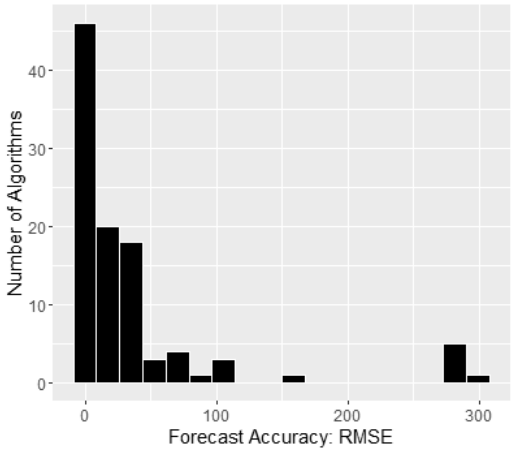
daily number of orders, which is an indicator of the levels of market demand and so is the target variable of the current task.

We emphasize that the database provided by Ferreira et al. (2016) is extremely small, containing observations for only 60 days. Thus, the analysis of the database with alternative algorithms will show the possibilities for applications of machine learning methods over a very limited sample of data. This allows us to trace whether it is appropriate to apply big data algorithms instead of traditional statistical methods in cases of small sample analysis. Ferreira et al. (2016) use this data to demonstrate the application of an artificial neural network of the multilayer perceptron type. They found that this model was suitable for modelling demand even for a small number of observations. Based on their results, here we look at the applications of a much wider range of algorithms and further investigate how those numerous alternatives compare against each other.

Using the data under investigation, we estimate 109 alternative forecast models with different forecasting algorithms. Their predictive accuracy, measured by the root mean squared error, is presented in Figure 4. The histogram clearly shows that the small number of observations leads to unstable predictions. There are a large number of algorithms that reach extremely low RMSE values close to zero, which is likely symptomatic of overfitting. We also notice a small number of algorithms with extremely poor performance - RMSE in the neighbourhood of 300. This result is significantly worse than the naive forecast for each value (e.g. the average for the sample).

Figure 9

Histogram of forecast accuracy for logistics demand data



As a potential way to avoid relying on models with uncertain performance outside the training sample, we elect to not consider models with RMSE <1, emphasizing that in the vast majority of such cases, RMSE in fact approaches zero. Among the other algorithms, we can highlight the ones with the highest predictive accuracy, the top ten presented in Table 4. The most optimal models are the multinomial adaptive regression splines (MARS) with RMSE = 2.51 and RMSE = 2.61 for the implementation with pruning. A number of representatives of the

family of generalized linear models as well as support vector machine implementations perform well in this task.

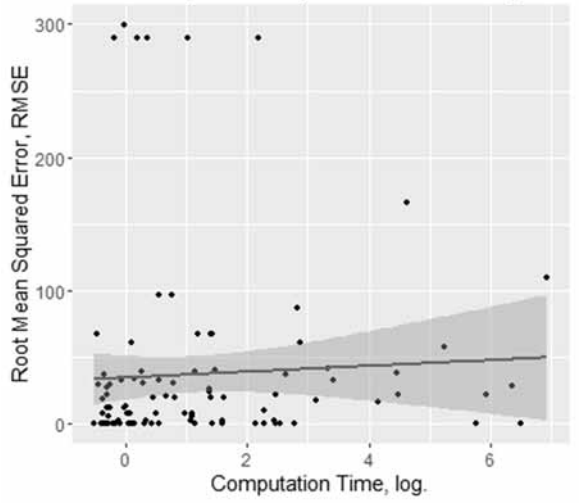
Table 5

Forecast accuracy of the top ten algorithms for logistics demand data

Algorithm	Method	Mean Error, ME	Root Mean Squared Error, RMSE	Mean Absolute Error, MAE	Complexity Measure
Bagged MARS	bagEarth	-0.056	2.509	2.076	1.12%
Bagged MARS using gCV Pruning	bagEarthGCV	0.107	2.605	2.185	0.48%
glmnet	glmnet	-1.188	2.780	2.384	0.14%
Gaussian Process with Linear Kernel	gaussprLinear	-0.966	2.843	2.357	0.28%
Bayesian Regularized Neural Networks	brnn	-0.910	2.853	2.374	0.08%
Support Vector Machines with Linear Kernel	svmLinear2	-3.153	5.865	5.129	0.07%
Support Vector Machines with Linear Kernel	svmLinear	-3.153	5.865	5.129	0.28%
Gaussian Process with Polynomial Kernel	gaussprPoly	-3.527	7.345	5.660	0.16%
Least Squares Support Vector Machine with Polynomial Kernel	svmPoly	-3.146	7.660	6.936	0.29%
Boosted Generalized Linear Model	glmboost	-2.669	7.863	6.994	0.10%

Figure 10

Link between forecast accuracy and computation time for logistics demand data



Again, we recognize that the best performing algorithms are not the most resource-intensive ones. This allows one to make an optimization decision for the optimal model for solving similar forecasting problems based on predictive accuracy and the measure of complexity. Given the accuracy and the complexity measure of the multinomial adaptive regression

splines (MARS) without pruning, we conjecture it to be the algorithm with the best overall performance for this data. We emphasize that with such a small sample size, all results should be interpreted with caution and that practical applications should seek to avoid such limited samples.

The problem of demand forecasting is a classical microeconomic task that hails back to the roots of the discipline. At least since the 1950s, there have been rigorous applications of econometric methods for demand planning. However, the proliferation of machine learning approaches, and the explosion of data has spelt a new era for this common problem. The results here indicate that advanced modelling yields satisfactory forecasts even under significant data restrictions. The results are of obvious value – the ability to forecast demand enables the firm to more efficiently plan the resources to meet them, thus minimizing costs during downturns and maximizing profit during spikes. This has both bottom-line implications as well as reputational ones.

V. Discussion

1. Statistical and Modeling Insights

The article reviews the application of forecasting algorithms in five typical business situations – to model workplace absenteeism, corporate online communication, housing prices, logistics demand, and incident processing. The main task here is to reach an optimal tradeoff between potentially negative and potentially positive consequences through forecasting, planning and control of potential deviations. 109 different forecasting methods are tested in this paper in order to aid the analytic part of this task.

The first major insight of the study is to underline the importance of choosing the appropriate forecasting algorithm for modelling individual business domains. This is clearly visible both in the results above and in the rank distribution of predictive accuracy (see Figure 6). All the algorithms under investigation are ranked in accordance with their position in terms of accuracy. Thus, the one with the highest accuracy, measured by the root mean squared error, gets a rank of 1. The algorithm with the second highest precision is ranked as 2, and so on to the most inaccurate algorithm, which gets a rank of 109. Figure 6 presents a histogram of the averaged ranks of the studied methods. There are a small number of algorithms that consistently generate forecasts with a high level of accuracy in all the tasks studied. On the other hand, this is not the case with most algorithms, most of them having an average rank between 25 and 75. One also sees a small number of particularly unsuccessful algorithms with an average rank of over 80. This underlines the utility and benefits of applying statistical algorithm selection before application to specific problems.

Second, we recognize that there are groups of algorithms that generate consistently good results. These are often different applications of the random forest method, with different implementations of the random forest approach being very close to each other. This justifies the use of highly optimized implementations of the method (such as the *ranger* implementation in the R language) as they allow significant savings of computational resources virtually without loss of predictive accuracy. Classical statistical methods such as

linear regression generally register much lower forecast accuracy than machine-learning methods. Thus, it may be appropriate to replace or at least supplement them with more complex algorithms from the field of machine learning. A notable exception to this is situations where extremely small samples are analyzed. We do not observe a difference between the linear regression model and alternative algorithms in such cases, as have seen in the logistics demand task. On the other hand, the accuracy measures in such a sample are unstable and less reliable, and this result should be interpreted with caution. In any case, all the methods under investigation perform better when trained with more data.

Figure 11

Histogram of average forecast accuracy across all datasets

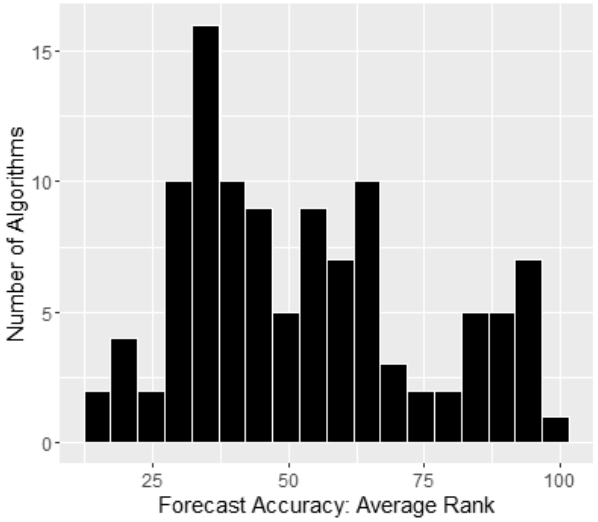
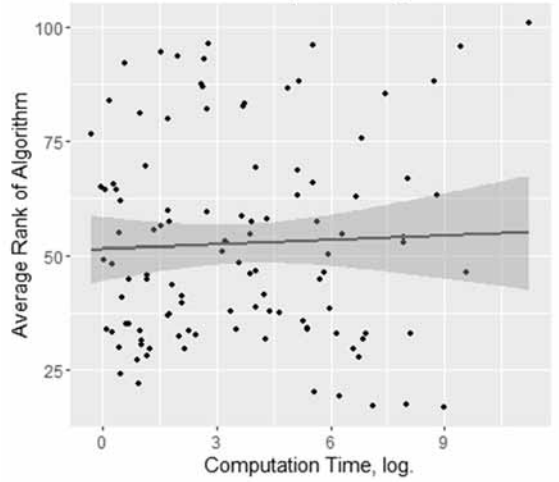


Figure 12

Link between forecast accuracy and computation time (log)



Third, we note that there is virtually no relationship between forecast accuracy and the required computational resources for the algorithms under study. Figure 7 presents graphically the relationship between the average rank of the algorithm and the log of the time required to calculate it. The visual inspection fails to reveal a clear link between these two characteristics of the considered algorithms. We formally test the relationship by regressing the mean rank on the required calculation time. Although the coefficient reaches statistical significance at levels of 5%, its magnitude is extremely small: $\beta = 0.0006$ and the explained variance is only 4%, indicating that it lacks practical significance. The almost imperceptible link between calculation time and predictive accuracy yet again underlines the possibility of choosing an algorithm with high accuracy and relatively low computational needs.

2. Economic Implications and Limitations of the Results

Each of the five business domains under investigation, in essence, presents different problems of information. Ranging from workplace absenteeism, online new sharing, modeling housing prices all the way into support tickets processing and demand planning, business activity is plagued by asymmetric information. In the domains under study, modern organization tend to only collect a limited set of data regarding those and are unable to fully predict an outcome under interest. For example, workplace data must be at an individual level and key employee characteristics such as a propensity for excessive absences could be difficult or even unethical to obtain. On the other hand, data on assets (such as housing) or processes (such as communication, IT support or demand planning) could be impossible or impractical to gather. In the end, the organization is left with only incomplete data that must be used to alleviate the economic problem of asymmetric information. Turning data into actionable knowledge thus requires algorithmic modelling to compensate for what is missing, and to quantify the impact and uncertainty of the decisions at hand. The article has thus reviewed leading algorithms to perform these tasks in a forecasting setting. Results are encouraging – businesses may reliably use a few out-of-the-box forecasting approaches such as random forests to generate useful projections. Those algorithms seem to work very well in medium-sized datasets where tens to hundreds of thousands of observations are described by tens of different predictors – a common situation in actual practice. Those results are in consonance with other research in the field (see, e.g., Fernandez-Delgado et al., 2014) and give businesses the confidence to base their analytic architecture on leveraging those algorithms. Moreover, the approach presented here gives a clear indication of the tradeoff between computational needs and forecasting accuracy, providing a primitive estimate of the cost-benefit tradeoff. This can be further elaborated and adapted for practical applications. The breadth of domains covered also hints at the generalizability of the results.

The limitations of the current study should also be noted and taken into account when interpreting its results. First, we are looking at five specific business situations that are described with a relatively sparse set of features. The specifics of the domain may have implications for the resulting forecast accuracy values. However, the robustness of top performers hints that these effects may be relatively small. More importantly, a sparse dataset will benefit more from sophisticated modelling that compensates for the missing data. Thus, the performance of forecasters may differ in more information-rich environments, with some

studies indicated that deep neural networks are preferable in such settings (Chiroma et al., 2018). Second, this article has looked at five different business domains and tried to outline the best performers across the board. However, the well-known no free lunch theorem states that there is no single best tool for every optimization problem (Cao et al., 2019). Thus, it may very well be the case for a specific business need is best met by a custom approach that is less suitable for other domains. Finally, results have tended to focus on traditional business activities such as forecasting employee behaviour, success of communication, asset pricing, process efficiency and demand planning. This study has not looked at novel forecasting and machine learning tasks such as image or voice recognition that are increasingly important for modern data-driven organizations. The investigation of algorithm effectiveness in such tasks will have to be the subject of further research.

VI. Conclusion

This study is in partial response to the concern posed by Fernandez-Delgado et al. (2014) whether we really need hundreds of classification algorithms. The same question, probably even more poignant, can be asked if we need hundreds of alternative regression algorithms for forecasting. Taking 109 statistical and machine learning algorithms, this research aims to investigate their applicability, speed, and accuracy to five typical microeconomic problems: excessive workplace absenteeism, online communication success, valuation of real estate asset prices, forecasting sharp changes in market demand, and improving customer support. The results are stark – a small number of algorithms tend to outperform the rest, with the random forest family being a particularly strong candidate.

Moreover, results are dispersed – while there are some clear winners, there is a large number of algorithms with mediocre or sub-optimal performance. Therefore, it does make sense for the analyst or researcher to spend time and resources for optimal algorithm selection. Of particular note is the fact that traditional econometric methods such as the multiple linear regressions are rarely among the top performers. Finally, the tradeoff between computational complexity and forecast accuracy is not clear-cut. There are some methods that are not among the most computationally intensive ones but still reliably produce highly accurate results. This clearly shows the possibility to make an optimal economic decision about the type of algorithms and methods used.

In short, this article aims at exploring a large set of primarily machine learning algorithms and testing their applicability to typical tasks in economics and business. Those methods, and particularly members of the CART family, have proven to deliver accurate forecasts suitable for both academics and practitioners in the fields of economics and business. With the advent of big data, the econometric toolbox will have to expand so that its methods scale well to large volumes, are able to produce meaningful conclusions and results, and improve our understanding of underlying process drivers. The introduction of more advanced machine learning methods is a good first step in this direction. This necessitates more research in both methodology and substantive modelling questions but, in the end, holds the promise to expand the scope and depth of problems economists can handle with confidence.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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Stefan Petranov[1]
Dimitar Zlatinov[2]
Milen Velushev[3]
Lillyana Georgieva[4]
Radostina Ivcheva[5]

SHADOW ECONOMY AND PRODUCTION FACTORS: RESULTS FROM AN EMPIRICAL ANALYSIS WITH A PANEL DATA SET[6]

The main objective of this article is to examine the existence of a relationship between the shadow economy and macroeconomic factors of production. Based on a dataset of 50 countries over the period from 1991 to 2015, we find that the size of the shadow economy is inversely related to all three macroeconomic production factors – labour, capital stock and total factor productivity. This result provides an explanation for the fact that, in many cases, the shadow economy has a negative impact on economic development. We also find that the strength of the relationship is not the same for all factors of production. While for capital and for total factor productivity, the inverse relationship with the size of the shadow economy is strong, in the case of labour, this relationship exists, but it is weaker. The reason for this is the specific nature of many of the shadow practices, related to undeclared work, which allow such an effect.
The results of the present study could provide arguments for the formation of effective economic policy measures to limit the negative effects of the shadow economy.
Keywords: shadow economy; undeclared work; economic development; GDP per capita; GDP per capita growth rates; macroeconomic factors of production
JEL: E22; E24; E26; O17; O43

[1] *Stefan Petranov, PhD, Professor at Sofia University "St. Kliment Ohridski", spetranov@feb.uni-sofia.bg.*
[2] *Dimitar Zlatinov, PhD, Associate Professor at Sofia University "St. Kliment Ohridski" and Economic Research Institute at Bulgarian Academy of Sciences, dzlatinov@feb.uni-sofia.bg and d.zlatinov@iki.bas.bg.*
[3] *Milen Velushev, PhD, Associate Professor at Sofia University "St. Kliment Ohridski", mvelushev@feb.uni-sofia.bg.*
[4] *Lillyana Georgieva, PhD student at Sofia University "St. Kliment Ohridski",lillyana.georgieva@abv.bg.*
[5] *Radostina Ivcheva, PhD Student at Sofia University "St. Kliment Ohridski", radi_ivcheva@abv.bg.*
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Introduction

The shadow economy and the official economy are not isolated from each other but are in constant interaction. From the point of view of economic theory, the effects of this interaction can work in different directions. On the one hand, it can be expected that lower tax revenues, a natural outcome of the shadow economy, will result in lower levels of public services and public investment. This would lead to lower economic growth and lower gross domestic product (GDP). On the other hand, the existence of an informal sector can play the role of a safety net in times of crisis, as well as provide employment and additional income that increase demand and thus stimulate production in the formal sector of the economy. This would lead to a higher gross domestic product, other things being equal.

Empirical data on the relationship between the size of the shadow economy and GDP are also ambiguous. There is evidence to support the hypothesis that such a relationship exists and that it is inverse: the shadow economy slows down economic growth and economic development. But there is also evidence to support the alternative hypothesis.

In this paper, we examine the shadow economy and GDP per capita nexus and find empirical arguments for the existence of a statistically significant inverse relationship between these two variables. However, this paper does not focus on the result, but its main objective is to examine the existence of a relationship between the shadow economy and macroeconomic factors of production. To the best of our knowledge, this issue has not been addressed in the economic literature so far. The results of the study of this issue can shed light on the specific reasons for the existence of a relationship between the shadow economy and economic development, as well as on the channels through which such a relationship is demonstrated in practice. This would help to better understand the processes of interaction between the formal and informal sectors of the economy, as well as the formulation of appropriate policies to limit the shadow economy. Moreover, such results may be important for analyzing the issue of causality in the relationship between shadow economy and economic development.

Our study is based on the logical assumption that if there is a relationship between the size of the shadow economy and GDP per capita, there must be a similar relationship between the shadow economy and some of the macroeconomic factors of production such as labour, capital, and technological progress.[7] On this basis, we analyzed a panel of data for fifty countries in the period 1991-2015. The countries analyzed consist of almost all European countries: both EU member states and not[8], as well as the former republics of the Soviet Union.

The article is organized into four different sections: each contains different aspects of the conducted research. In Section 1 we provide a literature review on the theoretical arguments and the empirical results related to our study. Section 2 presents our findings with respect to the relationship between the shadow economy and the GDP per capita nexus, including the

[7] We refer to the macroeconomic production factors according to Solow's growth model. Other possible production factors are out of the scope of this study.

[8] All countries in Europe are included except for Andorra, Lichtenstein, Monaco, San Marino, and Vatican City.

methodology used and the data set. In Section 3 we analyze the role of macroeconomic production factors: capital, labour, and technological progress. More precisely, Section 3.1 reveals the theoretical rationale for the expected relationships with respect to the factors of production – here, our reasoning is based on Solow's growth model. Then, in sections 3.2-3.4, the empirical results from our study for the possible impact of the shadow economy on production factors are presented and analyzed separately for each factor of production. We find that the shadow economy is negatively associated with all three macroeconomic factors of production, but the strength of this inverse relationship is different for the different factors/varies among the different factors. Section 4 presents our main conclusions from the study and provides some ideas for future research.

1. Is the Shadow Economy a Booster or a Bottleneck to Growth? A Literature Review

The shadow economy has been studied by many economists and there is an extensive literature in this field. Some of the main research directions and the most widely used methodological approaches are presented in Schneider & Williams (2016a) and Fleming, Roman & Farrell (2000).

Historically, the damage that the shadow economy causes on public finances has been a priority topic in research (Tanzi, 1999; Kanniainen, Pääkkönen, Schneider, 2004). Although this is logical and indisputable, recently, some authors have been focusing on a wider range of effects related to the economic and social development. Hoinaru et al. (2020) and Baklouti & Boujelbene (2020) put the emphasis on the relationship between the shadow economy and economic development, poverty, corruption, and human capital. Other researchers are more focused on determining the size of the shadow economy and comparing it by countries and regions to examine the indirect links to the socio-economic progress (Enste, 2015) and (Williams, Schneider, 2016).

Various arguments can be given about the relationship between the size of the shadow economy and GDP growth. Some researchers point out the strictly negative trade-off between the two variables due to tax evasion and subsequent budget problems[9], overestimated unemployment and inflation, lack of social protection[10] under unofficial employment status, corruption, and inefficient public administration. Other scientists find positive effects stemming from the shadow economy: additional workplaces are created, and new income sources are available for households that help to partially balance inequality and poverty reduction.

Schneider (2005) considers the relationship between the shadow economy and economic growth: it is positive in industrialized and transition countries and negative in developing countries. His argument is that economic agents in high-income countries are overburdened by taxes and regulation, so that the shadow economy stimulates economic activity by relaxing

[9] Shadow economy research rarely pays attention to tariff violations which lead to lower budget revenues. See Madanski (2019).

[10] Low social protection and insecurity are one of the main reasons for workplace conflicts bringing additional negative effects due to shadow economy practices. See Mihaylova (2022).

the tight regulations that governments implement. In the same manner, Williams (2006) claims there is a positive correlation between the underground economy and GDP growth when hidden entrepreneurs find ways to avoid strict government regulations.

Almenar, Sánchez & Sapena (2020) consider that the primary drivers of the shadow economy in Greece, Italy, Portugal, and Spain are the tax and social security payment burden. However, Denmark, Finland, and Sweden are among the EU Member States with the highest tax burden that amounts to over 50% of GDP, as well as among the top ten countries with the lowest size of the shadow economy (Krumplytė, 2010). Austria, Denmark, the Netherlands, Finland, Sweden, and Germany are also examples of that higher level of economic development is associated with a lower size of the shadow economy (Ginevicius, Kliestik, Stasiukynas, Suhajda, 2020). Such practical observations show that tax incentives can neither be the single, nor even the most important factor that determines the nature of the relationship between the shadow economy and GDP.

Tunyan (2005) stresses that many shadow activities such as small-scale production factories and unregistered street vendors provided employment and income to many Armenian families during the transition from centrally planned to market economy in the early 1990s. These activities fostered entrepreneurial skills and allowed new businessmen to accumulate initial capital, in order to shift their activity into the official sector of the economy. Similar arguments are provided for Baltic countries (Remeikiene, Gaspareniene, 2015) and for Russia by Mandroshchenko, Malkova & Tkacheva (2018). Dell'Anno (2008) also finds a positive correlation between unofficial economy and GDP in Latin American countries: during the transition to market economy factors, such as the lack of competence of official institutions, weak enforcement of legislation, unprotected property rights[11], and high costs of business development stimulated informal business activity which in turn facilitated demand-driven economic growth. In Bulgaria, this issue has been addressed in several publications of the Center for the Study of Democracy (Gancheva et al., 2004). However, the so-called "transitory effect" is ambiguously confirmed and limited: Zaman & Goschin (2015) failed to identify a significant positive impact of the shadow economy on economic growth in Romania, although they concluded that a long-run relationship between the shadow economy and GDP exists.

In an earlier research, Eilat & Zinnes (2000) estimate a negative impact of the size of the shadow economy on official GDP for 24 transition countries from Central and East Europe and the former Soviet bloc. A strong inverse relationship between shadow economy and GDP using a structural VAR model covering 2000-2013 is also found for Romania by Davidescu (2014). Moreover, Wu and Schneider (2019) find a non-linear relationship between the shadow economy and GDP which implies that the shadow economy can coexist with different levels of development.

Regarding developing countries, Kirchler (2007) estimated that 41% of all economic activities in South America and over 70% in Africa are in the unofficial sector. Based on the experience of Latin American countries in the early 1990s, Loayza (1996) also concludes

[11] In other aspects, the economic and social risks from higher protection of property rights are discussed in Shalamanov (2018).

that an increase in the size of the informal sector has a negative effect on GDP growth due to a large tax burden and poor legislation. Ineffective allocation of resources in these countries, combined with corruption and criminal activity, is a strong bottleneck to growth, which causes a prolonged economic stagnation. The negative effects that the shadow economy causes, i.e., a decrease in tax revenues, low productivity, and higher public expenditures that aim to compensate the subdued corporate activity but, in fact, stimulate corruption, are prevailing and researchers find a strong negative correlation between shadow economy and economic growth. Hoinaru et al. (2020) stress that the shadow economy is poverty-driven and correlated with low levels of both economic and sustainable development, which is highly valid for low-income countries. This conclusion is also evident for emerging and developing Asian economies (Nguyen, Luong, 2020) and Colombia (Schneider, Hametner, 2014).

One of the most recent and complex research on the relationship between shadow economy and GDP is conducted by Wu and Schneider (2019) using data for 158 countries in 1996-2015. They identify a U-shaped relationship between the size of the shadow economy and the level of economic development, which shows that "the economies at a low development level witness a negative relationship between the size of the shadow economy and GDP per capita, but when GDP per capita exceeds a threshold, the size of the shadow economy goes up with per capita income" (p. 4).

The research of Wu and Schneider (2019) not only summarizes the observations from past research, but it is also one of the few studies that examine the effect of factors of production on the size of the shadow economy, which is the focus of our paper. Wu and Schneider (2019) discuss the link between productivity improvement and technological advancement that may support the long-run expansion of the shadow economy thanks to a high level of human capital achieved. They also refer to stronger institution capacity and better social infrastructure that bring firms and individuals from the informal to the formal sector.

According to Mandroshchenko, Malkova & Tkacheva (2018), shadow economy firms do not invest in R&D and they also negatively affect the labour force available for production in the formal economy. Considering this negative effect on capital and labour, we can conclude that the authors view the shadow economy as a bottleneck to the long-run economic growth and potential GDP growth. Remeikiene & Gaspareniene (2015) conclude that the imperfections of the labour market are the most significant determinant of the shadow economy in the Baltic States. Unfavourable crediting policies and business conditions have a negative impact on the capital in Lithuania and Estonia and also foster shadow economy practices. Yaskal et al. (2021) consider labour market rigidities as one of the main reasons for the generation of informal employment that directly affects the labour market in the official economy. La Porta & Shleifer (2008) emphasize that human capital is lower in the unofficial economy because informal workers, on average, have a lower education level which leads to lower levels of innovation and productivity. Baklouti & Boujelbene (2020) focus that a reduction in the tax base because of shadow economy activities negatively affects the investment in public infrastructure, which, in turn, may harm the economic growth. Naghdi et al. (2015) draw attention to the fact that the underground economy has negative effects on the financial sector, as well as on the macroeconomic performance through capital accumulation.

Following the literature review we provided, one can conclude that the impact of the shadow economy on economic development and growth is very complex. It is not only related to purely fiscal effects but also to poverty, inequality, efficiency of governance, reforms implemented, and business cycle phase, as well as to the income level of the country. Therefore, it makes sense for research efforts to focus on the specific factors that stimulate or hinder the shadow economy at a certain phase of economic development. Although some researchers have drawn attention to the possible impact of the shadow economy on the factors of production, to the best of our knowledge, this issue has not been extensively researched with respect to all factors of production at the macroeconomic level and particularly with empirical evidence based on official statistical data. We believe this issue deserves more in-depth study and in the following sections, we have tried to fill this research gap, in order to deepen the analysis of the effects of the shadow economy.

2. Shadow Economy and Economic Development

The phenomenon of the shadow economy existence is historically connected to the centralization of political power and the emergence of the State. From the viewpoint of the government, any economy consists of an informal and an official (formal) sector. The informal sector is defined as the production of goods and services that have market value, but do not generate taxes and other contributions to the budget (OECD 2002). There are certain ambiguities connected to that definition that largely stem from the fact that the informal sector comprises three different types of activities: activities that are legal per se but are not subject to taxes nor obey government regulations, activities that are illegal, so they cannot be taxed or regulated, and, finally, activities that are not counted in GDP like charitable work and household activities, for example.

Like most of the other studies on the subject, we distinguish between the three types of activities, and in our study, we consider only the activities that are legal in nature but evade taxes or regulations. For those, we use another term, shadow economy, as per Schneider (2012) and Medina and Schneider (2018), who use this expression to describe the production of legal goods and services that is hidden from the government and labour that is hidden from public authorities but is employed in any production of legal goods and services.

There are several theories explaining the existence, as well as the size of the shadow economy, which point at different causes (Zolkover at al., 2020). The modernization theory connects the shadow economy with the stage of economic development of the country. According to this theory the more the economy of a country develops, the larger the number of shadow economy businesses that will abandon the informal sector and will enter the official sector. On the other hand, the neoliberal theory explains the existence and size of the shadow economy with the level (degree of?) of centralization of power, the efficiency of bureaucracy, the excessive regulation, and the (frequency of?) state interventions. The political economy theory points out that the informal sector will appear and grow whenever the State is uninvested in the well-being of its citizens. The institutional theory considers that the shadow economy is a result of formal rules and regulations that do not reflect what economic agents perceive as fair.

In essence, all mentioned theories conclude that the shadow economy is expected to be larger in the underdeveloped, emerging economies and its share and significance diminish as the economies and the societies develop. Yet there is a point to be made, that the shadow economy phenomenon is persistently present in all contemporary economies. There are estimates that currently, the shadow economy in the European economies ranges between less than 10 and over 40 per cent of GDP and its size tends to increase during recession and contracts in times of economic upturn (Kelmanson et al., 2019). The main reason for the existence of the shadow economy is that it provides something which the official sector cannot – market rules without government intervention. The shadow economy adds to the gross value-added by producing goods and services with a market value that might not be produced if government restrictions are applied. But at the same time, the shadow economy does not contribute to the redistribution of national income. It provides jobs mainly for the unskilled and illegal workers, but those jobs are usually low paid and/or dangerous. It helps with coping with cyclical downturns as it provides means to survive to people at or under the poverty line, but it diverts the workforce from the official sector.

In this section, we examine the relationship between real GDP (RGDP) per capita and its growth rate on the one hand and the shadow economy on the other. We do this for two purposes: firstly, we want to contribute to the discussion on the relationship between the shadow economy and economic development with concrete empirical results. As can be seen from the literature review, in some cases, there are conflicting opinions about this relationship. In addition, we will use these results as a basis on which to analyze the relationship between the shadow economy and macroeconomic factors of production in the following sections.

As we want to find out whether the level of economic development is correlated with the size of the shadow economy, we find it helpful to examine more observations of countries that are somewhat connected but are at different stages of their economic development. For this reason, we chose to study the data for 50 countries in Europe and Central Asia that share social values and civilizational paths and have strong trade relations. Namely, those are all of the European Union member states, the rest of the European countries, as well as the majority of the former republics of the Soviet Union. Thus, in this section, as well as in the following sections, we examine a panel database of 50 countries with annual data for each country for 1991-2015: the longest period for which we have comparable data. The list of countries in the current study is presented in Appendix I.

For the purposes of our study, we use estimates of the size of the shadow economy published by Medina and Schneider (2018)[12], which are presented as a percentage of the official GDP. RGDP data in constant prices (international 2011 USD) is taken from IMF (2017), while population data is from the World Bank database, available as World Bank Open Data on the

[12] This publication does not include estimates for Kosovo, Montenegro, Serbia, and Northern Macedonia. Therefore, for these countries we use estimates published by Kelmanson et al. (2019). In both cases the authors have used the so-called MIMIC (Multiple Indicators Multiple Causes) approach which is based on structural equations modeling.

institution's website. By dividing RGDP by population, we obtain data for RGDP per capita. These data are shown in Appendix I[13].

To find out whether there is a statistically significant relationship between RGDP per capita and the size of the shadow economy, we use cross-country correlation coefficients between the average RGDP and the average size of the shadow economy. The variables that we examine are 25-year averages (for the period 1991-2015), 17-year averages (for the period 1993-2009) and 20-year averages (for the period 1993-2012). From a formal point of view, we calculate $corr\ (\overline{RGDP},\ \overline{SE})$, where:

$$\overline{RGDPC_i} = \frac{1}{n}\sum_{t=1}^{n} RGDPC_{it}; \overline{SE_i} = \frac{1}{n}\sum_{t=1}^{n} SE_{it}$$

$RGDPC_{it}$ – real GDP per capita in country i for year t;

SE_{it} – size of the shadow economy in country i for year t;

n – number of years for the period under study.

We do these calculations using different time periods for robustness check. On the one hand, it is logical for the study to include as much data as possible in order to cover the longest period and thus to give an idea of the long-term characteristics. At the same time, the countries under study are at different phases of their business cycles that are not synchronized; therefore, the results for a single specific time period can be influenced by the business cycle phase. For this reason, in addition to the longest time period, we consider two additional periods, which cover one and two business cycles, respectively[14], within the period 1991-2015. The period 1993-2009 covers the business cycle, which started from the trough in 1993, because of the crisis of the centrally planned economies, to the trough in 2009, which was a result of the global financial crisis. The period up to 2012 includes, in addition to the above cycle, also the short cycle to the trough in 2012, following the debt crisis in Europe. The results are shown in Figure 1 of Annex II and in Table 1, Appendix III.

Figure 1 shows a scatter plot in terms of the average size of the shadow economy and the average RGDP per capita for the period 1991-2015, with each country included in the study presented separately. As seen(observed) from the graph, there is a clear inverse relationship between the two variables: countries that have a low size of the shadow economy are characterized by high real GDP per capita and vice versa. For example, Switzerland, Austria, Luxembourg, the Netherlands, which have estimates for the average size of the shadow economy between 7% and 11%, also have average real GDP per capita between 37 thousand and 47 thousand US dollars. At the same time, countries such as Georgia, Azerbaijan, Ukraine, Belarus, which have estimates for the average size of the shadow economy between 44% and 64%, similarly have average real GDP per capita between 6.8 thousand and 11 thousand US dollars per capita.

[13] The data sources for the variables used in the other sections are provided in the relevant sections.
[14] Cycles are with respect to the overall economy of the region – i.e.. Europe and Central Asia in total.

The conclusion from the graph for the presence of an inverse relationship between the two studied variables is also confirmed when calculating the correlation coefficients between them (Table 1, Appendix III). The coefficients for all three considered periods show the presence of a statistically significant[15], strong inverse relationship.

Once the inverse relationship between the shadow economy and real GDP per capita has been established, we apply the same procedure and analyze in the same way the possible relationship with respect to the growth rates of real GDP per capita. It turns out that in this case, the relationship changes.

Figure 2 in Annex 2 shows a scatter plot diagram of the average size of the shadow economy and the average growth rates of real GDP per capita for the period 1992-2015. The correlation coefficients for the three studied periods are presented in Table 1, Annex III and they show that in the period 1991-2015, there is no statistically significant correlation. However, if we consider the other two periods, which are consistent with the business cycles of the region, a correlation exists and it is statistically significant at 5% at 10% level, respectively. Moreover, the relationship is positive, i.e., countries with a larger size of the shadow economy are associated with higher growth rates of real GDP per capita.

At first glance, the above result contradicts the previous one that countries with a larger shadow economy are associated with a lower GDP per capita. Naturally, one could expect that higher growth rates of real GDP per capita should lead to higher levels of GDP per capita, not the opposite. But our interpretation of this result is that the inverse relationship between the shadow economy and GDP per capita is a long-term characteristic, while the positive relationship (or lack of relationship) between the shadow economy and the growth rate of GDP per capita is a short-term characteristic. Among the countries studied are many countries from Central and Eastern Europe, as well as from Central Asia, which in the early 1990s started their transition from a centrally planned to a market economy. They began their development after a major crisis of transformation, which led to a very low start base, and during the period under review, generally achieved higher growth rates than the developed economies in Western Europe. But as these growth rates are because of the low base, they are the result (outcome?) of the catch-up effect while the developed economies in Western Europe have already reached or are close to their steady-state development trajectories. In other words, the possibility to observe both high values for the size of the shadow economy and high values for the rates of real GDP per capita derives from the specifics of the studied period and is a temporary and transitional characteristic.

3. The Role of Production Factors

3.1. Why production factors are important

The volume of GDP for a given period depends on the factors of production that are included in the production process during the respective (given) period. It follows that if there is a relationship between real GDP per capita and the size of the shadow economy, then there

[15] In Table 1 p-values are equal to zero due to rounding.

should be a relationship between the shadow economy and some or all of the factors of production.

To formalize this idea, we use the apparatus of the Cobb-Douglas production function in the context of Solow's growth model. It relates the output of an economy to its productive inputs:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \quad (1)$$

where:

Y_t – real GDP in year t;

K_t – capital stock in year t;

L_t – labour employed in year t;

A_t – total factor productivity in year t;

α – output elasticity of capital;

$1 - \alpha$- output elasticity of labour.

Dividing both sides of the above equation (1) to the value of population P_t and after rearrangements, we arrive at the following result:

$$\frac{Y_t}{P_t} = \frac{A_t K_t^{\alpha} L_t^{1-\alpha}}{P_t} = \frac{A_t K_t^{\alpha} L_t^{1-\alpha}}{P_t^{\alpha} P_t^{1-\alpha}} = A_t \frac{K_t^{\alpha}}{P_t^{\alpha}} \frac{L_t^{1-\alpha}}{P_t^{1-\alpha}}$$

In this way, we derive the following equation:

$$\left(\frac{Y}{P}\right)_t = A_t \left(\frac{K}{P}\right)_t^{\alpha} \left(\frac{L}{P}\right)_t^{1-\alpha} \quad (2)$$

The obtained equation, which is a macroeconomic production function in intensive form with respect to the population, shows that GDP per capita is a function of the capital stock per capita, labour per capita and total factor productivity. At the same time, the results in Section 2 show that there is an inverse relationship between the shadow economy and GDP per capita. This conclusion, along with equation (2), shows that the shadow economy can be expected to have a similar inverse relationship with respect to capital per capita or with respect to the amount of labour employed per capita or with respect to total productivity. In the following sections, we analyze these issues.

3.2. Capital

The first factor of production that we examine for a relationship with the shadow economy is capital stock. There are many arguments based on economic logic, which give reason to expect a negative relationship between the size of the shadow economy and the amount of capital stock in a country. Some of them are highlighted in the literature review in Section 1.

Such is the argument of Baklouti & Boujelbene (2020) that the erosion of the tax base due to shadow practices negatively affects the investment in public infrastructure, as well as the conclusion of Naghdi et al. (2015) that the shadow economy has negative effects on the financial sector and as a result on capital accumulation.

But in our opinion, these are not the only channels through which the spread of shadow practices can affect investment activity and, ultimately, the amount of physical capital. We could add other options. For example, the reduced tax base not only decreases investment in public infrastructure, but also reduces investment opportunities in state-owned enterprises. In addition, shadow practices taking place in enterprises lead to an artificial reduction of their financial results. This, in turn, makes access to official financing of these enterprises from banks or from the capital market more difficult and consequently leads to lower volumes of investments. It is also very important to consider the impact of the investment climate in general. The relatively large size of the shadow economy creates an unfavourable investment environment in many aspects, and this naturally has a negative impact on investment.

To test the relationship between the size of the shadow economy and the amount of capital, we use annual data from the IMF (2017) for the capital stock in the relevant countries.[16] In accordance with equation (2), we divide the amount of capital by the value of population[17], in order to obtain the amount of capital per capita for each year of the period 1991-2015. Then, we calculate the average capital per capita for each country separately for the three periods studied.

Figure 3, Appendix II, shows a scatter plot diagram illustrating the relationship between the average size of the shadow economy and the average amount of capital per capita for the period 1991-2015, each point representing a separate country. Visual inspection of the graph clearly shows (illustrates) the inverse relationship between these two variables. The graph shows that countries where the level of capital per capita is high, for instance, Austria, Denmark, Switzerland, Norway, Luxemburg, tend to have a smaller size of the shadow economy. For these countries, the amount of average capital per capita is in the range between USD 112 th. (Austria) and USD 159 th. (Luxembourg) while the average size of the shadow economy is estimated to be between 7% (Switzerland) and 14% (Norway). On the other hand, countries whose shadow economy is estimated to be relatively large/countries with relatively large size of the shadow economy: like Georgia, Azerbaijan, Belarus, Ukraine, Moldova tend to have a small amount of capital per capita. For these countries, the amount of the average capital per capita varies between USD 5.4 th. (Azerbaijan) and USD 22.6 th. (Ukraine), while the average size of the shadow economy is estimated to be between 43% (Moldova) and 64% (Georgia).

This conclusion based on the visual inspection is also confirmed analytically by the respective correlation coefficients, which are presented in Table 1, Appendix III. As evident from Table 1 there is a statistically significant inverse relationship between shadow economy

[16] Data series for all countries are expressed in billions of constant 2011 international dollars (purchasing power parity adjusted), using the corresponding component-specific deflators from OECD, Penn World Tables, and World Bank databases.
[17] Population data are described in Section 2.

and capital per capita. The correlation coefficients show a strong inverse relationship, and their significance is confirmed by the low (zero due to rounding) values of p-value.

This correlation provides a possible explanation for the existence of a relationship between the shadow economy and GDP per capita. The informal economy is counterproductive to investment activity. The widespread use of shadow practices worsens the investment environment, limits access to finance for companies and directly reduces opportunities for private and public investment. This leads to less capital per capita and hence indirectly to less GDP per capita, other things being equal. According to the results in Table 1, this conclusion is stable over time. The strength and the direction of the correlation does not change significantly in the different periods considered.

3.3. Labour

The labour market plays a central role in any market economy. Having access to stable and protected employment is vital for escaping poverty and promoting inclusion. At the same time, shadow practices are often widespread on the labour markets. In many countries, the labour markets continue to be characterized by persistent informality and undeclared employment. This is not a surprise given the fact that some of the most important motives for the implementation of shadow practices are related to the labour market regulations. Very often, the practice of undeclared employment, "envelope wages", "moonlighting"[18] or bogus self-employment is motivated by the willingness to deliberately circumvent the payment of social security contributions and taxes or different requirements for the working conditions.

The above arguments give reason to expect that there might be a certain relationship between the size of the shadow economy and the amount of labour used to produce the official GDP. To test the probable existence of such dependence, we use data for employment from the International Labour Organization (2020).[19] The data is harmonized to account for differences in national data and scope of coverage, collection and tabulation methodologies, as well as for other country-specific factors.

The amount of labour employed in the production process is best described by the number of man-hours worked. But in our case, we use data on the number of people employed. This is due to the lack of harmonized time series data for such a wide range of countries as included in our study. This is an inevitable compromise for such type of comparative analysis. We believe that the number of people employed still gives a very good approximation for the labour input.

For testing the relationship between the size of the shadow economy and the amount of labour, we follow the procedure applied in Section 3.2 with respect to the capital stock. In accordance with equation (2), we divide the number of people employed by the number of

[18] An idiom for working on the side (at a secondary job), often in the evening or at night.

[19] ILOSTAT, Employment statistics. According to ILO's definition employed comprise all persons of working age who during a specified period were in one of the following categories: a) paid employment (whether at work or with a job but not at work); or b) self-employment (whether at work or with an enterprise but not at work).

the population[20] to obtain the ratio between employed and population[21] for the period 1991-2015. Then, we calculate the average employment rate per capita for each country separately for the three periods studied.

Figure 4 in Annex II shows a scatter plot diagram for the average size of the shadow economy and the average employment per capita for the period 1991-2015, where each country included in the study is depicted as a separate point. Visual inspection of the graph shows that in this case, again, we observe an inverse relationship between the two variables, but this relationship is clearly less strong than in the case of the capital stock.

Most countries concentrate around the line running from south-east to north-west. Countries with a low average size of the shadow economy tend to have higher employment per capita ratio. For example, Switzerland, Austria, the UK, the Netherlands have average employment per capita ratio between 0.5 and 0.55, while for countries with a relatively high share of the shadow economy like Armenia, Bosnia and Herzegovina or Kyrgyzstan, this ratio is between 0.34 and 0.37. But at the same time, there are countries that do not fit into such a model. For example, Georgia, Azerbaijan, Ukraine, Belarus, and several others seem to be outliers with respect to this pattern. These countries are characterized by both a large size of the shadow economy and a relatively high employment per capita. Such characteristics formally reduce the strength of the correlation relationship, and the respective statistics are shown in Table 1, Appendix III.

In this case, as it can be seen from Table 1, there is a moderate inverse relationship between employment per capita and the shadow economy. The relationship, in this case, is weaker[22] , but the correlation coefficients remain statistically significant. For two of the three periods examined in the study, the significance is at 5% confidence level, and for the other period (1993-2009), the significance is at 10% confidence level.

The relatively weaker relationship can be explained: the reason is rooted in the various forms through which the labour force participates in shadow practices and the ways in which labour is recorded in official statistics. There are several fundamentally different forms of undeclared labour that can be implemented to varying degrees depending on the circumstances. One possibility is for people working in an official/formal enterprise to accept a second job that is not officially declared for another enterprise or for a household. If the first job is officially declared, whether full-time or part-time, then these people will be included in official statistics as employed, although their second job generates shadow income. In this case, it is possible to have a large share of the informal economy and, at the same time, a relatively high official employment. A similar possibility is for employees to be (officially) part-time workers, but to work full-time and to receive an "envelope wage" funded from the sales of undeclared products. In this case, too, these workers still will be

[20] Population data is described in Section 2.
[21] The indicator obtained in this way is analogous to the employment rate, with the difference that the employment rate is calculated not based on the whole population but based on the working age population.
[22] If the outliers listed above are excluded from the sample, the strength of the correlation relationship is similar to that with respect to the capital stock.

counted in the official statistics as employed, meaning that both high employment and a high share of the shadow economy can coexist.

A special case is when there is a significant number of immigrant workers in a country who are not officially registered[23]. They can be cross border workers or permanent residents, but because they are not officially registered, they are not part of the official workforce. Therefore, their participation in the shadow economy does not affect national labour statistics and there is no obstacle for the latter to record high employment. The effect would be similar when people who are not included in the official workforce (not only immigrants, but also, for example, pensioners or students) are involved in shadow activities.

The above possibilities do not cover all cases. For example, there might be people who officially declare themselves as unemployed but at the same time work informally. Such people are part of the formal workforce but will not be counted as employed and therefore, their shadow work will not affect the employment per capita ratio. So even in this case, the presence of shadow practices does not necessarily lead to a reduction for the employment per capita.

There are, of course, situations in which the size of the informal economy and the officially employed per capita will be inversely related. This happens when individuals who are officially employed in an economic activity leave their jobs or lose their jobs and join the shadow economy. The opposite will happen when individuals working in the shadow economy leave or reduce their activity in this sector and at the same time accept a formal job. In these cases, the growth of the shadow economy will lead to a decrease in employment per capita and vice versa.

The latter situation is well documented by Lemieux et al. (1994). They analyze labour supply decisions in the underground economy based on microdata from a survey conducted in Canada. Their empirical findings indicate that "participation rates and hours worked in the underground sector also tend to be inversely related to the number of hours worked in the regular sector". In the same vein, Bajada & Schneider (2009) examine the relationship between the unemployment rate and the shadow economy and conclude that a relationship exists between changes in the unemployment rate and the shadow economy activity: short-term fluctuations in unemployment directly contribute to short-term fluctuations in the shadow economy.

3.4. Technological Progress

Economic theory adopts technology as a key driver of economic growth and views prosperity as dependent on technological progress. However, the mechanisms through which technology is incorporated in production are complex and often ambiguous to be formally

[23] Immigrant workers might contribute to the increase of the shadow economy in the recipient country and at the same time their remittance transfers to their home country might be a source for investment. For more details see Minassian & Yotzov (2021) and Minassian (2020).

expressed. The theoretical framework of our analysis provides us with the concept of total factor productivity (TFP). It refers to productivity in the production process, which is attributable not to any factor of production but to all factors. It measures the ability to employ the factors of production in the most effective way to achieve maximum output and studies show that its value typically increases over time. The causes of this growth are explained with the improved quality of equipment, the availability of innovative technologies, but also with the improved qualification of workers and managers, as well as the accumulated knowledge, embodied in organizational strategy. In a broader sense, TFP is considered as a measure of an economy's long-term technological change.

From equation (1), TFP can be calculated by dividing output by the weighted geometric average of labour and capital input with the relevant weighting for the inputs. Respectively, it follows that

$$A_t = \frac{Y_t}{K_t^{\alpha} L_t^{1-\alpha}} \tag{3}$$

Adopting the neoclassical theory, if the factor markets are competitive, then the marginal product of each input equals its factor price – the wage rate and the rental rate of capital, respectively. Under these assumptions, the output elasticities α and $1-\alpha$ are capital's and labour's share in total output.

When applying the Cobb-Douglas production function, it is usual to assume that the parameter is constant over time (see, for example, Giorno et al. (1995)). In our analysis, we adopt this assumption and assume the same specification of the Cobb-Douglas function for all countries under study, which enables us to use a uniform parameter α for all countries[24].

In our research, we rely on the estimates obtained by the International Labour Organization (2019). According to them, the average adjusted[25] labour income share for the region of Europe and Central Asia for the period 2004-2017 is 56%. As a result, we assume that $1-\alpha$ = 0.56 and hence α = 0.44. For robustness check, we have calculated TFP using other values for the elasticities as well: $1-\alpha$ = 0.65 and α = 0.35. The results using different parameters, show consistency. Figure 6 in Appendix II illustrates the scatter plot for all countries under study with respect to the average TPF calculated on the basis of different values for α (0.44 and 0.35). As shown, the two estimates are so close to each other, that all points are located almost perfectly on the 45-degree straight line. Obviously, both values for the parameter α provide very similar estimates for TFP, which are stable, not very sensitive with respect to the choice of α within the range between 0.44 and 0.35.[26]

Further on, we follow the same procedure as for the other factors of production. After obtaining the annual values of TFP for each country, the average values are calculated for

[24] Such assumption is often applied in the economic literature. For example, Denis et al. (2006) calculate the potential output for the EU countries assuming uniform Cobb-Douglas function for all countries. For the parameter $1-\alpha$ they take the value 0.63 which is the mean labor share in output for the EU-15 countries over the period 1960-2003.

[25] The adjustment takes into account the income received by the self-employed.

[26] It is unlikely the average capital share in income to be outside this interval.

the three periods examined. Then, the correlation between these averages and the average size of the shadow economy for the relevant periods is calculated. Figure 5 in Appendix II and Table 1 in Appendix III present the results.

The scatter plot on Figure 5 is with respect to the average size of the shadow economy and the average TFP for the period 1991-2015 in the fifty countries under study. The figure implies once more time a clear inverse relationship between the two variables: the smaller the size of the shadow economy, the larger the TPF in a country and vice versa. Countries with a small size of the shadow economy like Austria, the Netherlands, Switzerland, or the UK have an average TFP for the period 1991-2015 around 0.16-0.17[27], while countries with large size of the shadow economy like Ukraine, Georgia or Belarus have an average TFP around 0.7-0.11. The correlation coefficients in Table 1 confirm the existence of an inverse relationship. For all three considered periods, the coefficients are statistically significant, relatively large and with negative signs.

There is solid economic logic backing this result about productivity. One explanation is connected to the analysis in Section 3.2., where we find an inverse relationship between shadow economy and capital per capita. Countries with large shadow sector tend to have fewer investments, which leads to slower advances in the development of new technologies and the adoption of existing ones. This clearly has a negative impact on productivity. Another possible explanation is the relationship with the level of education. Countries with large shadow sector would suffer from low government revenues and as a result, the resources allocated for education would be insufficient. The latter leads to low values of human capital, which is key for the implementation of new technologies, for the implementation of effective forms of organization and ultimately, as a result, for productivity.

On the other hand, technology allows state revenue agencies to improve their detection, control, and tracking mechanisms. In some countries,[28] all of the cash registers should be directly connected to the Tax Authorities and have fiscal memory of all transactions with the purpose to tackle the practice of tax evasion by not issuing cash receipts. At the same time, big data techniques and data modelling allow national revenue agencies to analyze big datasets, which allows them to detect risk behaviour better and appoint appropriate further inspections in a timely manner. Technological progress also encourages the use of electronic money, decreasing the use of cash, hindering shadow activity. The use of electronic money and digital transactions might be imposed by law, as in many countries, making transactions in cash above a certain limit is forbidden[29]. Such a policy measure, along with the growing convenience of electronic money, puts obstacles in front of conduction shadow activities, limiting the possibilities to hide transactions or record a lesser value than the real one. When public authorities take advantage of technological progress by improving their control

[27] The size of the TFP depends on the units of measurement. In our case capital stock is measured in thousands of constant international, 2011 US dollars, while the amount of labor is measured by the number of people employed.
[28] Bulgaria is one of them.
[29] For Bulgaria payments above 5,000 euro cannot be done in cash legally.

mechanisms using innovations, combined with adopting changes in legislation, they can conduct effective policies tackling the shadow activity.

Conclusions

Based on the analysis carried out in the framework of the present study, several conclusions can be drawn that shed some light on the impact of the shadow economy on economic development. The empirical data that are the subject of the study refer to fifty countries in Europe and Central Asia for the period 1991-2015. They show that in the period under review, there is an inverse relationship between the size of the shadow economy and GDP per capita. At the same time, it turns out that for the same countries and for the same period, a relationship between the shadow economy and the growth rates of GDP per capita is either missing or a positive one. At first glance, these facts contradict each other. But we believe that while the first relationship is long-term and sustainable, the second one is rather a specific, short-term characteristic. In our opinion, this specific characteristic stems from the fact that in the group of countries under consideration, there are many in this period which are in transition, meaning that they start their development as market economies from a relatively low base. As a result, their economies are relatively far from the steady-state trajectory of development and therefore, they are subject to the catch-up effect.

The present study shows that the inverse relationship between the shadow economy and GDP per capita can be explained by the impact of the shadow economy on the factors of production. We find that the size of the shadow economy is inversely related to all three macroeconomic production factors – labour per capita, capital stock per capita and total factor productivity. Empirical data show that countries with large shadow economies tend to be associated with low levels of factors of production and this leads to a low level of economic development. In addition to the empirical basis of these results, we present logically sound theoretical explanations as to why such a relationship exists.

Another conclusion from the study is that the strength of the relationship is not the same for all factors of production. While for capital and for total factor productivity, the inverse relationship with the size of the shadow economy is strong, in the case of labour, this relationship exists, but it is weaker. The data show that for some countries large size of the shadow economy and relatively high employment can coexist. The reason for this is the specific nature of many of the shadow practices, related to undeclared work, which allow such an effect.

The results of the present study may serve as a ground for future studies. One possible direction is to investigate analytically the issues related to the causality of the described relationships. This, in turn, could provide arguments for the formation of effective economic policy measures to limit the negative effects of the shadow economy.

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Appendix I

Examined countries

EU Countries			Non-EU countries		
Country	Size of SE* (% of GDP)	RGDP per capita* (thous. international 2011 USD)	Country	Size of SE* (% of GDP)	RGDP per capita* (thous. international 2011 USD)
Austria	8,93	39,37	Albania	6,361	32,72
Belgium	20,57	37,202	Armenia	5,842	42,59
Bulgaria	29,17	11,649	Azerbaijan	9,555	52,19
Croatia	28,81	16,849	Belarus	11,468	44,52
Cyprus	31,3	18,295	Bosnia and Herzegovina	6,575	34,21
Czech Republic	14,83	23,606	Georgia	6,832	64,87
Denmark	15,19	40,378	Iceland	35,576	14,2
Estonia	23,8	17,222	Kazakhstan	14,853	38,88
Finland	13,49	34,842	Kosovo	7,316	38,33
France	14,08	34,569	Kyrgyzstan	3,507	37,92
Germany	11,97	38,187	Moldova	5,698	43,43
Greece	27,06	26,27	Montenegro	12,256	38,35
Hungary	25,23	19,745	North Macedonia	9,239	37,59
Ireland	13,89	40,447	Norway	58,641	14,06
Italy	24,95	34,257	Russian Federation	17,815	38,42
Latvia	22,23	20,845	Serbia	9,973	34,59
Lithuania	25,15	15,177	Switzerland	49,806	7,24
Luxembourg	10,67	47,75	Tajikistan	2,64	42,99
Malta	29,8	20,332	Turkey	14,422	31,38
The Netherlands	10,77	41,475	Turkmenistan	4,866	n/a
Poland	25,1	16,211	Ukraine	34,007	11,08
Portugal	21,88	24,862	United Kingdom	8,482	44,8
Romania	30,14	13,26	Uzbekistan	5,231	n/a
Slovakia	15,33	16,791			
Slovenia	24,09	24,174			
Spain	24,52	30,175			
Sweden	13,27	38,111			

*Average size of the variables for the period 1991-2015.

Sources: Medina and Schneider (2018), Kelmanson et al. (2019), World Bank, IMF, authors' calculation.

Appendix II

Scatter plots for the period 1991-2015

Figure 1

Shadow economy and RGDP per capita

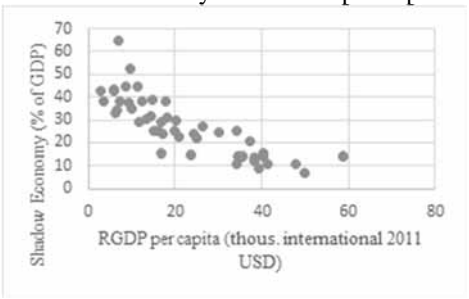


Figure 2

Shadow economy and RGDP per capita growth rate

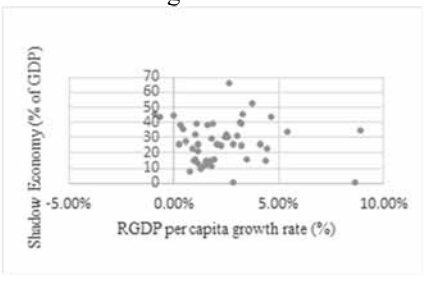


Figure 3
Shadow economy and capital per capita

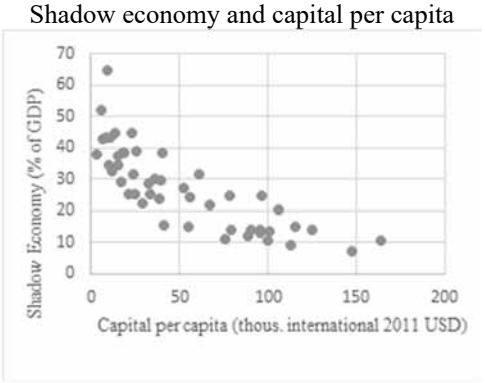


Figure 4
Shadow economy and employment per capita

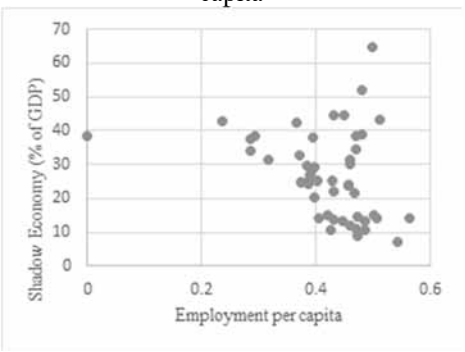


Figure 5
Shadow eonomy and total factor productivity

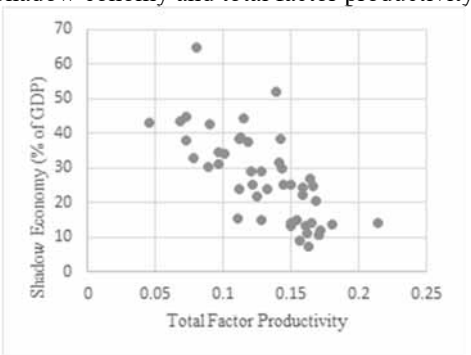
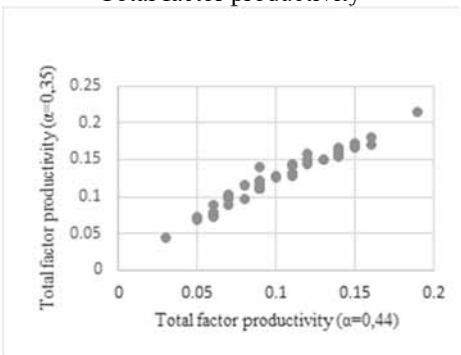


Figure 6
Total factor productivity



Sources: Medina and Schneider (2018), Kelmanson et al. (2019), World Bank, IMF, ILO, authors' calculation.

Appendix III

Table 1
Correlation coefficients between averages (p-values in brackets)

Period	Shadow economy and RGDP per capita	Shadow economy and RGDP per capita growth rate	Shadow economy and capital stock per capita	Shadow economy and labour per capita	Shadow economy and TFP
1991-2015	-0.829644*** (0.0000)	0.105720 (0.4794)	-0.804053 (0.0000)	-0.293699* (0.0451)	-0.776015 (0.0000)
1993-2012	-0.835992*** (0.0000)	0.322832** (0.0269)	-0.804244 (0.0000)	-0.279155** (0.0574)	-0.786695 (0.0000)
1993-2009	-0.833164*** (0.0000)	0.268849* (0.0672)	-0.804856 (0.0000)	-0.294026* (0.0449)	-0.783777 (0.0000)

* Significant at 10% level, **Significant at 5% level, *** Significant at 0.1% level
Source: Authors' calculation

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Emilia Chengelova[1]
Milena Angelova[2]

FACTORS DETERMINING THE UNDECLARED WORK IN BULGARIA[3]

The study presents empirical data gathered by recent studies on the factors that determine undeclared work in the Bulgarian economy. The relative weight and the specific functions of six categories of factors have been thoroughly analysed: 1) legislative, 2) situational, 3) mistrust and deficit of prestige to the state, 4) national psychology, 5) economic and 6) personal and family situation. The paper argues that the factors determining undeclared work have complicated and dynamic nature, but if a correct methodological approach is applied, they can be empirically studied and explained. The knowledge of the factors determining the undeclared work provides a basis for contemplating its genesis, nature and dissemination – especially in the case of societies in transition. The better the knowledge and understanding of the factors that determine undeclared work, the more effective and successful are selected and designed approaches and measures to limit and prevent it.
Keywords: undeclared work; gray practices; public opinion
JEL: E26; O17; D73; C18

1. Introduction

The undeclared work is a complex, multi-component, socio-economic phenomenon, that has a high degree of heterogeneity and internal discrepancy. Being extremely adaptable to socio-economic conditions and legislative base in every society system, the undeclared work is a very dynamic process. Its inherent heterogeneity, complexity and dynamism make this phenomenon very difficult to be empirically observed.

Defining the relationship between the grey practices and the undeclared work is an important methodological postulate when studying undeclared work. Many recent studies, that have been conveyed during the last five years (Edwards, Ram, Black, 2004; William et al., 2017; Medina, Schneider, 2018; Stefanov, Mineva, Karaboev, 2019) focus on an in-depth examination of the empirical display of undeclared work, stating explicitly, that this

[1] *Emilia Chengelova is a professor, doctor of sociological sciences, in the Institute of Philosophy and Sociology, the Bulgarian Academy of Sciences.*
[2] *Milena Angelova is a chief assistant, PhD, in Economic Research Institute at the Bulgarian Academy of Sciences and Secretary-General of BICA.*
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phenomenon constitutes the most important part of the grey economy. In the economic reality, undeclared work is motivated by a special type of grey practices, related to initiating and realising labour relations. It has to be noted, that often the applicable labour and security legislation is being not only ignored, but often violated[4] in the course of performing economic activities, which in principles are legitimate, but are to be qualified as "undeclared work", because not all of their aspects are declared to the state bodies and statistical services.

Considering the undeclared work as an academic issue requires placing it in the framework of political discussions and debates. An official definition of undeclared work was provided for the first time in 2007 by the European Commission[5]: '*any paid activities that are lawful as regards their nature but not declared to public authorities, taking into account differences in the regulatory systems of the Member States*'. That definition included all illegal activities.[6] It is to be noted, that till now, this definition remains the only comprehensive one and hence – is widely adopted and used by institutions and teams when they monitor or study the undeclared work (both at the European and national level). In 2020, a Bulgarian team developed this definition, by complementing it with an important precision regarding the link between the undeclared work and the grey economy: '*any paid activities that are lawful as regards their nature but not declared to public authorities. The undeclared work is a part of the grey economy and is a result from those grey practices that violate the labour, security and tax legislation and the Law on Statistics*'.[7]

Placed in chronological order, the studies of the undeclared work follow the political debates and reflect the outlined socio-economic priorities in the society.

In this regard, the Decision of the European Parliament and the Council on the establishment of a European Platform in order to strengthen cooperation to prevent and eliminate undeclared work is particularly important (European Parliament, 2014). Decision (EC) 2016/344 of the European Parliament and of the Council of 9 March 2016 established a European Platform in order to strengthen cooperation in combating undeclared work.

The **national context gives** a key role to the Bulgarian Economic and Social Council opinion, adopted in 2015 on 'Limiting and Preventing the Informal Economy in Bulgaria as to Stimulate Growth and Employment'. It resulted in inclusion in the Annual National Plans on Actions on Employment of texts, stressing on the need for adequately combating the undeclared work and undeclared labour (National Plans on Actions on Employment, 2017, 2018, 2019, 2020, 2021).

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[4] Studies show, that part of the non-compliance are done cautiously, while another part is done due to lack of knowledge of labour and social security legislation.

[5] Brussels, 24.10.2007, COM(2007) 628 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52007DC0628.

[6] Decision (EU) 2016/344 of the European Parliament and of the Council of 9 March 2016 on establishing a European Platform to enhance cooperation in tackling undeclared work (Text with EEA relevance), OJ L 65, 11.3.2016, p. 12–20 https://eur-lex.europa.eu/legal-content/BG/TXT/?uri=CELEX:32016D0344.

[7] Team led by Dr Milena Angelova, implementing the BICA project BG05M9OP001-1.051-001 'Improving the Access to Employment and the Quality of Jobs through Limiting and Preventing the Undeclared Work'.

The paper aims at presenting and analysing empirical data gathered by recent studies on the factors that determine the undeclared work in the Bulgarian economy in order to explore and define these factors, describe and assess their influence, and whenever possible – measure their weight – in order to build a scientific-based framework for their systematic analysis and prediction as to allow sound decision and policymaking. The main source of primary data is a survey conducted within the framework of the implementation of the project BG05M9OP001-1.051-001 'Improving the Access to Employment and the Quality of Jobs through Limiting and Preventing the Undeclared Work'.[8] The paper goes further beyond the scope of this project, as it intends at putting on a scientific basis the analysis of the data and builds the foundations for their better understanding and application in the decision and policymaking – by thoroughly analysing the relative weight and the specific functions of six categories of factors have been: 1) legislative; 2) situational; 3) mistrust and deficit of prestige to the state; 4) national psychology; 5) economic determinants; 6) personal and family situation.

The paper is based on the presumption that the participation in undeclared work practices is not an occasional behaviouristic act, but rather is a result of complicated psychological processes, within the framework of which an individual assesses which is the most favourable economic behaviour in terms of prosperity – up to the rules, based on compliance with the legislation, or a non-compliance behaviour, where an individual will use some legislative ommissions and institutional deficiencies to deviate from the rules as to derive benefits. The paper argues in favour of the hypothesis, that the factors determining undeclared work have a complex and dynamic nature, but if a correct methodological approach is applied, they can be empirically studied and explained. The knowledge of the factors determining the undeclared work provides a basis for contemplating its genesis, nature and dissemination – especially in the case of societies in transition. The better the knowledge and understanding of the factors that determine undeclared work, the more effective and successful are selected and designed approaches and measures to limit and prevent it.

The paper tests and verifies a series of additional, particular hypotheses. They touch upon the subordination of the six categories of factors, following the assumption that regardless the different nature of the factors in those categories, the economic determinants have the heaviest weight and cause the strongest influence on the propensity to engage in undeclared works practices. The study also verifies the hypothesis that the personal and family situation is being in a way underestimated in the related studies, while in reality, they cause very strong, even determining influence. Another hypothesis is that the national psychology is an important behaviouristic determinant, even though it is of complex and heterogeneous nature.

The authors' contributions are to be found in the facts that: 1) the authors have developed the study methodology of the survey done within the BICA project framework – they have designed all the components – including hypothesis formulation and verification and methodological approaches for their verification through gathering and analysing relevant empirical data; 2) the authors have performed a thorough analysis of the empirical data, and on this basis have tested and verified the hypothesis. In this context, the authors' contributions are to be found both in the methodological preparation of the study and in the analysis

[8] Ibid.

performed on the empirical data and the elaborated on these basic ideas for policies and measures to prevent and limit undeclared work in Bulgaria.

2. Study Methodology

The study is aimed at presenting and analysing the main results from series of empirical surveys of the factors determining undeclared work in the Bulgarian economy. These empirical surveys were performed in the framework of the implementation of the BG05M9OP001-1.051-001 'Improving the Access to Employment and the Quality of Jobs through Limiting and Preventing the Undeclared Work'**.** Two nationally representative studies were conducted in 2020 in the realisation of the project – amongst employers and employees. The survey method was a standardised personal interview (face-to-face interview), conducted with a number of enterprises and their employees. A representative tree-staged stratified sample was constructed, as to guarantee representativity against the criteria: 1) economic activity (according to the National Code of Economic Activities-2008), 2) size[9], and 3) location of the enterprise. Applying the described method, managers from 630 enterprises were interviewed, as well as altogether 1 311 of their employees. When calculating the sample size, a maximum allowable stochastic error $\Delta\_p\% = 2.25\%$ p is set, thus ensuring high accuracy in the interpretation of the percentages. As already mentioned earlier, the information was collected using two standardised questionnaires – one for managers and one for employees, elaborated following internationally recognised methodological standards, that guarantee the reliability of the data collected. The data were analysed by applying the specialised software SPSS, creating in this way the necessary technological prerequisites to perform as much productive analysis as possible.

We will not elaborate here in detail on the complex and multistage methodological preparation of the two surveys. However, we shall mention, that in order to guarantee the preciseness of the two surveys, a special desk research was conducted – on the European practices to combat and studies of undeclared work, and desk research – on the models, mechanisms and instruments for limiting and preventing the undeclared work. On this basis, for the purposes of the project implementation, an enriched definition on undeclared work was adopted (quoted above), a system of empirical indicators was developed – in order to describe all aspects of the undeclared work and its practical forms, and precise research hypothesis were formulated. Together with determining the scope of the typical forms of undeclared work, the two representative surveys were aimed at tackling the relations between the new forms of work[10] and undeclared work. As this aspect has not been so far extensively studied in Europe, it was given special importance by BICA when performing the surveys. A special **Matrix of 24 indicators** was elaborated in order to describe in detail all the aspects

[9] The study explicitly examined the relations between the company's size and the influence of the factors determining the propensity to engage into undeclared work. The findings are described when the different groups of factors are analysed.

[10] Also referred to as 'non-standard forms of employment' – e.g. https://www.ilo.org/global/topics/non-standard-employment/lang--en/index.htm#:~:text=They%20include%20temporary%20employment%3B%20part,employment%20and%20dependent%20self%2Demployment.

of work and to allow for operationalisation of the different types of work and for decomposing them into empirically observable indicators. This approach can be qualified as a **methodological innovation**.

Another important focus of the two representative surveys is the empirical research on the factors determining the undeclared work. In order to facilitate this, in the phase of elaborating the surveys' methodology, a special attention was devoted to the existing surveys and publications, tackling the factors and reasons for undeclared work existence. It is worthy to note that the most challenging methodological element of the research on undeclared work is to define the reasons and factors that cause it[11]. Most probably, this is the reason that a relatively small part of European studies is devoted to this theme. It is interesting to mention, in this respect, the research conducted by a multinational team, aimed at explaining how to decrease the cases of undeclared economic activities in Bulgaria (William, Franic, Dzhekova, 2015). The research concludes that it is advisable to reduce the application of rigid, restrictive measures, and rather to replace them with measures, targeted at producing sustainable changes in the tax moral of the society. Other studies with similar scope also arrived at similar conclusions and findings – pointing at the necessity of deepening the research on the factors determining the grey practices and undeclared work (William, Franic, 2016; William et al., 2017; Stefanov, Mineva, Karaboev, 2019).

The desk research, conducted by our team[12] showed, that **when conducting empirical research of the factors determining undeclared work, it is necessary to distinguish and empirically study the following six groups of factors:**

1. **Legislative factors** – primary and secondary legislation. The existing contradictions that they might contain, as well as potential often changes, create favourable conditions for undeclared work to occur. The desk research revealed that the respondents often tend to evaluate the legislative factors as one of the main reasons for emerge and spread of the undeclared work (Medina and Schneider, 2018). This conclusion is found valid also by studies, describing the situation in the Bulgarian economy (William, Yang, 2015).
2. **Situational factors:** this group of factors relates to the existence or the absence of legally operating economic subjects. The shared view is that their absence in a given territory leaves the workers there with no other choice, but to search for employment in 'grey' companies. To this group also can also be attributed: supply and demand disbalances on the labour market (William, Yang, 2018), inadequacy of the education system (e.g. outdated curricula, educating 'unnecessary' specialists, whose qualification does not meet the needs of the real business), but also the low social prestige of traditional and important for the development of competitive economy professions.

[11] The desk research conducted in the framework of the BICA's project implementation shows that most of the studies done so far have purely descriptive goals and aim at describing the undeclared work practices and forms. Important goal is to define the relative shares of such forms as well (CSD, 2015).

[12] The desk research was done in the framework of the implementation of the BICA project BG05M9OP001-1.051-001 'Improving the Access to Employment and the Quality of Jobs through Limiting and Preventing the Undeclared Work'.

3. **Mistrust to the state and deficit of prestige**: this category contains a lack of: trust and respect to the state and the state institutions; appreciation for the legislation and the legislative bodies; trust in the retirement and healthcare systems (Chengelova, Zlatanova, Spassova, 2019).
4. **National psychology:** existence of attitudes and stereotypes for "tricking out" the state, for going against the public interest, strong individualistic attitudes, lack of respect for others and their rights (Chengelova, Zlatanova, Spassova, 2019).
5. **Economic determinants (at individual level)**. Attention is particularly devoted to those factors that have strong personal implications and substantial effects on the possibility to generate legal incomes. Such factors include: long-term unemployment, inability to find a job, low incomes, as well as desire to have higher net income in the short run.
6. **Personal and family situation**: this is an important category of factors, which accounts for the existence of a particular situation in the family, that may lead to attitudes motivating participation in 'grey' practices. Such factors might include: gravely ill and/or unemployed family members, small children, retired relatives, etc., as well as: financial liabilities (loans, credits, mortgages, rents), substantial costs related to building projects, education, expensive medical services, etc.

Within the framework of conducting the two representative surveys (amongst employers and employees), special questions were asked in order to assess the importance of the six categories of factors and their real effect on the probability for inclusion in undeclared work.

The collected empirical evaluation, conclusions and findings are presented in the current paper.

3. Legislative Deficits – Risks of Creating Space for Incorrect Labour Relations

The relationship and interdependency between the quality of the legislative environment and the probability of grey practices emergence, as well as the influence of various other factors, has been studied in earlier years, including by Bulgarian researchers.[13] D. North formulates also in a clear and definitive manner the interdependency between the quality of the legislative environment and the probability of grey practices emergence. North places a central focus on the state of the institutional environment – understood as a system of rules (both written and not) coupled with the institutions themselves and proves that the "*main role of the institutions in a society is to reduce the uncertainty, by establishing the foundation of a stable (but not necessarily effective) structure of human interactions*" (North, 2000, p. 16). Within the context of the institutional theory of North, many studies test further the relations between the institutional (legal) environment and the grey practices scope (Hernando, 2000).

[13] See for instance: Hristoskov, J., Shopov, G., Beleva, I. 'Non-Institutionalized Work and Self-Employment', Sofia, IME, 1996; Kumanova, A., Dimitrova, R. 'The Hidden Economy through the Eyes of Experts', Statistics, 1998, no. 2; Stoyanova, K., Kirova, K., Kirova, A. 'Social Challenges of the Shadow Economy', Sofia, GorexPress, 1999; Todorov, T. 'Informal and Hidden Economic Activity in the Context of the Completeness of National Accounts', Statistics, 1999, no 5.

The conclusions are that the more uncertain, inappropriate and unstable is the legislative environment, the higher is the probability for grey economy practices to occur.

Following the concept of North and relevant leading European researches, the nationally representative studies conducted by BICA amongst the employers and employees tested the influence of five factors, describing the legislative framework. They include synthetic factors, representing at macro level two basic characteristics of the legal environment and three more particular aspects, capturing the possibilities created by the labour legislation for agile employment:

1) Omissions in the legislation.
2) Frequent changes in the primary and secondary legislation.
3) Misuse of the possibilities, provided by the Labour code to hire at the reduced working time – e.g., 2, 4 or 6 hours.
4) Misuse of the possibilities, provided by the Labour code to hire applying agile working time.
5) Misuse of possibilities, provided by the Labour Code for teleworking.

Opinions and evaluations about the relative share and influence of these five factors on the probability for undeclared work occurrence are collected – both from the employers and employees. The evaluations received are depicted in Figure 1, and on the basis of their analysis, important conclusions and findings are drawn.

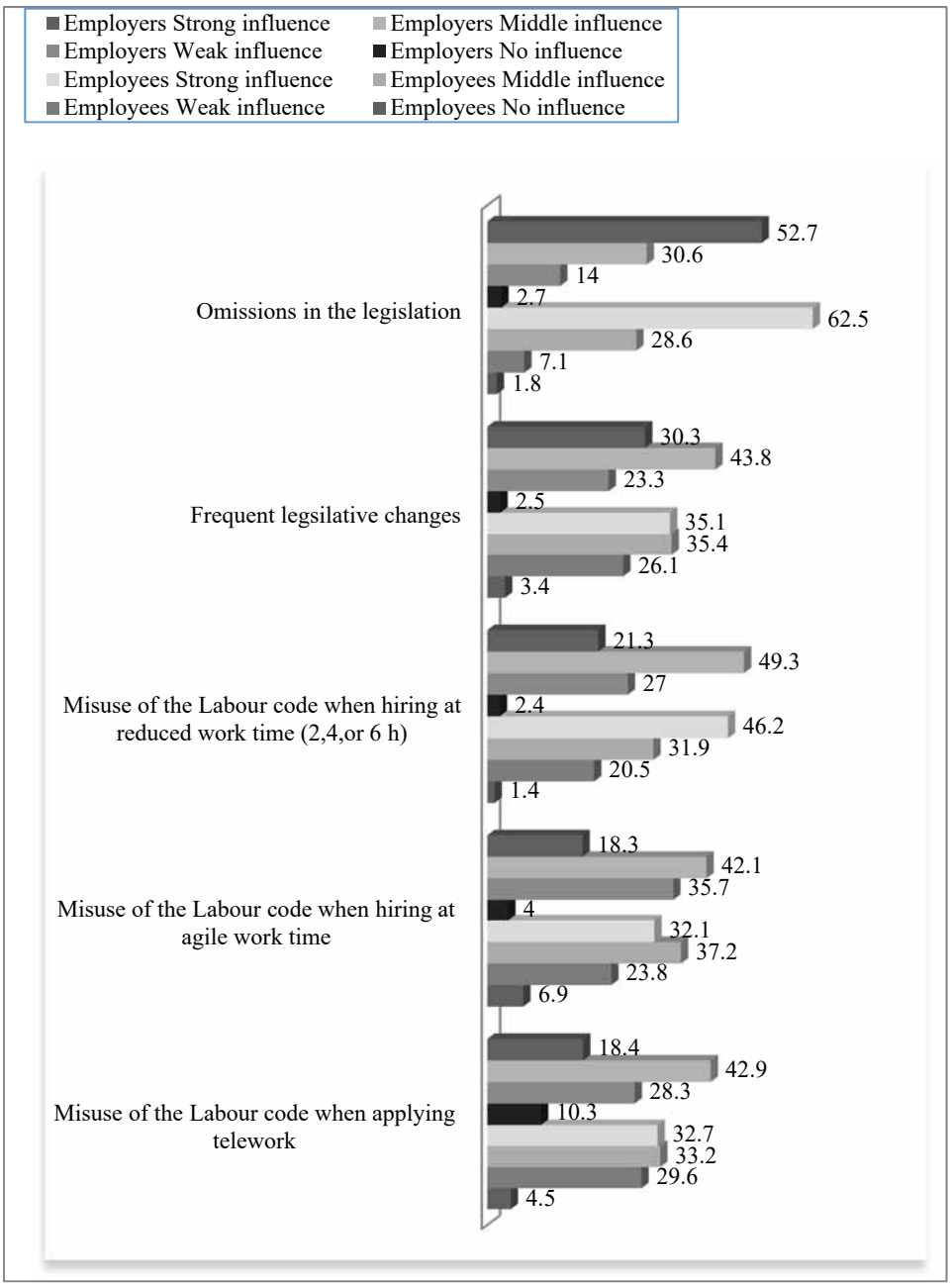
According to 83.3% of employers and 91.1% of employees[14]**, the existence of omissions in the labour and security legislation is one of the main factors that facilitates the undeclared work occurrence**. These evaluations reveal the convictions of the employers and employees that the quality of the legislative environment plays determining role in the proper functioning of the economy. An important element of these convictions is the belief that any omissions in the legislation will be used for illegitimate purposes, including undeclared work practising.

The omissions are not the only reason for the labour and security legislation to be not effective enough – the other being that **frequent changes were introduced in the legislative acts in Bulgaria**. Data show that the frequent legislative amendments are considered to be a serious factor creating prerequisites for undeclared work occurrence – by **74.1% of employers and 70.5% of employees**.

[14] Here and further down the relative shares are presented summarizing the replies “strong” and “middle” influence. Detailed data on the shares’ estimates are presented on the figures.

Figure 1

Evaluation of employers and employees about the relative share and influence of the five legislative factors on the probability for undeclared work occurrence



The analysis shows that there is a relation between the company's size and the evaluations received – the trend being that the bigger the company is, the more critical it is towards non-compliance. Also, the representatives of bigger companies are more convinced that the omissions and imperfections in the legislation act as a direct motivator for engaging in undeclared work practices.

Three particular hypotheses are tested through the representative studies amongst employers and employees – exploring the risks of misuse some legislative provisions, introduced originally to provide for more flexibility on the labour market.

The first one suggests that there is a **risk of misuse when applying in practice the possibility, enshrined in the Labour Code, to hire at a reduced working time – e.g., 2, 4 or 6 hours**.[15] **70.7% of employers and 78.1% the employees** are of the view that there is a risk of incorrect application of these provisions and it may lead to undeclared work.[16]

The second hypothesis stipulates that the **risk of undeclared work stems from the possibility of misuse of the flexible working time provisions in the Labour Code**: **60.4% of employers and 69.3% of employees** are of the view that undeclared work can occur because of misusing the legislation regarding flexible working time.

The third tested hypothesis explores **the possibility of legislative non-compliance in the case of teleworking**. **61.3% of employers and 65.9% of employees** are of the view that there is a risk of non-compliance to the legal framework that lays down the rules for teleworking, which may result in undeclared work practices.

4. The Effect of the Situational Factors for Occurrence and Dissemination of the Undeclared Work

This second category of factors, which we call "situational", consists of subjective circumstances, which characterise the Bulgarian society at present and which crate a macro framework, a model, within which the undeclared work emerges and occurs. Based on the assessment of the influence that the factors (forming the common macro national and regional environment) cause, we can place in the category of the situational factors, influencing the undeclared work:

1) Lack of companies respecting the rule of law in a particular territory;

2) Lack of qualified workers in key professions;

[15] The Bulgarian labour legislation gives the possibility to hire at reduced work time – art. 138, p. 1, 2, 3 and 4 of the Labour code. Additionally, a possibility is established to hire through a labour contract a person who works only on particular dates of the month (art. 114 of the Labour code).

[16] Hiring at a reduced work time is frequently used in Bulgaria. It particularly fits the needs of many sectors such as HORECA, retail, transport, logistics, art, administrative services, florist, care services, etc. The type of employment – permanent or temporary is the main determinant of the risk of undeclared work. Permanent employment is quite unlikely to cause any form of undeclared work, while temporary employment (temporary, for a given period, seasonal) is more likely to motivate undeclared work.

3) Relatively low social prestige of some traditional and important for the economy professions;
4) Relatively low readiness to go for labour mobility in Bulgaria;
5) Vocational education mismatches the needs of the real economy.

The first factor in this category is the lack of companies, respecting the rule of law. The presumptions are, that if a town lacks enough companies, operating in line with the rule of law, people will be forced to search for employment in companies, that might use 'grey' practices. **74.7% of employers and 73.1% of employees** believe, that the lack of companies, respecting the rule of law, produce a decisive impact to give birth to undeclared work. If workers cannot find employment in companies, respecting the rule of law, they will engage with companies, that will offer payment in cash, and will disregard the obligation to pay taxation, social security, etc. Such type of undeclared work can occur as a consequence of specific deformations in the local economy structures.

69.8% of employers and 78.9% of employees perceive that the lack of qualified workers in key professions creates a probability of undeclared work. This is a direct dependency – the more deficit a profession is, the higher is the probability for undeclared work occurrence – e.g., 'grey' oral arrangements between workers and the employer. Particular examples may involve undeclared cash payments on top of the contractual salary, or additional undeclared benefits (providing a car, mobile devices, better working tools, etc., on top of the contractual salary). Figure 2 depicts the evaluations of the employers and workers about the situational factors.

Relatively low social prestige of some traditional and important for the economy professions effect over the undeclared work shall be evaluated within the context of the above analysis. 55.6% of employers and 58.9% of employees believe, that low social prestige may cause undeclared work. Professions that are perceived not to be prestigious are not very attractive, which cause a lack of workforce supply and asymmetric bargaining power that can force the employer to compromise compliance. Most often, the non-compliance is related to ways of maximising the net salary amount – in many cases by disregarding tax and social security payment obligations.

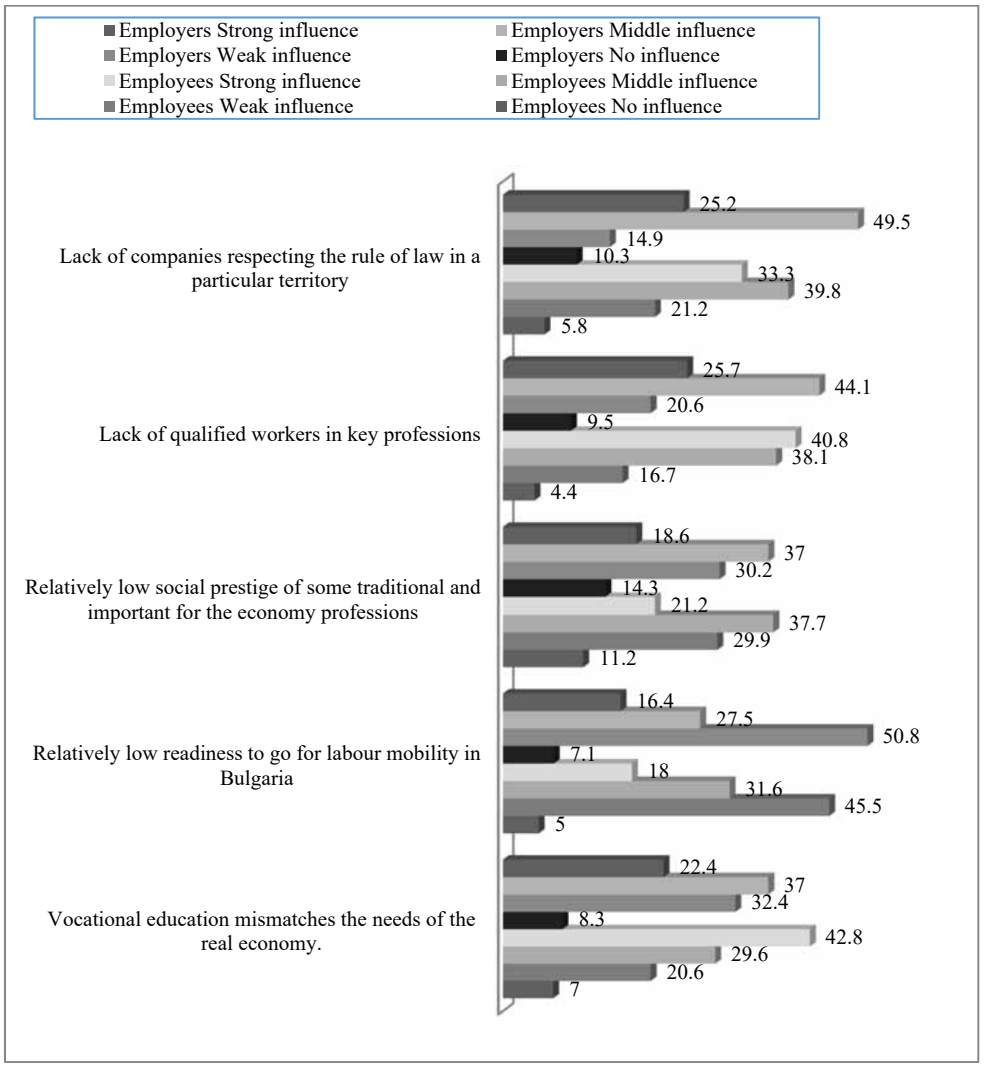
Educational system deficits also may cause undeclared work. 59.4% of employers and 72.4% of employees are of the view, that outdated curricula may stimulate undeclared work. Outdated curricula educate people to work using outdated methods, or outdated equipment, in both cases failing to equip them with the necessary theoretical knowledge and practical skills. Outdated curricula also cause a false impression of a balanced labour market – from one side, there are enough experts, but from another – they are equipped with outdated and irrelevant skills and knowledge – thus being unable to meet businesses' needs of qualified human resources. This creates a deficit of labour supply, where both employers and employees will be pushed towards undeclared work – as they are ready to do everything to move towards a balanced situation.

The relatively low readiness to go for labour mobility in Bulgaria was also explored. The presumption is that the low mobility will aggravate the lack of human resources in key professions. This will force the employers to accept all kinds of requirements of the potential

workers, including for non-compliance – so that the net payment is maximised. These concerns are shared by **50.8% of employers and by 45.5% of employees**.

Figure 2

Evaluations of the employers and workers about the situational factors



When the factors are analysed, a test was also made to check if there is a relation between the company's size and the evaluation received. The statistical coefficients values obtained (Cramer and Chi-square) indicate a weak relation. The conclusion is that, irrespective of the company's size, the determining influence of this group of factors as drivers of undeclared work is clearly articulated.

5. Mistrust and Deficit of Prestige as a Factor Causing Emerge and Spread of Undeclared Work

The third category of factors, determining undeclared work, is labelled **"mistrust and deficit of prestige".** It comprises seven factors, that reflect different aspects of trust and prestige related to key society systems and mechanisms. Leading European experts and analysts are of the view (William, Franic, Zhekova, 2015), that if key society systems and mechanisms lack public trust and prestige, this will create psychological readiness and attitudes favouring non-compliance, including undeclared work practices. The following factors are to be considered here:

1) Lack of respect towards state institutions and official regulations;
2) Lack of trust in pension system;
3) Lack of trust in the healthcare system;
4) Ineffective state control;
5) Low probability of detecting violations of labour and security laws;
6) Weak sanctions and consequences in case of non-compliance;
7) Believe that the society will accept avoidance of paying taxes and securities – completely or partially.

The overwhelming opinion of the employers and employees is that these seven factors are chosen correctly, and it is relevant and important to study them as they reflect important issues about Bulgarian society.

The first factor in this group regards the lack of respect for the state institutions and official regulations. There is scientific evidence that when large portions of the society violate the social norms and regulations, this leads the society to a state of anomy[17]. Leading Bulgarian social researchers concluded that anomy in the Bulgarian society started at the beginning of the transition period and is currently ongoing. The Bulgarian version of anomy is one of the extremes and is characterised by „*... a striking lack of social dimension, of shared responsibility towards our existence as a society"* (Dimitrov, 2009, p. 93). The current research shows that, **according to 62% of employers and 69.2% of employees,** the lack of respect for the institutions and regulations is a serious problem in Bulgarian society. These

[17] **ANOMY** (Greek anomiā, lawlessness, from anomos, lawless : a-, without; see a-1 + nomos, law; see nem- in Indo-European roots). Meaning: 1) Social instability caused by erosion of standards and values; 2) Alienation and purposelessness experienced by a person or a class as a result of a lack of standards, values, or ideals. "Anomy is a lack of the usual social or ethical standards in an individual or group. This is a social system state, under which the usual social behaviour rules implication is weaken. Large amount of people and groups of people, communities and institutions ignore and violate social behaviour rules. The principle of solidarity also is ignored and instead the principles of power and brutality are embraced. Rights and benefits are requested, and the common obligations and duties are ignored. In this way the society as a whole is depressed by risk amount of conflict and destructive attitudes, is pushed out of its equilibrium and in this way the society loses its balance and sustainability and enters a society crisis spiral" (Mirchev, M., 2000. *The Anomy*. http://assa-m.com/sociologia32.php).

evaluations are shared equally by all the respondents, irrespective company's size, which is a sign that the evaluations are stable and are not related to the company's size. The conclusions of the conducted research are that in a situation, where there is a lack of respect for the state institutions and official regulations, mighty stereotypes and attitudes towards internalisation of the behaviouristic patterns emerge, and they serve as an excuse for non-compliance and application of 'grey' practices. Such type of attitude is extremely dangerous, as it involves a high degree of rationality (the individual has an excuse for such a behaviour) and destructivity.

Another system of critical importance for the smooth functioning of society is the **pension system**. **67.8% of employers and 83.4% of employees** are of the view**, that when mistrust and disapproval towards pension system prevail in society, this will lead to hesitation for paying social security, which, in turn, will have a negative effect on the labour relation, pushing it to the 'grey' zone.**

Equally, critical assessment is given to the healthcare system. 74.3% of employers and 89.7% of the employees stressed, that if there is a lack of trust in the society towards the health care system, this will have a serious negative impact on the attitudes of the workers, pushing them towards deviating from compliance with labour and security norms.

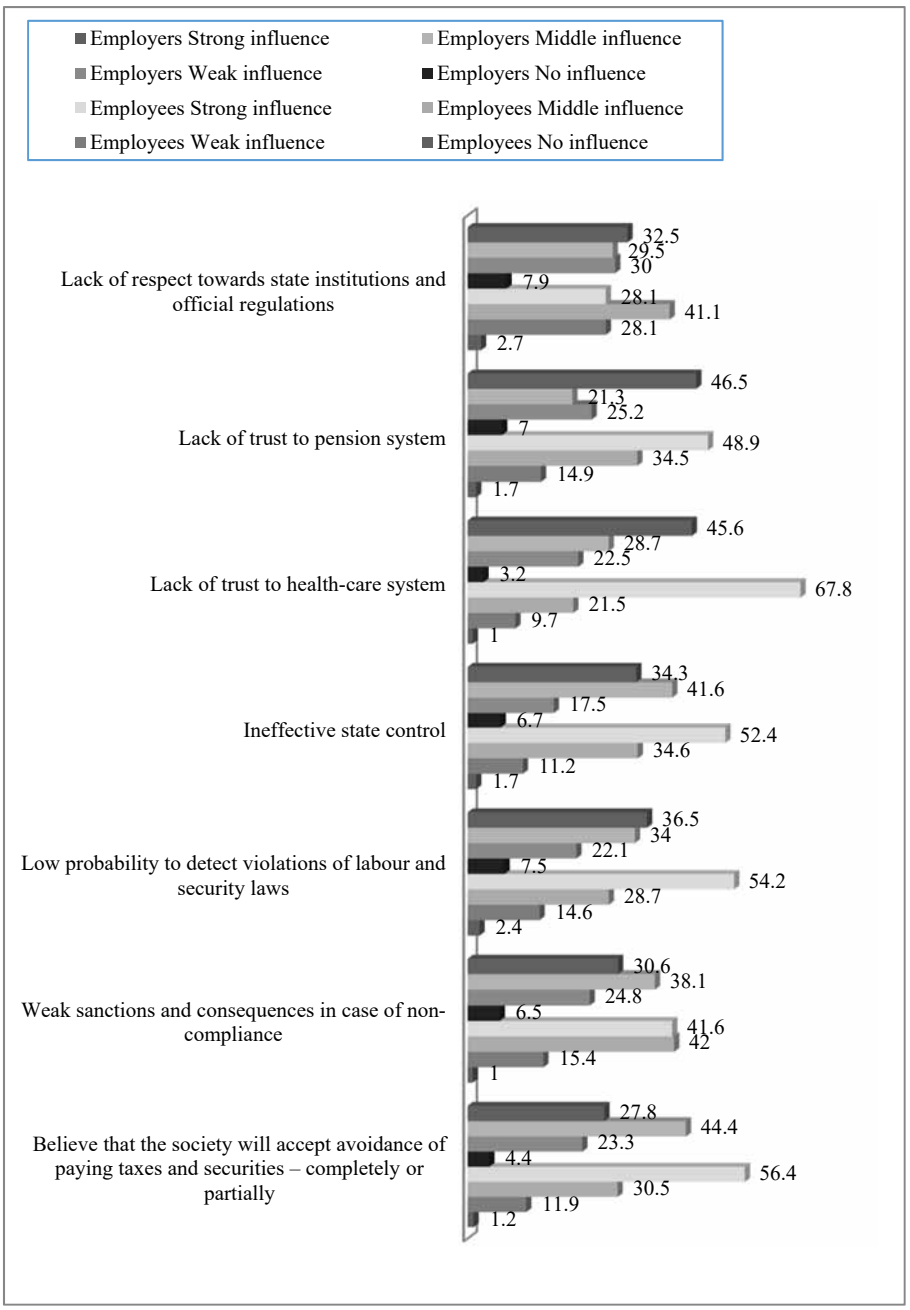
According to the data, the **lack of effective state control is a strong driver of the undeclared work.** This belief is expressed by **75.9% of employers and 87% of employees** – stating that when there is a lack of effective state control, the non-compliance attitudes rise rapidly. Closely linked to the weak control is also **the low probability of detecting** non-compliance with labour and security rules**. 70.5% of employers and 82.9% of employees** firmly believe, that the low probability of detecting non-compliance is a factor, which, in a substantial degree, provokes the emergence and spread of non-declared work. The lack of effective mechanisms for detecting non-compliance generates attitudes towards the application of deviating behaviouristic models, which tolerate and accept non-compliance. In this regard, **68.7% of employers and 83.6% of employees** are of the opinion that the non-compliance sanctions are somehow weak, which stimulates non-compliance, "grey" practices and demotivates compliance.

Figure 3 depicts the evaluations of employers and employees about the relevant importance of each of the seven factors within the group "mistrust and lack of image".

The studies also tested the thesis, that if **the society does not strongly condemn non-compliance in payment of the entire amount of tax and securities, this will directly unlock further non-compliance attitudes**. Assessing this factor, **72.2% of employers and 86.9% of employees stated**, that in a society the overwhelming majority believes that not to pay taxes and securities is allowed and shall not be condemned, then this will generate public attitudes and stereotypes, that stimulate "grey" economic behaviour.

Figure 3

Evaluations of employers and employees about the relevant importance of the factor group "mistrust and lack of image" on undeclared work



6. Influence of the National Psychology Factors on the Processes of Emergence and Spread of Undeclared Work

The next category of factors summarises the specific characteristics of the national psychology. Even though there are quite a few European studies, devoted to this group of factors, our preliminary analysis showed that underestimating the specific characteristics of the national psychology would be a mistake, as it will leave out of the scope of the analysis important stereotypes, attitudes and models of behaviour. Within the framework of the desk research conducted, many factors of the Bulgarian national psychology were identified, but at the end we have embarked at putting forward for evaluation through the representative study only three of them, considering them being key – as summarising and synthesising many elements, namely:

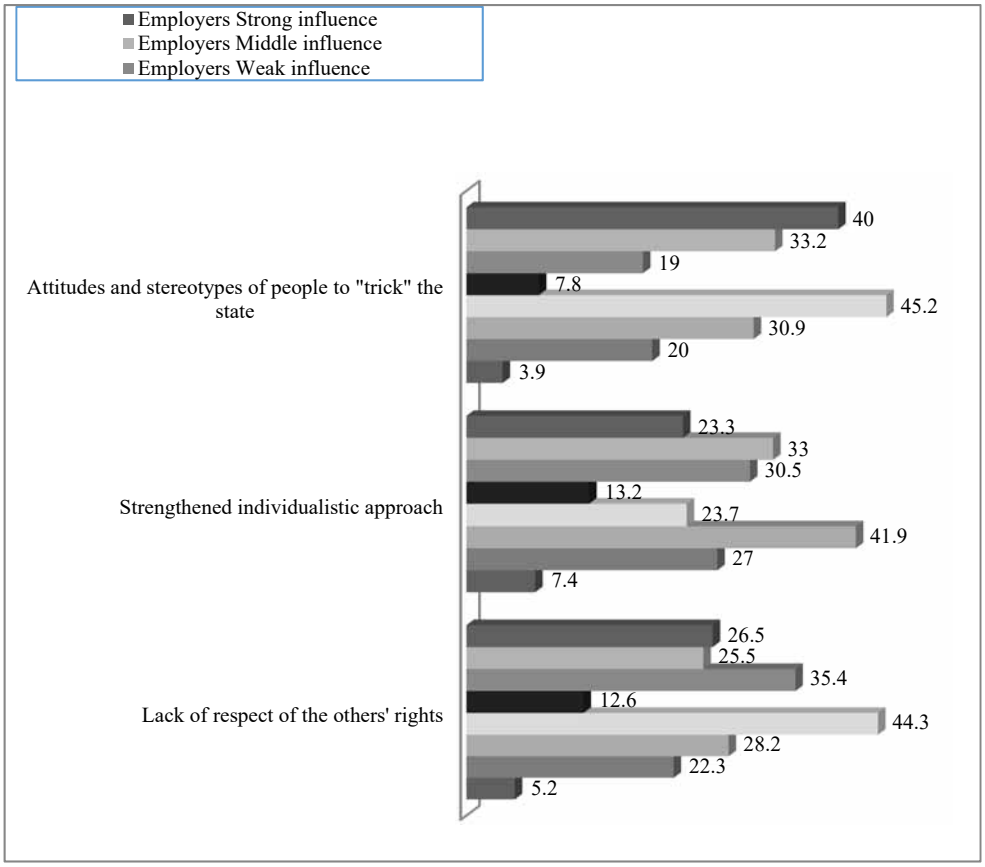
1) Attitudes and stereotypes of people to "trick" the state;
2) Strengthened individualistic approach;
3) Lack of respect of others' rights.

The first synthetic factor of this group – "attitudes and stereotypes of people to "trick" the state", is cumulative for a wide spectrum of attitudes, that cast a negative projection over the individuals' economic behaviour. **73.2% of employers and 76.1% of employees** evaluate the significance of the tested attitudes and stereotypes as very high and high. We believe that the very existence in the public opinion of stereotypes to "trick" the state[18] is typical and specific for the Bulgarian national psychology, and gives ground in favour of attitudes of non-compliance and "tricking" the state.

Another tested factor is the strong individualistic attitudes of modern people. It is typical for modern societies that the people tend to automise, close inside themselves and put their own interest above the interest of the society. **56.3% of employers and 65.6% of employees** consider reinforced individual attitudes as a factor that stimulates inclusion in undeclared work practices. The key characteristic of such an attitude is that personal interest is placed above the common interest. Following this logic, some individuals develop a "conformist" economic behaviour –placing their personal interest above all – even above the rule of law. Figure 4 depicts the cumulative evaluations of employers and employees.

[18] At the beginning of 20th century, Elin Pelin creates the literature type of Andreshko, who represents the typical type of a Bulgarian peasant. Although in the original novel of Elin Pelin, Andreshko undertakes a risky course of action to save a friend from punishment for non-compliance, gradually, a stereotype was created in the public opinion in favour of "Andreshko type of behaviour" – sympathizing to poor people "tricking" the state by every means. During 1940s, the Bulgarian sociologist and psychologist Ivan Hadjiyski develops his optimistic theory for the Bulgarian nation, where he depicts the drawbacks of his compatriots – and criticizes the attitude of many Bulgarians towards tricking and non-compliance.

Figure 4
Cumulative evaluations of employers and employees on the effects of psychological factors on undeclared work emergence and spread



The third factor, which the conducted studies evaluate, is the lack of respect for other people's rights. Social psychologists warn that a negative trend is gaining traction in modern society to ignore and not to respect the views and rights of others. Even being of a psychological nature, such an attitude has a social construction and cause a negative effect on the overall behaviouristic attitudes of individuals. One practical consequence of these types of attitudes is building a psychological readiness for nonlegitimate economic behaviour, where the individual puts his own interest at first place and tends to act as to endanger or violate the rights of other people. For example, a worker with the described mindset may insist to be hired without signing a contract – and be paid in cash, ignoring the fact that in this way, he puts the employer in a risky and dangerous situation. The conducted surveys show that **52.1% of employers and 72.5% of employees** perceive the attitudes towards disregarding the others' rights to be a strong non-compliance motivator, which also generates undeclared work.

The study also tested the relation between the company's size and the nature of the evaluations regarding the factors linked to the national psychology. The corresponding statistical coefficients have low values, meaning that the evaluations are not depending on the company's size. This proves the stability of the evaluations, and also shows that this group of factors represents common national characteristics, which are displayed in a similar way irrespective of the company's size and scope of the economic activities.

7. Economic Determinants of Undeclared Work

Taking the Weber's thesis of rationalising the behaviour of the "economic person" (Kirova, 2008), most contemporary studies resume, that the economic interest is at the foundation of all undeclared work practices. **Three factors are accessed by the conducted studies, in order to capture the projections of the economic environment on the possibility for individual professional realisation.** The presumption is, that the participation in undeclared work is motivated by purely economic factors, the most important of which being the need for constant and stable individual incomes. Ideally, an individual shall be hired with a legally sound contract and this shall be the source of income. Quite often, the legal income may not satisfy enough a person. Another problem is connected to the difficulty to find a job. The preliminary analysis shows that the economic factors are the strongest driver of entering into undeclared work arrangements.

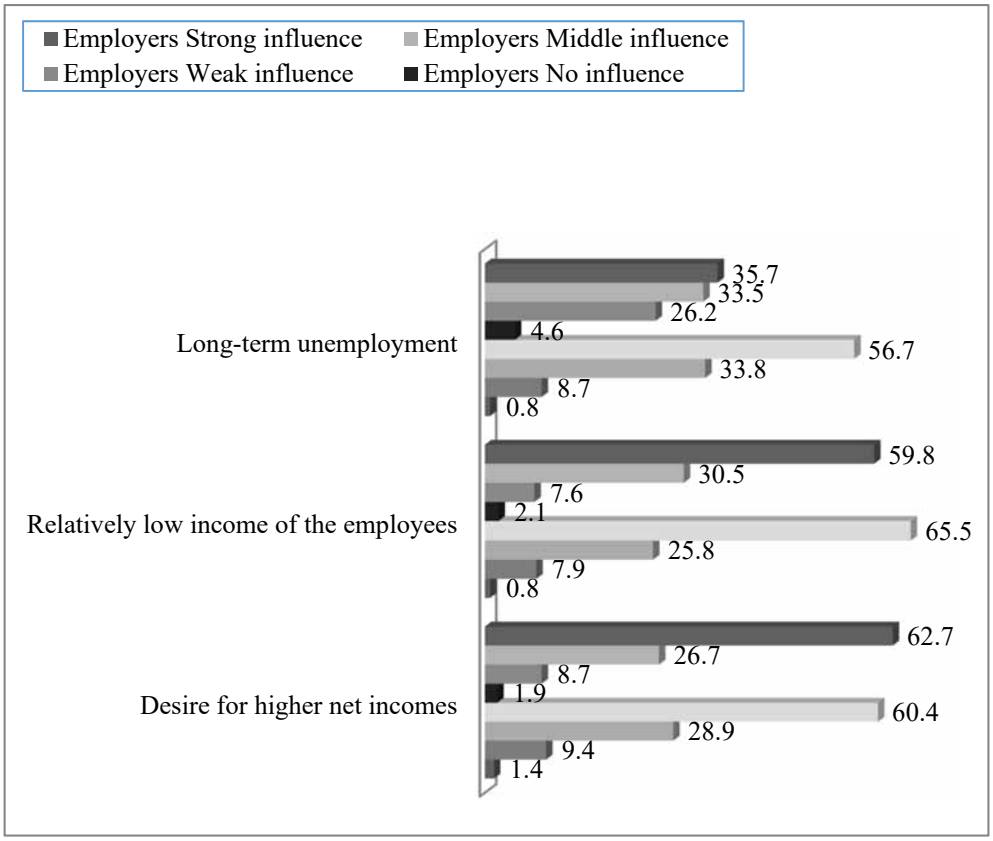
In order to test this assumption, the importance of the following three factors is assessed:

1) Long-term unemployment;
2) Relatively low income of the employees;
3) Desire for higher net incomes.

Fig. 5 illustrates the collected empirical assessments of employers and employees regarding these three factors.

89.4% of employers and 89.3% of employees stressed, that **the desire for higher net incomes in the short run is one of the strongest factors inspiring undeclared work practices.** One of the leading motives for a worker to choose a particular job, is the wage amount. If two companies compete with each other, a worker will choose – other things being equal, the company that offers higher net wage. This fact is well understood by both sides of the labour relation. This is the reason, in some cases, for generating "compromise solutions" – which de facto are forms of undeclared work – where a written labour contract is absolutely missing (maximising the net gain), or there is a written contract, but some labour elements are not included ("saving" some of the tax and security payments and increasing the net pay). The analysis also reveals that the employees in smaller companies are more inclined to evaluate the desire for higher net income as a motivator to engage in undeclared work.

Figure 5
Assessments of employers and employees on the economic factors' influence on the undeclared work occurrence



Data show, that workers' **low incomes** are yet another strong motivator for practising undeclared work. **90.3% of employers and 91.3% of employees** assessed low incomes as a direct driver for undeclared work emergence. This relation has a direct nature and easy can be traced. If a worker agrees to work for a payment, which is lower than his preliminary expectations, this can last for a while, but at a certain moment, most probably the worker will start to feel dissatisfaction and will try to renegotiate, including by asking for work without a written contract, or for work with a contract that does not cover all the aspects of the labour relation. The motive in such a case would be seeking to maximise the net amount of pay in the short run. The worker also can try finding employment within a rival company, that is expected to favour applying "compromise solutions" – i.e., undeclared working arrangements.

Another economic factor, which has a strong impact on the probability of undeclared work emergence, **is the long-term unemployment**. **The unemployment is one of the major**

enemies of compliance and the evaluations show that, **69.2% of employers and 90.5% of employees** are aware of this fact. These attitudes are especially spread amongst employees, which can be explained by the fact, that in a situation of unemployment, a worker will be more inclined to find a job regardless the compliance. The studies show that **the most vulnerable category in terms of undeclared work is unemployed**, and the relation is that the longer a person has been unemployed, the bigger is the probability to engage in undeclared work – being upon his initiative, or upon employer's proposal.

The analysis reveals that the bigger the company is, the lower the share of people, who evaluate the three examined factors as motivators for engaging in undeclared work. This can be explained by the fact that the employees of small and micro companies perceive a larger degree of uncertainty regarding the stability of their job and also perceive lower net incomes. Therefore, the bigger the company is, the lesser the probability to trigger economic determinants that will motivate undeclared work practices.

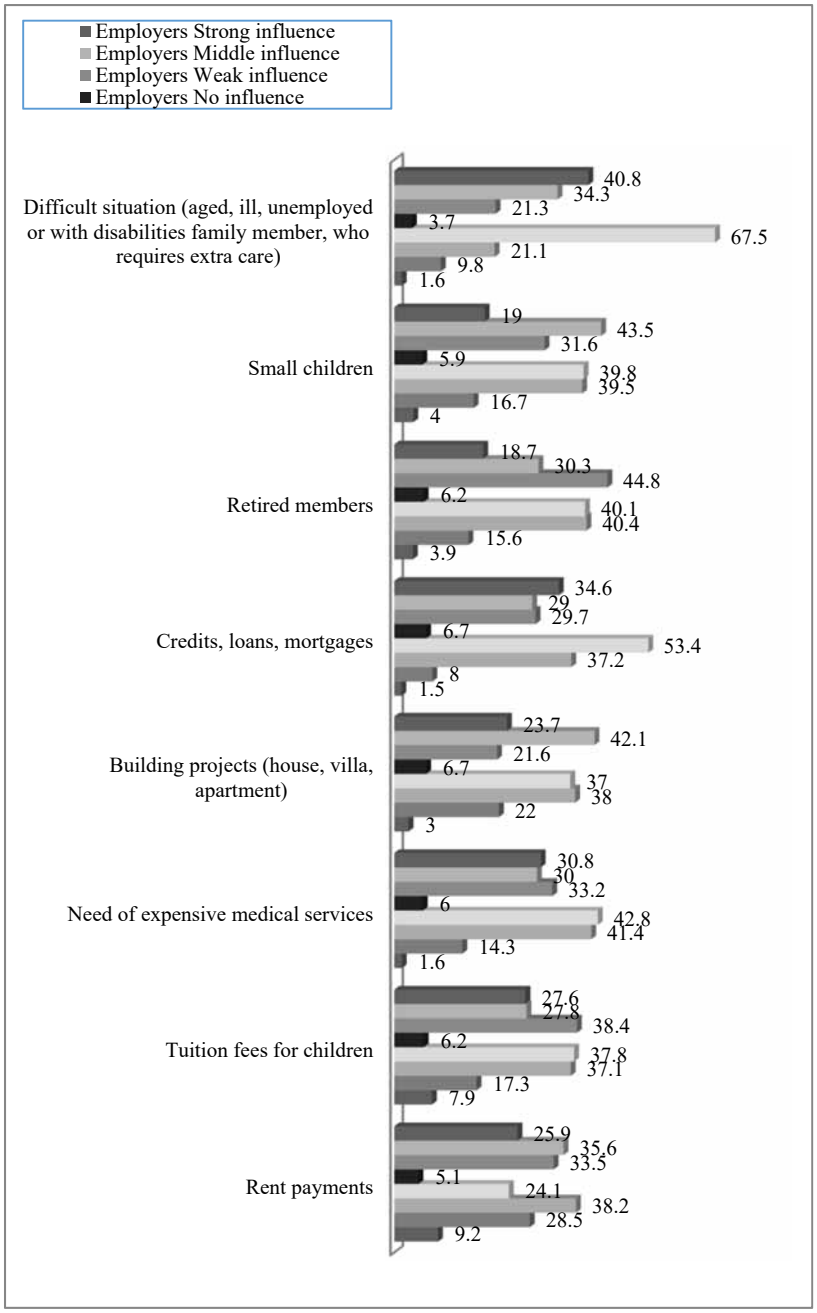
8. Personal and Family Situation as Undeclared Work Motivators

Personal and family situations as a whole cause serious influence over the individuals' economic behaviour and may push them towards undeclared work. As a result of the desk research (William, Renooy, 2013) and of the consecutive discussions, eight factors were identified as having a key role to motivate individuals to take part in undeclared work practices related to personal and family situations. These factors cover different aspects of family life – e.g., health problems, education and ageing issues of family members, and the need for serious investments in property. These eight factors, which were tested, are related to a situation, wherein a family there are:

1) Difficult situation (aged, ill, unemployed or with disabilities family member, who requires extra care);
2) Small children;
3) Retired members;
4) Credits, loans, mortgages;
5) Building projects (house, villa, apartment);
6) Need of expensive medical services;
7) Tuition fees for children;
8) Rent payments.

The evaluations of employers and employees on these 8 factors are depicted in Figure 6.

Figure 6
Evaluations of employers and employees on the impact of the personal and family situation on undeclared work emergence



The first estimated factor is of synthetic nature and is called a "complicated family situation". It refers to a situation where there are ill, unemployed, aged or with disabilities family members, who require special care and attention. **75.1% of employers and 88.6% of employees** reported, that such complicated family situation can motivate undeclared work practices. Each of those complicated family circumstances may motivate a family member to take part in undeclared work.

The second tested factor is small children in a family (under 18). The assumption here is that the dependent children require serious financial resources and – under given circumstances, the impossibility to provide such resources may motivate some family members to try filling this gap by undertaking undeclared work. Bulgarians are famous for their love for the children and for their readiness to do all for the children. Our studies show, that **62.5% of employers and 79.3% of employees** believe that the needs of the small children in a family may motivate the parents to enter into undeclared working arrangements.

The studies also checked the relative share of the factor "retired family members". The assumption is, that the retired people in Bulgaria have relatively low incomes[19] and – being a part of a larger household, their financial contribution to its budget is very modest. At the same time, the senior people often suffer some health problems that require substantial financial resources. That is why, under given circumstances, the need to devote financial resources for the treatment of senior family members may serve as a motivation for the working family members to include themselves in undeclared work. This assumption is supported by only **49% of employees, but by 80.5% of employers**, which illustrates the delicate nature of this fact and the very cautious manner in which the respondents give their evaluations.

The study tests the relative importance of the factor "existence of credits, loans, mortgages". This factor could be classified as an economic factor, as it directly concerns the incomes and financial resources of a family, but in the given situation, it is classified, however, in the group of the personal and family factors instead, because usually the existence of liabilities of any kind is motivated by serious family reasons. Altogether, **63.6% of employers and 90.6% of employees** evaluated as very significant or significant the existence in a family of financial liabilities towards other physical or legal entities. This type of thinking makes perfect logic: if the family has any financial liabilities, it is forced to search for sources of additional income. And in case legal sources are not found, then it will be quite likely a family to turn to not quite legal alternatives, including undeclared work.

[19] The scenario of having a family of two members – where both members are retired. It is quite likely in that case their income to be too restricted and this can motivate undeclared work commitments – not in compliance with the labour and security law. The study showed that the pensioners are quite a vulnerable group, with a high propensity to be included in grey practices. Apart from the strict economic compulsion, also socio-psychological factors can explain this phenomenon – the retired people outside the active labour age are more inclined to make compromise with the rule of law. Another explanation also can be provided – because of the low retirement pay, the pensioners are disappointed by the society and the solidarity principle. Therefore, they choose to demonstrate their disappointment by being socially noncompliant.

Building projects and works (e.g., house, cottage, apartment) is another factor which is quite likely to motivate undeclared work. When a family is engaged with building projects or works, it will need solid financial resources and constant income. If there is a lack of funds, this will stimulate the search for "fast" money – and undeclared work presents such an opportunity. **65.8% of employers and 75% of employees** are of the view, that a building project poses a serious challenge to the family budget and to its tax morale and can motivate undeclared work.

60.8% of employers and 84.2% of employees perceive that a **reason for undeclared work can be the need to pay for expensive medical services. 60.8% of employers and 84.2% of employees** expressed an opinion, that the need to pay for expensive medical services can be a reason for work without a contract, or for accepting false clauses in a contract.

The possible reason for inclusion in undeclared work may also be the need to pay **children's tuition fee and rental charges: 55.4% of employers and 64.9% of employees** are of the opinion that this is a very strong factor, that motivates undeclared work. This kind of motivation is a relatively new trend in the Bulgarian society, but it is objectively determined by the changes in the preferred modes of education. Many families send their children into expensive private schools, that might be both domestic and foreign. Usually, Bulgarian private schools are chosen for primary and secondary education and foreign schools – for high education. But not every family can afford such expenses easily.

61.5% of employers and 62.3% of employees think that **tuition fees and rental payment** may motivate the search for possibilities to gain money "fast and easy", even at the cost of law non-compliance.

It is to be noted that the respondents are equally certain in their evaluation of the importance of the personal and family situation as undeclared work motivators, and the evaluations do not depend on the company's size. This group of factors, because of their specific nature and high individual importance, cause equally strong influence for all the individuals, irrespective of the company's size and the type of the economic activities.

9. Common Ranging of the Factors, Determining the Emergence and Spread of Undeclared Work

Based on the average estimation for the six categories of evaluated factors, a common ranging is done, where the closer the unit is to 1, the stronger is the influence of the factor.

The employers evaluated two economic factors as causing the strongest influence – **desire for a higher net income and low net income in the short run of the employees.** The third place receives the factor **"omissions and inconsistencies in the legislation", which is to show, that the legislative environment is the second important factor after the economic factors.** Right after that come the factors from the group, "mistrust and lack of prestige", and the personal and family situation and psychological factors. **Employees** tend to evaluate those factors that cause direct effects on the people as having the strongest impact on the propensity for inclusion in undeclared work practices – e.g., **the state of the healthcare and**

pension systems, personal income, the existence of complicated family situation. A relatively small part of the workers take into consideration the overall economic macro framework and conditions in the country, which defines the living and working conditions for the citizens in a country and in a region. Often, the important negative effect that misuses of legislative texts can cause by giving opportunity for more flexible forms of offering and realising employment, is not understood and appreciated, as well as the significance of the factor "lack of healthy, competitive enterprises in the region". Figure 7 depicts the ranging of the six categories of evaluated factors, according to employers and Figure 8 – according to the employees.

Figure 7

Employers' ranging of the six categories of evaluated factors

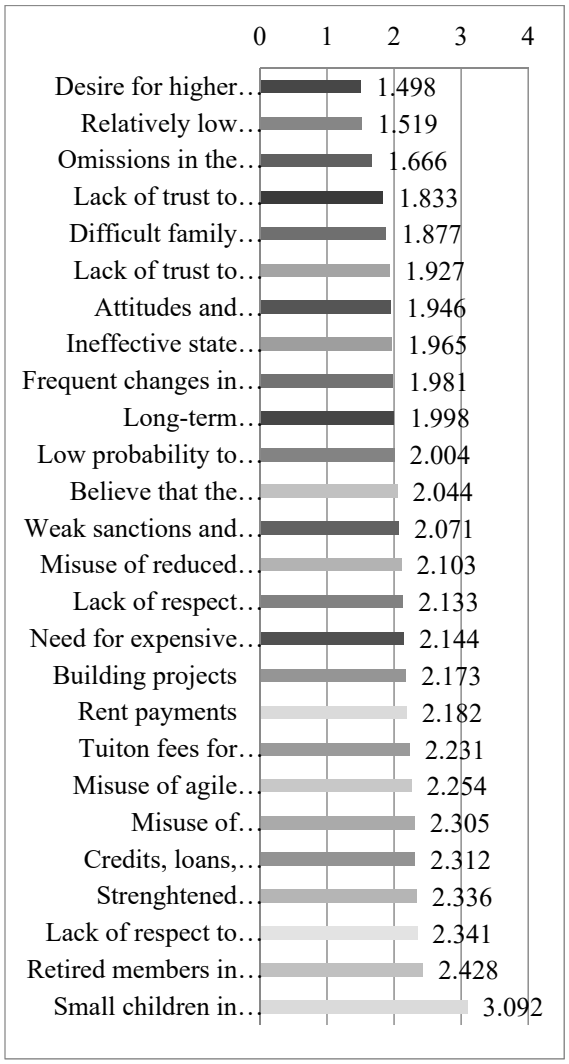
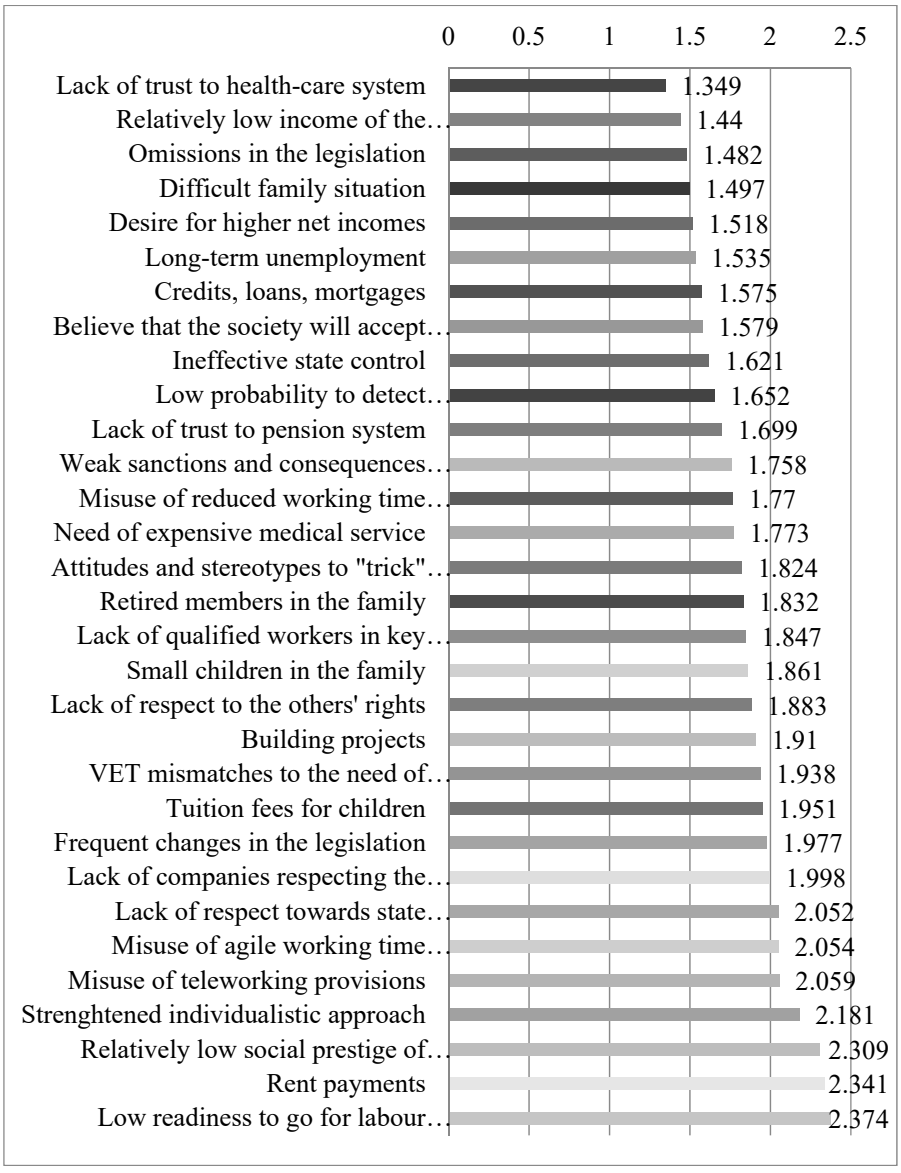


Figure 8

Employees' ranging of the six categories of evaluated factors



Ranging different factors, that affect the probability of undeclared work emergence, provides value for making managerial decisions, as it shows on a clear and definitive manner what is the hierarchy of the factors, that cause undeclared work. This

knowledge can be used when approaches, policies and measures for limiting and preventing undeclared work are devised.

10. Conclusion

The analysis of the empirical data, gathered by recent studies amongst employers and employees, presented in this paper, confirms entirely the preliminary hypothesis that the undeclared work has a controversial nature and is determined by very complicated and complexed factors. **The undeclared work practices emerge under the effect of a complex interaction between objective circumstances and subjective attitudes, stereotypes and behaviouristic patterns. Heterogenous and dynamically changing, these factors form a common legislative, institutional, values and behaviouristic framework, which affects the processes of undeclared work emergence and spread.**

The data gathered by the recent Bulgarian Industrial Capital Association studies confirmed the widely endorsed by experts thesis, that societies in transition – such as the Bulgarian society, are much more vulnerable to grey practices. The informality is a universal characteristic of modern economies, but the informal (grey) practices are boosting out of control in societies undergoing transition. Various and complex reasons and factors cause this – some of them being quite obvious and others – skilfully hidden behind complex socio-economic relations.

Amongst them, the **role of the legislative environment** is very important – as it determines the individual economic behaviour. **The more resilient, stable and internally coherent is the legislative environment, the less legislative prerequisites motivating attitudes for practising undeclared work are found. The introduction of new forms of work** gives raise to new challenges**, as the greater liberty and flexibility for realising the labour relation, created by the legislation, is perceived by some employers and employees as an opportunity for tricking and overcoming the law**.

The probability of undeclared work emergence depends directly on the stability and legitimacy of the economic environment at the national and local levels. Although the economy is a system of complex structured processes, relations and interactions, in one's mind, it is associated with the presence or absence of enterprises – of all size and from sectors. The lack of enterprises operating in compliance with the legislation, significantly narrows down the possibilities for legitimate employment, and pushes part of employers and employees into the 'grey' economic zone. Other factors that provoke strongly undeclared work emergence, **are the lack of qualified human resources, matching the needs of key for Bulgaria economic sectors, low prestige of traditional and key for the competitiveness professions and the mismatch between the vocational training and the needs of the labour market.** In their entirety, these factors create an unfavourable environment, which provokes the emergence of undeclared work – such as: work without a contract; work on a contract, containing false clauses; additional payment in cash, avoiding taxation; bogus self-employment and unpaid extra labour.

The empirical study of the factors determining undeclared work shows, that grey practices emergence is to a great extent determined by the **existence of sceptical or negative attitudes towards the state and state institutions.** The lack of respect towards the state is a serious problem that the societies in transition – such as the Bulgarian one – face. **The lack of respect to the state takes a form of non-compliance, including violation of the labour and security legislation.**

In that regard, it is very important to have a closer look at the **economic determinants of the undeclared work.** The conducted studies confirmed undoubtedly, that **the basis of any nonlegitimate economic models is the desire for higher net incomes and for minimising the costs**. This human characteristic is well described by social scientists, but it shall again be underlined, as it plays determining role in explaining the attitudes and psychological readiness for participating in undeclared work practices. The studies show, that, **driven by the desire for higher incomes and profits, individual of various sociodemographic background**, are ready to go against the rule of law and even to take the risk to be accused for that. To a great extent, this can be explained by the systematic downgrading of the gravity of these types of violations and the inadequate mechanism of the Bulgarian society for sanctioning and reprimanding such type of illegitimate economic behaviour.

Another group of negative attitudes, that motivates undeclared work emergence, are born by the **disapproval of the health and pension systems**. The **negative attitude towards these keys for the functioning of the society systems has reached critically high levels, which explains the openly demonstrated lack of will of part of employees to pay security instalments.** The employees expect to see a direct link between the social security payment and the relevance of services and benefits offered by the pension and health systems. As the current state of the pension and health systems in Bulgaria fails to demonstrate in a convincing manner such a link, this demotivated the employed to pay social security instalments.

Also, the existence of historical burdens that have deep roots in the Bulgarian psychology shall be added here. **Between them, the attitude to "trick out" the state prevails**, together with a lack of respect for the rights and interests of the others and with outlined individualistic attitude. All these created a favourable soil, on which the undeclared work flourishes.

The presented empirical data give reasons to worry. **Undeclared work has deep roots in the Bulgarian reality, as it is born simultaneously by legislative, situational, institutional, psychological and economic factors**. Their influence is reinforced by the presence of many subjective circumstances in ones' life. **In search of a rational and beneficial economic behaviour, the modern Bulgarian uptakes different behaviouristic patterns, including considering commitment in 'grey' practices.** These processes are quite understandable and logical, especially when placed in the context of the sound economic logic, which tends to dominate all other factors.

In the context of the enormous damages that the undeclared work causes to the society as a whole, to the individuals, to the state and its institutions, and to the very principles of the functioning of the modern society, it is necessary to think of a gradual putting under control the undeclared work – until it is eradicated. In that connection, the **good knowledge and**

understanding of the factors that determine the undeclared work is the key to identify effective approaches, policies and measures to create public attitudes that do not tolerate undeclared work or any of its practices. Identifying and applying holistic, consistent and sustainable measures that can make grey economy practices unattractive, is key.

The analysis of the primary data, gathered within the framework of the implemented by BICA project BG05M9OP001-1.051-001 'Improving the Access to Employment and the Quality of Jobs through Limiting and Preventing the Undeclared Work' shows that, irrespectively to the complex and contradictory nature of the undeclared work practices, they can be limited and prevented successfully. Based on the findings of the current study, relevant policies and measures can be suggested, elaborated on the basis of the influence of six groups of factors, and targeted at limiting or eliminating their effect on motivating undeclared work (Table 1).

Table 1

Factors	Polices and measures recommended to tackle undeclared work in Bulgaria
Legislative factors	Upgrading, actualising and enriching the existing strategic documents targeted at limiting and preventing the undeclared work. Possible measures: 1) Actualising the Employment Strategy of Bulgaria; 2) Upgrading and actualising the existing National plans on employment actions; 3) Actualising the Unified National Strategy for Increasing the Revenue Collection, Combating the Shadow Economy and Decreasing the Compliance Costs; 4) Actualising and Upgrading the Strategy of the National Center 'Business to the Rules'. Actualising the labour and security legislation with the aim of strengthening the legislative foundations for defining, limiting and preventing the grey practices that generate undeclared work, and hedging the risks related to the new forms of work. Possible measures: 1) Including in the Labour Code a definition of undeclared work and specifying the practices to be qualified in this category; 2) Creating legislative possibilities for application of payment by vouchers; 3) Continuing the work on simplification of the procedures for the application of the 1-day contracts; 4) Providing the employers with information about the best practices for shared employment of workers, and elaborating and adopting legislation for shared employment of workers; 5) Elaborating and adopting legislation for occasional (simplified) employment of workers; 6) Defining clear rules for platform work.
Situational factors	Developing a system of promotion measures to motivate the employers to comply with labour and security legislation. Possible measures: 1) Elaborating promotion measures for employers to hire young people on a permanent contract; 2) Elaborating promotion measures for employers to hire people in pre-retirement age on a permanent contract; 3) Introduction of a more effective mechanism to be used by the Executive Agency Main Labour Inspection to impose sanctions in case of detected employment without a labour contract or on a contract with fictive clauses. All the above measures aim at stabilising the local economies and at creating real conditions for compliance, declared work promotion and stable legal incomes.
Mistrust to the state and deficit of prestige	Developing capacity of the specialised bodies – that have functions and rights to control the compliance with labour and security legislation. Possible measures: 1) Increasing and further building the capacity of the Executive Agency Main Labour Inspection;

Factors	Polices and measures recommended to tackle undeclared work in Bulgaria
	2) Focusing on inspections and check performed by the Executive Agency Main Labour Inspection, based on preliminary risk analysis of undeclared work propensity; 3) Increasing the motivation of the labour inspectors to perform thorough checks of the compliance with the labour law; Specialised trainings for increasing the competences of the labour inspectors of the Executive Agency Main Labour Inspection to detect the undeclared work practices. Developing and upgrading the tools for detecting, limiting and preventing the grey economy through devoted components addressing the undeclared work issues. Possible measures: 1) Sub-index 'Work to the Rules' to be elaborated and estimated annually – as a component of the Composite Index 'Business to the Rules'; 2) Elaborating undeclared work risk measurement system and increasing the investigation and analytical capacity of the Executive Agency Main Labour Inspection; 3) Increasing the possibilities of the National Revenue Agency for risk assessment through behavioristic studies; 4) Data base sharing between the Executive Agency Main Labour Inspection and the National Revenue Agency; 5) Upgrading the tools for limiting and preventing undeclared work through information campaigns and trainings.
National psychology	Information dissemination – amongst employers, employees and all the citizens – about the benefits of tax discipline and tax payment compliance. Possible measures: 1) National, state financed, information campaign to promote the responsible behaviour and compliance with the tax and security legislation; 2) Best practices prmotion campaign; 3) Wide promotion amongst citizens of the possibility to receive Personal Inedificaiton Code from the National Security Institute and National Revenue Agency; 4) Wide promotion amongst citizens of the possibility the National Revenue Agency to send messages to persons, for which a labour contract conclusion notifications are received. Wide promotion amongst citizens about the benefits of the declared work, and about the damages that the undeclared work causes on the economy and society. Possible measures: 1) Initiating media publications focused on presenting and explaining the benefits of the declared work and the damages that the undeclared work causes on the economy and society; 2) Initiating curricula devoted to the labour, tax and security legislation and providing specialised training course.
Economic determinants (at individual level)	Devising key tools for realising effective and adequate income policy. Possible measures: 1) Ceasing the administrative setting of a national minimum wage and moving instead towards setting annualy sectoral minimum wages by bipirtatire social dialogue; ceasing the minimum security thresholds; 2) Ceasing the administrative setting of additional payments for length of service and moving rowards introducing additional payment based on productivity and personal results achieved by the employees. Improving the security system and pension policy. Possible measures: 1) Reducing the security payments levels; 2) Increasing the share of the statutory additional pension instalments.
Personal and family situation	Complex measures are required in order to improve the family situation, and these require a coordinated application of all the above measures and policies, adequate mechanisms and instruments for wage setting, improvement of security and pension policy so as to take account of the real security length of service.

In conclusion, the paper proves that in order to successfully limit and prevent the undeclared work, constant efforts are needed to study, analyse and explain this phenomenon – as to provide an empirical foundation that allows for deriving adequate conclusions and findings of the nature, the essence and the factors that determine the undeclared work. The approach of studying the undeclared work should be holistic and aimed at gathering the necessary empirical data for constructing adequate policies and measures to limit and prevent the undeclared work.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Munazah Nazeer[1]
Uzma Tabassum[2]

RELATIVE ATTRACTION OF CITIES AND INTER-CITY MIGRATION – AN ANALYSIS USING THE GRAVITY SETUP[3]

The study provides both descriptive as well as regression analysis explaining the relative dominance of one city (urban area) over another to attract migrants from other cities. The empirical analysis reveals that the relative size of the informal sector in a city and the magnitude of the flow of foreign direct investment towards these cities foster in-migration. Empirical assessment is based on two estimation techniques, the Generalised Method of Moments (GMM) and Tobit regression analysis. The techniques examine migration patterns across 14 major cities focusing over a time period of 7 years (2005-2006 to 2012-2013). It is found that the labour market variables (expected wages, employment, and unemployment rate) and regional economic contribution have a strong significant influence on inter-city migration flows. Distance, as suggested by the gravity model, and years of education, reflecting human capital, have a significant positive impact on migration flows across urban-urban (cities) regions. Further positive and negative amenities attached to the region significantly influence migration flows towards these areas, supporting theories of location. Migration is an equilibrating response to existing disparities and disequilibrium among regions and across cities. The concentration of economic activities generates employment opportunities, which are a strong driver of migration and development of the region. The study proposed that the government should opt for horizontal urbanisation rather than vertical urbanisation pattern. Hence, if the government wants to target the development of various regions, it should divert economic activities towards the targeted region and cities.
Keywords: Urban-urban migration; Pakistan; Location amenities; Type of cities; Tobit
JEL: J61; J68; R12

1. Introduction

It is in human's very nature that they keep seeking for more and more. They keep improving from a relatively low standard of living to a relatively better standard of living. If the natives are faced with unemployment, or if employed, they are not satisfied with what they earn or

[1] *Munazah Nazeer, Ph.D Scholar, Applied Economics Research Centre (AERC), corresponding author.*
[2] *Uzma Tabassum, Ph.D Scholar, Research Assistant, Applied Economics Research Centre (AERC).*
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with their standard of living, they seek places, offering what they felt deprived of at their current location. While on the other side of the coin, factors such as rapid economic growth, charm of better employment opportunities and physically attractive regions, such as regions with better recreational activities, high rises etc., pull individuals to move in. It is also apparent from the rapid pace of urbanisation, which is dominantly contributed from migration rather than from natural population increase, as the rate of natural population growth is declining in Pakistan. In Pakistan number of migrants is increasing year by year and so does the interests of researchers in analysing it. Though most, not all, of the existing research bore the country-level analysis. When it comes to migration in our country, the literature is found to focus on migrants and their characteristics rather than focusing on the characteristics of locations that attract migrants. This seeks answers to questions like why migrants rush towards some specific locations, what one location offers in relation to other locations, rural-urban migration is well defined, but what defines urban-urban migration, why one urban area is preferred over the other etc. This is the grey area in Pakistan's migration literature and this research is designed to explore the same area to the best it could.

People migrate from one place to another because of three major reasons Socio-Economic, Cultural and Environmental. Each of them can be analysed using Push and Pull Factor Analysis. The Push Factor is a reason or condition that drives out individuals from their current location, while a Pull Factor is the one that attracts them to move to a particular area. The table below summarises some of the push and pull factors under each head.

Table 1

Factors affecting migration

Factors Influencing Migration		
Reason		
	Factors	**Factors**
Socio-Economic	→ Relatively low income → Unemployment → Land shortage → Negative Amenities → Demographics → State policies	→ Industrial growth → Employment → Investment → Positive Amenities → Demographics → Social Network → State policies
Cultural	→ Political instability → Ethnic clashes	→ State policies → Mega socio-cultural opportunities
Environmental	→ High risk of natural disasters → Extreme climates → Pollution	→ Low risk of natural disasters → Physically attractive regions

Source: Author's presentation of migration reasons and the push-pull factors attached to them.

The difference between per capita income or wage level across regions is a significant variable for explaining migration. Expected wages that account for the probability of attaining employment in the destination is relatively a better major for explaining migration patterns as per Haris and Todaro (1970) & Barnum and Sabot (1977). The attraction of high wages attracts both skilled and unskilled labours (Glickman, McHone, 1977). More and better employment opportunities at a location, either in the formal or informal sector, raise in-migration to that location (Pissarides and Wadsworth, 1989). Apart from wage and employment, other attributes of destination such as education, health, social and recreational opportunities also foster rural-urban migration as well as urban-urban migration. Cities relatively richer in these attributes and contributing more to the economic growth of the nation attracts migrants not only from the traditional sector but also from relatively less urbanised sector following maximisation behaviour (Henderson, 1974).

Distance to and contacts in host location are also very important in deciding where to move for migrants (Schwartz, 1973). Distance deters migration as it has both economic and social costs. A larger distance means high commuting costs, not only between origin and destination. This higher commuting cost limits the frequency and ease for visiting back home, thus putting a social cost on migrants as well. However, negative distance consideration, commuting and moving cost, fades out as an individual's job earnings increases or means of transportation gets improve. As per Ravensten (1885), the second law of migration is *"**The facilities of communication may frequently countervail the disadvantages of distance**"*. Yap (1977) indicated that people are more migratory towards areas where they have their friends and family, linguistic, cultural or ethnic majority (Huntington, 1974) and earlier migrants from the same location they belong (Alpay et al., 2008). Despite of the social attachment, contacts in the destination are a source of information regarding socio-economic opportunities (employment, housing, wages etc.) at the destination for the ready-to-migrate individuals at origin (Greenwood, 1972, 1971).

Migration increases city size both physically and economically. The physical definition of city size incorporates population as greater land area is needed to accommodate it while economic size incorporates economic contribution by city. Domestic and foreign investment in a particular area increases the city size by increasing job opportunities resulting in increased labour demand and higher wages that foster migration flows towards that city from rural areas as well as other cities (Lowry, 1966).

Developing countries lack funds to follow a balance growth strategy. Hence, they follow an imbalance growth strategy[4] (Hirschman, 1988) and invest in some specific regions rather than in all. Usually, policies of developing countries are biased towards industrialisation or urbanisation for rapid economic growth. Thus, create inequalities between rural and urban areas, which provoke rural-urban migration. While the pace of growth and urbanisation in different urban areas majorly effects inter-urban migration (Cole, Sanders, 1985; Etzo, 2008; Andrienko, Guriev, 2003). This frames the base for this research. The aim of this research is to seek answers to what induces labour migration from one urban area towards another, rather

[4] Unbalanced growth theory: This theory stresses on the need of investment in strategic sector of the economy instead of all the sectors simultaneously According to this theory the other sectors would automatically develop themselves through what is known as "linkages effect".

from rural to urban that is common in literature, in the light of relationships discussed above. The analysis is based on descriptive as well as empirical investigation using a micro-penal data set comprising of 14 major cities in Pakistan defined by the Labour Force Survey (LFS) for the period 2005-2006 to 2012-2013. The rest of the paper is organised to present a review of existing theoretical and empirical literature in the next section, followed by the framework of the study, empirical analysis involving both descriptive and regression outcomes, conclusion and policy recommendations.

2. Review of Literature

2.1. Theoretical Literature

The regional labour market clearing process is based either on the adjustment of labour demand that depends on regional capital endowments or on the adjustment in labour supply that depends on the mobility of labour. The neo-classical remedy for adjustment of labour demand is based on wage flexibility. In the absence of any external factor, the theory suggests that a decline in wages increase labour demand. In contrast, Keynes (effect) argue that consumption is largely a function of local wages and if it is tackled by a wage decline, its effect would be a negative income effect on aggregate demand. Further, because of the multiplier impact of this negative effect, involuntary unemployment will be generated. In neo-classical approach Pigou effect[5] dominate Keynesian effect while in Keynesian approach Keynes effect will dominate.

An alternative mechanism to bring the regional labour market to equilibrium is by allowing the regional supplies of labour to adjust that depend on migration behaviour, which this research aims to deal with. In literature, we have various theories and models discussing these supply considerations to bring equilibrium in the regional labour market via inter-regional migration behaviour. In general, these inter-regional migration models and theories are classified depending on whether the wage is a key determinant of migration. Theories and models taking wages as a key factor defining migration falls under the head of wage models while those that don't belong to non-wage models. The basic underpinning behind migration is either disparity across regions or the urge for better and secure living that provides an incentive to migrate for individuals from one place to another.

As per Lewis (1954) in McCatty (2004), it is because of the difference in wages between the traditional and the industrial or modern sector that provides an incentive for individuals to move from the former to the latter sector. Lewis (1954)'s traditional sector can be agricultural, rural or any sector that is relatively less developed technologically or infra-structurally from the modern, industrial or urban sector (Ray, 2009). The classical approach explains labour migration by emphasising on actual wage differential, but Harris-Todero (1970), in their rural-urban migration model, emphasised on the expected wage differential between the rural and urban sectors. In Todero's own words,

[5] Pigou Effect: The willingness of firm to increase employment in response to decline in wage rate.

> *"The theory assumes that members of the labour force, both actual and potential, compare their expected incomes for a given time period in the urban sector (the difference between returns and costs of migration) with prevailing average rural incomes and migrate if the former exceeds the latter."*
>
> *(Economic Development, 8th edition)*

According to Harris-Todero (1970), along with the relatively high urban wages, the probability of obtaining employment in the urban sector will motivate migration even in the presence of urban unemployment. Other wage models or theories in literature considers equalisation of amenity[6]-adjusted wages for bringing inter-regional labour market to equilibrium rather simple wages or expected wages. Amenity-adjusted wages are the wages adjusted for the bundle of amenity goods to be consumed at a certain location or region. These location amenities differ across the region and can be positive or negative. Positive amenities provide utility while the negative cause disutility. Thus, the former attracts while the latter repels in-migration to a region. Wages, other than being a reward for labour services in production, are also perceived to be partial compensation for the amenity differences between regions. For a given level of utility, migrants can trade-off between wages and the amenities offered in different regions. Individuals may be willing to accept low (high) wages in a high (low) amenity area to be at a certain utility level. Thus, the decision to migrate will rely on the inter-regional amenity-adjusted wage differentials though inter-regional wages may be in equilibrium. Moreover, Sjaastad (1962) introduced a human-capital framework for explaining migration that was further discussed widely by Becker (1962). The basic idea behind this theory is that the more an individual invest in attaining human capital (education, training etc.) or in staying in regions with high average years of schooling (an indicator for human capital in a region) would increase their productivity and efficiency through knowledge spillover effects. This yields higher wages for them as they become more competent. Hence, in order to enhance their productivity and efficiency, individuals are more likely to migrate towards areas enriched with such knowledge of spillover effects. Thus, asymmetries in location and individuals also effect migration decisions, Bunea (2012).

Non-wage models suggest that migration will take place even though wages or expected wages, or amenity-adjusted wages, are in equilibrium. The gravity model of migration suggests that the level of migration between two regions are directly associated with the population sizes of the area and inversely related to the distance between the two regions. The distance deterrence argument implies that the likelihood of migration between any two locations will be inversely related to the distance between them because as distance increases, the economic cost and risk associated with migration increases as well.

2.2. Empirical literature

It was Ravenstein (1885) who came up with the laws of migration at first. He analysed 1881 UK census data descriptively and stated that migration is inversely proportional to distance

[6] An **amenity** is a desirable or useful feature or facility of a building or place.

and hazardous conditions while directly proportional to prosperous economic and environmental conditions.

Zhang and Shunfeng (2003) performed an empirical analysis using China's data for the year 1998 of 28 provinces, concluded that the urban-rural income gap was a significant factor in defining intra- and interprovincial migration. Distance tends to deter inter-provincial migration. Further unilateral causality flowing from rapid economic growth to migration using a data set from 1978 to 1999 was also found. Implementing a generalised gravity model Li (2004) also analysed China's two data sets, 1985-1990 and 1990-1995, showed that in comparison with migration from urban areas population pressure, lack of cultivated land and distance was more a push factor for migration from rural areas. GDP per capita was contradicting and was found to be positively related to urban migration. The urban unemployment rate was insignificant. Average wages were significant statistically with correct signs in all cases.

In the Netherland, internal and international migration flows were compared descriptively using 1997 data for four megacities, the capital Amsterdam, Rotterdam, Hogue and Utrecht. The research revealed these cities were well-hosting immigrants from across the national border, while as far as internal migration is concerned, they had a negative net balance that is individuals were moving out of these megacities to got settle in the adjacent areas (Van Huis et al., 2004). Alpay et al. (2008) also conducted research, using Turkish provincial data from the 1990 and 2000 census implying an extended gravity model for analysing gross migration flows from origins to destinations. Real GDP, Population, Unemployment rate, Youth share in total population, Average year of schooling, No of migrants prior to the period of analysis and cost of travelling in the province of destination and origin were all significant at 1 per cent significance level in explaining migration along with having the expected signs. Further, Ozmucur and Silber (2002) also highlighted the significance of spatial inequalities on turkey's internal migration, while Peeters (2012) emphasised the importance of gravity and spatial structure in the context of inter-state migration in Mexico.

3. Methodological Design

The methodological design adopted in this research for the empirical analysis includes descriptive as well as regression analysis. The descriptive analysis involves an examination of relationships in terms of data presented in tabular form, while the regression analysis determines the inferential strength and magnitude of the factors explaining urban-urban migration along with the relationship of these factors with the dependent variable.

3.1. Descriptive Analysis

The main contribution of this research is analysing the attractiveness and the relative attractiveness of urban areas in stimulating migration from one urban area to another urban area. For this, a detailed descriptive analysis is performed. To understand the individual city dynamics, various characteristics of a city are considered, which includes inter- and intracity

migration flows, economic participation of cities, employment opportunities, positive and negative amenities that each city holds.

3.2. Regression Analysis

This research targets the difference in one urban area from another in order to define migration across urban areas. The purpose is served by taking differenced variables representing city characteristics and analyse their impact on city-wise net migration for the major 14 cities in Pakistan over a period of 7 years using the gravity model. Net migration is the difference between out-migration (emigrants) end in-migration (immigrants). All variables in this regression model are used in difference form (destination value – origin value) so as to represent the gap between destinations and origins for a given variable. This means the greater the gap, for example, in the unemployment rate between destination and origin, the lesser is the resultant net migration because immigration is then expected to decline while emigration is expected to increase. Similarly, if the gap increases for positive urban amenity indicator, there will be more immigration and less emigration expectedly.

3.2.1. The Model

The econometric model for estimation is as follows

$$NM_{ijt} = \propto +\beta_1 D\_EW_{ijt} + \beta_2 D\_UER_{ijt} + \beta_3 D\_IFS_{ijt} + \beta_1 D\_EMP_{ijt-1} + \rho_1 D\_DR_{iJt} + \varphi_1 D_{ijt} + \gamma_1 D\_CEC_{Ijt} + \gamma_2 D\_UI_{ijt}^{+} + \gamma_3 NM_{ijt-1} + \gamma_4 D\_HC_{ijt} + \gamma_5 D\_FDI_{ijt} + \gamma_6 D_{UI_{ijt}^{-}} + \mu_{ijt} \quad (1)$$

Where,

i, j and *t* represent origin, destination and time, respectively;
NM_{ijt} = Net migration from origin city (i) to destination city (j) at time (t);
D_EW_{ijt} = difference of expected wages between cities (ji) at t;
D_UER_{ijt} = Differenced unemployment rate prevailing between cities (ji) at t;
D_IFS_{ijt} = difference of informal sectors own by city j and city i at t;
D_EMP_{ijt-1} = Lagged differenced of employment between cities (ji) at t;
D_DR_{iJt} = Differenced dependency ratio between cities (ji);
D_{ijt} = distance between cities (ji);
D_CEC_{ijt} = difference between economic contributions made by cities (ji) measured in terms of their real gross domestic product;
$D\_UI_{ijt}^{+}$ = difference between positive urban amenities of cities (ji);
$D\_UI_{ijt}^{-}$ = difference between negative urban amenities of cities (ji);
D_HC_{ijt} = Differenced years of education, attainment between cities (ji);
D_FDI_{ijt} = Differenced foreign direct investment inflows between cities (ji);
NM_{ijt-1} = Lagged net migration between cities;
μ_{ijt} = residuals from the regression model.

3.2.2. Variables and Data Sources

The analysis in this research demands data for all the variables in the model at city level, which in itself is quite challenging to gather, especially for the cities in Pakistan. The data set is compiled using various data sources and their various issues. Some variables are constructed using the published data sources while the others are extracted from micro-panel database, i.e. Labour Force Survey (LFS), by aggregating the data at a city level.

Migration is taken as the number of migrants in the region, excluding the non-migrant children of the migrated families. Net migrants to one city from another are immigrants fewer emigrants in that city from a particular city. Expected wages are defined as real wages times the probability of attaining employment at a destination following Harris-Todaro's definition. City-wise consumer price indices, obtained from an inflation monitor published by the State Bank of Pakistan, are used to make city-wise wages real. The dependency ratio is equal to the ratio of dependent population (population minus employed population) to employed population. Employment, years of schooling, informal sector and the unemployment rate were extracted from LFS as well.

For foreign direct investment in the cities, a proxy is used to reflect investment by foreign sources in intermediaries and telecommunication, which constitutes a substantial portion of FDI inflows (Nazeer, Tabassum, Alam, 2017). The data for this variable is gathered from the Banking Statistic of Pakistan and Pakistan Telecommunication Authority. Cities economic contributions are calculated using a top-down technique from the sector-wise national gross domestic product, published in Pakistan Statistical Yearbook. Urban amenity indices are calculated using Education Statistics of Pakistan and Development Statistics of Sindh, Punjab, KPK and Baluchistan. The variables, used for the positive urban amenity index include the provision of education and health by the individual city as well as domestic financial institutions there. While for negative amenity index, congestion and reported crimes are used. Finally, the data for the distance between one city to the remaining cities is obtained from the internet.[7]

3.2.3. Econometric Techniques

As the dependent variable in the above regression model is net migration, it may take a value equal to or less than zero. Positive values of net migration reflect more immigrants than emigrants; its negative values mean fewer immigrants than emigrants and its zero value indicates that either no one migrates from or migrates in city **i** from a particular city **j**. Or there is an exact number of immigrants and emigrants which on differencing yields zero net migration. Having values ≤ 0 limits the log transformation and makes the estimation biased. To tackle these two techniques are applied.

First is the use of Tobit regression for such censored data. The Tobit model, also called a censored regression model, is attributable to Tobins (1958)'s work. It is applied when the

[7] http://distancecalculator.globefeed.com/pakistan_distance_calculator.asp.

data is censored by some criteria**.** It is estimated on the basis that endogenous variable is censored at some value.

Consider a latent relationship, between x and y, of the form

$$y_i' = x_i'\beta + u_i, \;\; u_i \sim N(0, \sigma^2) \tag{2}$$

Where y_i is the dependent variable, xi represents independent variables, β are slope coefficients, and u is the independently distributed error term following a normal distribution with mean 0 and constant variance (σ^2).

The observability rules for a censored variable are

Rule: 1 $\quad y = y_i'.1(y' > c) + c\ 1(y' \leq c)$

Rule: 2 $\quad y = y_i'.1(y' < d) + d\ 1(y' \geq d)$

Rule: 3 $\quad y = y_i'.1(c < y' < d) + c\ 1(y' \leq c) + d\ 1(y' \geq d)$

Rule 1 is the case when the dependent variable (y) is censored at and below a limit c, rule 2 is the one when it is censored at and above a threshold d while rule 3 depicts the possibility that the data is censored from both ends, at and below the limit c and at and above the limit d at the same time. Depending on the characteristics of the regresand considered in urban-urban regression, the observability criterion followed is:

$$y_i = y_i'.1(y_i' > 0) \tag{3}$$

The probability of observing censored and non-censored observation can be calculated as,

$$\Pr(y_i = 0|xi) = 1 - \Phi(x_i^*\beta/\sigma) \tag{4}$$

$$\Pr(y_i > 0|x_i) = \Phi(x_i^*\beta/\sigma) \tag{5}$$

From the Tobit specification with censoring from below at zero, we can derive the expected value of the observed dependent variable y_i as

$$E(y_i \mid x_i) = \Pr(y_i > 0/x_i).E(y_i \mid x_i > 0) \tag{6}$$

That is, the expected value of all observation, Ey, is equal to the product of the probability of being above the limit, $\Pr(y_i > 0/x_i)$ = F(z), and the expected value is conditional upon being above the limit.

Marginal effects for latent, censored and uncensored expected values can be obtained by taking the partial differential of equation 6 (Mcdonald, Moffitt, 1980). The marginal effect on the latent variable is given by

$$\frac{\partial E(y_i)}{\partial x_i} = \beta \tag{7}$$

Considering the effect of change in independent variable on the expected value of observed dependent variables for the whole sample, the marginal effect conditional on censoring is expressed as the product of the marginal effect of the latent variable multiplied by the probability of being above the limit. Symbolically,

$$\frac{\partial E(y_i \mid x_i)}{\partial x_i} = \beta \,.\, \Phi(x_i^* \, \beta / \, \sigma) \tag{8}$$

Finally, the marginal effect of change in some independent variables on non-censored dependent variables is

$$\frac{\partial E(y_i \mid x_i, y_i > 0)}{\partial x_i} = \beta \, (\, 1 - \, \frac{\partial E(y_i \mid x_i)}{\partial x_i}) \tag{9}$$

Apart from the Tobit analysis, a statistical concept is also applied to deal with the censored dependent variable. A constant greater than the minimum of the dependent variable series (C > min. NM) is added to the dependent series (NM+C) just to make it greater than zero (NM>0), and then GMM estimation is carried out following Arellano-Bover / Blundell-Bond (1998) linear dynamic panel-data approach. The approach is designed especially to account for a panel with time (t) less than cross-sectional units (n). Arellano-Bover / Blundell-Bond (1998)'s methodology is more feasible, than the one presented by Arellano-Bond in 1991, because of an additional assumption that the first differences of instrument variables are uncorrelated with the fixed effects that allow the introduction of more instruments and increase efficiency. The results from the two techniques are then compared. The consistency of the GMM estimator depends on the validity of the moment conditions and this can be tested using two specification tests: the Hansen test is a test of the overidentifying restrictions and the joint null hypothesis is that the instruments are valid, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation; and the Arellano-Bond test for no second-order serial correlation in the error term (Baltagi, 2005).

4. Descriptive Results

As per descriptive scrutiny of the fact, about 41% of the total migrants rushed towards major fourteen cities who only occupy 11% of the total region in Pakistan as per the labour force survey (LFS) on average. 20% of the regions attract 15% of the total migrants and 69% of the regions are successful in grabbing 44% of total migrants.

Table 2

In-migration by destination regions

In-Migration by Destination Region					
S. No.	Area	Average		2012-13	
		Migrants	In %	Migrants	In %
1	Major cities	5273353	40.90	4396405	36.41
2	Other Urban areas	1991578	15.45	2005063	16.60
3	Rural areas	5627671	43.65	5674621	46.99
	Total	12892603	100.00	12076089	100.00

Source: Author's Tabulation.

It would be interesting to know the characteristics of these 11 % regions, the fourteen major cities that caught a bigger chunk of the migrant pie. Urban migration is different from simple

migration as it takes into account the geography of the region's location and its location-specific features.

4.1. Migration and Economic City Size

The size of a city plays an important role in defining the in-migration of a city. The size of a city is usually measured in terms of real GDP produced by a city. Cities with relatively greater economic size tend to experience more in-migration.

Table 3

Migration, Real GDP and type of cities

Migration, Real GDP And Type Of City Averaged For 7 Years		
Cities	Migration	Real GDP
	Count	Rs In Million
Lahore	1057704	299734.4
Faisalabad	359138	120765.2
Rawalpindi	394077	76714.6
Multan	130691	59055.4
Gujranwala	194122	61772.4
Sargodha	31901	18963.6
Sialkot	40765	17304.1
Bahawalpur	77140	30877.3
Islamabad	276048	24256.7
Karachi	2234148	516157.4
Hyderabad	138566	63095.6
Sukkur	32936	19416.7
Peshawar	250670	55345.9
Quetta	27356	25731.2

Source: Author's Tabulation.

The above tabulation shows that Karachi has the largest share in income among cities and thus hosts the largest number of migrants among cities also, followed by Lahore and others. The relatively greater share of a city in gross domestic product reflects relatively greater production and employment opportunities in them. Thus, attracting more migration towards them.

4.2. Size of informal sector and In-Migration

Migration and the size of the informal sector are positively linked to one another. The existence of a large informal sector is a strong driver for attracting unskilled labour migration especially. Informal sector and migration flows in major cities are tabulated below, sorted in ascending order with respect to the size of the informal sector, held by the cities on average.

Cities with enlarged informal sector encounter more migration inflows. Karachi has the largest informal sector employment and hosts the highest number of migrants as well. In-

migration is highest in Lahore after Karachi and so does its informal sector. Islamabad has the smallest informal sector. Islamabad is the capital city of Pakistan. It is home to ministries and major government headquarters. Thus, the city is more documented (formal economy). Migrants reaching Islamabad are mostly the skilled ones and for them, the informal sector matters less.

Table 4

Size of informal sector and in-migration in major cities of Pakistan

Informal sector and In-migration		
Name	Average City-wise	
	In Migration	Informal Sector
Karachi	2234148	1541552
Lahore	1057704	1096897
Faisalabad	359138	471303
Gujranwala	194122	266756
Rawalpindi	394077	261200
Multan	130691	248558
Hyderabad	138566	207513
Peshawar	250670	188376
Bhawalpur	77140	90084
Sargodha	31901	74581
Quetta	27356	68937
Sialkot	40765	68054
Sukkur	32936	66733
Islamabad	276048	61692

Source: Author's Tabulation.

4.3. Urban amenities influencing migration

Urban amenities play an important role in grabbing migrants from various destinations. Positive amenities such as financial intermediaries, education, health and recreational opportunities tend to increase in-migration. While, the view from the other side of the mirror, negative area amenities like crime rate and congestion are repulsive in nature. It is more economical and viable for the public and private sector both to incur overheads for providing such social services to masses because of relatively lower unit costs rather than to those divergent over geographical limits of an area. Cities are areas with high population concentrations living in intimate proximity; hence these positive amenities are readily available and accessible there. Apart from the spillover effects of concentrations, ills generated from them were also enormous. Population concentrations give rise to conflicts and congestion as well. Hence, the area with higher concentrations may have higher positive as well as negative amenities.

Karachi ranked first for both the highest in-migration and for the highest positive amenities indicator among major cities. Lahore is second and so on. Cities with higher positive amenities indicator also suffer potentially from the negative by-products of higher concentrations as well. Also, initially, the prime objective of migrants in their working life is earning rather concerning about amenities, especially the negative ones. Hence, despite the

high negative amenities indicator, cities seems to have high in-migration as individuals got compensated economically for bearing them.

Table 5

Urban amenities influencing migration in major cities of Pakistan

Urban Amenities Influencing Migration (Average of 7 Years)				
S. No.	Cities	Migration	Positive Urban Amenities Indicator	Negative Urban Amenities Indicator
1	Karachi	2234148	722.91	223592.04
2	Lahore	1057704	554.79	387711.51
3	Rawalpindi	394077	359.85	68028.05
4	Faisalabad	359138	337.98	97595.56
5	Islamabad	276048	268.78	67961.81
6	Peshawar	250670	217.63	78086.71
7	Gujranwala	194122	249.86	61440.89
8	Hyderabad	138566	240.70	14176.05
9	Multan	130691	244.32	174533.10
10	Bhawalpur	77140	290.43	50132.38
11	Sialkot	40765	295.97	50574.85
12	Sukkur	32936	178.08	8106.43
13	Sargodha	31901	282.00	40306.32
14	Quetta	27356	218.15	32730.84

Source: Author's Tabulation.

4.4. Foreign Direct Investment in City and In-Migration

Cities with greater foreign direct investment generate greater and better employment opportunism than local investment, which in turn increases labour demand that has to be met either locally or migrated labour force. Thus cities with high FDI signals migrants to rush towards them.

Karachi and then Lahore holds the highest FDI index among all cities. These two cities facilitate other cities, host migrants and provide social, political and economic opportunities as well. The index for Faisalabad is almost half that of Lahore and so does its in-migration. Developments carried out in Peshawar and Multan might be contributing to increased employment, in-migration and better FDI indices over there. There also exists a possibility that cities with relatively low FDI indices might have some forces at work such as receiving domestic investment, unfavourable conditions for living in other areas, political or social pressures etc., which are creating employment or catching migrants.

Table 6

City-wise FDI indices, in-migration and employment for the year 2012-2013

City-wise FDI indices, in-migration and employment				
S. No.	Cities	In-Migration	FDI Indicator Index	Employment
1	Lahore	832993	73.67	1273932
2	Faisalabad	401666	30.17	746108
3	Rawalpindi	384726	22.00	361584
4	Multan	98107	36.17	302701
5	Gujranwala	180678	26.17	328416
6	Sargodha	27436	17.67	99190
7	Sialkot	28505	10.33	105699
8	Bhawalpur	68683	6.67	147636
9	Islamabad	305617	18.50	189238
10	Karachi	1658442	86.17	2823079
11	Hyderabad	108450	21.83	293450
12	Sukkur	25235	15.67	85081
13	Peshawar	254297	36.00	289041
14	Quetta	21570	17.17	120800

Source: Authors calculation using various data sources and official websites.

4.5. City-wise migration: within and across cities

The forthcoming table enlightens our understandings about migration with-in and between cities. Out of total in-migration in these cities, 29.19 % and 25.51 % migration is intra-city migration as per the average and 2012-13 figures. Karachi's share in intra-migration is very much higher for both average around the years and in 2012-13, 23.76 and 19.70 % in the exact sequence as stated. This is understandable as Karachi, the city of lights, is the only city that has five districts in it; otherwise, cities is usually situated with-in a district. This is the reason why statistics for Karachi usually stands out predominantly among other cities. It also has highest in as well as out migration.

Lahore earned the second position for both in and out migration. The rest of the cities follow afterwards. As for the net migration, Hyderabad, Sialkot, Peshawar, Quetta, Sukkur, Sargodha and Multan experience net out migration while Karachi, Lahore, Islamabad, Rawalpindi, Gujranwala and Bahawalpur are more prone to net in-migration for overall average and for the latest year statistics. Faisalabad had net out-migration on average while having net in-migration in 2012-13.

Table 7(a)

Migration with-in and in between major cities

Migration With-in & Between Cities										
Names	Average (7 Years)					2012-13				
	In-Mig[8]			Out-Mig	Net Mig	In-Mig			Out-Mig	Net Mig
	Intra	Inter	Total			Intra	Inter	Total		
	(a)	(b)	(c= a+b)	(d)	(e= c-d)	(a)	(b)	(c= a+b)	(d)	(e= c-d)
Lahore	2.13	10.24	12.37	13.24	10.27	1.14	9.23	10.37	10.83	9.01
Faisalabad	0.57	3.79	4.36	7.66	-3.55	1.39	5.09	6.48	6.91	5.24
Rawalpindi	0.44	4.73	5.17	6.57	1.84	0.73	6.71	7.44	7.95	5.97
Multan	0.45	2.28	2.73	5.18	-3.15	0.41	1.91	2.32	4.95	-5.35
Gujranwala	0.88	5.64	6.53	5.92	7.98	1.45	6.26	7.72	4.82	16.18
Sargodha	0.05	0.62	0.67	3.24	-5.51	0.11	0.52	0.64	3.89	-8.86
Sialkot	0.01	0.71	0.72	5.37	-10.45	0.00	0.28	0.28	3.32	-8.60
Bahawalpur	0.27	1.87	2.13	2.45	1.37	0.27	1.92	2.19	1.58	3.98
Islamabad	0.01	4.65	4.66	1.79	11.55	0.00	5.82	5.82	1.67	17.92
Karachi	23.76	33.02	56.79	33.02	113.80	19.70	34.58	54.28	38.26	101.05
Hyderabad	0.17	1.16	1.33	6.87	-11.97	0.09	1.13	1.22	6.44	-14.02
Sukkur	0.14	0.70	0.84	2.53	-3.20	0.17	0.47	0.64	2.41	-4.54
Peshawar	0.29	1.25	1.54	4.41	-5.34	0.02	0.56	0.58	5.69	-14.35
Quetta	0.02	0.15	0.17	1.76	-3.63	0.02	0.01	0.04	1.30	-3.65
Total	29.19	70.81	100.00	100.00	100.00	25.51	74.49	100.00	100.00	100.00

Source: Author's Tabulation.

5. Regression Analysis

The outcome of both estimation techniques is tabulated below for easy comparison. Post estimation tests of GMM estimation are reported in Tables A2 and A3 in Appendix. The informal sector is dropped from the model on the basis of its high correlation with a real gross domestic product, a proxy for the city's economic contribution (CEC). The results of the Tobit and GMM estimations of the model presented in equation 3.6 of chapter 3, are reported in Table 1.

All variables bear correct signs except for distance in both regressions. Distance is significant in Tobit results, while it is insignificant in GMM results. Distance is found to be positively linked with migration and which is justified partially because of the ease in mobility within the cities with no barriers, controls or policies limiting or directing migration flows. Thus, for individuals, employment opportunities matter more and they are willing to move across distances if they expect to grab either employment or a better employment opportunity at the destination. In-migration is partial, because of the argument that increased expected wages and improved means of transportation vanish distance's negative consideration, especially across Punjab, the province with the majority of the migration flows.

[8] Mig stands for migration.

Table 8

Urban-urban regression model results

Urban-Urban Regression Results						
Method	GMM Results			TOBIT Results		
Regressand	NM*C			NM		
Regressors	Coefficient	Z	P>|z|	Coefficient	Z	P>|z|
NM (-1)	0.132	11.31*	0.000	0.107	2.55*	0.011
D_CEC	0.012	2.46*	0.014	0.022	1.89*	0.058
D_CEC(-1)	0.013	1.46	0.145			
D_UI^{+}	2.544	2.89*	0.004	4.210	2.37*	0.017
D_UI^{-}	-0.007	-2.46*	0.014	-0.014	-2.02*	0.047
D_HC	735.019	2.33*	0.020	934.730	2.08*	0.038
D_DR	-69.732	-0.38	0.705	-787.727	-2.33*	0.020
D_EW	0.023	2.56*	0.010	0.048	2.74*	0.006
D_UER	-30.867	-2.51*	0.012	-57.781	-2.47*	0.014
D_FDI	30.574	0.89	0.374	-38.513	-0.78	0.433
D_EMP (-1)	0.002	2.01*	0.044	0.005	2.01*	0.048
D	7.268	1.11	0.269	2.651	1.73*	0.084
Constant	75118.880	16.89*	0.000	840.752	0.73	0.467
Number of obs		=	1092		=	1092
Number of groups		=	182		=	182
Wald chi2(11)		=	528.6		=	83.49
Prob > chi2		=	0		=	0
Number of instruments		=	49			
Log likelihood		=		-5585.7		
Rho		=		0.4882	0.393	0.584

* Mean significant at less than 5%
** Mean significant at less than 10%
Source: Author's estimation and tabulation using Stata 12.

The economic contribution of a city is reflective of the concentration of economic activities in it, such as investment, production, consumption, trade etc. Hence, cities contributing more towards the national GDP are more prone to net immigration relative to the origin city. If the real GDP of a city increases by one thousand relative to other cities, net immigration to that city increases by 12 migrants.

The three labour market variables that are expected wages, unemployment rate and lagged employment, are statistically significant in both models, endorsing the fact that relative difference in labour market variables even across cities is of immense importance in directing migration flows from one city to another. With a one per cent change in the unemployment rate gap (D_UER) between destination and origin city, net migration change by 31 and 58 migrants as per GMM and Tobit estimations respectively in the opposite direction at the destination city. Likewise, if the expected wage gap (D_EW) between the two cities increases, the city with higher expected wages tend to encounter relatively more in-migration and less out-migration or a net in-migration. The result indicates that if the expected wage gap between cities changes by 1000 rupees, net migration in the city with relatively higher wages changes by 23 (0.023*1000) migrants in the same direction. The greater the gap in lagged employment (D_EMP (-1)) between cities, the greater the net migration is inclined towards the city that relatively has more employment in the previous time period. More

employment in the previous year reflects more investment expenditure in it. Moreover, as investment follows the multiplier effect, more opportunities in the current period are to be generated, which attracts migrants in the current year.

Dependency ratio (D_DR) is insignificant in GMM estimation, while the Tobit estimation contradicts it. More dependency ratio at origin city relative to destination city results in increased net migration at destination through discouraging emigration from destination city and encouraging immigration into it.

A high year of educational attainment in a city is backed by the provision of a sound education system. Inhabitants of cities with better access to education facilities are relatively more productive, efficient and equipped to adopt new technologies easily. Cities with more human capital (HC) attract more investment because of their efficient labour force. Investment generates more employment vacancies, and thus, migrants are attracted toward the city. In both GMM and Tobit results, the statistical significance and positive sign of the coefficient of the variable reflecting human capital have provided evidence for it.

Migration is positively linked with positive amenity provision not only for a better livelihood but also for the betterment of their family. The index for positive urban amenity is significant in GMM and Tobit estimation. The more positive amenities destination city holds in comparison with origin city, more net in-migration is experienced by the destination city. For a unit increase in positive urban indicator gap (D_UI^{+}), net migration is increased by three (GMM results) and four (Tobit results) migrants approximately. Similarly, negative amenities (D_UI^{-}) like congestion and crime in a city discourage immigration and encourage emigration from it. Negative amenities slow down the pace of the city's economic growth.

6. Conclusion and Policy Suggestions

This research is designed to explore and explain the inter-city migration patterns in Pakistan. Migration is a major contributor towards the rapid urbanisation than the natural population increase. Migration is derived by various push and pull factors at various origins and destinations. The desire to be economically prosperous motivates individuals to move towards an area with a relatively better economic and social environment offering a better standard of living. Hence, they move from relatively less urbanised areas to highly urbanised and modernised areas.

This research is unique in explaining intercity migration in the context of Pakistan. The study provides both descriptive as well as regression analysis explaining the relative dominance of one city (urban area) over another, to attract migrants from other cities. The empirical analysis reveals that the relative size of the informal sector in a city and the magnitude of foreign direct investment in them fosters in-migration towards cities. Regression analysis that consist of two regression techniques, generalised method of moments (GMM) and Tobit regression techniques to examine migration across 14 major cities, is focused over a time period of 7 years (2005-2006 to 2012-2013). It is found that the labour market variables (expected wages, employment, and unemployment rate) and regional economic contribution have a strong significant influence on inter-city migration flows. Dependency ratio is

statistically insignificant to affect migration flows as per GMM estimation though it is significant in explaining migration across major cities as per Tobit estimation results. Distance, as suggested by the gravity model, and years of education, reflecting human capital, have a significant positive impact on migration flows across urban-urban (cities) regions. Further migration flows are significantly depending on the area or regional positive and negative amenities attached to it, supporting theories of location.

Government policies, in developing countries especially, are of immense importance in shaping and directing migration flows in order to accelerate the pace of sustainable development. In developing countries, a balanced growth strategy is difficult to adopt usually owing to lack of availability of funds. Thus, an unbalanced growth strategy is being implemented, usually biased towards a few urban regions. The policies implemented are unduly inclined towards rapid urbanisation via industrialisation. As a result, investment is confined to some specific regions leading to unequal income distribution and disparities across regions, provoking migration towards few urban centres. A number of valuable policy recommendations can be drawn from this research that would enable the government and the relevant authorities to control and direct migration towards the betterment of our nation and converge it towards the path of prosperous relative balance growth and development.

Government should revise its policies in favour of balanced growth of regions and cities. It should make effective policy arrangements for slowing down the pace of rapid urbanisation, concentrating in only a few regions or cities; rather, it should divert and boost the process of urbanisation to small towns and rural areas. This would help not only in growing the number of urban areas, but also stabilises the existing major urban centres like Karachi and Lahore, for which diseconomies of scale are becoming persistently more visible with the bulk of masses moving into them year after year, making their sustainable development debatable. Even across major cities, there exist inequalities in their growth resulting from biased policies in favour of a few cities. Government should accelerate development in comparatively smaller cities rather than over-investing in one or two. Migration is considered as an equilibrating response to existing disparities and disequilibrium among regions and across cities and the government should come forward to reduce this urban bias. The concentration of economic activities generates employment opportunities which are a strong driver of migration and development of the region. Hence, if the government wants to target the development of various regions following a balanced strategy, it should divert economic activities towards the targeted region and cities.

Provision of basic utilities and facilities such as health, education, recreational activities, stable law and order conditions etc., also plays a vital role in shaping migration and encouraging a region's growth. These factors can also be used by the government to formulate effective policies regarding migration and growth. Availability of better health, education and political stability across regions would diminish the need to move towards certain specific areas for such facilities and would eventually reduce the unnecessary burden from these specific host regions and cities. Moreover, the provision of health and education facilities across regions would increase labour productivity and efficiency. They would become more skilled, trained and productive, thus would contribute more towards national development and growth.

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APPENDIX

A-1. Correlation matrix of the variables in urban-urban regression

Correlation Matrix	D_DR	D_HC	D_EW	D_FDI	D_IFS	D_NUI	D_CEC	D_UER	D	D_EMP (-1)	D_PUI
D_DR	**1.000**										
D_HC	-0.098	**1.000**									
D_EW	-0.077	0.661	**1.000**								
D_FDI	-0.119	0.025	0.092	**1.000**							
D_IFS	-0.234	-0.007	-0.004	0.898	**1.000**						
D_NUI	-0.189	0.125	0.065	0.586	0.828	**1.000**					
D_CEC	-0.211	0.064	0.067	0.492	0.980	0.680	**1.000**				
D_UER	0.268	-0.071	-0.522	-0.126	-0.161	-0.089	-0.146	**1.000**			
D	0.036	-0.037	-0.027	0.013	-0.011	0.004	-0.004	0.059	**1.000**		
D_EMP (-1)	-0.209	0.053	0.056	0.591	0.981	0.819	0.699	-0.154	-0.006	**1.000**	
D_PUI	-0.171	0.224	0.131	0.699	0.701	0.696	0.741	-0.111	-0.002	0.753	**1.000**

A-2. Urban-urban regression model post-estimation Sargan test of over identifying restrictions

Urban-Urban Regression Model		
Sargan test of over identifying restrictions		
H0: over identifying restrictions are valid		
chi2(34)	=	18.69218
Prob > chi2	=	0.6503

A-3. Urban-urban regression model post-estimation Arellano-Bond test for autocorrelation

Urban-Urban Regression Model		
Arellano-Bond test for zero autocorrelation in first-differenced errors		
Order	**z**	**Prob > z**
1	-4.6705	0
2	-0.06827	0.9456
H0: no autocorrelation		

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Ivanka Mihaylova[1]

WORKPLACE CONFLICT: EVIDENCE FROM BULGARIA[2]

The paper presents the results of a study on workplace conflict in Bulgarian organizations. The data were collected by means of a questionnaire among 708 employees. Findings reveal that most Bulgarian employees have to deal with conflict at work to some extent and two in ten employees do so always or frequently. Conflict is most common between entry-level/front-line roles and between managers and their reports. The primary causes leading to disagreements at work are stress, personal clashes and heavy workloads. Employees in Bulgaria mostly often spend 2.5 hours per week dealing with conflict, equating to approximately $1.4 billion in paid hours in 2020. The paper provides original findings on workplace conflict, and therefore, it contributes to the research of conflict in Bulgarian organizations.
Keywords: conflict management; workplace conflict; Bulgaria
JEL: M12; M19

1. Introduction

Conflict is an essential aspect of organizational life. Various types of conflicts arise within every organization, regardless of its size, sector, organizational structure, etc. They are due to the interactions between individuals and groups in the process of their joint activities and communication.

Workplace conflict should not be ignored as it has a considerable impact on individuals, groups and the organization as a whole. Unmanaged or poorly managed conflict can result in significant financial, human and credibility cost to organizations, their employees and their clients (Buss, 2011). On the other hand, when addressed with the appropriate tools and expertise, conflict can lead to positive outcomes, such as improved problem-solving, better understanding of others and innovative thinking (CPP, 2008).

Since conflict is unavoidable, in order to achieve their goals, organizations have to learn to live with it and manage it in an appropriate manner. The issue of conflict management is a significant and relevant topic for any organization. To deal with conflict effectively, organizations and their managers need to have a better understanding of the conflict.

[1] *Ivanka Mihaylova, PhD, Chief Assistant Professor, Sofia University "St. Kliment Ohridski", Faculty of Economics and Business Administration, Department of Business Administration, phone: +359889255105, e-mail: ivanka_mihaylova@feb.uni-sofia.bg.*
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Analyzing and understanding workplace conflict is the first and perhaps the most important step that has to be taken before any other conflict management activities are carried out. It appears necessary that managers learn more about the organizational conflict before taking any concrete action to manage it. The more they are aware of workplace conflict – the levels at which it occurs, the causes of it, its constructive and destructive potential, the more confident they will be in dealing with it (Mihaylova, 2020).

The objective of the paper is to examine the incidence of workplace conflict, the levels at which it occurs, the causes of it and the time spent on dealing with it in Bulgarian organizations. In other words, we want to explore employees' perceptions on how common conflict is in their organizations, which working relationships are most exposed to conflict, what are the main sources of conflict and what is the cost of conflict in terms of wasted time. We are also interested in comparing our findings with the results of studies on workplace conflict in other countries.

While several studies have been conducted on workplace conflict in different countries (CIPD, 2015, 2020; CPP, 2008; OPP, 2008; Psychometrics Canada, 2009), there is a lack of empirical research on the conflict at work in Bulgaria.

The present study is the first we know of to provide empirical evidence on workplace conflict in Bulgarian organizations from various economic sectors, and therefore, it contributes to the research of conflict by investigating its unique nature, causes and impact in the Bulgarian working environment.

2. Literature Review

2.1. Defining Conflict in the Organization

There is no single definition of conflict. Rashid and Archer (Rashid and Archer, 1983, p. 311) view conflict as "the pursuit by two different persons of goals that are incompatible so that gains by one person must inevitably come about at the expense of the other". Robbins' definition of conflict acknowledges awareness (perception), opposition, scarcity, and blockage (Robbins, 1991). The author also assumes that conflict is a determined action that can exist at either latent or overt levels. Robbins (Robbins, 1991, p. 428) defines conflict as "a process in which an effort is purposely made by A to offset the efforts of B by some form of blocking that will result in frustrating B in attaining his or her goals or furthering his or her interests". Rahim (Rahim, 2001, p. 18) conceptualizes conflict as "an interactive process manifested in incompatibility, disagreement, or dissonance within or between social entities (i.e., individual, group, organization, etc.)". Dimitrov associates conflict with a form of manifestation of contradictions. The author describes it as a universal and eternal human and social phenomenon based on a dynamic interaction between at least two opposing parties and caused by different interests, needs, goals, values, motives, and lack of resources. Means of various kinds are used for achieving the objectives and satisfying the interests of the parties (Dimitrov, 2004, pp. 39-40). According to Wilmot and Hocker (Wilmot and Hocker, 2011, p. 11), conflict is a felt struggle between two or more interdependent individuals over perceived incompatible differences in beliefs, values, and goals, or over differences in desires

for esteem, control, and connectedness. Paunov, Paunova and Paunov specify that conflict in organizations is related to the power relations, distribution of resources, social positions, and differences in value systems (Paunov, Paunova and Paunov, 2019, p. 255). In accordance with their view, the conflicts arise in connection with the organizational goals or the methods of achieving them. Bankova describes conflict as "an open form of confrontation of opposing values and interests arising in the process of interaction of organizational members in solving problems of official and personal nature" (Bankova, 2019a, p. 26).

Based on the review of different definitions, we can highlight several common aspects of the conflict:

- Conflict is a confrontation of two or more parties (individuals and groups).
- Conflict is associated with an interaction between the parties.
- There needs to be some kind of interdependence between the parties.
- Conflict is a process, and it changes over time.
- The confrontation is based on differences between the parties (in their interests, goals, values, needs, opinions or in resources, power, control, etc.) that are considered to be incompatible.
- Conflict exists if the differences are perceived by the parties.
- The confrontation is realized through specific conflict behaviour by each of the parties.

In the current paper, conflict is defined as a dynamic process of open confrontation arising in the interaction of two or more interdependent parties (individuals and groups) over perceived incompatible differences (in interests, needs, goals, values, opinions or in resources, power, control, etc.).

2.2. Levels of Conflict in the Organization

A starting point for examining organizational conflict is to determine the levels at which it may originate[3]. Four main levels of conflict are usually discussed in the literature: intrapersonal, interpersonal, intragroup, and intergroup (Gordon, 1993; Rahim, 2001; Vedar, 2014; Georgieva, 2016). A brief description of these five levels of conflict is as follows (Rahim, 2001):

- Intrapersonal conflict occurs when an organizational member is required to perform certain tasks and roles that do not match his or her expertise, interests, goals, and values.

[3] A broader classification includes two types of organizational conflict: *intraorganizational* (i.e., conflict within an organization) and *interorganizational* (i.e., conflict between two or more organizations) (Rahim, 2001). Intraorganizational conflict is categorized on the basis of levels (individual, group, etc.) at which it occurs.

- Interpersonal conflict refers to conflict between two or more organizational members of the same or different hierarchical levels or units. The disagreements between a superior and subordinates are related to this type of conflict.
- Intragroup conflict refers to conflict among members of a group or between two or more subgroups within a group in connection with its goals, tasks, procedures, and so on. It may also occur as a result of incompatibilities or disagreements between some or all the members of a group and its leader.
- Intergroup conflict is a conflict between two or more units or groups within an organization. Examples of this type of conflict are conflicts between line and staff, production and marketing, and headquarters and field staffs.

Gordon (Gordon, 1993) discussed the fifth level of conflict and defined it as intra organizational. It encompasses all the previous levels and is diagnosed when conflict characterizes overall organizational functioning (Gordon, 1993, p. 451).

2.3. Causes of Organizational Conflict

Various antecedent conditions (events, problems, etc.) may lead to conflict. Identifying and understanding the possible causes of conflict is essential for dealing with it effectively.

The variety of potential causes of organizational conflict does not allow their systematization in a single classification. Yulk and Wexley (Yulk and Wexley, 1985) determine six major categories of causes of conflict: competition for resources, task interdependence, jurisdictional ambiguity, status problems, communication barriers, and individual traits. Many conflicts involve more than one of these antecedent conditions, and the categories are not always mutually exclusive (Yulk and Wexley, 1985, p. 87). Robbins (Robbins, 1991) identifies three general categories of factors that can lead to conflict: communication, structural and personal factors. A large proportion of the conflicts that arise in the organizations are due to semantic difficulties, misunderstandings, and “noise” in the communication channels. Structural factors refer to organizational size, degree of specialization in the task assigned to group members, jurisdictional clarity, member goal compatibility, leadership styles, reward system, and the degree of dependence between groups. Personal behaviour factors include the individual value system that each person has and the individual characteristics of employees. According to Kreitner and Kinicki (Kreitner and Kinicki, 1995), among some of the situations that tend to produce conflict are: incompatible personalities or values, overlapping or unclear job boundaries, competition for limited resources, inadequate communication, interdependent tasks, organizational complexity, unreasonable or unclear policies, standards, or rules, unreasonable deadlines or extreme pressure, unmet expectations, unresolved or suppressed conflict. Paunov, Paunova and Paunov systematize the main general preconditions for conflict as mostly personal and mostly organizational (Paunov, Paunova and Paunov, 2019, pp. 255-256). The personal preconditions are associated with incompatible personal characteristics, divergent value orientations and ethics, threat to individual status and unrealistic expectations. The organizational preconditions are unclear or overlapping job boundaries, unreasonable or unclear organizational rules and policies, unreasonable deadlines, task interdependence,

competition for scarce resources, inadequate communication system, collective decision making, organizational complexity, organizational change, etc. Other authors identify seven main causes of organizational conflict: scarce resources, task interdependence, goal differences, differences in ideas and values, differences in behaviour and life experience, poor communication, and managerial chaos (Panayotov, 2003; Leonov, 2006).

Although the foregoing shows that there is a wide range of possible causes of organizational conflict, the similarities in the views of different authors are obvious. The discussed views do not encompass all the possible factors that can precipitate organizational conflict, but they can help to build readiness to anticipate conflict and to take steps to handle it.

2.4. Time Spent on Conflict – a Hidden Cost of Conflict

Managing conflict is both a huge challenge and a responsibility for organizations. Unmanaged or badly managed conflict can lead to significant costs to an organization. Direct costs such as legal fees, insurances, theft, and sabotage are the most visible and easy to measure (Ford, 2017). The "hidden" costs of conflict are also significant and should not be underestimated. They include time spent on conflict, absenteeism, turnover and grievance filing (Ford, 2017).

One of the "hidden" costs – the time spent on dealing with conflict – frequently goes unnoticed by organizations. Conflict is a considerable time consumer. Previous research has shown that managers spend a significant amount of time per day (over a third) resolving conflicts and dealing with their consequences (Thomas and Schmidt, 1976; Watson and Hoffman, 1996). The financial cost of time spent unproductively on conflict can be calculated by using various measurement tools (Mediation Training Institute, 2016; Ford, 2017). In addition to the monetary cost, there are opportunity costs for the organizations. While dealing with dysfunctional conflict, managers and employees get distracted and are not focusing on their work. In business organizations, this lost time could result in lost revenue (Mediation Training Institute, 2016).

It has to be noted that not all time spent on conflict is unproductive. Clarifying issues, exploring options, and developing solutions are constructive responses to organizational conflicts (Mediation Training Institute, 2016).

2.5. Research on Conflict in Bulgaria

There is a lack of empirical research on workplace conflict in Bulgaria. Previous research on conflict is mainly focused on the styles of handling conflicts based on the models of Rahim and Bonoma (Krumov and Ilieva, 1995: Krumov, Ilieva and Andonova, 1994, 1996; Rahim et al., 2000; Mitevska-Encheva, 2013, 2015; Ilieva, 2000) and Thomas and Kilmann (Raykova, Semerdjieva and Tornyova, 2020; Todorova and Mihaylova-Alakidi, 2010).

Other publications are dedicated to managerial interventions in employees' conflict (Mihaylova, 2017), managers' attitudes towards conflicts (Mihaylova, 2018) and the outcomes from conflict (Mihaylova, 2019; Raykova, Semerjieva and Yordanov, 2012;

Raykova et al., 2015). Recent studies examine the relationship between conflict management training and managers' confidence in their conflict knowledge (Mihaylova, 2020) and approaches for dealing with conflict in medical teams (Raykova et al., 2021).

In recent years, however, there have been some publications, regarding the workplace conflict in hospitals in Bulgaria (Raykova, 2019; Raykova, Semerjieva and Tornyova, 2011; Raykova et al., 2015; Raykova et al., 2017; Raykova and Semerdjieva, 2019). Other studies draw attention to the conflict in the public sector (Chorbadzhiyska, 2013a, 2013b; Bankova, 2019a, 2019b). There seems to be a need to extend the research on workplace conflict in organizations of all sizes and all industries in Bulgaria.

In 2008 CPP, Ltd.[4] undertook a global survey on the conflict in the workplace. It questioned 5,000 employees in nine countries around Europe and the Americas (Belgium, Brazil, Denmark, France, Germany, Ireland, the Netherlands, the United Kingdom, and the United States) (CPP, 2008; OPP, 2008). With the aim to fill the identified research gap, we duplicated the CPP's research and conducted a study in organizations of all sizes and all industries in Bulgaria. Using the same methodology allows us to see the results alongside the results of the survey by CPP.

The question arises as to whether we can compare the results on workplace conflict from the nine countries in 2008 with the results from Bulgaria in 2021. We believe that the answer is positive, and two arguments can be given in support of this claim. First, the COVID-19 pandemic has led the global economy in an ongoing economic recession. Prior to it, the Global Financial Crisis of 2007-2009 significantly affected the global economic and financial conditions. The effects of such crises can be examined at a macro level, at a firm-level and at a level of individual actors, including the experiences and views of employees (Johnstone, Saridakis and Wilkinson, 2019). Previous research indicates that an economic crisis is a threatening contextual circumstance that influences employees' approaches in life and evaluations of their work situations (Bell and Blanchflower, 2011; Mehri et al., 2011; Markovits, Boer and van Dick, 2013). Studies also suggest a range of negative consequences for employees as a result of an economic downturn, such as stress, anxiety, anger, job insecurity, and decreased motivation (Brockner et al., 1992; Cutcher-Gershenfeld, 1991; Kinnie, Hutchinson and Purcell, 1998; Mehri et al., 2011; Shaw and Barrett-Power, 1997; Sverke and Hellgren, 2001). All this might manifest in dysfunctional employee behaviours, including increased levels of conflicts and lowered the speed of conflict resolution (Cutcher-Gershenfeld, 1991; Hansson, 2008). As both surveys (the one by CPP and ours) are conducted during severe economic periods, we expect that the two crises would have a similar impact on the extent and nature of workplace conflict. Secondly, as we did not find any other recent global studies on workplace conflict, seeing our results alongside the common tendency in 2008 would enrich our analysis and contribute to a better understanding of where Bulgarian organizations stand in regard to conflicts.

[4] The survey was conducted in partnership with OPP, Ltd. and Fellipelli that are leading business psychology firms, respectively in Europe and in South America.

3. Method

3.1. Participants

A total of 708 full-time employees from different Bulgarian organizations participated in the current study. Of these, 45% were male and 55% were female. Approximately two-thirds of respondents were up to 30 years old (29%) or between 31 and 40 years old (34%), 24% were between 41 and 50 years old and 13% were older than 51 years old. Regarding the educational background, most employees had a master's or a doctoral degree (65%), 22% had a bachelor's degree and 13% had a secondary level of education. 18% of respondents had work experience up to 5 years, 24% – from 6 to 10 years, 30% – from 11 to 20 years, 28% – from 21 and more years. Seven in ten respondents (70%) were non-managers and three in ten (30%) were managers. 11% of employees had worked in the organization for less than a year, 46% – between 1 and 5 years, 17% – between 6 and 10 years, 19% – between 11 and 20 years and 7% – more than 21 years. Respondents from large enterprises represented the biggest group of the sample (41%), followed by employees from medium enterprises (26%), from small enterprises (24%) and from micro-enterprises (9%). The greatest was the share of employees occupied in the service industry (54%), 15% worked in the commercial sector, 12% – in the manufacturing industry, 14% – in the public sector and 5% – in the voluntary sector. The majority of the employees' organizations were located in the capital of Bulgaria (77%), 16% – in district cities, 7% – in small cities or villages.

A limitation of the study is the convenience sample that included employees who happened to be most accessible to the researcher. Therefore, the sample is not representative, and we cannot provide generalizable results. Another potential weakness of the study is the choice to draw a parallel between our results and the CPP's results. As crises may have different characteristics in different countries, they also may have a different impact on workplace conflict. Even in less turbulent economic periods, there are economic, social, and cultural differences between Bulgaria and the nine countries that could be factors influencing the extent and nature of workplace conflict, and they are also not taken into account in our analysis. The comparison should therefore be considered carefully. Despite these limitations of the study, the paper provides original findings on workplace conflict in Bulgarian organizations and thus, it contributes to this under-researched area.

3.2. Procedure

The current paper is part of a research project on workplace conflict in Bulgarian organizations. The survey was conducted in 2021 using an online questionnaire in Google forms. The questionnaire was designed in accordance with the methodological framework of CPP (CPP, 2008). It included two sections. The first section consisted of questions about the incidence of conflict in the organization, the levels at which conflict is most common, the causes of conflict, the time spent on dealing with conflict, the positive and negative outcomes from conflict, the role of managers in managing conflicts and the value of training in conflict management. The second section included questions that aimed to gather information about the personal characteristics of the respondents (including gender, age, educational background, years of work experience, years of work experience in the organization and type

of position in the organizational hierarchy) and the characteristics of the organizations (including type of settlement, sector, and size).

Findings from the first four questions of the survey are presented in the current paper.

3.3. Measures

Incidence of conflict. Respondents were asked to indicate how often they have to deal with conflict in the workplace on a four-point Likert scale (1 – No, never, 2 – Yes, occasionally, 3 – Yes, frequently, 4 – Yes, always).

Levels of conflict. Levels of conflict were measured with a single-response question. Employees were asked to point the level of the organization at which conflict is most observed. The six levels of conflict were defined as follows: between entry-level/front-line roles, between line managers and their reports (the employees in the manager's team that directly report to him), between different levels of management, between middle managers, between first-line management/supervisors and between senior leadership/executives.

Causes of conflict. Causes of conflict were measured using a multiple-response question. Respondents were asked to indicate the main sources of conflict in the following categories: personality clashes, clash of values, lack of honesty and openness, lack of role clarity, lack of clarity about accountability, poor selection/pairing teams, poor line management, poor leadership from the top of the organization, poor performance management, heavy workloads, stress, discrimination, bullying/harassment, and taboo topics.

Time spent on dealing with conflict. Respondents were asked to rate how much time they spend a day dealing with conflict in the workplace on a three-point scale (1 – less than 30 minutes, 2 – between 30 and 60 minutes, 3 – more than 60 minutes).

The data from the survey were processed in IBM SPSS Statistics 25.

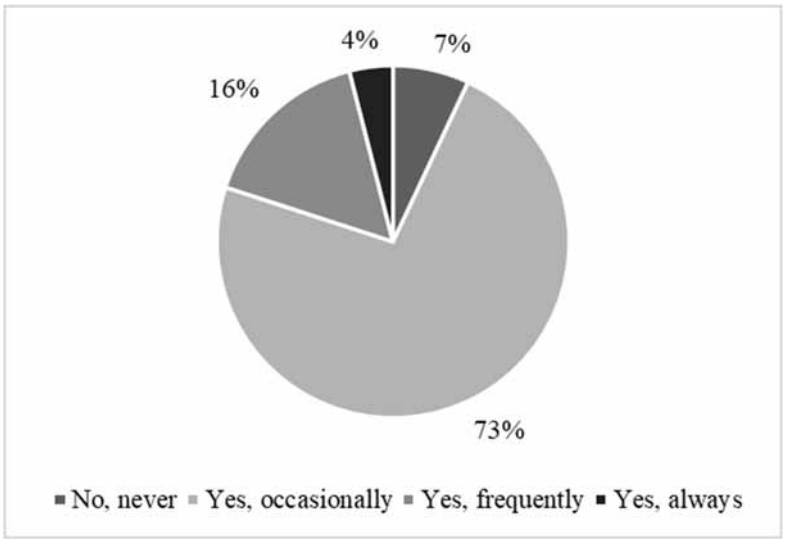
4. Results and Discussion

4.1. Incidence of Conflict in Organizations

The study found that the majority of employees had experienced conflict at work. One in five respondents (20%) considered conflict a common occurrence in their workplace (of these, 4% had to deal with conflict always) and seven in ten respondents (73%) had to deal with conflict occasionally. Only 7% of the employees reported an absence of conflict in the workplace (Figure 1).

Figure 1

Do you ever have to deal with conflict in the workplace?



Source: Created by the author on the basis of the results of the study.

There were no significant differences in the incidence of workplace conflict across the gender, age and educational background of the respondents. Significant differences were found according to the work experience of respondents. Employees with work experience from 6 and more years (21% of employees with work experience from 6 to 10 years, 22% – from 11 to 20 years and 22% – from 21 and more years) were more likely to deal with conflict always or frequently than employees with work experience up to 5 years (11%) (Cramer's V = 0.135, Approx. Sig. = 0.000). This result suggests that younger workers who have just started their careers and are in a period of adaptation and socialization seem to avoid disagreements at work, while more experienced employees are more confident to raise issues. The years of work experience in the organization are also an influential factor. Employees who worked in the organization between 1 and 5 years (20%), between 6 and 10 years (20%) and for more than 21 years (27%) were more likely to handle conflict frequently or always than employees who were in the organization between 11 and 20 years and less than a year (20%) (Cramer's V = 0.117, Approx. Sig. = 0.013). Significant differences were also found in the proportion of non-manager and managers who reported experiencing conflict. Managers (28%) were more likely to say they had to deal with conflict frequently or always compared with non-managers (17%) (Cramer's V = 0.154, Approx. Sig. = 0.000). This result is not surprising given that managers often assume third-party roles to help employees resolve workplace disagreements (Sheppard, 1984; Shapiro and Rosen, 1994; Elangovan, 1995; Jameson, 1996; Nugent and Broedling, 2002; Mihaylova, 2017).

No significant differences were found across the characteristics of the organizations (type of settlement, sector, and size).

Findings suggest that the levels of workplace conflict are slightly higher in Bulgaria compared with the average result of the survey by CPP. According to the global survey, 85% of the employees had experienced conflict in their workplace (versus 93% of Bulgarian employees) (CPP, 2008). While one in seven respondents (14%) in the global survey said that they never had to deal with disagreements, only one in fourteen Bulgarians (7%) stated the same. A closer inspection of the incidence of conflict shows that the percentage of respondents that had to deal with conflict always or frequently is greater in the survey by CPP (29% versus 20% of Bulgarians). Moreover, Bulgarian employees face disagreements almost three times less than German employees who reported the highest levels of workplace conflict (with 56% of them having to deal with conflict always or frequently).

Our study confirms the existence of conflict in Bulgarian organizations. Conflict is typical for the Bulgarian working environment and there are signals that it is a major issue for organizations and needs to be addressed in order to achieve positive outcomes (such as better solutions to workplace problems, increased motivation, a better understanding of others).

4.2. Levels of Conflict

When asked to identify the levels of the organization at which conflict is most common, four out of ten (43%) employees stated conflicts arising between entry-level/front-line roles (Figure 2). As the report of CPP suggests, these employees are likely to have spent the least time at the organization and are therefore the least likely to have learned how best to deal with conflict situations (CPP, 2008). Significant differences were found in the proportion of groups with a different educational background, who reported conflicts arising between entry-level/front-line roles. Employees with a bachelor's degree (50%) were more likely to state such conflicts compared with the other groups (employees with high-school education (41%), a master's degree (42%) and a doctoral degree (23%) (Cramer's V = 0.105, Approx. Sig. = 0.049). Organizational size is another influential factor in the common occurrence of conflicts arising between entry-level/front-line roles. Employees in small enterprises (48%) and large enterprises (47%) were more likely to mention this conflict zone than employees in micro-enterprises (41%) and medium enterprises (34%) (Cramer's V = 0.115, Approx. Sig. = 0.025).

The second most conflict zone is between managers and their reports (21%). This result is not surprising, considering that managers are often uncomfortable when communicating with employees (Solomon, 2016). Certain groups reported conflict between managers and their reports more often than others. Respondents with a secondary level of education (35%) and a bachelor's degree (23%) were more likely to observe the most conflict at this level of the organization compared with the respondents with a master's degree (18%) and a doctorate (19%) (Cramer's V = 0.136, Approx. Sig. = 0.004).

The third most cited conflict area is between different levels of management (16%). Employees were more likely to see the relations between managers from different levels as the most conflict zone if they worked in the voluntary sector or the manufacturing industry. Respectively, 28% and 26% of these employees reported conflict at this level, compared with

10% of public sector employees, 14% of commercial sector employees and 14% of service sector employees (Cramer's V = 0.142, Approx. Sig. = 0.007).

Figure 2

At what level of your organization do you observe the most conflict? (Bulgaria versus CPP's average)

Source: Created by the author on the basis of the results of the study and the results of the CPP's global survey (CPP, 2008, p. 9).

The list continues with conflicts between middle managers (9%). There were significant differences in the proportion of groups with a different educational background who reported conflicts between middle managers. Employees with a master's degree (10%) and a doctorate (23%) were more likely to observe the most conflict at this level of the organization compared with high-school graduates (6%) and employees with a bachelor's degree (7%) (Cramer's V = 0.110, Approx. Sig. = 0.035). Significant differences were also found in conflicts between middle managers reported by respondents from organizations of different sizes. Employees in medium enterprises (14%) and large enterprises (10%) were more likely to mention this conflict zone than employees in micro-enterprises (2%) and small enterprises (5%) (Cramer's V = 0.135, Approx. Sig. = 0.005). A possible explanation for this result could be that the organizational structure of smaller companies is usually flat with few or no middle management levels between staff and executives.

The next most commonly mentioned conflict zone is between first-line management/ supervisors (6%). Respondents with up to 5 five years of work experience (9%), with 11 and 20 years of work experience (8%) or with more than 21 years of work experience (7%) were more likely to observe conflict at this level than respondents with 6 and 10 years of work experience (2%) (Cramer's V = 0.110, Approx. Sig. = 0.036).

Only 5% of employees saw conflict took place mostly between senior leadership/executives. This may be due to lack of information – employees are not usually eyewitnesses of the

disagreements at senior levels. Executive managers (13%) were significantly more likely to perceive conflicts between them as the most observed in the organization than managers (4%) and non-managers (4%) (Cramer's V = 0.101, Approx. Sig. = 0.027). A possible explanation for this result may be that executives have a closer look at the working relationships at this level of the organization than managers and employees. Employees in micro-organizations (8%) and small organizations (8%) were more likely to mention conflicts between senior leadership/executives than employees in medium organizations (4%) and micro-organizations (3%) (Cramer's V = 0.105, Approx. Sig. = 0.049). These differences may be due to the flatter organizational structure in smaller organizations that makes the disagreements between senior managers more visible to employees.

Our findings for the levels at which conflict is most observed in Bulgarian organizations are consistent with the results of the survey by CPP (CPP, 2008). Employees to both surveys ranked the levels of conflict in the same order (Figure 2). It seems that employees in Bulgarian organizations see more conflict between entry-level/front line roles and between middle managers than their average foreign colleague. The comparison also shows that Bulgarian employees perceive similar levels of tension between middle managers, first-line management/supervisors and senior leadership/executives as employees in the global survey.

The results for the levels at which conflict is most common indicate the most widespread forms of workplace conflict in Bulgarian organizations that should be analyzed and addressed properly.

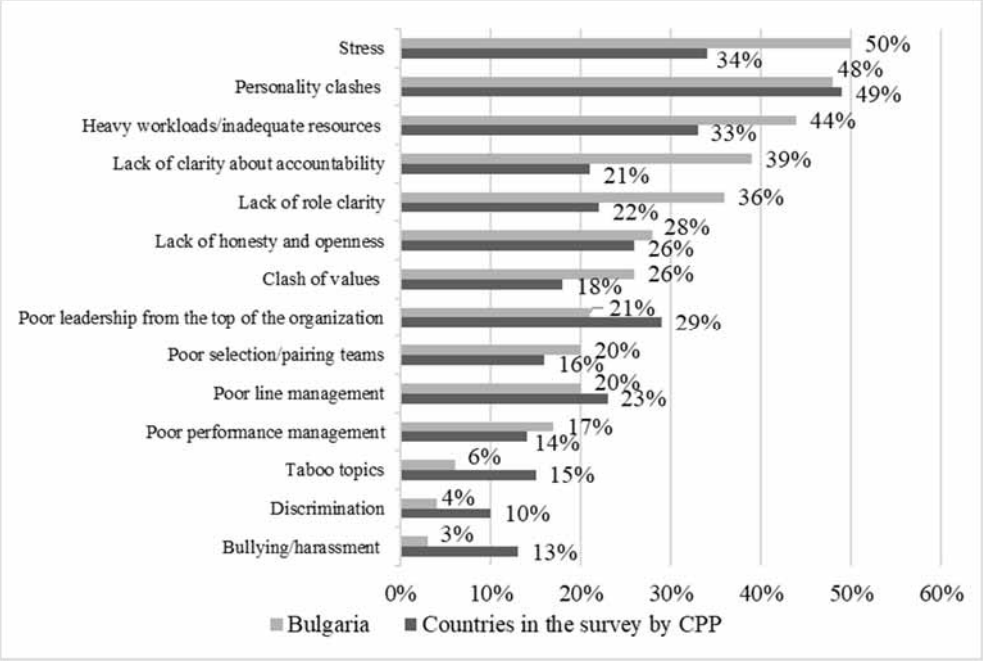
4.3. Causes of Conflict

Stress seems to be the most major issue for Bulgarian employees when it comes to conflict in the workplace. Half of the employees indicated stress (50%) as the primary cause of disagreements (Figure 3).

Personality clashes are the second most observed cause of conflict (cited by 48%). Employees who had worked in the organization between 11 and 20 years (60%) were more likely to report this key factor in generating conflict at work than the other groups (employees with less than a year of work experience in the organization (44%), with 1 and 5 years of work experience (47%), with 6 and 10 years of work experience (44%) and with more than 21 years of work experience (35%) (Cramer's V = 0.131, Approx. Sig. = 0.017). Respondents from organizations located in the capital (50%) were more likely to cite personality clashes than respondents from organizations in the district cities (41%) or small cities and villages (35%) (Cramer's V = 0.099, Approx. Sig. = 0.031). This result suggests that the working environment in the organizations in the capital is more stressful than in organizations in the smaller cities and villages.

Figure 3

Main causes of conflict in organizations (Bulgaria versus CPP's average)



Source: Created by the author on the basis of the results of the study and the results of the CPP's global survey (CPP, 2008, p. 10).

Heavy workloads are third, cited by 44% as a source of conflict. Employees who were up to 30 years old (55%) and between 41 and 50 years old (47%) were more likely to see heavy workloads as a primary source of conflict than employees between 31 and 40 years old (39%) and employees older than 51 years old (29%) (Cramer's V = 0.179, Approx. Sig. = 0.000).

Lack of clarity also seems to be a major issue in Bulgarian organizations. The fourth most commonly mentioned cause of conflict is the lack of clarity about accountability (cited by 39%). Employees were more likely to cite it if they were younger – up to 30 years old or between 31 and 40 years old. Respectively, 47% and 41% of these employees reported this key factor for workplace disagreements, compared with 30% of employees between 41 and 50 years and 32% of employees older than 51 years (Cramer's V = 0.139, Approx. Sig. = 0.003). Respondents with less work experience (44% of these who worked up to 5 years and 46% of these who worked between 6 to 10 years) were also significantly more likely to see the lack of clarity about accountability as a primary source of conflict compared with respondents with more work experience (35% of these who worked between 11 and 20 years and 34% of these who worked more than 21 years) (Cramer's V = 0.112, Approx. Sig. = 0.032). All these results suggest that organizational policies and procedures are not clear enough to be easily understood by younger employees, who are usually those with less work experience. Providing clear guidance for employees, especially at the beginning of their

careers, may facilitate their inclusion and create a harmonious working environment. Managers must play a significant role in this process by properly communicating the organizational policies and procedures to employees. The last influential factor for the lack of clarity about accountability is the type of settlement of the organizations. Employees from organizations in the capital (41%) were more likely to report it than employees from organizations in the district cities (32%) and from small cities or villages (25%) (Cramer's V = 0.103, Approx. Sig. = 0.024).

The next most commonly cited key factor for conflict is the lack of role clarity (cited by 36%). Younger respondents (45% of these up to 30 years and 38% of these between 31 and 40 years) were more likely to mention it than older respondents (30% of these between 41 and 50 years and 22% of these older than 51 years) (Cramer's V = 0.159, Approx. Sig. = 0.000). Employees who had fewer years of work experience (40% of these who worked up to 5 years and 43% of those who worked between 6 to 10 years) were also significantly more likely to indicate the lack of role clarity as a main cause of conflict compared with employees with more work experience (35% of these who worked between 11 and 20 years and 28% of these who worked more than 21 years) (Cramer's V = 0.119, Approx. Sig. = 0.018). Respondents were more likely to cite this source of workplace disagreements if they had worked less in the organization – less than a year or from 1 to 5 years. Respectively, 42% and 40% of these respondents reported it, compared with 32% of employees with 6 to 10 years of work experience in the organization, 31% of employees with 11 to 20 years of work experience in the organization and 21% of employees with more than 21 years in the organization (Cramer's V = 0.124, Approx. Sig. = 0.028). All these results support our suggestion about the lack of clear organizational policies and procedures that can provide support for younger and inexperienced employees in the process of their effective orientation and socialization in the organization. Employees from organizations in the capital (38%) were significantly more likely to state the lack of role clarity than employees from organizations in the district cities (27%) and from small cities or villages (29%) (Cramer's V = 0.095, Approx. Sig. = 0.042).

The lack of honesty and openness is ranked as the sixth most commonly perceived cause of conflict (cited by 28%). Non-managers to our survey (30%) were significantly more likely to report it than managers (28%) and executives (10%) (Cramer's V = 0.108, Approx. Sig. = 0.016). These differences may be due to a perception gap between managers' and employees' views on the characteristics of the working environment. This can be seen as a signal of the need to create organizational cultures based on honesty and openness. Previous studies highlight the crucial role of corporate culture for the successful dealing with conflict in organizations in Bulgaria (Dimitrova, 2012; Ilieva, 2018). A culture of openness and cooperation in which any problems are addressed can build the understanding that conflicts can be used to guide organizational efforts and encourage the search for new methods[5] of work.

[5] For instance, Zlatinov (Zlatinov, 2018; Zlatinov and Kabatliyska, 2020) argues the challenges in this direction arising from the digital transformation in the context of Economy 4.0, while Madanski (Madanski, 2021) and Nedev (Nedev, 2018; 2019) discuss them in specific sectors (respectively customs activities and finance).

A quarter of employees (26%) name a clash of values as a main source of conflict at work. Respondents from organizations in the capital (29%) were more likely to mention it than respondents from organizations in district cities (18%) and small cities or villages (18%) (Cramer's V = 0.098, Approx. Sig. = 0.032).

Two out of ten employees identified poor leadership from the top of the organization, poor selection, and poor line management as the prime source of conflict (cited by 21%, 20% and 20%, respectively). There were no significant differences in the respondents' responses to poor leadership from the top of the organization according to the personal characteristics or the characteristics of the organizations.

Older respondents (26% of these between 41 and 50 years and 27% of these older than 51 years) were significantly more likely to see poor selection as a key issue for workplace disagreements than younger respondents (17% of these up to 30 years and 17% of these between 31 and 40 years) (Cramer's V = 0.113, Approx. Sig. = 0.029). Respondents with more than 21 years of work experience (27%) were also more likely to report this source of workplace disagreements compared with respondents with less work experience (19% of respondents with up to 5 years of work, 19% of respondents with 6 to 10 years of work experience and 16% of respondents with 11 to 20 years of work experience (Cramer's V = 0.112, Approx. Sig. = 0.030). A possible reason for these differences may be that older and more experienced employees sometimes underestimate the skills and the abilities of new hires, who are usually younger and less experienced than them. Employees were more likely to cite poor selection if they had a high-school education or a doctoral degree. Respectively, 28% and 42% of these respondents mentioned it, compared with 19% of employees with a bachelor' degree and 18% of employees with a master' degree (Cramer's V = 0.138, Approx. Sig. = 0.004).

It seems that managers' self-assessment of their managerial skills differs from the views of their reports. Non-managers (24%) were significantly more likely to report poor line management as a key factor for conflict at work than managers (11%) and executives (10%) (Cramer's V = 0.150, Approx. Sig. = 0.000).

Poor performance management is cited by 17% of employees as a significant factor in generating conflict at work. Taboo topics (6%), perceived discrimination (4%) and bullying (3%) were the least commonly observed areas that lead to conflict.

Female employees (6%) were significantly more likely to report discrimination as a main cause of conflict compared with male employees (2%) (Phi = 0.092, Approx. Sig. = 0.014). Respondents were more likely to report this source of workplace disagreements if they were up to 30 years or more than 51 years old. Respectively, 4% and 10% of these respondents cited discrimination, compared with 3% of respondents between 31 and 40 years old and 2% of respondents between 41 and 50 years (Cramer's V = 0.110, Approx. Sig. = 0.036).

The main causes of conflict in Bulgarian organizations differ from the results of the survey by CPP (CPP, 2008). A comparison of the results of our study and the survey by CPP shows that the three most commonly mentioned causes of workplace conflict are the same. Countries in the global survey, with the exception of Germany, ranked personality clashes at the top of the list, while Bulgarian employees ranked them second. Stress is the second most

cited cause of conflict in the overall average results for the nine countries and the first in our study. Heavy workloads appear to be the third key factor for conflict for both Bulgarian employees and their foreign colleagues. There are no other similarities in the results of the two studies. Bulgarian employees have different perceptions of the major areas that lead to disagreements in the workplace and rank them in a specific order.

Our findings seem to be consistent with the results of the survey by CPP (CPP, 2008), which indicated that the most observed causes of conflict differ between countries due to differences in working life. The research also highlighted the impact of cultural factors on conflict (CPP, 2008). Having this in mind, it is not surprising that employees from Bulgarian organizations ranked the causes of conflict in a different way.

Employees to the global survey see more conflict arising from poor leadership from the top of the organization, poor line management, taboo topics, discrimination, and harassment than Bulgarian employees. Personality clashes are seen as a major causative factor by a similar percentage of respondents in both surveys. It should be pointed out that most of the key factors leading to an organizational conflict are more frequently reported by Bulgarian employees than by the employees in the survey by CPP. These results suggest that the working environment in Bulgaria generates more conflict than in the other nine countries and are indicative for the organizations to make efforts to create a healthy and harmonious working environment.

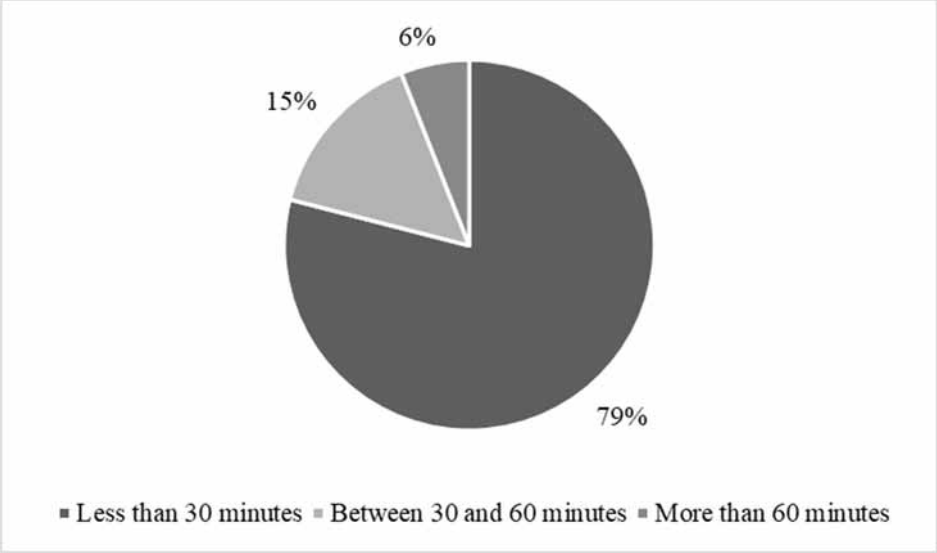
4.4. Time Spent on Dealing with Conflict

Given the levels of workplace conflict in Bulgaria organizations, it is not surprising that dealing with conflict takes considerable time. The majority of employees (79%) stated that they spent up to 30 minutes per day in a conflict situation (Figure 4). According to 15% of the respondents, conflict at work lasted from 30 to 60 minutes and 6% answered that they spent more than 60 minutes dealing with conflicts.

In most of the responses, there were no significant differences across the personal characteristics of respondents as well as across the characteristics of the organizations. Significant differences were found in the time spent on dealing with conflict reported by groups with different work experiences. Employees were more likely to spend more than 1 hour a day in conflict if they had worked in the organization for more than 21 years. 11% of these employees reported this, compared with 4% of employees with up to 5 years of work experience, 3% of employees with 6 to 10 years of work experience and 6% of employees with 11 to 20 years of work experience (Cramer's V = 0.145, Approx. Sig. = 0.021). We can speculate about the reasons for these differences. Employees with more work experience usually occupy more responsible positions in the organizational hierarchy (like managers, supervisors, etc.) and have to deal more often with disagreements between other members of the organizations or between their reports.

Figure 4

Time spent on dealing with conflict per day



Source: Created by the author on the basis of the results of the study.

The time that employees most often spend on conflict situations equals 2.5 hours per week (approximately one day a month). A possible explanation for this amount of time can be sought in the dimensions of national culture. According to Hofstede, Hofstede and Minkov (2010), the masculinity-femininity dimension of culture affects the ways of handling conflicts in organizations (Hofstede, Hofstede and Minkov, 2010). In masculine cultures, conflicts are resolved by a good fight and by letting the strongest win. In feminine cultures, conflicts are resolved by compromise and negotiation. Bulgaria is considered a relatively feminine society (with a score of 40[6] on Hofstede's masculinity-femininity dimension) (Hofstede Insights, 2021), and we can assume that employees spend so much time in conflict because they are trying to reach a solution through compromise.

It is not difficult to put a cost on the wasted time on conflict of an employee. The total cost for an employee equals his hourly rate of pay multiplied by the hours spent on conflict (Ford, 2017). In the case of Bulgaria, it amounts to approximately €10.5 or $13 (based on average hourly earnings of €4.2 or $5.2)[7] per week. The loss rises to €42 or $52 per month and to €504 or $624 per year. Based on these calculations, the total cost of conflict for the Bulgarian

[6] For the purpose of the study, we chose to consider the score of Hofstede. According to other researchers the value of the dimension for Bulgaria is slightly high (Silgidzhiyan et al., 2007; Sotirova and Davidkov, 2005; Davidkov, 2009; 2019).

[7] The result is obtained on the basis of the average annual wages and salaries of the employees under labour contract in 2020 (16642BGN, approximately 709EUR or 863USD per month) (National Statistical Institute, 2021) and the average working hours per month in 2020 (167 working hours, calculated for 250 working days).

economy equals to approximately €1 1.09 billion or $1.4 billion in paid hours in 2020[8]. Certainly, we must take into consideration that perhaps not all that time spent on conflict is unproductive. Further research is needed to differentiate total time spent on conflict from unproductive time.

We can also calculate the approximate cost of a single hypothetical conflict that takes 2.5 hours per week of the parties involved in it. There are usually at least two employees in a conflict. A superior (the manager of the employees) and/or an HR professional[9] often involves in setting the workplace conflict if the employees cannot achieve a resolution on their own. Having this information in mind, the sum of totals for all the employees involved equals the organization's total costs of the conflict per (4 x €10.5 / $13 = €42 / $52). This cost will increase if the conflict continues longer than a week or more employees get involved in it.

It should be noted that this calculation is not entirely accurate. Not all employees waste an equal amount of time on a given conflict. The measurement will be more accurate if the actual salary (including bonuses) and all the benefits of each employee are used in the calculation.

5. Conclusions

The current paper highlights the need for acknowledging the significance of conflict in organizations. It gives some valuable knowledge on workplace conflict in the Bulgarian context.

First, our findings reveal that conflict is typical for Bulgarian organizations. It goes without saying that this result is not surprising given the inherence of conflict within all human interactions. Most employees experience workplace conflict to some extent, and a fifth of them have to deal with conflict always or frequently.

Second, Bulgarian employees identify the conflict at all levels of the organization. Conflict is most common between entry-level/front-line roles and between managers and their reports. Our evidence appears to be in line with the overall average in the survey by CPP (CPP, 2008). Employees to both surveys ranked the levels of conflict in the same order. Conflicts between entry-level/front-line roles and between middle managers are more frequently reported by Bulgarian respondents than by their foreign colleagues. The results underline the importance of building supportive work relationships and effective communication at all levels of organizations.

Third, conflict in Bulgarian organizations occurs across a wide range of causes. Stress, personality clashes and heavy workloads are seen as the primary factors leading to disagreements at work. Although the first three causes of conflict are the same as in the survey

[8] The result is obtained on the basis of the average annual number of employees under labour contract in 2020 (National Statistical Institute, 2021).

[9] The calculation is made for organizations in which HR professionals are not formally involved in the process of dealing with conflicts in the workplace, their job responsibilities do not include resolving problems between employees and therefore they are not paid for it.

by CPP, Bulgarian employees have different perceptions of the major areas that lead to disagreements. Our findings reveal the specifics of the working environment in Bulgaria and draw attention to the key factors that need to be addressed in order to deal with workplace conflict.

Fourth, in terms of lost time, the conflict appears to be costly to Bulgarian organizations. Our evidence shows that Bulgarian employees mostly often spend 2.5 hours per week dealing with conflict. If all this wasted time is unproductive, the losses for the economy are significant – about €1 billion or $1.4 billion in paid hours in 2020. The aggregate losses associated with conflict are even greater given the other direct and hidden costs to the organization resulting from the poorly managed conflict. Hence, the question for organizations is how they can reduce the costs of conflict and achieve a positive outcome from conflict.

The present study has several implications for organizations. First, it was shown that conflict is certain to occur in any organization, and therefore, it must be recognized as an integral part of working life. To learn how to live with conflict and achieve positive outcomes, organizations must foster organizational cultures that encourage constructive attitudes of employees to conflict. Second, to demonstrate their ability to handle conflict, organizations must provide employees with adequate conflict management training. Formal training is considered the most powerful tool for successfully dealing with organizational conflict.

The results of the study could also be useful for further research on workplace conflict in Bulgarian organizations.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Oxana Bezler[1]
Teodor Sedlarski[2]

QUANTITATIVE ANALYSIS OF THE INTERACTION OF THE LABOUR MARKET AND THE HIGHER EDUCATION MARKET (ON THE EXAMPLE OF KAZAKHSTAN)[3]

The importance of the interaction of the labour market and the higher education market is beyond doubt. The analysis of scientific articles has shown that this type of interaction is considered by scientists depending on the direction of research. Only a few works are devoted to the quantitative analysis of the interaction of these domestic markets. The task is complicated by the fact that today there is no clear methodology for quantitative analysis of the interaction of subjects of different markets. The authors made an attempt to adapt the analysis methodology proposed by Russian scientists. The methodology used is based on an economic and statistical analysis of the interaction of the labour market and the higher education market, with the determination of the type of interaction under the influence of individual factor indicators of these markets and the use of systematic and structural group data. As a result of quantitative analysis, the lack of elasticity between the supply of universities and the needs of the labour market was revealed. The imbalance has led to the fact that in the sectors of the economy of Kazakhstan, there is a shortage in one industry and a surplus of personnel with higher education in another. The results of this study are important for stakeholders, such as politicians, universities, to solve the problems of unemployment among recent graduates.
Keywords: labour market; demand of labour market, higher education market; proposals from university graduates; interaction; types of interaction of different markets
JEL: A10; I2; J6

Introduction

The labour market and the higher education market are characterized by internal factors and socio-economic indicators. The employment of the population is one of the key indicators of the development of the socio-economic policy of the state. The mandatory employment rate of university graduates in the first year of its completion in Kazakhstan should be 80%. An important role in the growth of employment and recruitment is played by the quantitative

[1] *Oxana Bezler, Karaganda University of Kazpotrebsoyuz, e-mail: bezleroxana@mail.ru.*
[2] *Teodor Sedlarski, Sofia University "St. Kliment Ohridski", e-mail: sedlarski@feb.uni-sofia.bg.*
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interaction of the subjects of the labour market and the subjects of the higher education market. A university graduate is a participant in this interaction. Entering the university, a student decides to master certain competencies, at best, in accordance with their inclinations, ideas about the expected level of wages, income and demand in the labour market. The university strives to sell educational services of already open educational programs to as many potential applicants as possible. The more students enter the university, the higher the level of financial condition of the university. The state order for training specialists for most universities is minimal. The largest share of students in Kazakhstan receives higher education on a fee-based basis. According to official data[4] for the 2020-2021 academic year, the number of students studying at universities amounted to 576.6 thousand students. And only 29.8% (171.8 thousand students) study at the expense of state educational grants. The state does not regulate the quantitative influx of specialists of the highest category. In Kazakhstan, neither the university nor the state studies the quantitative sectoral needs of the labour market. The analysis of personnel needs is carried out only according to the documents of statistical reporting. This situation leads to a violation of the balance between the quantitative demand of the labour market for young professionals with higher education and the quantitative supply of the higher education market. In this case, it is not necessary to talk about the equilibrium price. The economic opportunities of the employer and the desires of the university graduate do not coincide. If the labour market is not able to offer enough jobs that graduates expect, then many graduates will receive limited profits from their education (Lauder, Mayhew, 2020).

The work on making projections, in developed countries, enjoys state support; however, not everywhere state institutions are producers of forecast works. Only in the USA and Canada, government agencies are responsible for this direction. In European countries, professional structure projection is carried out by non-profit organizations, for example, the English Institute for Employment Research at Warwick University or the German Institute for Employment and Occupational Research at the Federal Institute of Labour in Nuremberg. Many researchers explain the non-participation of the state in forecasting activities by the fact that the authorities are afraid to take responsibility for the quality of forecast estimates. In addition to forecasts that are developed by specialists of individual countries, there are forecasts for groups of countries of the European Union. This work is performed by CEDEFOP (Vishnevskaya, Zudina, 2017).

This imbalance, in our opinion, arises as a result of the lack of a clear organizational and economic mechanism between the interaction of the labour market and the higher education market. And also, as a result of the lack of a methodology for analyzing this interaction, the results of which can be considered in the system of planning, forecasting and state regulation.

[4] Official website of the Bureau of National Statistics Agencies for Strategic Planning and Reforms of the Republic of Kazakhstan - https://stat.gov.kz/for_users/dynamic.

Literature Review

In the international practice, a sufficient number of modern scientific works is devoted to the interaction of the higher educational market and the labour market. The absence of effective modern interaction is recognized by all authors without any exception. The authors reveal and investigate this problem from their own scientific point of view.

Kostina and Orlova (2016) conducted an empirical study of the interaction of the labour market and educational services. The authors came to the conclusion that the optimal employment structure can be achieved as a result of the employers' participation in the development of requirements for future graduates and the development of educational material.

With the objective interaction of the labour market and educational services, according to Borisenko (2017), a labour market emerges. The labour market provides a qualitative assessment of the professional competencies of its participants. The quantitative regulation is imposed on the state. Only with such a model of interaction, in his opinion, it is possible to maintain a balance of labour resources.

In the works of Perevozchikova and Vasilenko (2018), the conceptual foundations of the labour market and the higher education market services at the current stage of their interaction are defined.

Digital technologies are intensively included in all spheres of human economic activity. Their influence transforms employment, increases the mobility and innovation of the labour force. In general, this causes a change in the employer's requirements not only for the digital competencies of university graduates but also for their quantity.

In the scientific discussion, there are works devoted to the changes in the content of the labour market, its organization, and the skills of personnel under the influence of computer technology, such as Handel M. J. (2008), Green F. (2012), Seo H. J., Lee Y. S., Hur J.J., Kim J.K. (2012), Frey C. B., Osborne M. A. (2013), Azmuk N. (2015). A number of scientific works is devoted to determining the influence of information technologies on the formation of students' competencies, which in general form a qualitative component (Youssef, Dahmani, 2008; Sampath Kumar, Manjunath, 2013; Castillo-Merino, Serradell- Lopez, 2014). The state, society, and family also have a direct impact on the choice of a future speciality (Barham et al., 2009; Rodriguez – Planas, Benus, 2010; Bacher et al. 2017; Spencer-Oatey et al., 2017). The role of companies and organizations in the development of competencies of their employees with the highlighting of successful strategies and views on performance is of considerable importance in the issue under consideration (Eilström, Kock, 2008; Ronald, 2009; Lai, Teng, 2011; Velasco, 2014; Delaney et al., 2020).

In the research, the authors also focus on the significant role of competition factors in the formation of professional competencies of graduates to meet the needs of the labour market (Ma'dan Marfunizah, Muhamad Takiyuddin Ismail, 2020).

Competition in the higher education market does not lead to an increase in the quality of educational services, but to an oversupply of specialists in certain areas and a shortage in others. In order to maintain a balance, the markets should be provided with data on the

economic and personnel development of the country in the form of macroeconomic forecasts. The data should be partially corrected by employers' expectations in the short and long term. The guarantee of employment after receiving higher education should be an important competitive advantage of the university in the higher education market, the problems of which we considered in previous studies. (Borbasova, Sedlarski, Bezler, 2019).

Having studied the scientific works of domestic and foreign scientists, we can conclude that the interaction of the labour market and higher education is largely investigated through qualitative assessments. Within the framework of this study, the authors tried to give a quantitative analysis of the interaction of the labour market and the higher education market.

Analysis Methodology

The qualitative analysis of university graduates consists of studies of professional competencies. A university graduate must meet the employer's requirements for the professional and qualification composition of staff. The elasticity of the qualitative interaction of markets should be achieved due to the coincidence of the qualitative demand of the labour market with the qualitative supply of the higher education market.

A quantitative analysis of the interaction consists in the balance of the demand for labour resources with higher education (the number of vacancies) in a particular industry and the supply of the higher education market of graduates for certain educational programs. The elasticity of the interaction of quantitative and qualitative characteristics of the markets under research will provide a high level of employment. At the same time, the planning and forecasting system plays an important role in this process.

The process of interaction between the labour market and higher education market reflects the possible balance between labour demand and supply. A market in which demand matches supply reaches equilibrium, but this ideal model is not always supported. The divergence of interests creates an imbalance that requires the participation of all actors in this interaction process.

In this article, we will conduct a quantitative analysis of the interaction of the labour market and the higher education market according to available data from Kazakhstan. For quantitative analysis of interaction, the authors tried to adapt the methodology proposed by Russian scientists Khamalinsky and Zavgorodnya (2010).

The purpose of the methodology used is to identify the type and trends of interaction between the labour market and the higher education market at the current stage of socio-economic development under the influence of various factors with the possibility of planning and forecasting based on the results obtained.

Quantitative analysis of the interaction of labour market demand for personnel in certain industries and the supply of university graduates in certain areas of training is carried out using secondary data analysis. The data of the Ministry of National Economy of the Republic of Kazakhstan Committee on Statistics and the data request of the National Chamber of

Entrepreneurs (NCE) of the Republic of Kazakhstan "Atameken"[5](analyzes the employment of graduates of universities of Kazakhstan according to official data of the State Pension Payment Center and determines whether the graduate has mandatory pension contributions from wages, which confirms the official employment of graduates) were used as sources.

The methodology of quantitative analysis of the interaction of the labour market and the higher education market is implemented using a comprehensive analysis procedure (Table 1).

Table 1

Procedure for analyzing the interaction of the labour market and the higher education market

Analysis and assessment	Indicators
The dynamics of the labour market	The number of economically active people employed, unemployed, including by level of education, by vocational-qualification structure, in industry and regional contexts, allocation of the employable youth level, youth unemployment, and labour replacement rate.
Analysis of the educational services market	The number of universities, the number of universities' graduates, the employment percentage of graduates according their educational programs, the ratio of budget and extra-budgetary financing of universities.
Analysis of factors that determine the formation and functioning of the labour market with the identification of factors that have the greatest impact on the interaction of the studied markets	The total population, graduates gender structure, the number of job opportunities, the number of specialists admitted with higher education during the graduation year, the average annual salary, the cost of educational services
Analysis of the quantitative correspondence of the professional and qualification composition of the labour force to the needs of the labour market (the ratio of supply and demand in the labour market as a whole and by groups of educational programs)	The coefficient of the interaction: $C_i = \frac{S_i}{D_i}$. S_i– graduates supply with a certain of the educational programs; D_i – demand for graduates of the same educational programs. Demand elasticity coefficient (supply) from *i* (factor).
Evaluating interactions based on type and trend identification	Types of interaction with tendencies to increase or decrease the coefficient of interaction: $T_p = C_{i1} / C_{i0}$

Source: Khamalinsky, Zavgorodnaya, 2010.

In our opinion, the choice of a certain speciality for higher education depends on a number of factors:

The supply of graduates of a particular speciality depends on a number of factors:

$$S_i = F(P, P_T, N, K), \quad (1)$$

[5] https://atameken.kz.

P – educational service price;

P_T – average salary;

N – average number of universities;

K – number of working-age population.

The demand for specialists in a particular educational program depends on factors:

$$D_i = F(P_T, E, G), \quad (2)$$

P_T – average salary;

E – workplaces number;

G – number of state orders for specialists in the given educational program (number of allocated grants).

The degree of influence of one or another factor on the resulting indicator can be estimated using the elasticity coefficient. The coefficient of elasticity of demand (supply) from the *i*-factor allows you to determine the percentage change in the effective feature (supply, demand) with an increase in the factor feature by 1%:

$$E_i = y'(x_i / y_x) \quad (3)$$

E_i – elasticity coefficient from the *i* factorial feature;

y' – first derived function;

x_i – *i*-factorial feature;

y_x – aligned value of effective feature.

A multivariate model can be constructed using a linear function:

$$y_{x1,x2\ldots xn} = a + b_1 * x_1 + b_2 * x_{2+} \ldots b_n * x_n \quad (4)$$

$b_1, b_2 \ldots b_n$ – regression coefficients are showing the intensity of factors influence on the effective feature, that is, for how many units will be increased the accepted Y value, if the variable X changes by one (Khamalinsky, Zavgorodnaya, 2010).

The interaction of the higher education market takes place with a different state of demand for specialists and their supply. In the methodology used, the authors propose to determine 4 types of interaction depending on the ratio of specialists trained by the higher education market and the need for specialists with higher education in the labour market (Table 2).

Table 2

Combined matrix of types and trends of interaction between the labour market and the higher education market

Trends of market interaction	Types of market interaction			
	I	II	III	IV
The strengthening of interaction	$C_i=1,\ T_pC_i>0$	$C_i<1, T_pC_i>0$	$C_i>1,\ T_pC_i\leq 0$	$C_i=1,\ T_pC_i\geq 0$
The weakening of the interaction	$C_i>1,\ T_pC_i\geq 0$	$C_i<1, T_pC_i\leq 0$	$C_i>1, TpCi>0$	$C_i=1,\ T_pC_i<0$ $C_i>1,\ T_pC_i>0$

Source: Khamalinsky, Zavgorodnaya, 2010.

To assess trends in the interaction of the studied markets, the indicator of the growth rate of the interaction coefficient is used:

$$T_p = C_{i1} / C_{i0}, \quad (5)$$

T – growth rate of the coefficient of the interaction of market;

C – coefficient of the interaction of markets.

The I type is a weak level of market interaction, characterized by a low degree of job creation and training to meet the requirements.

The II type – the analyzed interaction is weakened by universities. In this situation, the labour market is able to move towards a new employment structure, under the influence of changed institutional conditions. Changing demand in the labour market is the impetus for changes in universities. The offer of universities hinders the development of the labour market, not satisfying its quantitative needs.

The III type of interaction, shown by a low intensity of job creation and relocation. In this case, the supply of labour for a particular educational program exceeds the demand for it.

The IV type is high interaction intensity (Khamalinsky, Zavgorodnaya, 2010).

Results

In the quantitative analysis, the factors influencing the supply and demand for graduates were determined. The primary data of the state statistics bodies, the employment service and the legal system of regulatory acts of the Republic of Kazakhstan "Adilet" and the data of NCE "Atameken" were used to conduct a secondary analysis for 2011-2019 and forecasting on 2020-2024.

Initially, with the help of correlation analysis, the influence of various factors on the graduates' supply in all educational programs was determined. The following factors were used:

S – graduates supply (persons);

P – educational services price (EUR);

P_T – cost of studying at a Universities (EUR);

N – average number of Universities (units);

K – population over the age of 15 and above (thousand people).

The results show that the average monthly salary has the greatest impact on the supply of graduates, where the relationship between this factor and the supply is opposite. This can be explained by the fact that with an increase in wages, parents have more opportunities to provide their children with the opportunity to study abroad. This has been a trend in recent years. The average number of universities has the least impact on the supply of graduates. Based on the available data, we will create a regression model of the dependence of the graduates' supply on these factors. The multiple regression equation in general looks like this:

$$S = a + b_1 P + b_2 P_T + b_3 N + b_4 K, \quad (6)$$

We will evaluate the multiple regression equation parameters using the "Regression" tool. As a result of data approximation, we've got a protocol for performing regression analysis (Table 3).

Table 3

The regression analysis protocol (graduates supply)

Regression statistics				
Multiple R	0,933955			
R-square	0,872272			
Standard R- square	0,616816			
Standard error	12012,46			
Observations	7			
Variance analysis				
	df	*SS*	*MS*	*F*
Regression	4	1970876023	4,93E+08	19,34566
Balance	2	288598304	1,44E+08	
Total	6	2259474327		
	Coefficients	*Standard error*	*t-statistic*	
a	500972,143	234274,905	2,138394	
b_1	-0,10953	0,25605646	-4,42777	
b_2	-1,31017	0,55907076	-5,34348	
b_3	-1680,38	1050,24062	-1,59999	
b_4	6,034636	9,2121187	5,655076	

Source: compiled by authors

As a result, we have the following equation of multiple linear regression:

$$S = 500972{,}14 - 0{,}11P - 1{,}31P_T - 1680{,}38N + 6{,}03K \quad (7)$$

The multiple correlation coefficient is equal to $R = 0{,}93$, which indicates a close relationship of the resulting feature with four factorial features simultaneously. The

determination coefficient is equal to $R^2 = 0{,}87$, i.e. 87% of the dependent variable variation is explained by the regression obtained. Check the statistical significance and reliability of the obtained regression equation and its coefficients. The data of regression analysis execution protocol provide that the observed value of the F-test is equal to $F_{obser} = 19{,}35$. The critical value of the F-test at the level $\alpha = 0{,}05$ and the degrees of freedom number $k_1 = m = 4$, $k_2 = n - m - 1 = 2$ (where n – number of observations, m – factors number) is equal to $F_{crit.}(0{,}05\,;\,4\,;\,2) = 19{,}25$.

As $F_{obser.} > F_{crit.}$ $(19{,}35 > 19{,}25)$, then we can conclude concerning the statistical significance and reliability of the obtained regression equation. The statistical significance of the equation certain coefficients shall be determined using a t-student statistic. The observed values of this statistic for the certain coefficients are respectively equal to:

$$t_a = 2{,}14, \quad |t_{b_1}| = 4{,}42, \quad |t_{b_2}| = 5{,}34, |t_{b_3}| = 1{,}6, \quad t_{b_4} = 5{,}7.$$

The critical value of the student criteria at the significance level $\alpha = 0{,}05$ and the number of degrees of freedom $k = n - m - 1 = 2$ is equal to $t_{crit.}(0{,}05\,;\,2) = 4{,}3$.

Comparing the observed values of t-statistics with critical ones, we can conclude about the statistical significance and reliability of only coefficients that take into account such variables as university tuition fees, the average monthly nominal salary and the population aged 15 years and older.

Let's analyze statistically significant coefficients of the obtained regression equation: with an increase in the cost of training by 10 euros, the graduates supply decreases by 110 people; with an increase in the average monthly nominal salary of 10 euros, the graduates supply decreases by 1,310 people; with an increase in the population aged 15 years and older by 1,000 people, the number of graduates increases by 6 people. Let's determine the average value of the elasticity coefficients:

$$\overline{E}_{SP} = b_1 \cdot \frac{\overline{P}}{\overline{S}} = -0{,}11 \cdot \frac{402018}{156485} = -0{,}281\ \%\ ,$$

$$\overline{E}_{SP_T} = b_2 \cdot \frac{\overline{P_T}}{\overline{S}} = -1{,}31 \cdot \frac{120005}{156485} = -1{,}005\ \%\ ,$$

$$\overline{E}_{SK} = b_4 \cdot \frac{\overline{K}}{\overline{S}} = 6{,}04 \cdot \frac{121147}{156485} = 0{,}468\ \%\ .$$

Elasticity coefficients indicate the following: with an increase in the cost of studying by 1% of the average level, the graduates supply decreases by 0.281% of its average level with the unchanged values of the remaining factors; with an increase in the average monthly nominal wage by 1% from the average level, the graduates supply decreases by 1.005% from its average level with the unchanged values of the remaining factors; with population growth aged 15 and older by 1% of the average level, the graduates supply increases by 0.468% of its average level with the unchanged values of the remaining factors.

Thus, we can conclude the average monthly nominal wage has the greatest impact on graduates' supply, and this effect is the opposite, and the possible reasons for this were indicated therein. Further, using the correlation analysis, the influence of various factors on the graduates' demand in all educational programs was determined.

The following indications were used:

D – graduates' demand (persons);

P_T – average monthly nominal wage (EUR);

E – workplaces number (units);

G – state order size for specialists (number of grants allocated, units).

The obtained results show the average monthly wage has the greatest impact on graduates' demand. The least impact on graduates' demand has a number of state orders. Based on the available data, we will create a regression model of the graduates' supply dependence from these factors. The multiple regression equation in a general way is the following:

$$D = a + b_1 P_T + b_2 E + b_3 G, \quad (8)$$

As a result of data approximation, we've got a protocol for performing regression analysis (Table 4).

Table 4

The regression analysis protocol (graduates' demand)

Regression statistics				
Multiple R	0,933955			
R-square	0,872272			
Standard R- square	0,616816			
Standard error	12012,46			
Observations	7			
	Variance analysis			
	df	*SS*	*MS*	*F*
Regression	4	1970876023	4,93E+08	19,34566
Balance	2	288598304	1,44E+08	
Total	6	2259474327		
	Coefficients	*Standard error*	*t-statistic*	
a	500972,143	234274,905	2,138394	
b_1	-0,10953	0,25605646	-4,42777	
b_2	-1,31017	0,55907076	-5,34348	
b_3	-1680,38	1050,24062	-1,59999	
b_4	6,034636	9,2121187	5,655076	

As a result, we have the following equation of multiple linear regression:

$$y = -23683{,}91 + 0{,}43P_T - 0.04E + 1{,}45G, \quad (9)$$

The multiple correlation coefficient is equal to $R = 0{,}94$, which indicates a close relationship of the resulting feature with four factorial features simultaneously. The determination coefficient is equal to $R^2 = 0{,}88$, i.e. 88% of the dependent variable variation is explained by the regression obtained. Let us check the statistical significance and reliability of the obtained regression equation and its coefficients. The data of regression analysis execution protocol provide that the observed value of the F-test is equal to $F_{obser} = 9{,}61$. The critical value of the F-test at the level $\alpha = 0{,}05$ and the degrees of freedom number $k_1 = m = 3$, $k_2 = n - m - 1 = 3$ (where n – number of observations, m – factors number) is equal to $F_{crit.}(0{,}05\,;\,4\,;\,2) = 9{,}28$.

As $F_{obser.} > F_{crit.}$ ($9{,}61 > 9{,}28$), then we can conclude concerning the statistical significance and reliability of the obtained regression equation.

The statistical significance of the equation certain coefficients shall be determined using a t-student statistic. The observed values of these statistics for the certain coefficients are respectively equal to: $|t_a| = 0{,}43$, $t_{b_1} = 5{,}55$, $|t_{b_2}| = 4{,}75$, $t_{b_3} = 3{,}41$.

The critical value of the student criteria at the significance level $\alpha = 0{,}05$ and the number of degrees of freedom $k = n - m - 1 = 3$ is equal to $t_{crit.}(0{,}05\,;\,3) = 3{,}18$.

Comparing the observed values of the t-statistic with a critical one, we can conclude the statistical significance and reliability of only coefficients proceeding all variables, except for an intercept term.

Let us analyze the statistically significant coefficients of the obtained regression equation: with an increase in the average monthly nominal wage by 1000 EUR, the graduates demand decreases by 430 people; with an increase in the number of workplaces by 100 units, the graduates demand decreases by 4 persons, it can be explained by the fact that employers prefer to hire specialists with work experience; with the increase in the size of state order for specialists by 100 units, the graduates demand increases by 145 people, i.e. the state order does not completely cover the need for specialists.

Let us define the grand mean of elasticity coefficients:

$$\overline{E}_{DT_T} = b_1 \cdot \frac{\overline{P_T}}{\overline{D}} = 0{,}43 \cdot \frac{120005}{23923{,}71} = 2{,}146\ \%\ ,$$

$$\overline{E}_{DE} = b_2 \cdot \frac{\overline{E}}{\overline{D}} = -0{,}04 \cdot \frac{1043091}{23923{,}71} = -1{,}787\ \%\ ,$$

$$\overline{E}_{DG} = b_3 \cdot \frac{\overline{G}}{\overline{D}} = 1{,}45 \cdot \frac{26971}{23923{,}71} = 1{,}630\ \%\ .$$

Elasticity coefficients indicate the following: with an increase in the average monthly nominal wage by 1% of the average level, the graduates demand increases by 2.146% of its average level with the unchanged values of the remaining factors; with an increase in the

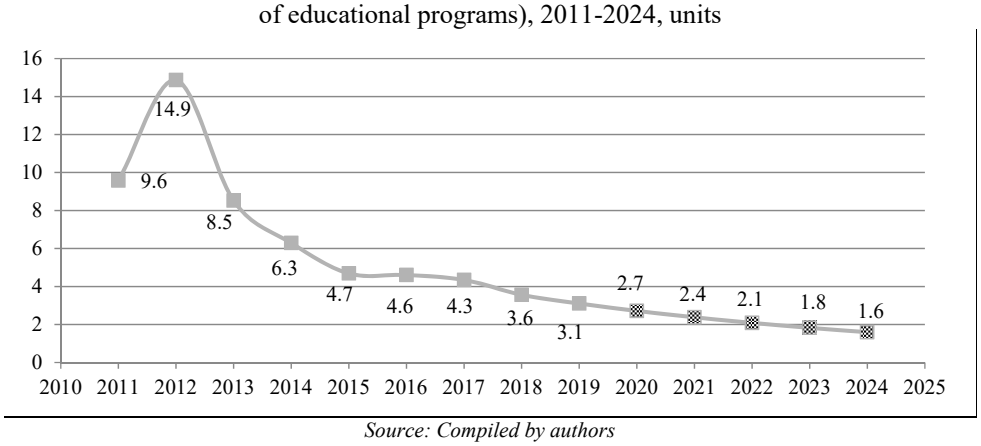
number of workplaces by 1% from the average level, the graduates demand decreases by 1.787% from its average level with the unchanged values of the remaining factors; with an increase in the size of state orders for specialists by 1% of the average level, the graduates' demand increases by 1.630% of its average level with the unchanged values of the remaining factors. Thus, we can conclude the graduates' demand is most affected by the average monthly nominal wage.

Further quantitative analysis of the interaction between the labour market demand for specialists and the supply of university graduates was as follows:

1) all educational programs were combined into 8 enlarged groups of educational programs: education; law; art; agriculture sciences; services; technical sciences and technologies; social sciences, economics, and business; healthcare and social security (medicine) using the Classifier for higher and postgraduate education educational programs of the Republic of Kazakhstan. Such groups of educational programs as the natural sciences and humanities, military affairs, and security were not included in this assessment since it is not possible to define the exact type of professional activity for these groups of educational programs;
2) building of similar regression dependence models of graduates supply and demand for each group of educational programs;
3) defining of projected values of graduates supply and demand for 2020-2024, both in general for all educational programs and for selected groups of educational programs;
4) defining the coefficient of the interaction of the higher education market and the labour market. The coefficient was calculated both according to the available data from 2011 to 2019 and according to the projected values of 2020-2024 (the 2020 data was included in the analysis as a forecast indicator, due to the lack of data during the study);
5) calculation of the coefficient of the interaction growth rate coefficient of the interaction.

Figure 1

Dynamics and forecast of the coefficient of interaction (according to the considered groups of educational programs), 2011-2024, units



Source: Compiled by authors

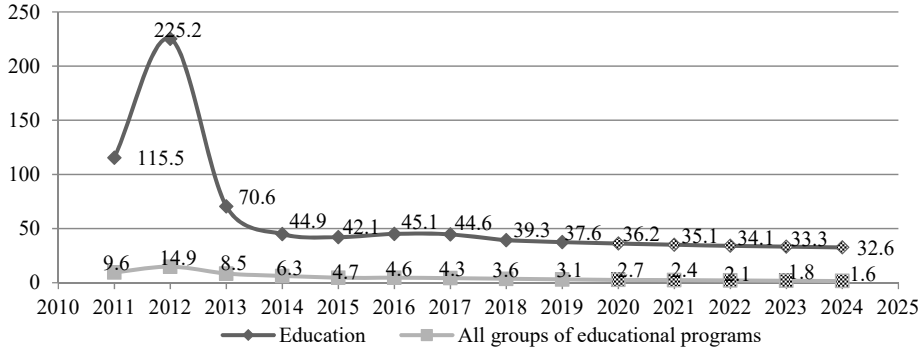
Over the period being evaluated, the interaction coefficient has an annual positive trend from 14.9 in 2012 to 3.1 in 2019. While maintaining annual economic conditions, the interaction coefficient may approach the best value of 1 (in 2024, it will be 1.6).

According to the group of educational programs "Education", the worst value of the interaction coefficient was observed in 2012, for this period, supply exceeded demand by 225.2 times, which is significantly higher than the same indicator for all educational programs (14.9).

Since 2017, the coefficient has shown a positive trend, which indicates a decrease in the imbalance between the supply and demand of graduates. The forecast values do not indicate a decrease in this gap (Figure 2).

Figure 2

Dynamics and forecast of the coefficient of the interaction for the "Education" group of educational programs, 2011-2024, units



Source: Compiled by authors

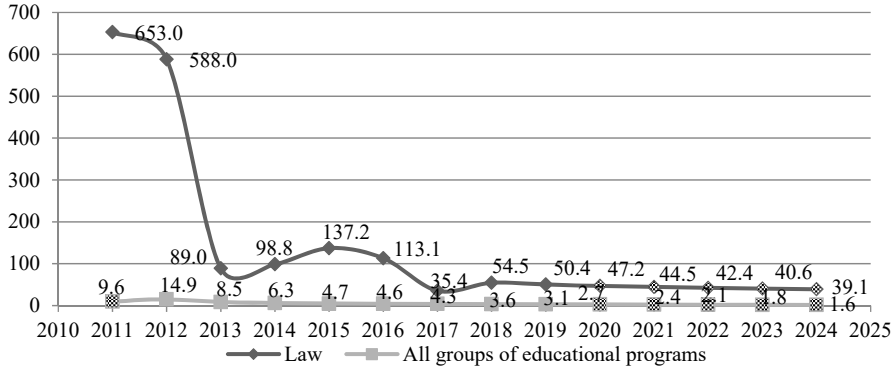
In general, the results obtained reflect the existing problems in the interaction of supply and demand for graduates in the group of educational programs "Education". There is a shortage of teachers in the republic. At a time when the state annually increases the volume of the state order for the training of pedagogical personnel at the expense of the republican budget. Educational grants are being mastered, but work in a school or college among Kazakh youth is not in demand.

For the group of the "Law" educational programs, the coefficient of the interaction has an irregular change (C>1). The greatest oversaturation of the labour market by lawyers with higher education was observed from 2011 to 2016. Over the same period, there is a significant difference with the same indicator for all educational programs (9.6 and 14.9, respectively).

In 2017, the disparity between the supply and demand of law graduates is the smallest. The forecast values for the next four years show that the interaction coefficient will be in the range from 47.2 to 39.1 and is far from an optimistic value (Figure 3).

Figure 3

Dynamics and forecast of the coefficient of the interaction for the "Law" group of educational programs, 2011-2024, units

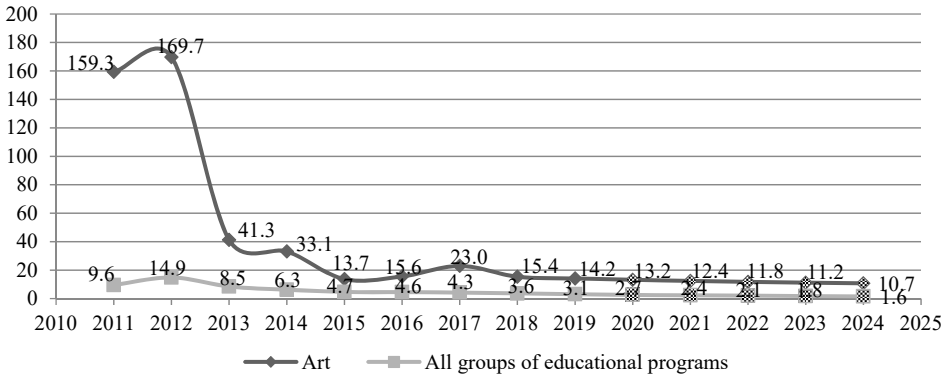


Source: Compiled by authors

For the group of educational programs "Art", the coefficient of interaction has the greatest negative effect in 2012 by 169.7 times. In general, a moderate irregular change is observed in the group of educational programs "Art" (Figure 4).

Figure 4

Dynamics and forecast of the coefficient of the interaction for the "Art" group of educational programs, 2011-2024, units

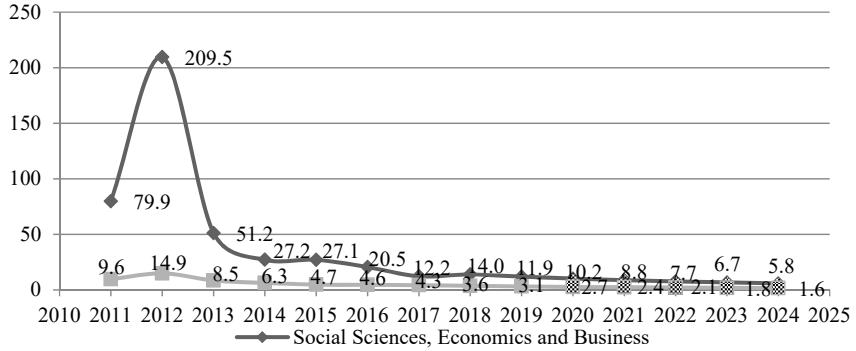


Source: Compiled by authors

For the group of educational programs "Social Sciences, Economics and Business", the worst value of the interaction coefficient was observed in 2012, during this period, supply exceeded demand by 209.5 times, which is significantly higher than the same indicator for all educational programs (14.9) (Figure 5).

Figure 5

Dynamics and forecast of the integration coefficient for the "Social Sciences, Economics and Business" group of educational programs, 2011-2024, units



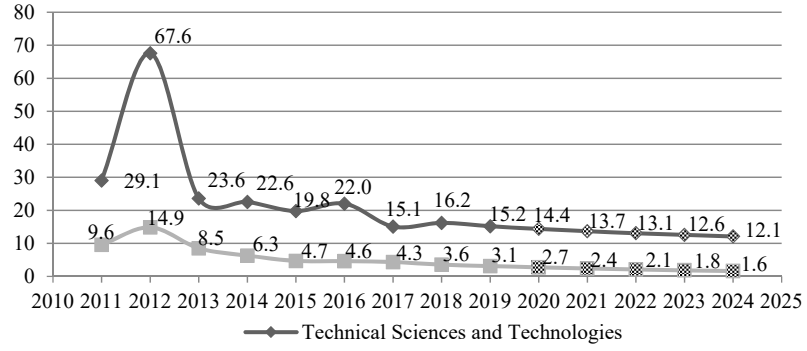
Source: Compiled by authors

However, after reaching a peak in 2012, since 2013, the interaction coefficient follows a downward trend, the imbalance between supply and demand in the studied markets decreases. In 2019, the imbalance decreased by 17.6 times (11.9) compared to 2012 (209.5). In the forecast by 2024, this tendency to reduce the imbalance between the supply and demand of graduates will continue and will strive for an ideal value.

The coefficient of interaction for the group of educational programs "Technical Sciences and Technologies" has the largest gap between the supply and demand of graduates in 2012 and exceeded it by 67.6 times, i.e. almost 68 graduates applied for 1 vacant place in this group of educational programs (Figure 6).

Figure 6

Dynamics and forecast of the integration coefficient for the "Technical Sciences and Technologies" group of educational programs, 2011-2024, units



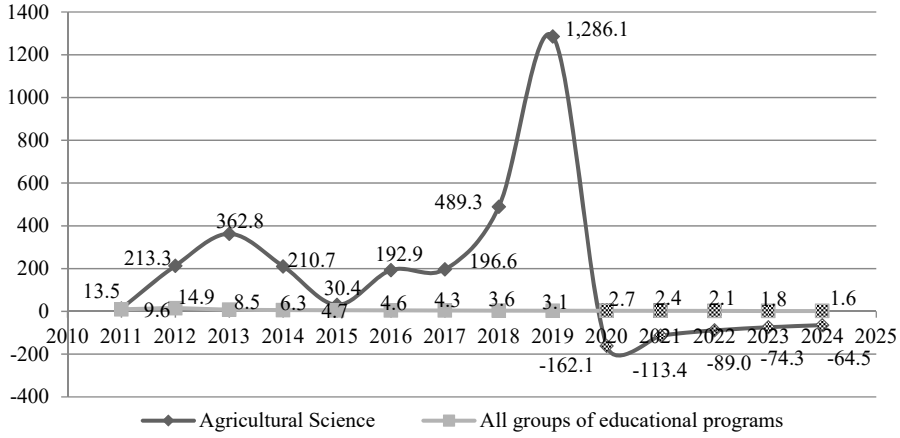
Source: Compiled by authors

Further, we can see a wavy value of the coefficient of interaction for this group of educational programs. The smallest imbalance was observed in 2017 (15.1), in our opinion, this was due to the active phase of the implementation of state programs to support technical education. However, if the current situation persists, the indicators will not be close to the optimal value.

Significant fluctuations in the coefficient of interaction are observed for the group of educational programs "Agricultural Sciences". During the study period, the smallest disproportion in the supply and demand of graduates for this group of educational programs was observed in 2011 (13.5), followed by intensive growth in 2012 and 2013 – 213.3 and 362.8, respectively. The largest oversupply in the agricultural sector was observed in 2019 by 1286.1 times. However, at the moment, the agricultural sector of Kazakhstan is experiencing an acute "personnel shortage", including personnel shortage with higher education. This problem requires a systematic state approach and serious strategic decisions of large agricultural holdings (Figure 7).

Figure 7

Dynamics and forecast of the integration coefficient for the "Agricultural Science" group of educational programs, 2011-2024, units



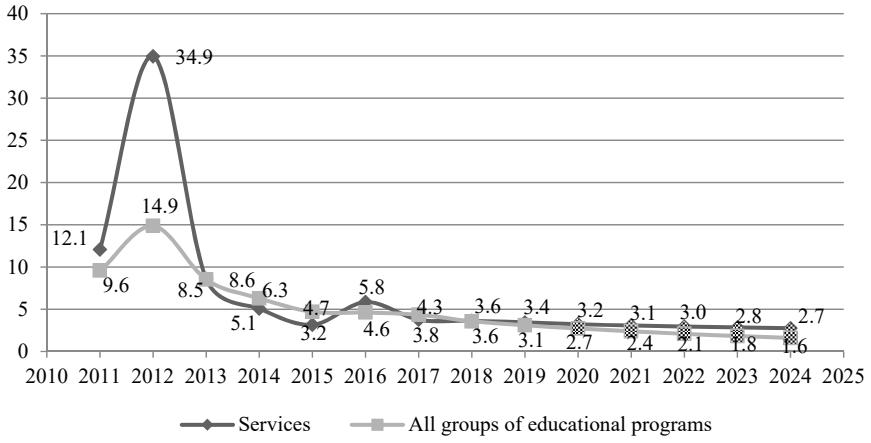
Source: Compiled by authors

In the group of educational programs "Services", the worst value of the coefficient of interaction was observed in 2012, during this period, supply exceeded demand by 34.9 times, which is significantly higher than the same indicator for all educational programs (14.9). In the service sector, the best closeness of the relationship with the general values in the country is observed (Figure 8).

Significant ups and downs are observed in the close relationship in the group of educational programs "Health and social security" ("Medicine") (Figure 9). In 2012, the World Health Organization indicated that there is an acute shortage of medical personnel in the world. The effective provision of the country with medical workers is determined by the ratio of the number of medical workers to the population. Kazakhstan is urgently considering new mechanisms for regulating the personnel issue in the field of medical services.

Figure 8

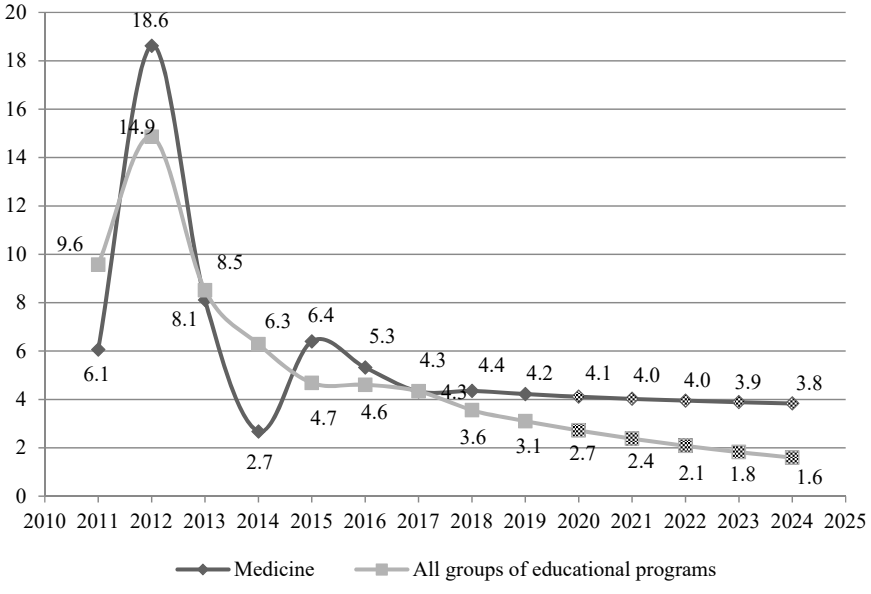
Dynamics and forecast of the integration coefficient for the "Services" group of educational programs, 2011-2024, units



Source: Compiled by authors

Figure 9

Dynamics and forecast of the integration coefficient for the "Medicine" group of educational programs, 2011-2021, units



Source: Compiled by authors

According to the research methodology used, it is now necessary to calculate and analyze the growth rates of the interaction coefficient for groups of educational programs. The type of dynamic and predictive interaction between the labour market and the higher education market is determined (Table 5).

Table 5

Type and trends of quantitative interaction between the labour market and the higher education market

Group of educational programs	The current interaction					The expected interaction				
	Ci_0	C_{i1}	T_pC_i	indicator values	type of interaction	Ci_0	C_{i1}	T_pC_i	indicator values	type of interaction
All groups of educational programs	9.6	3.1	0.32	$C_{i1}>1$ $T_pC_i>0$	III	2.7	1.6	0.59	$C_{i1}>1$ $T_pC_i>0$	III
Education	115.5	37.6	0.33	$C_{i1}>1$ $T_pC_i>0$	III	36.2	32.6	0.9	$C_{i1}>1$ $T_pC_i>0$	III
Law	653.0	50.4	0.08	$C_{i1}>1$ $T_pC_i>0$	III	47.2	39.1	0.83	$C_{i1}>1$ $T_pC_i>0$	III
Art	159.3	14.2	0.09	$C_{i1}>1$ $T_pC_i>0$	III	13.2	10.7	0.81	$C_{i1}>1$ $T_pC_i>0$	III
Social Sciences, Economics and Business	79.9	11.9	0.15	$C_{i1}>1$ $T_pC_i>0$	III	10.2	5.8	0.57	$C_{i1}>1$ $T_pC_i>0$	III
Engineering Science and Technology	29.1	15.2	0.52	$C_{i1}>1$ $T_pC_i>0$	III	14.4	12.1	0.84	$C_{i1}>1$ $T_pC_i>0$	III
Agricultural sciences	13.5	1286.1	95.2	$C_{i1}>1$ $T_pC_i>0$	III	-162.1	-6.45	-226.6	$C_{i1}>1$ $T_pC_i>0$	II
Services	12.1	3.4	0.28	$C_{i1}>1$ $T_pC_i>0$	III	3.2	2.7	0.84	$C_{i1}>1$ $T_pC_i>0$	III
Medicine	6.1	4.2	0.69	$C_{i1}>1$ $T_pC_i>0$	III	4.1	3.8	0.93	$C_{i1}>1$ $T_pC_i>0$	III

Source: compiled by authors

The dynamics of the coefficient of interaction between the higher education market and the labour market in combination with the third type of interaction shows a tendency to weaken interaction. This weakening is associated with a reduction in jobs by type of economic activity and an increase in the number of graduates.

Conclusions

Applying the methodology of quantitative analysis of interaction, the republican features of the interaction of the higher education market and the labour market were identified, in the context of groups of educational programs - “Education”, “Law”, “Art”, “Social Sciences, Economics and Business”, “Engineering Science and Technology”, “Agricultural Sciences”, “Services”, “Medicine”, which revealed that the interaction of the studied markets belongs

to the 3rd type. The labour market is weakened due to the low intensity of job creation and relocation, while the supply of graduates exceeds its demand.

The Kazakhstan Government is taking certain steps to stimulate employment and education among the population, and this cannot be denied. The labour market and the higher education market are in the process of constant development, but as we can see, the measures taken are insufficient. Perhaps the Kazakhstan Government should pay attention to the European experience of organizing a professional structure forecasting, using the services of research institutes, non-profit scientific organizations.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Ihor L. Leonidov[1]
Daria K. Kovalchuk[2]
Valentyna K. Lebedeva[3]
Victor N. Tarasevich[4]

ECONOMIC ASPECTS OF TRANSFER OF EDUCATIONAL TECHNOLOGIES AT CONTEXT OF APPROPRIATION OF INTELLECTUAL PRODUCT[5]

Results of research of specific of transfer of educational technologies as a demonstration of them appropriation as of intellectual product was represented in the article. The looks of Ukrainian and foreign scientists on the place of educational technologies in the composition of intellectual capital was analysed. The motives of appropriation of the intellectual product as factors of the mechanism of governance of transfer of educational technologies were defined. On a functional level, this mechanism formalises motives of creation of an environment of transfer of educational technologies for a partnership of all interested sides was discovered. Directions of transfer of educational technologies obtained actualisation on the basis of analysis of the marked motives. Composition of subjects of transfer of educational technologies per their roles as seller, legislator (government authorised organs), technological broker, buyer, was concretised. The contradiction of priorities among economic interests, motives and actions at a combination of roles within one subject was revealed. The factors of external appropriation of the intellectual product by subjects on the stages of "preparation – legitimation – restriction" were found out. The common and distinctive traits of the stages of "preparation – legitimation – restriction" were found. The basic criteria of transfer of educational technologies on the stages of preparation, legitimation and restriction were proposed. The criteria of institutionalisation of external interactions of subjects of the transfer of educational technologies were

[1] *Ihor L. Leonidov, PhD of Economic Sciences, Associate Professor of the Department, National Metallurgical Academy of Ukraine, Dnipro, Ukraine, ORCID ID 0000-0001-7369-2464, e-mail: leonidovil@gmail.com.*
[2] *Daria K. Kovalchuk, PhD of Pedagogical Sciences, Associate Professor of the Department, National Metallurgical Academy of Ukraine, Dnipro, Ukraine, ORCID ID 0000-0003-2559-6413, e-mail: lebtoval@gmail.com.*
[3] *Valentyna K. Lebedeva, PhD of Economic Sciences, Professor of the Department, National Metallurgical Academy of Ukraine, Dnipro, Ukraine, ORCID ID 0000-0002-2744-5435, e-mail: lebtoval@gmail.com.*
[4] *Victor N. Tarasevich, Doctor Science (Economics), Professor, Head of the Department, National Metallurgical Academy of Ukraine, Dnipro, Ukraine, ORCID ID 0000-0001-7369-2464, e-mail: viktarasevich@gmail.com.*
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formalised. Updating of an educational network, including the use of open platforms of informatively-communication technologies and cloudy servers, was proposed. Actual directions of further researches of transfer of educational technologies, methodologies of determination of their market prices with the use of modern ICT, development of the special economic-mathematical models of such estimation was delineated.
Keywords: intellectual product; ownership and appropriation of intellectual product; infrastructure of transfer of educational technologies; informatively-computer technologies
JEL: B41; D11; D23; I25; J24; O34; P26

1. Introduction

Formulation of the problem

The changes that take place in the educational process of the professionally-oriented tuition of specialists under acts of pandemics of COVID-19 and the role of educational technologies are undeniable facts. Questions of appropriation of intellectual product in the sphere of its transfer as a transition of the full or limited ownership rights on the educational technologies have actualisation in the conditions of distribution of the remote forms and electronic facilities of tuition. Into this connection, the problem of the transfer of educational technologies has appeared before the government organs of regulation of education for countries majority in the context of efficiency of the educational process and professionally-oriented tuition of specialists for a budgetary sphere and business, what able to provide the competitiveness of national economy on the global markets of hi-tech commodities, as results of modern informatively-technological revolution (ITR). It found a reflection in national scientific literature as research of traditions of rigid «attachment» of educational technologies and their transfer to the efficiency of financing of scientifically-research and educational organisations of Ukraine. Addition of these traditions, the researches of such stimulus of creative activity of participants of the educational process, as an appropriation of the intellectual product (Tarasevich, 2017), will promote integration in the educational process the tuition, scientific and innovative activity, in particular, with the use of informatively-computer technologies (ICT).

The problem of «innovation-tradition» in the professionally-oriented tuition of specialists is differently perceived in scientific circles in connection with the process of differentiation of network of appropriation of an intellectual product and her visualisation in the transfer of educational technologies. Such theoretical questions, as the connection between the network of appropriation of educational technologies and infrastructure of their transfer, and also possibilities of governance of transfer of educational technologies into forming the developed potential of innovative educational technologies is remaining debatable.

Analysis of the latest research and publications

Increase of interest of specialists to the range of problems of informative economy in all (Jochimsen, 1996; Rosenstein-Rodan, 1961; Hirschmann, 1967; Chernyavskij, 1979; Simonis, 1972) took place an across the research of influence of her becoming on the

introduction of corresponding educational innovations, including, new educational technologies (Shkarlet, 2019; Arutyunova, 2010; Vul'fson, 1999; Zadorozhnaya, 2012; Delmon, 2010; Ford, 1991). The catalyst of this process can become the transfer of educational technologies. But for today, research in the branch of transfer of technologies, as a rule, is limited to the sphere of material production of commodities and services (Grosse, 1996), not touching spheres of education. Together with the same, distribution of the remote forms of tuition and other electronic means of studies more and more is put a question of appropriation of intellectual product at this sphere, infrastructures of his transfer as delivers of full or limited ownership rights on educational technologies, de facto the exchange technologies. For today educational technologies conceptually did not get the worthy place and as a part of the intellectual capital (Maslak, 2019). By defined step on a way of solving of these problems is possible to consider results of the researches lighted up in works (Tarasevich, 2019; Drach, 2018), where are defined the general features of intellectually-informative commodity, was developed the approaches (including, multicriteria) to the determination of its cost and market price. Analogical approaches can be used and for the estimation of educational technologies in the process of their transfer. The hypotheses about stimulation on the basis of a transfer of educational technologies of the growing markets were promoted (Mate, 2020). But this anticipation, as a rule, has a declarative character which demands more detailed research of infrastructure of a transfer of educational technologies as a component of the network of appropriation of intellectually-informative products in general.

Formulating the goals of the article

Elaboration of the mechanism of governance of transfer of educational technologies and detection of economic interests, motives and actions of his subjects.

2. Theoretical Bases of the Research

In theoretical-methodological measurement, the network of appropriation of educational technologies how intellectual products can be concretised in forms of the infrastructure of their transfer. Educational technology as the intellectual product is the mode of realisation of the educational process via its partition into the system of sequentially and interconnected stages, procedures and operations, which was directed on achievement of the educational aims (Kurljand, 2007). The different traditional technologies of tuition, namely, technologies of the developing tuition, technologies of design tuition, the technology of adaptive tuition, dual technology of tuition and others, are used in educational practice. Authors understand a transfer of educational technologies as a transaction of educational technology from belonging to one subject in the acquisition of another subject. Transactions with educational technologies are generating a special network of appropriation of educational technologies, which was self-organised. In this sense, the infrastructure of transfer of educational technologies is a set of legal, institutional, communication, etc., facilities which provide the reproduction of the transfer of educational technologies. Accordingly, the governance of a transfer of educational technologies is revealed as fixing by the owner of innovative

educational technologies of rules and prognostic conditions of their use for their maximum realisation in the sphere of education via the transfer.

Into relations between the subjects of transfer of educational technologies about the appropriation of the last was concerning not only the known theses about the magic of ownership, what "converts sand into gold", about different forms, subjects and objects of appropriation, not only a linear motion of educational technologies in the direction from a developer to an end-user, but also located the basic functions (roles) of subjects: developer, producer, mediator, consumer. The various functions of the subject represent the differentiation of transfer of educational technologies in a corresponding infrastructure. Thus, in the infrastructure of transfer of educational technologies, the function of subjects are specified per economic roles, namely: seller, legislator (government authorised organs), technological broker, buyer.

Consumers or customers of educational technologies realise the economic role of the buyer, for example, establishments of higher education, National academy of pedagogical sciences of Ukraine. In the practice of economy, the action of the consumer is connected with the dematerialisation of the substantiated intellectual product, or visual-hearing the acquiring of a non-material intellectual product. The consumer is ordering, acquiring or using the materialised forms of intellectual product for satisfaction as the personal, family, house and other needs (personal consumption), so and for the business activity (production-consumption). Such consumer is invocatory to the adaptation of innovations on the production or in the life in conditions of use of materialised of intellectual product.

Institutional subjects of purchase, transfer and/or use of the educational technologies are realising an economic role of legislator, for example, the government represented by the Ministry of Education and Science of Ukraine, the central and municipal organs of executive power, organs of municipal self-government. The legislature is able to update the legal form of an authorial copy of the seller via legitimation of intellectual product. Respectively, the legislator how the actor of belonging of the legal form of the materialised of the intellectual product has actualisation of it via the signing of the contract of realisation of a legal form of intellectual product.

Technological brokers appropriate the incomes per mediatorial functions between sellers and buyers. In economic practice, the technological broker is subject of acquisition which aims to encompass the contract of buying-sale of the legal form of intellectual product. Respectively, the technological broker as subject of belonging of mediately-humanised intellectual product has an ability to actualise it via the signing of the contract of buying-sale of the legal form of intellectual product.

Developers or performers of educational technologies, or a furnisher of technical services are realising the economic role of the seller, for example, the scientists and their labour collectives. However, in economic practice, the seller is demonstrating how the subject of acquiring, which aimed to encompass the materialised intellectual product in the form of authorial copy. Respectively, the seller how the subject of belonging of the materialised intellectual product has an ability to the actualisation of it via the signing of the contract of the publishing (legalisation) of the authorial copy of the intellectual product.

Fixing the marked economic roles per the subjects of transfer of educational technologies is not a constant and may change at the measure of the presence of conflicts of their economic interests, motives and actions. Together with it, if a concentration of economic roles in one subject took place, then was increased the indeterminacy of priorities of his economic interests, motives and actions. One of the variants of decrease of this indeterminacy may be a ranking per importances of those economic roles, what a combined into itself by any subject. Admitted importances of role for the subject will result in equivalent to the priority of him economic interests, motives and actions. Say, if the legislator of transfer of educational technologies is simultaneously by their buyer and technological broker, by priority of him economic interests there will be an appropriation of income from the realisation of such product, and among motives will outweigh the pragmatic. In a situation, when the buyer of educational technologies, the technological broker and the legislator are different subjects, each of them will have own interests, motives and actions (Table 1).

Table 1

Comparison of economic interests, motives and actions of subjects of transfer of educational technologies

Subjects	Economic interests	Motives	Actions
seller	increment of intellectual essence forces; income from realisation authorial to the copy of intellectual product or wages	receipt quality of new intellectual product	presentation to authorial the copy
legislator (government authorised organs)	income from the creation of forms of the materialisation of intellectual product	legalisation of the materialisation of intellectual product	given of legal protect of the materialisation of intellectual product
technological broker	profit or income is from the realisation of forms of the materialisation of intellectual product	distribution of innovations as legalisation forms of materialising of intellectual product	realisation of legalisation forms of the materialisation of intellectual product
buyer	utility from the use of legalisation forms of the materialisation of intellectual product	satisfaction of needs at the forms of the materialisation of intellectual product	use of legalisation forms of the materialisation of intellectual product

Source: developed by the author.

In the most abstract view in the infrastructure of transfer of educational technologies the functional (***F***) of the interaction of their subjects, – seller (A_{SL}), legislator (A_{LW}), technological broker (A_{BT}), buyer (A_{BR}), – able be presented as (author's vision):

$$F = f(A_{SL}, A_{LW}, A_{BT}, A_{BR}), \quad (1)$$

The delineated abstractions of the functional are formalised into the infrastructure of transfer of educational technologies on the stages of external interaction with his subjects. The initial moment of external interaction of subjects of transfer of educational technologies is the stage of preparation to such interaction (**P**), what characterised by semantic-neos designing of educational technologies by the seller and formalisation of legal conditions of materialisation of these technologies by the producer in the conditions of mainly planned transaction of technologies (Table 2) from belonging of seller to the acquisition of producer. Such

translation is directed at the vector of «emanation of new-open – dissemination publicly of known», via presentation semantics-neos of educational technologies from the borders of functioning of buyers (A_{SL}) to the legislator (A_{LW}), what formalised, as (author's interpretation):

$$P = f(A_{SL}, A_{LW}), \quad (2)$$

Table 2

Characteristics of product-subject changes at the transfer of educational technologies

Stages	Change subject	Changes product
preparations	irrevocability	multichoice
legitimation	reflexive	limitedness
restriction	iteration	wearing

Source: developed by the author.

The signs of the stage of legitimation (**L**) are givens of the legislator ($\mathbf{A_{LW}}$) of legal protection to educational technologies and contract conduction of distribution of such technologies by a technological broker ($\mathbf{A_{BT}}$) for the commodity or planned (see a table. 2) transmission of technologies from belonging of legislator in the acquisition of technological broker. Such translation gravitates between poles «subjective reality – objective reality» as given of legislator of the right-protected educational technologies to the technological broker and formalised, as (author's interpretation):

$$L = f(A_{LW}, A_{BT}), \quad (3)$$

In the legitimation, the interaction of subjects of transfer of educational technologies concerning the increase of materialisation and humanise of essential the human forces, and in preparation is an increase of humanising of essential the human forces, directly and indirectly, are objectified.

The defining line of a stage of a regulation (**R**) is the order of sale by the technological broker and payments by the buyer of the rights for educational technologies as dominants of commodity transfer of these technologies from belonging of the technological broker in the acquisition of the buyer (look tab. 2). This transfer in a range «efficiency – equitable» appears as an order of a transfer of human rights educational technologies from the technological broker ($\mathbf{A_{BT}}$) to the buyer ($\mathbf{A_{BR}}$), which is formalised as (author's interpretation):

$$R = f(A_{BT}, A_{BR}), \quad (4)$$

Thus, in the infrastructure of transfer of educational technologies the functional (**Fi**) of external interactions of subjects of transfer on the stages of preparation (**Pi**), legitimation (**Li**) and restriction (**Ri**) it maybe to formalise the next system (author's vision):

$$Fi = \begin{cases} P = f(A_{SL}, A_{LW}), \\ L = f(A_{LW}, A_{BT}), \\ R = f(A_{BT}, A_{BR}), \end{cases} \quad (5)$$

Optimisation of the system provides her aspiration on the effective functioning of the infrastructure of transfer of educational technologies, him corresponding interaction of subjects of the transfer of educational technologies on the stages of preparation to interaction (in relation to the institutions of education, research institutes and laboratories), legitimation (in relation to the government organs of governance) and regulation (in relation the institutions of education, the enterprises and indirectly – the population).

Formalisation of governance of infrastructure of a transfer of educational technologies (at the level of actions for external optimisation and interactions of subjects of a transfer of educational technologies – «***Pp***») able to presented (author's vision) by the next expression:

$$\boldsymbol{Pp = <Pi; Li; Ri>,} \quad (6)$$

The governance of infrastructure of a transfer of educational technologies provides, what institutions the higher educations not only act as creators of an intellectual product, but also distribute new knowledge and technologies, tuition specialists able to use them, and also are key mediators between researchers and consumers of innovations, carrying out an exchange of knowledge (as conferences, seminars and so forth), thus, with use of modern ICT.

3. Methods of the Research

Into research of our scientific problem was estimated the relevance of a set of traditional scientific methods. Author's grouping of this set per by the criteria of the sphere of use (Ms1 – general scientific, specific), of methodological base (Ms2 – empiricism, pragmatism, deductive, conventionalism), of domination in theoretical concepts (Ms3 – methods of descriptive, causal, functional), of science ontology (Ms4 – methods of formal logic, the dialectics, dialectics-materialistic, synergetic) was applied. The proposed groups of methods definitely corresponded to the own historical conditions of research – Ch1, Ch2, Ch3, Ch4, was ascertained. However, in the conditions of the XXI century (Nch), the proposed groups of methods were represented research stage, when its object appears before the subject in the most abstracted look (author's interpretation):

$$\boldsymbol{Ms1/Ch1 + Ms2/Ch2 + Ms3/Ch3 + Ms4/Ch4 = Ap^{Ms}/Nch,} \quad (7)$$

Accordingly, each component of the left part of the equation have appears as a method, which is inadequate to the nature of the researched object. This equation was solved for the search of Ap^{Ms} as a method of the research of a scientific problem, what adequate to modern conditions of research of appropriation of an intellectual product and transfer of educational technologies.

The results, obtained by applying the integration method, are as follows: dialectical method – at the opening of the motive role of contradictions in the evolution of appropriation of the intellectual product; modelling – at logical generalisation and specification of external interactions of subjects of transfer of educational technologies; praxiological approach – at the analysis of infrastructure of transfer of educational technologies as to the fragment of human activity; system method – at the exposure of building and structure of governance of educational technologies a transfer.

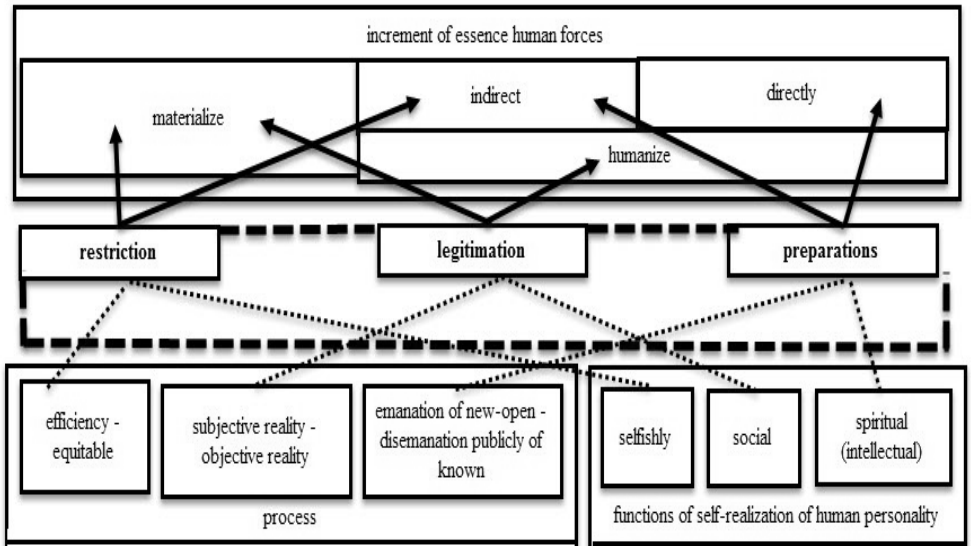
4. Results of the Research

4.1. Mechanism of the governance by transfer of educational technologies

From the author's point of view, the system of governance of the transfer of educational technologies is a set of the main subjects of the transfer of educational technologies and ties between them. It was activated via interaction of subjects of the transfer on the stages of «preparation-legitimation-restriction», which have as general so and distinctive traits (Figure 1). Factors of motives of the interaction of subjects of a transfer of educational technologies on the corresponding stages able to modelling as rational (fully and limitedly), normative (organically rational, opportunism full and hidden) and rationally-normative (alternative, long-term).

Figure 1

The general and distinctive trait of interactions of subjects of a transfer of educational technologies



Source: developed by the author.

The known-model of REMM (resourceful, evaluative, maximising man) (Brunner, 1987) is suitable for governance of factors full- and limitedly-rational interaction of subjects of transfer of educational technologies. In this model of rational external interaction of subjects on the stage of restriction identity with an optimal choice in the sphere of market allocation of the limited resources at the equilibrium situation and actualisation of certain competencies. The initial moment of such choice is forming of a set of possible variants of the interaction of subjects (competence of communication) in whom standard means of achievement of goal was adapted to concrete conditions. From the possible variants of means of achievements of goal (social competences) is selected in what is optimised a utility for the certain subjects of transfer of educational technologies (individual competencies) per by criterion of

maximisation. Thus, the governance of factors of the interaction of subjects of transfer of educational technologies on the stage of restriction at the supporters of rationality is formalised as the function of utility and choice of variants – as the optimising task (author's interpretation):

$$f\ (Pi^{O}, Li^{O}, Ri^{O}) \rightarrow max, \quad (8)$$

where:

Pi – quantity of intellectual product (educational technologies), what is transiting from belonging of seller in the acquisition of legislator on the stage of preparation;

Li – quantity of intellectual product (educational technologies), what is transiting from belonging of legislator in the acquisition of technological brokers on the stage of legitimation;

Ri – quantity of intellectual product (educational technologies), what is transiting from belonging of technological brokers in the acquisition of buyer on the stage of restriction;

o – is the optimal choice at the sphere of allocation by the market of the limited resources at the situation of equilibrium.

The known-model of SRSM (socialised, role-playing, sanctioned man) (Brunner, 1987) can be into the basis of governance by factors of normative and opportunism (organic and rationality) of the interaction of subjects of transfer of educational technologies. According to the model, the organic rationality of external interactions of subjects of transfer of educational technologies on the stage of preparation (prevailing of competence of ability for opening) is coordinating with the norms and standards of society. The interaction of such subjects do not define and solve the task of choice (competence of self-development, creativity), and its criterion is conformity to norms (theoretical knowledge, abilities, skills). Thus, at the governance of factors of the interaction of subjects on the stage of preparation been attempt of replacement of principle of maximisation by its weakened version, that is instead of the best variant are electing the satisfactory or acceptable (author's interpretation):

$$f\ (Pi^{O}, Li^{O}, Ri^{O}) \rightarrow max, \quad (9)$$

$$Pmin < Pi^{O} < Pmax,\ Lmin < Li^{O} < Lmax,\ Rmin < Ri^{O} < Rmax,$$

where:

Pi – quantity of intellectual product (educational technologies), what is transiting from belonging of seller in acquisition of legislator on the stage of preparation;

Li – quantity of intellectual product (educational technologies), what is transiting from belonging of legislator in the acquisition of technological brokers on the stage of legitimation;

Ri – quantity of intellectual product (educational technologies), what is transiting from belonging of technological brokers in the acquisition of buyer on the stage of restriction;

o – is the optimal choice at the sphere of allocation by the market of the limited resources at the situation of equilibrium;

min – minimum and *max* – maximal limitations are on the stages of the interaction of subjects of transfer of educational technologies.

For a governance, the action of the rationally-normative factor of external interactions of subjects of transfer of educational technologies on the stage legitimation is expedient to "approximate" the rationality of their interactions to the certain norms. The corresponding criteria of external interaction of subjects of the transfer of educational technologies as the intellectual product are known, for example, for the stage of preparation as an abridging of time of tuition at invariable its quality or upgrading of the quality of tuition at an invariable of its time. However, adduction of rationality to normative level is a basis of formalisation of priorities of such interaction as a situation, where the subjects increments the materialised and humanised forms of the intellectual product on the stages "preparation-legitimation-restriction". For example, forming the legal, interested in innovations a proprietary of educational technologies (competences are mental, psychomotor, position) and conditions of legalised activity (competences of procedural) in an intellectual sphere. Thus, per the author's vision, is offered to modelling the governance of factors of noted the "approximate" per a unit criterion:

$$(f\ (Pi^{O}, Li^{O}, Ri^{O}) / f\ (Pi^{N}, Li^{N}, Ri^{N})) \dashrightarrow 1, \quad (10)$$

where:

Pi – quantity of intellectual product (educational technologies), what is transiting from belonging of seller in the acquisition of legislator on the stage of preparation;

Li – quantity of intellectual product (educational technologies), what is transiting from belonging of legislator in the acquisition of technological brokers on the stage of legitimation;

Ri – quantity of intellectual product (educational technologies), what is transiting from belonging of technological brokers in the acquisition of buyer on the stage of restriction;

o – is the optimal choice at the sphere of allocation by the market of the limited resources at the situation of equilibrium;

n – normative choice at the sphere of allocation by the market of the limited resources at the situation of equilibrium;

As we see, the aim of adduced of system governance by the transfer of educational technologies is, on the one hand, forming of the powerful potential of innovative educational technologies, and from another – its maximal realisation in the sphere of higher education via by an effective transfer of educational technologies.

The qualitative concretisation of action of factors of motives (Leonidov, 2020) of the interaction of subjects of the transfer of educational technologies is facilitating the development of corresponding indexes, what invocatory to estimate the variants of the interaction of subjects of transfer of educational technologies.

On the stage of preparation, the institutionalisation of the interaction of subjects of the transfer of educational technologies will be initialised by groups, what will realise the special and common interests of appropriation of the intellectual product ("interest groups" (Olson,

1965)). Into the regulating measures of the government, the institutionalisation is prognosticated via inclusion in the analysis of the methodological principles of trust, obligation and sanctions. In such institutionalisation, the shortcomings and advantage of formal and informal character may be represented: a decreasing in trust to measures of government regulation, obligation of their performance, responsibility per consequences of these actions, and also a conscious reproduction of "institutional trap". "Institutional trap" can exemplify of the situation when, the efficiency of legitimate transactions with intellectual ownership is below, then at the non-formalised transactions. Into the non-formalised transactions, the informal relations are transformed to formal, when most of the subjects of the transfer of educational technologies adhere to the informal rules on which are directed the measures of government regulation. From here, the criterion of government regulation of external interaction of subjects of the transfer of educational technologies on the stage of preparation may be a scale of deviation of informal results of intellectual activity of creators from norms (author's vision):

$$f(Pnf) / f(Pf)) \rightarrow 0, \quad (11)$$

where:

Pnf is quantity of transactions with intellectual ownership, what is characterized as informal;

Pf is quantity of transactions with intellectual ownership, what is characterized as formal.

The set of indicators of government regulation of external interactions of subjects of the transfer of educational technologies at the stage of preparation may be hypothetical based on the quantitative estimating of deviations from a certain formal norm in a spectrum: quantity of "abandonments" of legal transactions of intellectual ownership, specific weight of informal norms of appropriation of intellectual product, scales of "secrets of production" and other.

On the stage of legitimation, the institutionalisation of the interaction of subjects of a transfer of educational technologies is realisation with the help of formal norms and the simulated rules. Procedures of patenting, licensing and others like that can exemplify of regulation of institutionalisation of the interaction of subjects of the transfer of educational technologies. Into the regulating measures of the government, the institutionalisation is prognosticated on the basis of consciously or unconsciously fastened norms and rules, which define a form and logical sequence of the interaction of subjects of the transfer of educational technologies. For example, the reproduction of information as a resource in society is legalised within state law. If the legal ability of subjects of transfer of educational technologies has contradiction with government power, then all the processes of their reproduction will be deformed. Shortcomings of government regulation of such institutionalisation are shown in the insolvency of adequately a regulate interaction of subjects of the transfer of educational technologies, disappearance at owners of stimulus to long-term and effective use of intellectual assets, narrowing of prospects of making investment solutions, decrease in capitalisation of economy, rates and volumes of the national income and so forth. From here, the criterion of government regulation of external interaction of subjects of transfer of the educational technologies on the stage of legitimation can be a maximal dynamics (max) of

legalisation of results of intellectual activity (Lia) in the current period (C) of the relatively base period (B) (author's vision):

$$\mathbf{(f (Lia^B) - f (Lia^C)) / f (Lia^B) \text{ –> } max}, \quad (12)$$

The set of such known indicators as dynamics of submission of application for a patent, registration of patents and licenses, specific weight of persons with a scientific degree, etc. may be hypothetical indicators of government regulation of external interactions of subjects of the transfer of educational technologies on the stage of regulation.

On the stage of restriction, the institutionalisation of the interaction of subjects of the transfer of educational technologies has transference of his samples from theoretical models to practice. The variants of the regulating measures of the government are presented by samples from the economic history of own country, or other countries (North, 1991). Into the regulating measures of the government, the institutionalisation is estimated on the basis of the increment of changes in habits, stereotypes, traditions of external interactions of subjects of the transfer of educational technologies which were more effective in comparison with alternative. The rating of its estimates depends on understanding by subjects of the transfer of educational technologies of samples in part of contents of rules and norms (mainly, formal) of regulating measures of the government. These measures are realised via the officially regulated norms in which the shortcomings of changeability and contradiction is expedient prevented through the decrease in costs of rapid distribution of effective samples in external interaction of subjects of the transfer of educational technologies on the stage of restriction. As a criterion of government regulation of interaction of subjects of the transfer of educational technologies at the stage of regulation may be argued the part of the most-rating educational technologies in their total quantity, which are used in educational practice (author's vision):

$$\mathbf{f (Qr) / f (Q) \text{ –> } max}, \quad (13)$$

where:

Qr – quantity of cases of use of rating technologies;

Q – total quantity of all technologies which are used in educational practice.

The following hypothetical situation can be an example of the use of criterion (13). Computer technologies are the most rated among other educational technologies, but are applied in 5% of educational programs in educational establishments. From here, the estimate of government regulation of interaction of subjects of the transfer of educational technologies at the stage of regulation is unsatisfactory.

The developed criteria of governance of a transfer of educational technologies provide a possibility of updating an educational network via by use of the open platform of ICT and the cloudy servers.

4.2. Place of ICT into the transfer of educational technologies

As a generally known, countries-members of the European Union (EU) are the participants of Agreement about a trade aspect of rights of intellectual property (TRIPS), what being the confessedly international standard (Otten, 1998) of appropriation of results of intellectual activity. Besides it, in the EU, the systems of protection of trademarks, industrial prototypes, plants variety are successfully functioning. For example, per trademarks and industrial prototypes is responsible Department of harmonisation in the domestic market (Office of Harmonization in the Internal Market, http://www.oami.eu.int), per patents on plant variety – Department on plant varieties of Community (Community Plant Variety Office, http://www.cpvo.europa.eu). On the one hand, competition between the universally recognised European standard of appropriation of results of intellectual activity and its autonomous (national) phenomenon is possible, and on the other hand, the only-similarity in the period of their legitimacy is functioning. It is an empirical moment of the economic concept of "information society" with its problem of interrelation of constructivism and scientific rationality in the context of informatisation, computerisation and development of network technologies.

Distribution into the EU of new forms of intellectual activity has created a need for innovative educational technologies which have to promote the efficiency of tuition during all life. The important factor of competitive activity in the world market are modern educational technologies. The new conception of education in "society of knowledge" stimulates a forming in the educational process of competencies, what is necessary for the creation of educational technologies and their association with an educational network. For it of aim is prudent activating in the infrastructure of transfer of educational technologies all aggregate of types of providing (technical, programmatic, informative, methodical, organisational) of the informative, modern environment of establishments of higher education with the aim of organic combination in the educational process of educational, scientific, and innovative activity.

In the infrastructure of transfer of educational technologies, the external interaction of their subjects on the stage of preparation and actualisation via control per the observance of academic respectability and his realisation on the basis of online-services of network the Internet. So, the competencies of subjects of transfer of educational technologies on the stage of preparation able to develop with the use on-line of services of checking for plagiarism: StrikePlagiarism (http://Plagiat.pl/), Advego Plagiatus (https://advego.com/plagiatus/), Copyscape (https://www.copyscape.com/), Contentyoda (http://contentyoda.com/), Viper (http://www.scanmyessay.com) and other.

The competences of subjects of transfer of educational technologies on the stage of legitimation able to expansion via the skills of searching operations in on-line services of patent search (Patent Lens, WikiPatents, Free Patents Online, PRIORSMART та ін.) or in the open database of objects of intellectual ownership, such, as: USPTO (http://www.uspto.gov/patents/process/search/index.jsp – database of patent department of the USA with few million patents per period from 1976), Canadian Patents Database (http://patents.ic.gc.ca/opic-cipo/cpd/eng/search/advanced.html – database of patent service of Canada with more than 1.9 million patents for period from 1869), Esp@cenet (http://ep.espacenet.com/ – the

database of the European patent department of «European Patent Office» has more 60 million patent requests and patents), UKRPATENT (http://base.ukrpatent.org/searchINV/ – the database of patents on inventions and useful models of Ukraine), UAPD (http://www.eapatis.com/ – Eurasian patent department, what has over 30 local patent databases) and others.

On the stage of restriction, the competence of subjects of transfer of educational technologies are fixed per to such means of ICT: web-technologist (professional networks, forums), server programmatic-imitation complexes, telecommunications (videos-conferences). The elements of the infrastructure of transfer of educational technologies will contribute to the improvement of skills of searching-analytical activity, processing of information, inclusive development of the creative potential of subjects.

The transfer of educational technologies has nexus not only with the distribution of results of research and developments in the sphere of education and their further use in the national economy, but also attracting of employers to the educational process (informing about production base of subjects of economics, the existing production problems, prospects of further employment, etc.), forming at subjects of adaptive competence. The activation of participation of establishments of education in a transfer of educational technologies opens a way for the attraction of additional financing for the creation of necessary material and technical resources, modern means of informatively-computer technologies and so forth.

5. Conclusions and Prospects of Further Researches

Per by results of the development of the mechanism of governance of the transfer of educational technologies and detection of specifics of economic interests, motives and actions of it of subjects has a possibility to draw such conclusions:

- process of interaction of subjects of the transfer of educational technologies is divided into three main stages: preparation (developer or seller is forming a presentation about the educational technology as about the innovative intellectual product); legitimation (educational technology as at the innovative intellectual product has juridical recognition as at object of the ownership right); restriction (the transaction of rights of property or use of the educational technologies aimed to the buyer);
- on the stage of preparation, the main criterion of innovation of educational technology is an abridging of time of tuition at invariable its quality or upgrading of the quality of tuition at an invariable of its time;
- on the stage of legitimation, the main criterion for an estimate of the interaction of subjects of the transfer of educational technologies is the acceleration of legitimation with an adequate abridging of time of consideration of the submitted applications;
- on the stage of restriction, the main criterion of estimation of the interaction of subjects of the transfer of educational technologies is the speed of distribution of the innovative educational technologies in educational practice;

- discovered at the stages of "preparation – legitimation – restriction" general traits (aiming at an increment by subjects the materialised and humanised forms of intellectual product) and distinctive traits (processing of interaction, functions of self-realisation of human personality);
- the developed criteria of governance of the transfer of educational technologies can be a basis for making decisions in the sphere of an educational network, including, by way of the use of open platforms of information and communication technologies and cloudy servers;
- further researches must be aimed at an exactitude of methodologies of the definition of market prices of the educational technologies (as commodity form of the intellectual product) with use of modern ICT and development of special economic-mathematical models of such estimation.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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Ventsislava Nikolova-Minkova[1]

BULGARIAN AND FOREIGN TRADEMARK ACTIVITY IN BULGARIA AND BULGARIAN TRADEMARK ACTIVITY ABROAD FOR THE PERIOD 2000-2019[2]

This study presents the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria, measured by the number of trademark applications and the number of registered trademarks for the period 2000 – 2019. We also show Bulgarian trademark activity abroad. Some of the existing trends in trademark research and their role as an indicator of the business development environment are also considered. We have defined the impact of legislative changes on trademark activity during the examined period. We have confirmed the existence of a relationship between the trademark activity and the state of the business environment.
Keywords: trademark activity; applicant activity; trademark registration; foreign trademark activity; state of business environment
JEL: F23; M31; O34

1. Introduction

The importance of trademarks has increased in recent years along with other objects of industrial property. In the conditions of increasing competition, trademarks and their commercial value assume a critical role in the market success and competitiveness of trademark owners.

The object of this study is the legal protection of trademarks.

The subject of the study is the Bulgarian and foreign trademark activity over the period 2000-2019 and the mutual commitment between trademark activity and business environment.

The purpose of this study is to: within the period 2000-2019 to investigate the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria, measured with trademark applications and registered trademarks; establish the impact of legislative changes on trademark activity in trademarks and unpredictable economic changes; analyse the existence

[1] *Ventsislava Nikolova-Minkova, Head Assist. Prof., PhD, Technical University of Gabrovo, 0876 444 307, ventsislava_n@mail.bg.*
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of mutual commitment between trademark activity and the state of the business environment. The study period includes twenty years during which the impact of important economic events such as the accession of Bulgaria to the European Union in 2007 and the Global economic crisis in 2008-2009. This allows the dynamics of trademark activity to be taken into account compared to these specific events and reveal a link between trademark activity and the changing business environment.

With regards to the above, the formulated objective is achieved through the following tasks:

1. Analysing trademark application activity for the period 2000 – 2019 of Bulgarian and foreign applicants.
2. Following up the registered trademarks for the period 2000 – 2019.
3. Conducting an empirical analysis revealing the mutual commitment between trademark activity and the state of the business environment.

The author's **hypothesis** is: There is a mutual commitment between trademark activity and the business environment for business development.

In order to prove or reject the author's hypothesis, data has been used for the number of trademark applications and registered trademarks, considering that the application for and registration of a trademark can be done in the following ways:

- *Direct registration (national registration)* – at the competent national intellectual property office of the state where legal protection is sought. The owner's rights have a limited territorial scope in the country where the application has been submitted.
- *International registration* – the Madrid System for international registration of a trademark provides a wider scope of protection. Through an application, the applicant may seek protection on the territory of more than one Member State under the Madrid Agreement and the Protocol to the Madrid Agreement.
- *Regional trademark registration systems* – one of the most famous regional systems is that of the European Union Intellectual Property Office, EUIPO. A "Community Trademark" is registered via EUIPO, which is common for all EU Member States. In 2017 the "Community Trademark" was replaced by European Union TradeMark (EUTM) according to Regulation (EU) 2017/1001 of the European Parliament and of the Council of 14 June 2017 on the European Union trademark.

The source of analyses is the WIPO Statistic Database supported by the World Intellectual Property Organization (WIPO), including submitted applications and registered trademarks through the Madrid Registration System and the national intellectual property offices of the countries included in the study.

The data provided by WIPO offer a different perspective for consumers. For the purposes of this study, the information for the number of submitted applications and registered trademarks is categorised according to the following criteria:

- Count by filling office – provides information about where the legal protection is sought and which national intellectual property office makes the decision to register a trademark.

- Count by applicant's origin – the count shall be carried out according to the nationality of the applicant/trademark owner. The criteria show the number of trademark applications/trademark registrations at an equivalent count.
- Equivalent count – the data is received, with one trademark application taken into account many times according to the number of territories where legal protection is sought. "*Applications at regional offices are equivalent to multiple applications, one in each of the states member of those offices"* (WIPO, 2020, p.15).
- Resident – applications/registrations of trademarks from Bulgarian citizens at the Bulgarian Patent Office.
- Non-resident – applications/registrations of trademarks from foreign citizens in the Bulgarian Patent Office.
- Abroad – applications/registrations of trademarks from Bulgarian citizens in a foreign intellectual property office.

Indicators used for trademark activity analysis are:

1. Total number of Bulgarian and foreign trademark applications:

   1A – direct application at the Bulgarian Patent Office;

   1B – applications submitted via the Madrid System.

2. Total number of registered trademarks by Bulgarian and foreign owners:

   2A – direct application at the Bulgarian Patent Office;

   2B – application submitted via the Madrid System.

4. Foreign activity measured by a total number of trademark applications submitted by foreign applicants in Bulgaria.
5. Foreign activity measured by a total number of registered trademarks by foreign owners in Bulgaria.

Indicators 1 and 2 are measurements of trademark activity, which, by a number of submitted applications and registered trademarks, are indicators of the business environment stability and the aspirations of companies to develop and expand their market share.

Indicators 3 and 4 testify to the existence of a foreign interest in carrying out economic activity on the territory of Bulgaria and imply the existence of an adequate and appropriate legal framework for carrying out this activity complying with the international trademark legislation.

1. Existing Trademark Research

The specialised economic literature analysis testifies to the increasing interest of researchers towards trademarks as an indicator with a strong impact on business development (Millot,

2009; Çela, 2015; Graham et al., 2018). The increasing attention to trademarks has been addressed in several aspects (Castaldi, 2019). *First*: the role of symbols and signs used by companies for attracting consumer attention is increasing. *Second*: the increasing role of services nowadays encourages the use of objects of industrial property other than patents to protect non-technological assets and forms of innovation. *Third*: the share of strategic intangible assets of companies is increasing, and in a number of cases, the market value of trademarks is more than half of the market value of some global companies (Corrado & Hulten, 2010).

The founding works in which trademarks are subject of study are organised in the following categories:

- *Using a historical and legal or economic approach* – Higgins & Rubin (1986) examine the replicas of "snobbish" goods; Wilkins (1992) demonstrates the relationship between the number of registered trademarks and the clustering of large companies in the US; Huntley & Stephen (1995) explore the copying of trademarks in the context of unfair competition.
- *Focused on the presentation of trademarks on the oligopolistic markets* – Rozek (1982) analyses the impact of advertising strategies in the trademark transformation process in a generic trademark and distinguishes trademarks from brands by examining their interaction; Perry & Groff (1986) present the role of trademarks in differentiating products but do not clarify its specificity; Veall (1992) examines patents and trademarks as equivalent legal protection instruments.
- *Focusing on the relationship between trademarks and the market value of companies and their innovation ability* – Bosworth, Rogers (2001), Feeny, Rogers (2003), Mendonça, Pereira & Godinho (2004), Griffiths, Jensen, Webster (2005), Fink, Javorcik, Spatareanu (2005), Malmberg (2005), Greenhalgh & Rogers (2007), Helmers & Rogers (2008), Krasnikov, Mishra, & Orozco (2009), L. Davies, J. Davies (2011), Brahem, El Harbi, Grolleau (2013), Çela (2015).
- *Focusing on the relationship between trademarks activity and the business environment for business development* – Ovaska & Sobel (2005) explore the relationship between entrepreneurial activity and business environment conditions. The authors consider key to entrepreneurial activity indicators, including patent and trademark applications. In its study on types of innovations, which can be measured by market-based indicators, Götsch and Hipp (2012) reveal a number of factors influencing the use of trademarks, including the competitive business environment. Authors deGrazia, Charles and Myers, Amanda and Toole, Andrew A. (2019) present trademark activity as an indicator of business cycles. The latest researches in the field emphasise the importance of trademark as an indicator of the influence of COVID-19 on environmental and business activity (Reading, 2020).

These research directions on the specificity of trademarks and their relationship with business do not exhaust the possible fields for trademark analysis as an indicator of the business environment for business development. Moreover, turning into a source of reputation and consumer loyalty, trademarks are a strategic asset for companies and a prerequisite for

generating high revenues. This determines the growing interest of researchers in trademarks and opportunities for sustainable development they provide to companies.

The economic functions of trademarks to differentiate products of one trademark owner from those of another by distinguishing them with high quality and encouraging consumers to buy them, make trademarks a major competitive advantage for companies.

Flikkema, De Man, Wolters (2010) indicate four main motivations for trademark registration:

First: **sustainability of other company assets**. The approach is used in cases where, by registering trademarks, the company seeks to increase the value of the owned assets.

Second: **strengthening the importance of innovation**. The aim is by registering a trademark to "inform" stakeholders (natural and legal persons) that the company is capable of expanding its innovation activity.

Third: **improving market competitiveness of company assets.** "The trademarking" of an asset increases its recognition and indicates its "value". The registered trademark also hampers direct imitation by competitors.

Fourth: **the company's management opinion** that the increase in registered trademarks is an indicator of the company's striving for acquisitions of sustainable market benefits (Greenhallgh, Rogers, 2007).

By confirming the conclusions of the abovementioned authors and for the purposes of this paper, the author assumes that: **Trademark application activity is an indicator of the business environment's state and also an indicator of foreign interest in the registration of trademarks.**

2. General Analysis of Trademark Applicant Activity

The state and dynamics of trademark activity of Bulgarian and foreign citizens, measured by the number of submitted trademark applications in Bulgaria for the period 2000-2019, are presented in Table 1 and Figure 1.

The data in Table 1 illustrate trademark activity, measured by a number of applications submitted to the Bulgarian Patent Office by both Bulgarian and foreign applicants. There is also information on how to submit a request – direct application or via the Madrid System.

The total number of applications during the study period submitted to the Bulgarian Patent Office is 168,773, with 44.03% of them by foreign applicants. These data testify to the greater interest of Bulgarian trademarks applicants for the submission of direct trademark applications at the Bulgarian Patent Office (55.97%).

The image (see Figure 1) presenting the Bulgarian and foreign applications outlines two periods: 2000-2006 and 2006-2019. During the first period, foreign trademark activity predominates, and after 2006, Bulgarian trademark activity prevails. By 2006, the total number of applications increased with an average annual of 9.02%. After 2006 and until 2019, total activity decreased with an average annual of 7.05%.

Table 1

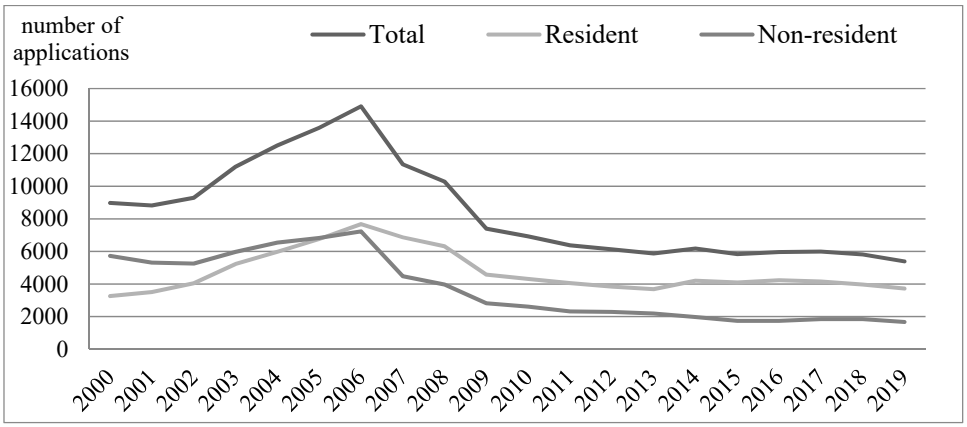
General (Bulgarian and foreign) trademark application activity in Bulgaria (number of applications)

Indicator: **1 - Total trademark applications (direct and via the Madrid system)**												Reporting type: **Total count by filing office**										
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	8982	8820	9293	11197	12510	13587	14906	11348	10282	7391	6921	6374	6124	5868	6178	5836	5965	5989	5815	5387
2	Bulgaria	Resident	3256	3508	4043	5225	5974	6757	7677	6868	6315	4578	4308	4058	3840	3680	4205	4096	4234	4150	3969	3721
3	Bulgaria	Non-resident	5726	5312	5250	5972	6536	6830	7229	4480	3967	2813	2613	2316	2284	2188	1973	1740	1731	1839	1846	1666
Indicator: **1a - Direct applications**																						
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	4547	4598	4926	6148	7060	8009	9173	7542	7068	5139	4831	4490	4258	4120	4625	4508	4648	4536	4345	4109
2	Bulgaria	Resident	3256	3508	4043	5225	5974	6757	7677	6868	6315	4578	4308	4058	3840	3680	4205	4096	4234	4150	3967	3717
3	Bulgaria	Non-resident	1291	1090	883	923	1086	1252	1496	674	753	561	523	432	418	440	420	412	414	386	378	392
Indicator: **1b - Applications via the Madrid system**																						
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	4435	4222	4367	5049	5450	5578	5733	3806	3214	2252	2090	1884	1866	1748	1553	1328	1317	1453	1470	1278
2	Bulgaria	Resident	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4
3	Bulgaria	Non-resident	4435	4222	4367	5049	5450	5578	5733	3806	3214	2252	2090	1884	1866	1748	1553	1328	1317	1453	1468	1274

Source: WIPO Statistic Data Center, Author's calculations.

Figure 1

Dynamic of the trademark application in Bulgarian Patent Office



Source: WIPO Statistic Data Center, Author's calculations.

2.1. Bulgarian Trademark Applicant Activity

Bulgarian trademark applicant activity can be traced by the number of applications submitted by Bulgarian citizens in Bulgaria and abroad (see Table 2 and Figure 2).

The total number of trademark applications during the study period increases continuously, with the trend being analogical for the number of trademark applications submitted abroad (by equivalent count). The trademark applications on the territory of Bulgaria increased by 2006, after which, by 2009, the number of applications was 1.5 times lower. From 2009 to 2019, submitted trademark applications in Bulgaria are approximately 4,000 to 5,000 and maintain a relatively constant level.

Table 2

Bulgarian trademark application activity in Bulgaria and abroad (number of applications)

Indicator: **1 - Total trademark applications (direct and via the Madrid system)**												Reporting type: **Total count by applicant's origin (equivalent count)**										
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	5199	5143	5852	8350	9863	12276	13418	18232	18511	16894	18912	20413	21947	20111	26333	25616	29275	26309	30231	32044
2	Bulgaria	Resident	3256	3508	4043	5225	5974	6757	7677	7127	6622	4906	4734	4523	4353	4155	4886	4751	4977	4843	4731	4550
3	Bulgaria	Abroad	1943	1635	1809	3125	3889	5519	5741	11105	11889	11988	14178	15890	17594	15956	21447	20865	24298	21466	25500	27494
Indicator: **1a- Direct applications**																						
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	3575	3995	4342	5617	6169	7409	8454	12669	13358	12724	15355	16407	16754	15567	21572	21420	22688	22723	22671	25054
2	Bulgaria	Resident	3256	3508	4043	5225	5974	6757	7677	7076	6551	4843	4676	4475	4281	4080	4804	4677	4880	4784	4620	4461
3	Bulgaria	Abroad	319	487	299	392	195	652	777	5593	6807	7881	10679	11932	12473	11487	16768	16743	17808	17939	18051	20593
Indicator: **1b- Applications via the Madrid system**																						
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	1624	1148	1510	2733	3694	4867	4964	5563	5153	4170	3557	4006	5193	4544	4761	4196	6587	3586	7560	6990
2	Bulgaria	Resident	-	-	-	-	-	-	-	51	71	63	58	48	72	75	82	74	97	59	111	89
3	Bulgaria	Abroad	1624	1148	1510	2733	3694	4867	4964	5512	5082	4107	3499	3958	5121	4469	4679	4122	6490	3527	7449	6901

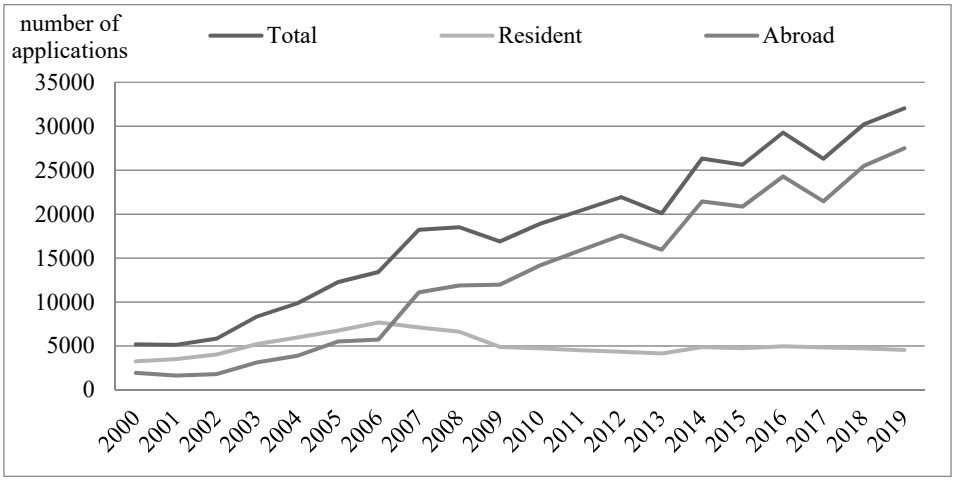
Source: WIPO Statistic Data Center, Author's calculations.

The dynamics of Bulgarian activity (see Figure 2) clearly outlines two trends:

- Trademark applicant activity of Bulgarian citizens on the territory of Bulgaria marks a slight increase by 2006, from 2006 to 2009 – some decline, and then it hit a relatively sustainable level until the end of the period.
- Bulgarian applicant activity abroad has an increasing trend throughout the surveyed period, which gives reason to argue that the total Bulgarian applicant activity is mainly influenced by the activity abroad.

Figure 2

Dynamic of general Bulgarian trademark activity – in Bulgaria and abroad



Source: WIPO Statistic Data Center, Author's calculations.

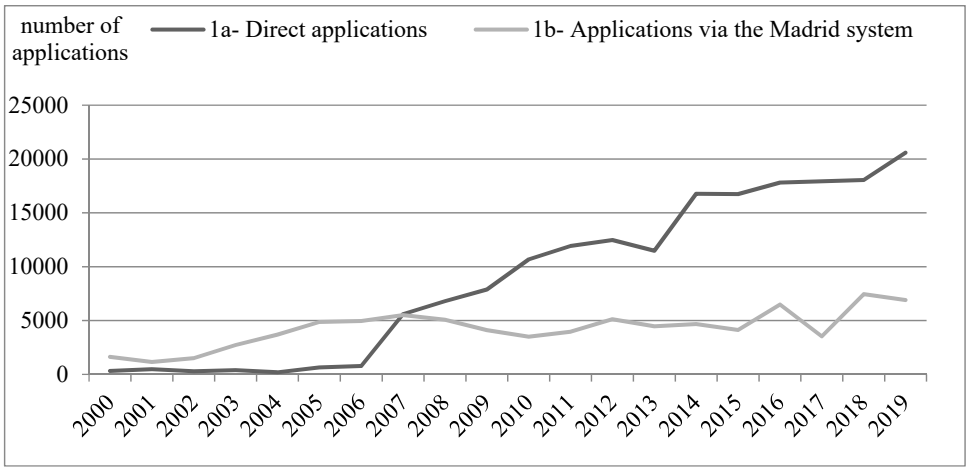
From the beginning till the end of the period 2000-2019, the total Bulgarian applicant activity increased 6.16 times, with an average annual growth of 10.96%. Bulgarian activity abroad

throughout the surveyed period marked a significant average annual growth of 17.58%. This indicates the aspirations of Bulgarian trademark applicants for business development, market expansion and targeting their activity abroad.

A comparison between the methods for submitting trademark applications abroad by Bulgarian applicants is presented in Figure 3.

Figure 3

Dynamic of general Bulgarian applicant activity abroad by the methods for submitting the trademark application



Source: WIPO Statistic Data Center, Author's calculations.

For the entire surveyed period, direct applications abroad dominate (177,875) over those submitted through the Madrid System (85,456). The national applications increase is 3.76 times more than the submitted applications via the Madrid System.

For the period 2000-2007, trademark applications via the Madrid System increased with an average annual of 25.35%, while direct applications at foreign intellectual property offices maintained a low level (Figure 3). In 2007, trends differed. There was a significant increase (62.89%) of trademark applications from 2006 to 2019 and a decrease in the applications submitted via the Madrid System that remained relatively constant with more significant fluctuations from 2015 to 2019 when the growth was 27.77%.

Information about the territories where Bulgarian applicants are looking for legal protection is provided in Table 3 and Figure 4. Please note that the data do not cover all countries in which Bulgarian applicants are interested. Out of a total of 139 countries where more than 70,000 trademark applications have been submitted for the specified period 2000 – 2019, those (19 territories) are presented where trademark activity exceeds 1,000 trademark applications. They form a 54.24% share.

Table 3

Bulgarian trademark applicant activity abroad (number of applications)

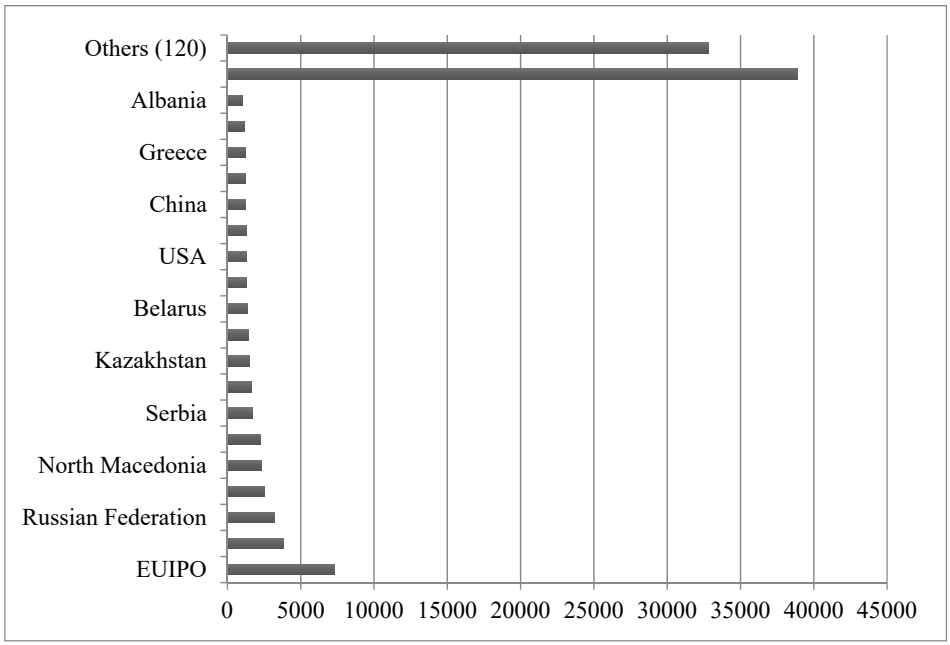
Office	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	ALL
1.EUIPO	4	8	1	5	4	53	77	259	307	328	426	465	513	475	681	655	743	693	762	829	7288
2. DE	33	31	41	58	96	161	99	111	528	391	640	752	443	39	37	30	66	86	88	79	3809
3. RU	124	100	89	170	220	235	248	217	182	163	121	158	170	200	151	103	126	124	137	149	3187
4. UA	102	78	77	163	194	185	199	181	148	153	113	114	157	117	121	78	99	68	103	107	2557
5. MG	101	61	70	125	152	166	191	218	222	136	109	103	91	92	87	79	88	56	103	81	2331
6. RO	63	65	74	127	191	215	191	233	219	120	82	75	87	75	69	46	82	51	101	94	2260
7. RS	-	-	-	-	-	-	112	215	225	150	111	116	111	104	111	86	101	76	119	97	1734
8. TR	-	4	38	64	122	144	122	145	134	88	78	82	104	76	99	68	69	56	81	67	1641
9. KZ	73	50	46	77	72	66	84	67	56	118	91	85	98	86	92	53	85	58	73	82	1512
10. AT	23	21	21	41	59	62	54	68	30	491	316	31	26	22	12	13	43	14	58	54	1459
11. BY	79	56	45	85	95	73	108	85	71	51	44	54	78	58	50	29	80	64	74	89	1368
12. MC	76	43	42	69	81	76	84	98	82	65	65	52	76	60	48	30	73	36	77	94	1327
13. US	5	3	3	10	50	35	56	63	53	43	32	43	85	80	95	90	127	103	165	164	1305
14. BA	24	20	22	61	61	93	77	82	106	86	66	62	62	62	68	46	73	43	90	80	1284
15. CN	29	33	64	35	37	49	48	60	85	61	67	97	96	79	97	84	66	56	49	44	1236
16. PL	54	37	55	76	116	106	87	124	57	41	33	43	62	37	26	32	59	29	71	70	1215
17. GR	4	10	32	62	106	137	112	140	122	58	44	46	36	26	30	18	48	31	74	65	1201
18. HR	25	22	27	75	77	110	83	108	82	55	63	64	61	53	42	25	46	23	58	62	1161
19. AL	42	23	25	59	77	47	51	65	80	61	58	81	61	54	69	41	35	38	41	20	1028
TOP 19	861	665	772	1362	1810	2013	2083	2539	2789	2659	2559	2523	2417	1795	1985	1606	2109	1705	2324	2327	38903
Others (120)	966	812	957	1583	1843	2098	1713	1975	1359	1093	937	1684	2300	1625	1604	1677	2027	1493	2384	2687	32817
ALL	1827	1477	1729	2945	3653	4111	3796	4514	4148	3752	3496	4207	4717	3420	3589	3283	4136	3198	4708	5014	71720

Source: WIPO Statistic Data Center, Author's calculations.

The data in Table 3 and Figure 4 testify that Bulgarian trademark applicants are mainly oriented towards neighbouring Balkan and European countries and the period 2006-2007 is a turning point with regards the number of applications to EUIPO. From 2007 to 2019, submitted trademark applications via EUIPO increased more than 3 times. Thus, Bulgarian applicant activity abroad for the period 2000 – 2019 was mostly targeted at the registration of an "EU TradeMark/Community trademark" (7,288). Germany ranks second among the preferred territories for business expansion by submitting trademark applications (3,809) and Russia ranks third (3,187). The countries that follow them are Ukraine (2,557), Northern Macedonia (2,331), Romania (2,260), Serbia (1,734), Turkey (1,641), Kazakhstan (1,512), Austria (1,459), Belarus (1,368), Moldova (1,327), USA (1,305), Bosnia and Herzegovina (1,284), China (1,236), Poland (1,215), Greece (1,201), Croatia (1,161), Albania (1,028). The other countries in which Bulgarian trademark applicants are interested to form a 45.76% share.

Figure 4

Total number of trademark applications from Bulgarian applicants abroad



Source: WIPO Statistic Data Center, Author's calculations.

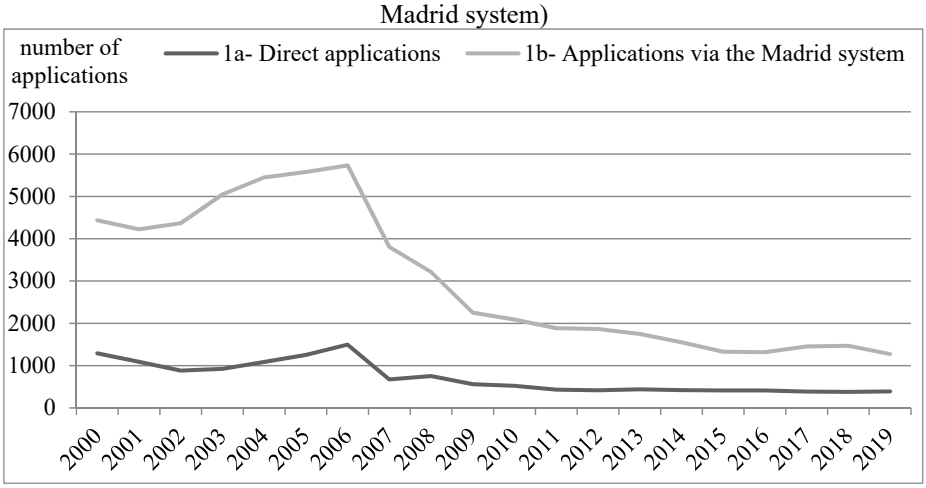
2.2. Foreign Trademark Applicant Activity

The image in Figure 5, drawn up according to Table 2, presents foreign trademark applications in Bulgaria via the Madrid System and direct applications at the Bulgarian Patent Office.

Throughout the studied period, the submitted applications via the Madrid System (60,087) significantly outnumber those submitted by direct application (14,224). From 2000 to 2006, submitted applications via the Madrid System were 34,834, and direct applications were 8,021 (nearly 4.5 times less). After 2006, the gap between the two types of application decreased significantly. For the period 2007 – 2019, the trademark applications via the Madrid System are 25,253, whereas direct applications are 6,203. During the period 2015-2019, the gap remained at a relatively constant level – the applications via the Madrid System were about 3.5 times more.

The described trends in the dynamics of the ways of submitting trademark applications give rise to the conclusion that direct applications, for which a slow decline has been observed from 2000 to 2002 followed by an increase in 2006, retained a relatively constant level after 2007 till the end of the study period. This trend is due to foreign trademark applications outside the Member States via the Madrid System, which submits direct applications to the Bulgarian Patent Office.

Figure 5
Dynamic of foreign trademark registration activity in Bulgaria (direct registration and via Madrid system)



Source: WIPO Statistic Data Center, Author's calculations.

Application submitted via the Madrid System mark a decline in 2001 and an increase by 2006. The image presents two periods of decrease in activity: 2006 – 2009, during which the decrease was with an average annual of 26.37%, and after 2009 to 2019, when activity dropped with an average annual of 5.27%. The reasons for these trends can be found in:

- Macroeconomic stability, improving the institutional environment and high investment activity in Bulgaria prior to 2007 – the basis for accelerated economic development in the years before the accession of Bulgaria to the European Union (EU). These, along with the harmonisation of trademark legislation, are a prerequisite for high foreign trademark application activity in the period 2000-2006, with applications submitted via the Madrid System.
- Following Bulgaria's accession to the EU (2007), foreign application activity declined compared to the 2006 level. The data in Table 3 clearly shows that, for the most part, this decrease is due to the redirection of applicants from the EU Member States to submit an EU TradeMark/Community trademark application.
- Highly impacted by the global economic crisis (2008-2009) and the subsequent contraction of markets, the instability of the environment, as well as the reduced business costs and investments during a crisis, foreign trademark applications in Bulgaria maintained a downward trend for the period 2008-2015.

An analysis was carried out for the study period of foreign trademark application activity in Bulgaria of applicants from 122 countries, and Table 4 and Figure 6 show data for 18 of them who submitted more than 1,000 applications for the specified period, with a total share of 84.55%. The information is also indicative of pinpointing the countries for which the business environment in Bulgaria is an economic interest and an opportunity for development.

Table 4

Foreign trademark applicant activity (number of applications)

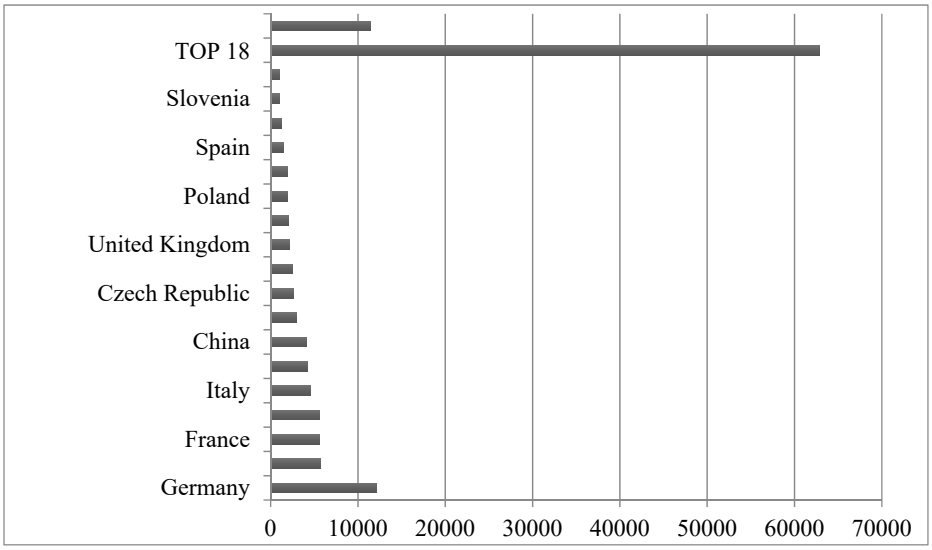
Origin	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	ALL
1. DE	1409	1180	1003	1371	1357	1401	1244	660	529	334	253	199	177	178	216	141	134	120	99	97	12102
2. UA	532	433	339	368	528	719	896	309	210	149	153	132	124	150	134	142	121	119	109	82	5749
3. FR	687	510	536	540	523	494	615	300	269	173	127	111	104	120	95	88	96	107	64	72	5631
4. CH	561	592	452	378	379	407	477	295	294	237	196	173	168	140	101	130	143	152	135	124	5534
5. IT	511	455	384	477	551	553	553	230	256	114	89	69	58	52	51	39	21	38	32	24	4557
6. TR	41	107	245	261	326	331	328	331	341	232	235	195	201	214	189	158	154	137	116	111	4253
7. CN	58	73	96	97	189	219	250	196	202	193	225	240	221	186	197	118	237	384	503	227	4111
8. RU	42	58	90	136	179	140	172	216	165	157	183	210	188	166	153	114	114	156	123	147	2909
9. CZ	158	161	167	170	216	166	225	219	196	131	86	84	150	146	28	54	67	43	47	44	2558
10. AT	224	227	185	158	234	267	274	186	146	113	67	57	76	43	37	32	60	37	21	33	2477
11.GB	204	139	182	220	205	252	234	108	56	68	36	22	36	58	48	30	33	49	65	161	2206
12. NL	310	224	270	219	214	167	175	80	68	43	53	48	27	17	30	25	23	11	14	22	2040
13. PL	84	102	132	135	190	240	127	152	156	112	91	101	75	44	46	47	31	24	31	45	1965
14.HU	74	131	70	76	155	47	72	162	118	109	86	115	105	133	165	95	21	64	51	35	1884
15. ES	133	143	158	262	189	134	165	82	76	21	16	15	13	14	17	14	11	10	9	13	1495
16. BE	145	191	134	148	112	129	115	69	42	24	23	17	26	22	6	9	11	2	13	12	1250
17. SI	34	33	63	49	56	76	58	76	97	81	92	50	78	35	31	45	21	33	23	24	1055
18. JP	47	66	69	120	118	134	130	47	42	31	36	30	41	29	23	26	14	19	16	16	1054
TOP 18	5254	4825	4575	5185	5721	5876	6110	3718	3263	2322	2047	1868	1868	1747	1567	1307	1312	1505	1471	1289	62830
Others (103)	472	487	675	787	815	954	1119	762	704	491	566	448	416	441	406	433	419	334	375	377	11481
ALL	5726	5312	5250	5972	6536	6830	7229	4480	3967	2813	2613	2316	2284	2188	1973	1740	1731	1839	1846	1666	74311

Source: WIPO Statistic Data Center, Author's calculations.

The data show a high foreign activity of EU applicants by 2006, after which the number of trademark applications from the Member States decreased. A comparatively sustainable number of applications for the analysed period was submitted by persons (both natural and legal) from non-EU countries.

The image in Figure 6 shows a total number of submitted trademark applications from those countries for the period 2000 – 2019 ranged by activity. The data highlight the applicants from Germany as the most active when submitting trademark applications on the territory of Bulgaria. The country that follows is the USA, although, for the analysed period, trademark applicant activity is twice as low (5,749) compared to Germany (12,102). The third country whose citizens are interested in business development on the territory of Bulgaria is France (5,631). That is followed by Switzerland (5,534), Italy (4,557), Turkey (4,253), China (4,111), Russia (2,909), the Czech Republic (2,558), Austria (2,477), the United Kingdom (2,206), the Netherlands (2,040), Poland (1,965), Hungary (1,884), Spain (1,495), Belgium (1,250), Slovenia (1,055) and Japan (1,054). The share of foreign trademark applicant activity from other countries is 15.45% (11,481).

Figure 6
Foreign trademark applicant activity in Bulgaria according to the applicants' nationality (number of applications)



Source: WIPO Statistic Data Center, Author's calculations.

3. General Analysis of Trademark Activity, According to the Number of Registered Trademarks

In order to assess to what extent these trends are also observed in registered trademarks, a similar analysis of registered trademarks during the period 2000 – 2019 has been carried out in Bulgaria.

Table 5 presents data on registered trademarks at the Bulgarian Patent Office by Bulgarian and foreign trademark owners.

By comparing the number of registered trademarks for the period 2000 – 2019 and the number of trademark applications submitted for the same period, the impression is that the applications submitted (168,773) exceed the registered trademarks (140,765) by only 16%. Unlike trademark applicant activity, different trends (see Figure 7) are observed in registered trademarks.

From 2000 to 2006, total activity is largely determined by foreign activity and by average annual growth of 7.93%. During this period, a total of 58,790 trademarks were registered, with those owned by foreigners (43,913) being 2.95 times more than the trademarks with Bulgarian owners (14,877). Since 2006, with some fluctuations, the number of registered trademarks of Bulgarian and foreign trademark owners decreased with an average annual of 4.32% by the end of 2019, with the decrease being more significant by 2011 (7.95%). From 2012 till the end of the period, Bulgarian trademark owners outnumber the foreign owners.

Table 5

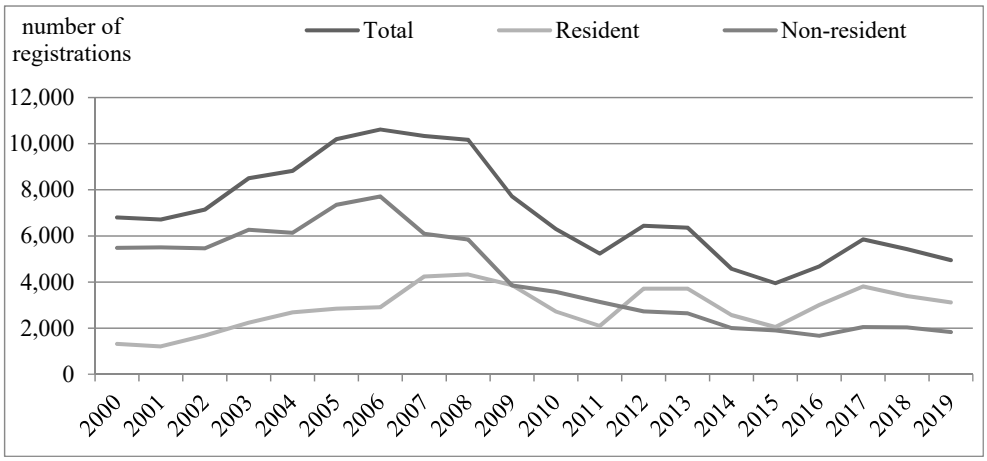
General (Bulgarian and foreign) trademark activity in Bulgarian Patent Office (number of registrations)

Indicator: **2 - Total trademark registrations (direct and via the Madrid system)**												Reporting type: **Total count by filing office**										
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	6802	6709	7145	8503	8820	10194	10617	10337	10172	7712	6292	5235	6440	6360	4575	3948	4675	5853	5428	4948
2	Bulgaria	Resident	1318	1208	1681	2233	2687	2845	2905	4241	4329	3862	2718	2098	3715	3713	2567	2049	3007	3808	3393	3115
3	Bulgaria	Non-resident	5484	5501	5464	6270	6133	7349	7712	6096	5843	3850	3574	3137	2725	2647	2008	1899	1668	2045	2035	1833
Indicator: **2a- Registrations for direct applications**																						
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	2138	1919	2464	3058	3417	3600	3711	5342	6397	4955	3977	3095	4363	4294	3000	2317	3423	4297	3784	3467
2	Bulgaria	Resident	1318	1208	1681	2233	2687	2845	2905	4241	4329	3862	2718	2098	3715	3713	2567	2049	3007	3808	3391	3111
3	Bulgaria	Non-resident	820	711	783	825	730	755	806	1101	2068	1093	1259	997	648	581	433	268	416	489	393	356
Indicator: **2b- Registrations for applications via the Madrid system**																						
	Office	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	4664	4790	4681	5445	5403	6594	6906	4995	3775	2757	2315	2140	2077	2066	1575	1631	1252	1556	1644	1481
2	Bulgaria	Resident	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4
3	Bulgaria	Non-resident	4664	4790	4681	5445	5403	6594	6906	4995	3775	2757	2315	2140	2077	2066	1575	1631	1252	1556	1642	1477

Source: WIPO Statistic Data Center, Author's calculations

Figure 7

Dynamic of registered trademarks in Bulgaria from Bulgarian and foreign trademark registrar



Source: WIPO Statistic Data Center, Author's calculations.

Until 2008 the activity of Bulgarian trademark owners increased with an average annual of 17.5%, after which strong fluctuations were reported until the end of the study period. In 2015, Bulgarian and foreign trademark activity marked similar levels.

3.1. Activity of Bulgarian trademark owners in Bulgaria and abroad

Registered trademarks by Bulgarian citizens for the period 2000-2019 on the territory of the country and abroad are presented in Table 6 and Figure 8. Numbers of registered trademarks were obtained at "equivalent count".

Table 6

Bulgarian trademark owners in Bulgaria and abroad (number of registrations)

Indicator :												Reporting type :										
2 - Total trademark registrations (direct and via the Madrid system)												**Total count by applicant's origin (equivalent count)**										
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	3321	2708	3671	5184	5951	8205	8155	9337	11827	12839	13938	13604	16438	16787	19266	19804	19469	26939	23943	29175
2	Bulgaria	Resident	1318	1208	1681	2233	2687	2845	2905	4301	4493	4113	3057	2432	4058	4060	3071	2568	3531	4468	3980	3831
3	Bulgaria	Abroad	2003	1500	1990	2951	3264	5360	5250	5036	7334	8726	10881	11172	12380	12727	16195	17236	15938	22471	19963	25344
Indicator :																						
2a- Registrations for direct applications																						
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	1652	1430	2039	2438	2916	3068	3376	4991	7760	9861	11117	9992	11794	12286	15208	14992	16844	19866	17974	20616
2	Bulgaria	Resident	1318	1208	1681	2233	2687	2845	2905	4260	4448	4077	3021	2382	4004	4003	2999	2497	3484	4366	3900	3723
3	Bulgaria	Abroad	334	222	358	205	229	223	471	731	3312	5784	8096	7610	7790	8283	12209	12495	13360	15500	14074	16893
Indicator :																						
2b- Registrations for applications via the Madrid system																						
	Origin	**Type**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
1	Bulgaria	Total	1669	1278	1632	2746	3035	5137	4779	4346	4067	2978	2821	3612	4644	4501	4058	4812	2625	7073	5969	8559
2	Bulgaria	Resident	-	-	-	-	-	-	-	41	45	36	36	50	54	57	72	71	47	102	80	108
3	Bulgaria	Abroad	1669	1278	1632	2746	3035	5137	4779	4305	4022	2942	2785	3562	4590	4444	3986	4741	2578	6971	5889	8451

Source: WIPO Statistic Data Center, Author's calculations.

The dynamics of the total Bulgarian activity – registered trademarks in the country and abroad throughout the study period are determined by and, to a large degree, depend on Bulgarian activity abroad (see Figure 8). Registered trademarks abroad are 207,721 – 3.3 times more than those registered in Bulgaria.

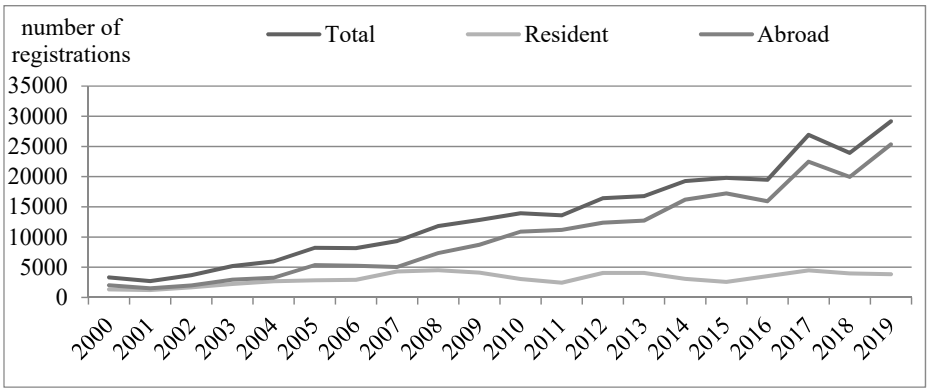
Registered trademarks on the territory of Bulgaria during the study period increased with an average annual of 8.71% and in 2000 were 1,318, increasing to 3,831 in 2019 (a total number for the period – 62,840).

Registered trademarks by Bulgarians abroad also increased during the study period. In 2000 they were 2003, and in 2019 their number was 25,344, which is 12.65 times more – the average annual growth was 16.48%. This gives reason to argue that the total Bulgarian activity – registered trademarks – is mainly influenced by Bulgarian activity abroad (207,720 in total).

Analysing the methods of trademark registration (see Figure 9), we observe the trends outlined in the process of submitting trademark applications – preference to the use of the Madrid System by 2008. In 2008, trends turned in favour of direct applications until the end of the study period. From 2007 to 2010, there was a sharp increase in direct applications, with an average annual of 130.72%. After 2010 and until 2019, the growth was 9.58%.

Figure 8

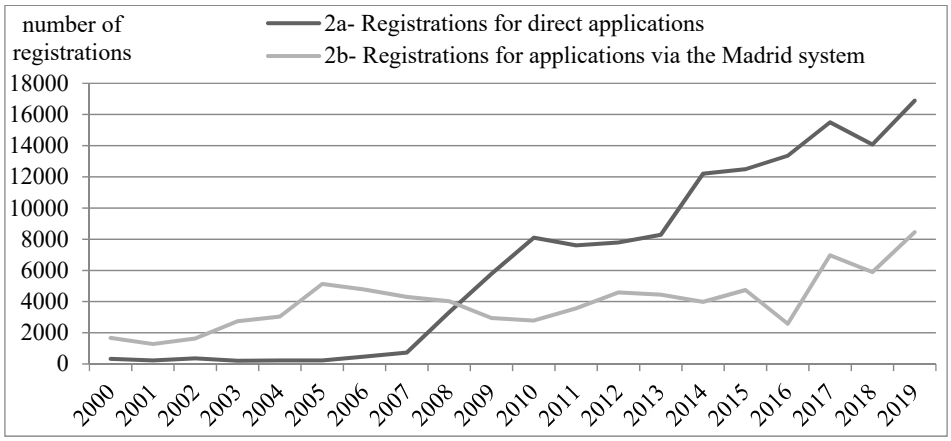
Dynamic of general Bulgarian activity of trademark owners in Bulgaria and abroad



Source: WIPO Statistic Data Center, Author's calculations.

Figure 9

Dynamic of general Bulgarian activity (in Bulgaria and abroad) by the methods for submitting the trademark registration



Source: WIPO Statistic Data Center, Author's calculations.

Typical of the trademarks registered via the Madrid System is their significant increase after 2016 and until 2019, with an average annual of 66.13%.

The activity of trademark owners abroad is largely oriented towards neighbouring Balkan countries and European countries, and there is a strong orientation towards economically significant countries such as the United States of America and China. Table 7 and Figure 10 provide information on 18 (47.73% share) of 143 territories in which Bulgarian trademark owners have submitted more than 1,000 trademark applications for the study period 2000-2019. Bulgarian trademark owners express the greatest interest in registering an "EU TradeMark/Community trademark" via EUIPO.

Table 7

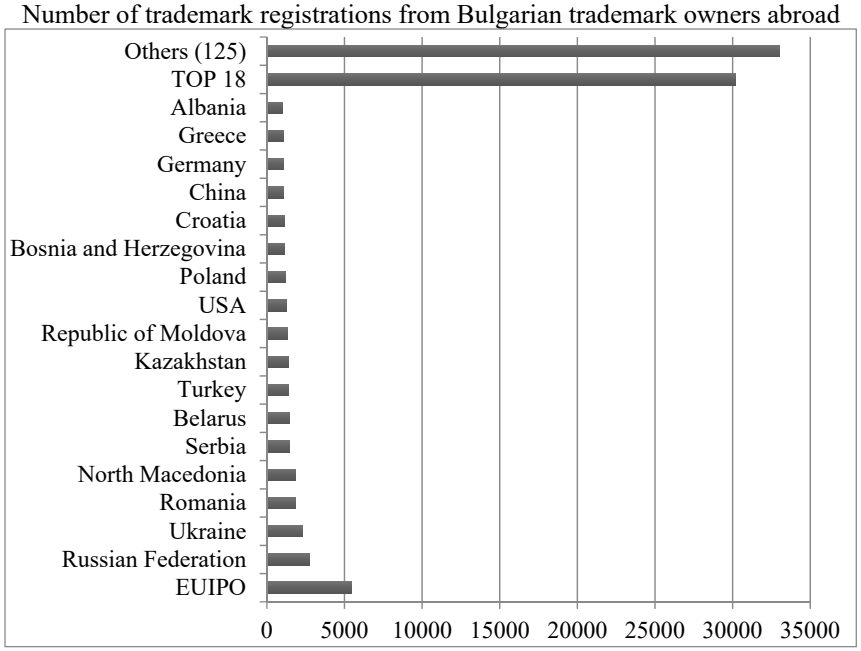
Number of trademark registrations from Bulgarian trademark owners abroad

Office	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	ALL
1.EUIPO	5	-	-	-	1	48	55	60	164	251	339	334	343	347	504	519	524	660	587	716	5457
2.RU	141	71	105	147	198	182	211	192	150	122	105	98	148	151	139	110	64	157	129	145	2765
3.UA	87	80	97	147	163	176	157	157	131	99	107	102	125	126	90	77	62	127	80	126	2316
4.RO	62	63	63	108	119	186	150	150	133	103	83	56	81	73	52	55	33	85	89	104	1848
5.MG	58	55	64	94	129	136	106	126	149	104	86	87	92	74	58	91	46	100	86	105	1846
6.RS	-	-	-	-	-	-	99	138	164	114	94	94	112	79	81	93	64	114	110	114	1470
7.BY	117	69	43	87	87	94	93	91	62	56	42	49	73	49	70	44	28	110	67	102	1433
8.TR	-	2	44	57	77	125	95	94	96	77	68	71	79	86	71	91	62	56	67	69	1387
9.KZ	72	41	53	86	82	72	84	66	49	44	55	63	111	76	59	48	34	114	75	90	1374
10.MC	71	45	39	74	77	90	84	83	77	59	54	51	72	66	53	42	19	80	66	97	1299
11.US	2	1	7	2	28	52	83	86	48	55	47	54	63	74	77	82	77	123	114	164	1239
12.PL	54	32	49	86	107	120	105	97	72	47	33	34	55	48	20	24	24	63	60	89	1219
13.BA	25	22	27	40	50	64	56	57	97	54	51	66	85	60	38	69	28	91	71	89	1140
14.HR	27	23	36	50	87	84	84	74	101	55	52	65	76	54	30	36	8	53	49	79	1123
15.CH	25	41	23	40	18	43	50	40	47	59	65	58	79	94	100	84	48	82	53	46	1095
16.DE	42	25	43	60	58	140	96	73	72	40	44	22	39	33	30	25	22	66	59	92	1081
17.GR	8	12	40	61	71	121	86	82	85	49	46	30	38	35	26	33	10	59	61	85	1038
18.AL	38	36	32	51	71	60	47	56	77	55	50	78	62	56	40	61	28	53	49	25	1025
TOP 18	834	618	765	1190	1423	1793	1741	1722	1774	1443	1421	1412	1733	1581	1538	1584	1181	2193	1872	2337	30155
Others (125)	1033	844	1155	1667	1703	2257	2073	1726	1392	974	965	1364	2008	1952	1439	1886	973	2304	2113	3195	33023
ALL	1867	1462	1920	2857	3126	4050	3814	3448	3166	2417	2386	2776	3741	3533	2977	3470	2154	4497	3985	5532	63178

Source: WIPO Statistic Data Center, Author's calculations.

Figure 10

Number of trademark registrations from Bulgarian trademark owners abroad



Source: WIPO Statistic Data Center, Author's calculations.

Ranked second among the Bulgarian owners is a trademark registration in Russia (2,765) and third is Ukraine (2,316). Following them are Romania (1,848), Northern Macedonia (1,846), Serbia (1,470), Belarus (1,433), Turkey (1,387), Kazakhstan (1,374), Moldova (1,299), USA (1,239), Poland (1,219), Bosnia and Herzegovina (1,140), Croatia (1,123), China (1,095), Germany (1,081), Greece (1,038), Albania (1,025). On the remaining 125 territories with a share of 57.27%, a total of 33,023 trademarks were registered for the study period.

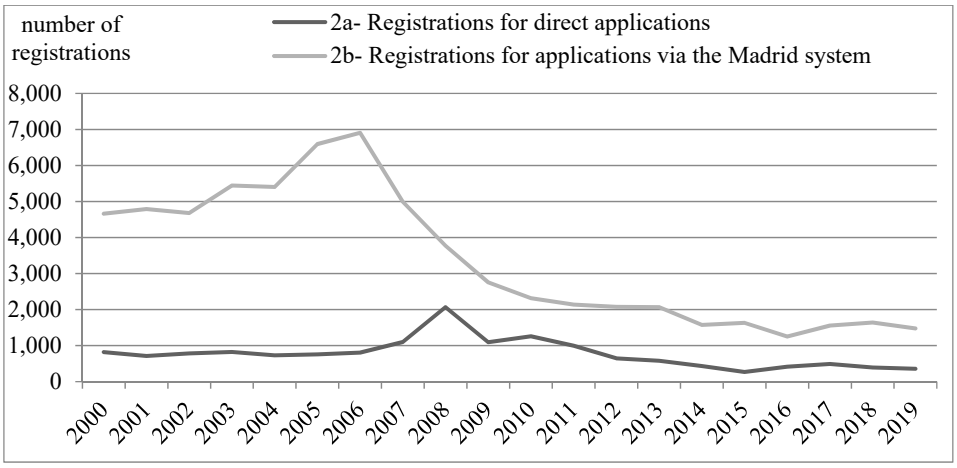
3.2. Foreign trademark activity of trademark owners in Bulgaria

By analysing the methods of trademark registration (see Figure 11), we observe a significant majority throughout the period (4.36 times) of foreign owners using the Madrid System (67,741) compared to a direct application (15,532). The reason for this majority is the facilitated trademark registration procedure via the Madrid System, allowing legal protection of a registered trademark on the territory of more than one Member State specified by the trademark owner.

The image (see Figure 11) highlights two periods in the registration of a trademark via the Madrid System: a first period (2000 – 2006) when registered trademarks increased with an average annual of 7.13% and second period (2006 – 2019) when there was a decrease in registered trademarks with an average annual of 9.99%, significantly more pronounced by 2012 (17.6%).

Figure 11

Dynamic of foreign trademark activity in Bulgaria by the methods for submitting trademark application – direct registration and via The Madrid system



Source: WIPO Statistic Data Center, Author's calculations.

The dynamics of registered trademarks issued following a direct application is different, and its level remained relatively constant, with one exception in 2008 when they had their highest number. The average annual decrease from 2008 till 2019 is by 10.72%.

Table 8

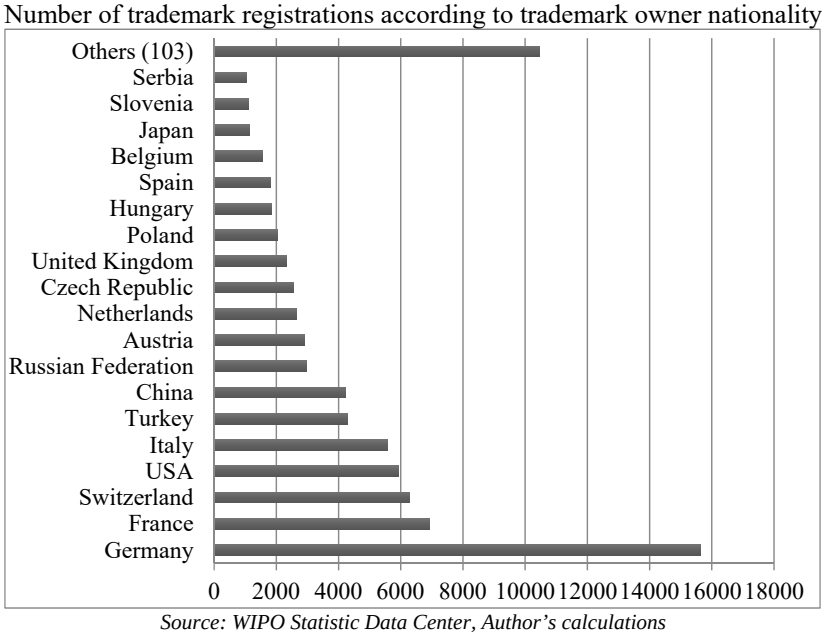
Number of registration according to trademark owner nationality

Origin	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	ALL
1.DE	1516	1448	1185	1628	1427	1678	1716	1047	928	598	500	454	271	238	229	156	158	165	150	132	15624
2.FR	727	590	598	591	561	653	641	477	415	263	269	202	141	155	116	120	90	143	83	91	6926
3.CH	555	694	508	458	390	472	536	362	335	286	299	198	200	187	115	93	116	190	161	127	6282
4.US	372	321	326	360	414	537	501	580	678	231	268	202	182	156	161	140	138	138	131	87	5923
5.IT	525	500	482	481	561	654	727	407	311	191	151	146	85	78	55	59	37	38	63	34	5585
6.TR	34	20	226	280	219	331	372	344	367	256	236	246	169	278	168	192	133	178	139	115	4303
7.CH	56	66	34	110	160	239	240	230	253	189	255	245	208	244	169	175	162	301	482	409	4227
8.RU	-	45	78	94	138	150	179	190	216	153	159	215	229	182	181	127	119	151	167	147	2967
9.AT	225	248	214	145	203	301	292	260	271	141	106	87	100	73	37	35	54	55	32	28	2907
10.NL	304	255	285	254	265	217	252	126	141	102	111	103	51	45	19	30	22	25	20	20	2647
11.CZ	144	144	165	126	189	197	219	201	240	142	97	84	92	167	82	43	42	64	51	53	2542
12.GB	132	109	214	164	197	253	256	174	144	110	138	85	38	42	40	52	27	48	46	56	2325
13.PL	62	125	79	118	152	167	190	194	196	161	109	87	104	60	39	56	33	37	20	60	2049
14.HU	58	119	69	73	131	68	59	184	91	129	84	108	122	139	111	149	26	18	63	48	1849
15.ES	126	188	145	334	193	165	172	129	111	47	44	45	25	17	11	14	16	9	19	6	1816
16.BE	137	219	124	169	112	179	148	71	88	58	50	46	35	30	19	7	10	12	11	17	1542
17.JP	43	36	64	114	109	134	120	103	78	41	55	27	49	41	31	14	34	19	19	17	1148
18.SI	40	27	65	51	58	85	67	72	101	95	107	41	77	49	23	30	34	38	23	24	1107
19.RS	2	11	25	39	20	50	63	134	83	98	66	59	26	47	40	40	74	62	54	57	1050
TOP 19	5105	5165	4886	5589	5499	6530	6750	5285	5047	3291	3104	2680	2204	2228	1646	1532	1325	1691	1734	1528	**72819**
Others (103)	379	336	578	681	634	819	962	811	796	559	470	457	521	419	362	367	343	354	301	305	**10454**
ALL	**5484**	**5501**	**5464**	**6270**	**6133**	**7349**	**7712**	**6096**	**5843**	**3850**	**3574**	**3137**	**2725**	**2647**	**2008**	**1899**	**1668**	**2045**	**2035**	**1833**	**83273**

Source: WIPO Statistic Data Center, Author's calculations.

Figure 12

Number of trademark registrations according to trademark owner nationality



Source: WIPO Statistic Data Center, Author's calculations

These trends and changes in the methods of foreign trademark registrations are significantly influenced by two factors:

First: Bulgaria's accession to the EU (2007) – we observe a distinct decrease in trademark owners registering a trademark via the Madrid System in 2007 compared to 2006 (27.67%).

Second: The World Economic Crisis (2008) – decline trends were observed during the period 2008 – 2009 both for the registration of trademarks via the Madrid System and the direct application process by foreign trademark owners in Bulgaria.

An analysis of foreign trademark activity was carried out in 122 countries, with a total of 72,819 registrations. Table 8 and Figure 12 present data for 19 of them, whose citizens have more than 1,000 registered trademarks, during the analysed period with a total share of 87.45%.

The image in Figure 12 shows the total number of registered trademarks in the period 2000-2019. According to the data Germany again is the country with the highest activity in registration of trademarks on the territory of Bulgaria (15,624). Following Germany, with owners who have registered a large number of trademarks in Bulgaria, are: France (6,926); Switzerland (6,286); USA (5,923); Italy (5,585); Turkey (4,303); China (4,227); Russia (2,967); Austria (2,907); the Netherlands (2,647); Czech Republic (2,542); United Kingdom (2,325); Poland (2,049); Hungary (1,849); Spain (1,816); Belgium (1,542); Japan (1,148); Slovenia (1,107); Serbia (1,050). The share of foreign trademark activity from other countries is 12.55% (10,454).

4. Summary and Conclusions

Four periods can be outlined as a result of the analyses of Bulgarian and foreign trademark activity in Bulgaria and of trademark activity of Bulgarian trademark owners abroad.

First Period: 2000-2006: The trends observed are associated with trademark application activity growth. By 2002, it was less pronounced and under the influence of foreign activity, and higher for the period 2003 – 2006, strongly influenced by Bulgarian applicant activity. The observed trends for trademark owners are similar for the specified period, and the trademark activity rises by 2006.

Second Period: 2007-2008: This period is a cornerstone for trademark applicants/trademark owners in the business environment. The accession of the Republic of Bulgaria in the European Union (EU) is a determining factor. Bulgaria's EU membership provides Bulgarian citizens with the opportunity of protecting trademarks by submitting an "EU TradeMark/Community trademark" application. It is common to all EU Member States. Bulgaria's EU membership is the reason for the observed continuous increase in the number of registered trademarks in the EUIPO system since 2007. The importance of Bulgaria's accession to the EU is also evident from another trend – the decreasing number of applications and trademark registrations after 2007 via the Madrid System. By 2006 there was a steady increase of these applications, as the European Union is a party to the Madrid System, allowing Bulgarian applicants to register trademarks in European Union countries

through the membership of Bulgaria in the Madrid System. Following Bulgaria's accession to the EU in 2007, this "roundabout" access to European countries is losing its importance due to the possibility of a direct "EU TradeMark/Community trademark" application through EUIPO.

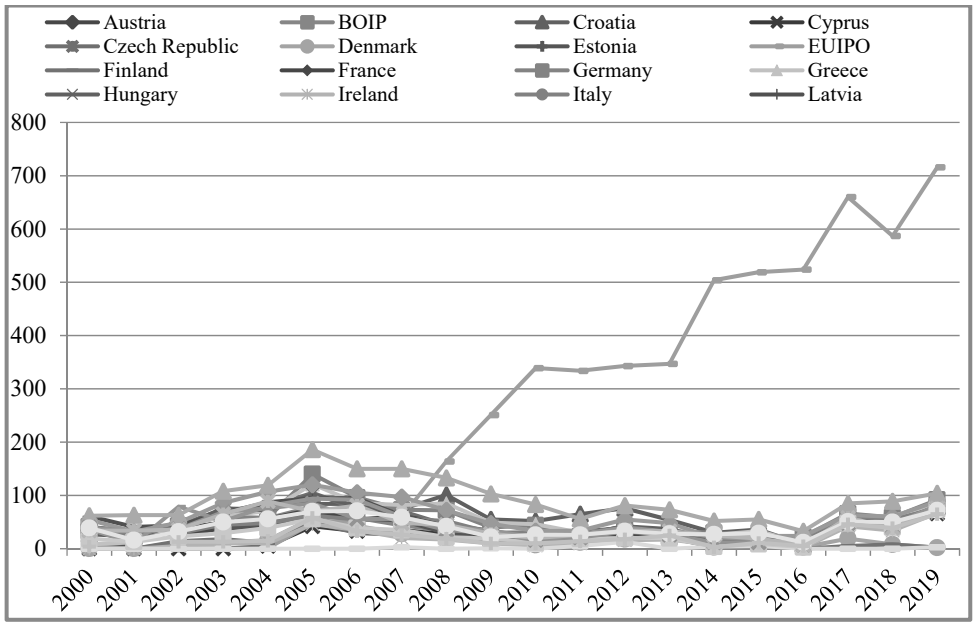
The trend is proven through its visualisation and the dynamics of registered trademarks by Bulgarian trademark owners in the EU Member States and registered EU TradeMarks (Community trademarks) via EUIPO for the period 2000 – 2019 is presented (figure 13).

After 2007, the number of registered trademarks via EUIPO grew progressively (with an average annual increase of 29.16% from 2007 till 2019) compared to the decreased number of registrations in the EU Member States. **The trend of increasing trademark registrations after Bulgaria's accession in the EU proves the hypothesis for a mutual commitment between trademark activity and the business environment conditions in which natural and legal persons operate.**

The access of Bulgarian trademark applicants to the single European market through a simplified application and trademark registration procedure expands the opportunities for the development of Bulgarian enterprises and provides equal conditions for carrying out their activities.

Figure 13

Number of trademark registrations from Bulgarian trademark applicants in the EU Member States and via EUIPO



Source: WIPO Statistic Data Center, Author's calculations.

Third Period: 2008-2011: There is a decline in trademark activity by Bulgarian and foreign trademark applicants and trademark owners on the territory of Bulgaria and by Bulgarian trademark applicants and trademark owners abroad. This fact is defined by the World Economic Crisis, which began in 2008. It led to a high degree of uncertainty and the environment for business development deteriorated. The key points of this period are related to increasing the bankruptcy degree of credit institutions (dates back to 2007), collapsing of stock markets and real estate markets, a gross world product decrease, the increase of product prices, record high values of gold and oil, growth of unemployment in some of the affected countries. Negative trends in the deterioration of the environment for business development also affected trademark activity and defined the reported decline in trademark applications during the World Economic Crisis of 2008, which again confirms the output of the hypothesis. The negative impact of the crisis on trademark activity is also confirmed by a WIPO report (2010, p. 26-28). The report also states that the trademark activity by the Madrid system is most affected. Prerequisites for this are sought in the reorientation of natural and legal persons to national markets.

Fourth period: 2012-2019: During that period, the total applicant activity (Bulgarian and foreign) is relatively stable. The activity of trademark owners is characterised by a lack of clearly outlined trends – we observe both an increase and decrease in activity. Since 2017 there has been a downward trend in the activity of Bulgarian and foreign trademark owners in Bulgaria.

The results of the analyses of trademark applicant activity and the activity of trademark owners on the territory of Bulgaria as well as the activity of Bulgarian applicants and trademark owners abroad for the period 2000-2019 allow for the following conclusions to be made:

1. There is an increased trademark applicant activity for the period 2000-2006, after which the number of applications for trademark registration on the territory of the country by Bulgarian and foreign trademark owners decreased.
2. In 2007, trademark owners changed their method of submitting trademark applications abroad. Until 2006, the number of trademark applications submitted through the Madrid System was constantly increasing, while direct applications were fewer. Since 2007, the trend sharply changed with an increase in the direct applications at the Bulgarian Patent Office and a decrease of trademark applications through the Madrid System.
3. There is a sharp decline in the number of trademark applications and trademark registrations in Bulgaria from 2008 to 2009, both from Bulgarian and foreign trademark applicants.
4. There is an increase in the number of trademark applications by Bulgarian citizens abroad, and this growth maintains a higher positive change of 22.99% for the period 2000 – 2007 and 15.09% for the period 2008-2019.
5. The highest trademark activity is observed in the application and registration of an "EU TradeMark" (Community trademark). For the period 2000-2007, the average annual change was 271.3% and from 2008 till 2019, trademark activity decreased but maintained positive growth of 11.03%.

As a result of the study, we have achieved the following:

- We presented existing studies in the field of trademarks related to the subject.
- We studied and analysed the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria for the period 2000-2019, on trademark applications and registered trademarks.
- We identified the countries in which Bulgarian trademark applicants and trademark owners are mostly interested.
- We identified the impact of legislative changes in the field of trademarks and unpredictable economic changes on trademark activity.
- We analysed the impact of business environment change in Bulgaria on trademark activity.

We can conclude that the study tasks have been completed and the objective has been achieved.

Some issues remain that are not included in this paper and would be the subject of future studies: other factors, in addition to the business environment conditions, affecting the trademark activity of natural and legal persons; the correlation "competitiveness index – trademark activity"; the relationship between the Nice Classification of trademarks and the economic sectors of Bulgaria.

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SUMMARIES

Rupal Chowdhary, Isha Joshi

ECONOMIC GROWTH AND TRADE OPENNESS: A CASE OF ASEAN 9

A popular opinion amongst economists is that trade openness leads to the economic growth of a country. However, this relationship is not that straightforward and sometimes inconclusive as well. While the theoretical literature states that opening up an economy increases trade, leading to the country's economic growth, the empirical findings greatly differ in many cases. This paper explores the impact that trade openness has on the economic growth of select ASEAN countries from 2008 to 2019. For this purpose, first, panel unit root tests have been employed to find out the stationarity of data. Then Pedroni and Kao residual cointegration tests are used to examine the long-run relationship between variables such as Gross Domestic Product (GDP), Gross Fixed Capital Formation (GFCF), Labour Force (LF), and Trade Openness (TO). Finally, long-run estimations have been conducted through FMOLS and DOLS and the causality of the panel is studied through the Dumitrescu Hurlin panel causality test. Our results show that trade openness has a positive impact on the economic growth of select ASEAN countries in the long run.
Keywords: Trade Openness; Economic Growth; ASEAN, Panel Cointegration; Granger Causality
JEL: F15; F14; F13

Anton A. Gerunov

PERFORMANCE OF 109 MACHINE LEARNING ALGORITHMS ACROSS FIVE FORECASTING TASKS: EMPLOYEE BEHAVIOR MODELING, ONLINE COMMUNICATION, HOUSE PRICING, IT SUPPORT AND DEMAND PLANNING

This article puts the problem of forecasting in economic and business situations under scrutiny. Starting from the premise that accurate forecasting is now a key capability for analyzing problems of business operations and public policy, we investigate the performance of alternative prediction methods that include both traditional econometric approaches as well as novel algorithms from the field of machine learning. The article tests a total of 109 different regression-type algorithms across five pertinent business domains – employee absenteeism, success of online communication, real estate asset pricing, support ticket processing, and demand forecasting. The results indicate that forecasting algorithms tend to produce a set of widely dispersed outcome, with some methods such as random forecast and neural network implementations being able to consistently generate superior performance. We further argue that forecast accuracy is not necessarily predicated upon computational complexity and thus, an optimization decision between the costs and benefits of using a certain algorithm can feasibly be made.
Keywords: forecasting; algorithms; random forest; neural network; regression; machine learning
JEL: C44; C45; C52; D81

Stefan Petranov, Dimitar Zlatinov, Milen Velushev, Lillyana Georgieva, Radostina Ivcheva

SHADOW ECONOMY AND PRODUCTION FACTORS: RESULTS FROM AN EMPIRICAL ANALYSIS WITH A PANEL DATA SET

The main objective of this article is to examine the existence of a relationship between the shadow economy and macroeconomic factors of production. Based on a dataset of 50 countries over the

period from 1991 to 2015, we find that the size of the shadow economy is inversely related to all three macroeconomic production factors – labour, capital stock and total factor productivity. This result provides an explanation for the fact that, in many cases, the shadow economy has a negative impact on economic development. We also find that the strength of the relationship is not the same for all factors of production. While for capital and for total factor productivity, the inverse relationship with the size of the shadow economy is strong, in the case of labour, this relationship exists, but it is weaker. The reason for this is the specific nature of many of the shadow practices, related to undeclared work, which allow such an effect.
The results of the present study could provide arguments for the formation of effective economic policy measures to limit the negative effects of the shadow economy.
Keywords: shadow economy; undeclared work; economic development; GDP per capita; GDP per capita growth rates; macroeconomic factors of production
JEL: E22; E24; E26; O17; O43

Emilia Chengelova, Milena Angelova

FACTORS DETERMINING THE UNDECLARED WORK IN BULGARIA

The study presents empirical data gathered by recent studies on the factors that determine undeclared work in the Bulgarian economy. The relative weight and the specific functions of six categories of factors have been thoroughly analysed: 1) legislative, 2) situational, 3) mistrust and deficit of prestige to the state, 4) national psychology, 5) economic and 6) personal and family situation. The paper argues that the factors determining undeclared work have complicated and dynamic nature, but if a correct methodological approach is applied, they can be empirically studied and explained. The knowledge of the factors determining the undeclared work provides a basis for contemplating its genesis, nature and dissemination – especially in the case of societies in transition. The better the knowledge and understanding of the factors that determine undeclared work, the more effective and successful are selected and designed approaches and measures to limit and prevent it.
Keywords: undeclared work; gray practices; public opinion
JEL: E26; O17; D73; C18

Munazah Nazeer, Uzma Tabassum

RELATIVE ATTRACTION OF CITIES AND INTER-CITY MIGRATION – AN ANALYSIS USING THE GRAVITY SETUP

The study provides both descriptive as well as regression analysis explaining the relative dominance of one city (urban area) over another to attract migrants from other cities. The empirical analysis reveals that the relative size of the informal sector in a city and the magnitude of the flow of foreign direct investment towards these cities foster in-migration. Empirical assessment is based on two estimation techniques, the Generalised Method of Moments (GMM) and Tobit regression analysis. The techniques examine migration patterns across 14 major cities focusing over a time period of 7 years (2005-2006 to 2012-2013). It is found that the labour market variables (expected wages, employment, and unemployment rate) and regional economic contribution have a strong significant influence on inter-city migration flows. Distance, as suggested by the gravity model, and years of education, reflecting human capital, have a significant positive impact on migration flows across urban-urban (cities) regions. Further positive and negative amenities attached to the region significantly influence migration flows towards these areas, supporting theories of location. Migration is an equilibrating response to existing disparities and disequilibrium among regions and across cities. The concentration of economic activities generates employment opportunities, which are a strong

driver of migration and development of the region. The study proposed that the government should opt for horizontal urbanisation rather than vertical urbanisation pattern. Hence, if the government wants to target the development of various regions, it should divert economic activities towards the targeted region and cities.
Keywords: Urban-urban migration; Pakistan; Location amenities; Type of cities; Tobit
JEL: J61; J68; R12

Ivanka Mihaylova

WORKPLACE CONFLICT: EVIDENCE FROM BULGARIA

The paper presents the results of a study on workplace conflict in Bulgarian organizations. The data were collected by means of a questionnaire among 708 employees. Findings reveal that most Bulgarian employees have to deal with conflict at work to some extent and two in ten employees do so always or frequently. Conflict is most common between entry-level/front-line roles and between managers and their reports. The primary causes leading to disagreements at work are stress, personal clashes and heavy workloads. Employees in Bulgaria mostly often spend 2.5 hours per week dealing with conflict, equating to approximately $1.4 billion in paid hours in 2020. The paper provides original findings on workplace conflict, and therefore, it contributes to the research of conflict in Bulgarian organizations.
Keywords: conflict management; workplace conflict; Bulgaria
JEL: M12; M19

Oxana Bezler, Teodor Sedlarski

QUANTITATIVE ANALYSIS OF THE INTERACTION OF THE LABOR MARKET AND THE HIGHER EDUCATION MARKET (ON THE EXAMPLE OF KAZAKHSTAN)

The importance of the interaction of the labour market and the higher education market is beyond doubt. The analysis of scientific articles has shown that this type of interaction is considered by scientists depending on the direction of research. Only a few works are devoted to the quantitative analysis of the interaction of these domestic markets. The task is complicated by the fact that today there is no clear methodology for quantitative analysis of the interaction of subjects of different markets. The authors made an attempt to adapt the analysis methodology proposed by Russian scientists. The methodology used is based on an economic and statistical analysis of the interaction of the labour market and the higher education market, with the determination of the type of interaction under the influence of individual factor indicators of these markets and the use of systematic and structural group data. As a result of quantitative analysis, the lack of elasticity between the supply of universities and the needs of the labour market was revealed. The imbalance has led to the fact that in the sectors of the economy of Kazakhstan, there is a shortage in one industry and a surplus of personnel with higher education in another. The results of this study are important for stakeholders, such as politicians, universities, to solve the problems of unemployment among recent graduates.
Keywords: labour market; demand of labour market, higher education market; proposals from university graduates; interaction; types of interaction of different markets
JEL: A10; I2; J6

Ihor L. Leonidov, Daria K. Kovalchuk, Valentyna K. Lebedeva, Victor N. Tarasevich

ECONOMIC ASPECTS OF TRANSFER OF EDUCATIONAL TECHNOLOGIES AT CONTEXT OF APPROPRIATION OF INTELLECTUAL PRODUCT

Results of research of specific of transfer of educational technologies as a demonstration of them appropriation as of intellectual product was represented in the article. The looks of Ukrainian and foreign scientists on the place of educational technologies in the composition of intellectual capital was analysed. The motives of appropriation of the intellectual product as factors of the mechanism of governance of transfer of educational technologies were defined. On a functional level, this mechanism formalises motives of creation of an environment of transfer of educational technologies for a partnership of all interested sides was discovered. Directions of transfer of educational technologies obtained actualisation on the basis of analysis of the marked motives. Composition of subjects of transfer of educational technologies per their roles as seller, legislator (government authorised organs), technological broker, buyer, was concretised. The contradiction of priorities among economic interests, motives and actions at a combination of roles within one subject was revealed. The factors of external appropriation of the intellectual product by subjects on the stages of "preparation – legitimation – restriction" were found out. The common and distinctive traits of the stages of "preparation – legitimation – restriction" were found. The basic criteria of transfer of educational technologies on the stages of preparation, legitimation and restriction were proposed. The criteria of institutionalisation of external interactions of subjects of the transfer of educational technologies were formalised. Updating of an educational network, including the use of open platforms of informatively-communication technologies and cloudy servers, was proposed. Actual directions of further researches of transfer of educational technologies, methodologies of determination of their market prices with the use of modern ICT, development of the special economic-mathematical models of such estimation was delineated.
Keywords: intellectual product; ownership and appropriation of intellectual product; infrastructure of transfer of educational technologies; informatively-computer technologies
JEL: B41; D11; D23; I25; J24; O34; P26

Ventsislava Nikolova-Minkova

BULGARIAN AND FOREIGN TRADEMARK ACTIVITY IN BULGARIA AND BULGARIAN TRADEMARK ACTIVITY ABROAD FOR THE PERIOD 2000-2019

This study presents the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria, measured by the number of trademark applications and the number of registered trademarks for the period 2000 – 2019. We also show Bulgarian trademark activity abroad. Some of the existing trends in trademark research and their role as an indicator of the business development environment are also considered. We have defined the impact of legislative changes on trademark activity during the examined period. We have confirmed the existence of a relationship between the trademark activity and the state of the business environment.
Keywords: trademark activity; applicant activity; trademark registration; foreign trademark activity; state of business environment
JEL: F23; M31; O34