ИНСТИТУТ ЗА ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ НА БЪЛГАРСКАТА АКАДЕМИЯ НА НАУКИТЕ

Икономически Изследвания

ECONOMIC STUDIES

CONTENTS

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LABOUR PRODUCTIVITY CONVERGENCE OF CEE COUNTRIES WITH THE EURO AREA – EVIDENCE AT AGGREGATE AND SECTORAL LEVEL[2]

The paper aims to verify the existence of labour productivity convergence of Central and Eastern European (CEE) countries with the euro area over the period 2000-2020 at aggregate and sectoral levels. For this purpose, the study uses the beta and sigma convergence methods. The application of the ordinary least squares fixed effects panel regression proves the existence of beta convergence of the countries of Central and Eastern Europe with the euro area at both aggregate and sectoral levels. Stronger convergence is observed in the agriculture, forestry and fishing sector and in the industry sector (including construction) than at aggregate level. The weakest convergence is observed in the services sector. The results of the linear trend model of the coefficient of variation for the σ-coefficient confirm the hypothesis of sigma convergence between the average level of labour productivity of the countries of Central and Eastern Europe and the average of the euro area at aggregate and sectoral levels. At the same time, the differences in the degree of convergence between the three sectors resulting from the application of beta convergence are confirmed. The comparison according to the degree of sigma convergence with the euro area in the different countries of Central and Eastern Europe shows stronger convergence in the countries that have adopted the euro than in the countries outside the euro area, which is considered to be a consequence of the Europeanisation effect.
Keywords: Labour productivity convergence; Beta and Sigma convergence; countries from Central and Eastern Europe; Euro area; Panel regression model
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1. Introduction

Labour productivity is an important indicator of the level of economic development achieved. It reflects both productivity through the use of labour and the contribution of other factors of production and technologies used. At the same time, labour productivity is a main characteristic of the labour market and is inextricably linked to income in society. According to neoclassical and endogenous growth theory, labour productivity plays a key role in achieving economic growth and improving living conditions in the long run. In this respect,

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the study of labour productivity convergence is an important part of the analysis of real convergence, together with the study of income convergence. In this context, positive labour productivity dynamics and convergence are identified as a factor for real convergence (e.g. Schadler et al., 2006;Grela et al., 2017;Adomnicai, 2018, etc.).

The analysis of the real convergence of the Central and Eastern European (CEE) countries to the euro area or to the old Member States has aroused academic interest over a long period of time. It is well understood in the literature that nominal convergence should be accompanied by real convergence of incomes and labour productivity in order to increase the effectiveness of the monetary policy. In this context, and in view of the adoption of the euro in Bulgaria and other CEE countries that are not yet part of the euro area, it is important to achieve convergence of labour productivity with the euro area, as this facilitates the convergence of real incomes and is an indicator of similarities in the technological principles used.

Different dynamics and magnitudes of labour productivity can be observed in the distinct sectors of the economy. This is due to their specific characteristics in terms of the combination and quantity of factors of production used, the technological principles applied, their share in the economy, etc. Changes in labour productivity at the sectoral level, as well as the presence of structural change, generally characterised by the transition of the economy from a dominant share of agriculture through a dominant share of industry to a dominant share of services, may influence the dynamics of labour productivity in the economy as a whole. In this respect, the identification of trends in individual sectors of the economy reveals what the drivers of labour productivity dynamics are at the aggregate level.

The study of labour productivity convergence between the CEE countries and the euro area at sectoral level addresses, on the one hand, the issue of real convergence and, on the other hand, partly the question of convergence of certain structural characteristics of the economy. Structural changes in the economies of the CEE countries are reported for the period 2000-2020, which are consistent with trends in the euro area. The share of value added and employment in the agriculture, forestry and fishing sector is declining and is higher in CEE countries on average than in the euro area throughout the period 2000-2020. In industry, the share of the sector in gross value added and employment is declining in the euro area and in the CEE countries on average. At the same time, the share of the sector is higher in the CEE countries on average than in the euro area during the period under investigation. Opposite trends can be observed in the services sector. On the one hand, the share of employment in this sector is growing in the CEE countries and in the euro area. On the other hand, the share is higher in the euro area than in the CEE countries.

Differences in labour productivity between countries determine variation in the competitiveness of economies and comparative advantages in international trade, which show peculiar differences in individual economic sectors. Labour productivity in the CEE countries has traditionally lagged behind that of the euro area. In 2020, the average in the CEE countries was only 37.9% of the value in the euro area. At the same time, there are differences in the individual sectors (agriculture, forestry and fishing sector – 46.3% of euro area labour productivity, industry (including construction) sector – 34.3% of euro area labour productivity, services sector – 40.5% of euro area labour productivity), but on average the

CEE countries do not reach 50% of euro area labour productivity in any of the sectors. However, some countries reach more than 50% of the euro area average in 2020 – Slovenia and Slovakia at the aggregate level, Slovakia, Estonia and Czechia in the agriculture, forestry and fishing sector, Slovenia in the industry sector and in the services sector. The lowest labour productivity as a percentage of the euro area is reported from countries outside the euro area, namely Bulgaria and Romania. These results indicate some differences between the countries of CEE in terms of labour productivity levels and convergence with the euro area, largely due to the distinct levels of development and integration into the European economy.

The existence of common policies, institutions and regulations, as well as the functioning of the Single market and Monetary union in the European Union, provide an appropriate framework for analysing labour productivity convergence between countries. Despite the reported trends and differences in labour productivity between the CEE countries and the euro area over the period 2000-2020, there has been an improvement in the position of this group of countries. The growth rate of labour productivity in the CEE countries, on average, as a percentage of the euro area for this period is 50.4%, which is a significant improvement. Facilitating factors for convergence between CEE countries and the euro area could be the integration and functioning of the economies in the European single market with all the consequences that this entails, the pursuit of common objectives and priorities of the Union, the transfer of knowledge and technologies, the identical structural change in the economies, the impact of the EU structural and investment funds, etc. The economies of the countries that have adopted the euro are even more interdependent, which may, to some extent, lead to greater convergence with the euro area. According to Bower and Turrini (2010), the EU accession has accelerated the catching-up process and improved the institutions of the new Member States' laggards.The impact of EU and euro area membership on various aspects of Member States' development is known in the literature as the "Europeanisation effect" and can be seen as a factor facilitating convergence between countries, but not equally strong for all CEE countries.

The Europeanisation effect can influence convergence between the CEE countries and the euro area through various transmission mechanisms. If labour productivity improves in one sector in an EU country as a result of R&D and the new knowledge is transferred to the same sector in another country, this leads to sectoral convergence in labour productivity. At the same time, it is also possible that new knowledge in one sector is transferred to another sector, increasing productivity at the aggregate level. In this respect, the standardisation of technological principles can manifest itself as a convergence factor both in aggregate labour productivity and at the sectoral level. There is free movement of capital and labour within the EU and channels for the diffusion of technology and innovation. As trade between countries increases, relations between firms intensify. Firms from more backward countries are able to copy firms from more developed countries in terms of production processes and technology, management techniques, etc. In addition, the increasing trade in capital and intermediate goods leads to standardisation of production technologies in companies, and the increasing mobility of labour within the Single market facilitates the transfer of new ideas between countries. There are also some factors, such as institutions and national characteristics, that affect labour productivity, regardless of the economic sectors. The

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psychology of the nation, cultural characteristics and traditions, etc., can be perceived as such.

The aim of the article is to investigate the existence and degree of convergence of labour productivity of the CEE countries with the euro area by applying the sigma and beta convergence methods. An important research question is whether the trends that characterise the productivity of the economy at the aggregate level can also be found in the individual sectors of the economy and what specific characteristics exist at the sectoral level. In this respect, this paper contributes to the literature by providing empirical evidence on the presence or absence of unconditional beta and sigma convergence of labour productivity at both aggregate and sectoral levels of CEE countries to the euro area over a 21-year period (2000-2020). The study presents an original beta convergence approach based on time series analysis and the use of the euro area as a benchmark (common steady-state). At the same time, it investigates the impact of the Europeanisation effect on the degree of convergence by highlighting the specificities of each CEE country.

The paper is structured as follows. The next section provides a brief review of relevant literature in the field. The third part describes the methodology adopted. The fourth part presents the main findings of the application of beta and sigma convergence, aiming to verify the hypothesis of the existence of labour productivity convergence of countries of Central and Eastern Europe with the euro area at aggregate and sectoral levels. The last part presents the main conclusions drawn from the analysis.

2. Literature Review

The empirical examination of labour productivity convergence at the aggregate and sectoral levels is a topic of academic interest, as it plays an important role in revealing trends in real convergence. This type of studies are often conducted in the context of the integration of countries within the European Union, as such processes are expected due to the Europeanisation effect and the strong interdependence of Member States' economies. The results of the studies on labour productivity convergence do not lead to unambiguous conclusions, which is mainly due to the different periods of investigation and the methodology chosen.

The study by Bernard and Jones (1996) is one of the founders in this field. It examines labour productivity convergence at an aggregate level and in six economic sectors (agriculture, mining, manufacturing, electricity/gas/water, construction and services) in 14 OECD countries for the period 1970-1987. By applying the beta and sigma convergence methods, aggregate labour productivity was found to converge across countries. The application of the beta convergence method shows that this trend masks growing differences in individual sectors. In manufacturing, the study finds evidence of divergence or a weak convergence process. Similar results are obtained for agriculture and mining. At the same time, labour productivity in the services sector shows strong convergence between the countries studied. Convergence also exists in the electricity/gas/water and construction sectors. According to Bernard and Jones (1996), the strong convergence in the services sector, together with the structural change characterised by the declining share of industry in all countries, is the main

factor for the existing convergence of labour productivity at an aggregate level. The authors explain the lack of convergence in certain sectors by specialisation based on comparative advantages. Such an analysis is particularly interesting in an economic integration project such as the European Union. Similar studies have been conducted by a number of authors (Doyle, O'Leary, 1999; Sondermann, 2012; Naveed, Ahmad, 2016, etc.). There are also studies that examine the convergence of a particular country with the EU, the EU-15 or the euro area (Doyle, 1997; Wojciechowski, 2016; Adomnicai, 2018; Micallef, 2020; Stefanova, 2021a; Stefanova, 2021b; Raleva et al., 2022, etc.).

Doyle and O'Leary (1999) examine whether there is convergence in labour productivity between 11 EU countries over the period 1970-1990 at the aggregate level and across the three economic sectors (agriculture, including agriculture, forestry and fisheries; manufacturing, including manufacturing, mining and quarrying; and services, including electricity, construction, trade, transport, finance, community and government services). Despite the differences in the scope of the countries studied and the methodology used, the results of the study confirm the conclusions of Bernard and Jones (1996), who find greater convergence between countries in labour productivity at an aggregate level than in labour productivity at a sectoral level. Doyle and O'Leary (1999) confirm that these results may be due to the same structural changes across countries. At the same time, they find that labour productivity diverges in the industry and agriculture, forestry and fisheries sectors, while in the services sector, there is a convergence between the countries studied. According to the authors, structural change in two or more countries, associated with a reduction in the share of the less productive sectors in the economy, leads to higher labour productivity in the economy at an aggregate level and to a convergent trend in this area rather than at the sectoral level. It should be noted, however, that there is also empirical evidence for the opposite trend. This is the conclusion of a study by Sondermann (2012), which examined the convergence of labour productivity in twelve euro area countries over a much longer period of time (1970 to 2007) and at a more disaggregated level of economic activity. The analysis covers eleven sectors and 11 sub-sectors of industry according to the classification NACE Rev. 1.1. The study is based on the beta convergence method and the panel unit root test model and draws different conclusions than Bernard and Jones (1996) and Doyle and O'Leary (1999). The results show no convergence between the countries studied in terms of labour productivity at the aggregate level and show a low degree of convergence at the sectoral level. On the other hand, Sondermann (2012) also demonstrates divergence in manufacturing, but at a disaggregated level, it shows that the opposite trend is observed in some low-technology sub-industries. In the services sector, the empirical results show convergence in transport and communications, financial services and non-market services. Convergence is also observed in agriculture.

A more recent study by Naveed and Ahmad (2016) comes to different conclusions. The authors examine the convergence of labour productivity at an aggregate level and in six economic sectors between 19 European countries for the period 1991-2009. By applying the method of beta convergence, the study concludes that there is a convergence of labour productivity between countries at an aggregate level and in individual sectors.

Peshev and Pirimova (2020) examine the presence of beta and sigma convergence processes (measured by calculating coefficients of variance) in labour productivity between NUTS2

regions in all CEE member states during the period 2000-2016. The results demonstrate the presence of a beta convergence process and a decrease in differences in labour productivity in NUTS2 regions in all CEE member states during the period studied, indicating sigma convergence.

The factors behind the convergence process of labour productivity may be different. Structural change (as measured by changes in employment in different economic sectors) is considered one of these factors because of its impact on the dynamics of labour productivity (e.g. Ark, 1995; Naveed, Ahmad, 2016). According to Ark (1995), the movement of workers from less productive sectors to higher productive sectors can lead to an overall increase in labour productivity in the economy. In this context, it is pointed out that structural change is seen as a factor that has a stronger impact on labour productivity at an aggregate level than on sectoral labour productivity. If there is a similar structural change in two or more countries, it is possible that this will lead to a convergence of labour productivity at an aggregate level.

The importance of the diffusion of technology between countries for the convergence of labour productivity between them has been recognised by a number of authors (e.g. Wacziarg, 2004; Barro, Sala-i-Martin, 1997). Technology transfer can lead to a reduction in labour productivity differences between CEE countries and the euro area. In this respect, the degree of convergence depends on the extent to which technologies are transferred and absorbed within the EU. This is what most theories of economic growth predict – the openness of economies and the spillover effects of R&D investment will contribute to convergence between countries. The question of interest is whether this dependence exists and accordingly affects the convergence process of labour productivity between CEE countries and the euro area, and whether it also exists at the sectoral level. Bernard and Jones (1996) point out that in sectors where comparative advantages lead to a specialisation of the countries, labour productivity convergence between them is not to be expected.

Sondermann (2012) distinguishes between the factors of labour productivity convergence in the industrial sector and in the services sector in the context of European integration. According to him, the process of European integration reduces barriers to capital, labour and knowledge, which stimulates labour productivity convergence in the industrial sector, where technology transfers between EU countries are facilitated. As regards the services sector, progress in the development of information and communication technologies and the reduction of regulations in some areas have had a positive impact on productivity growth and convergence between countries.

A review of some of the existing empirical studies on labour productivity convergence has shown that differences are found at an aggregate level and in individual sectors of the economy. This paper offers a different approach to examine the convergence of CEE countries by assessing their convergence with the euro area as a benchmark.

3. Methodology

The paper examines the existence of convergence/divergence of labour productivity of CEE countries to the euro area as a benchmark at both aggregate and sectoral levels over the period 2000-2020. For this purpose, real labour productivity is calculated for each economic sector and for the economy at an aggregate level. The three main economic sectors are defined according to the classification NACE Rev.2 (revision 2008): agriculture, forestry and fishing sector – activity A, industry (including construction) by activities C to F and services by activities G to U. Real labour productivity is calculated as a ratio between gross value added (GVA) at constant prices (chain-linked volumes 2010) and employment for each CEE country and the euro area (19) on average for each year of the period under review. Employment is expressed in thousands of hours worked, as this indicator is more precise than employment, measured as thousand people. The data source is Eurostat. The sigma and beta convergence approaches, first introduced by Barro and Sala-I-Martin (1991) in the study of income convergence, are used to study the convergence of CEE countries to the euro area. Because the process of convergence to the euro area as a common steady state is taken into consideration, the research tests for unconditional (absolute) beta convergence rather than conditional beta convergence. Conditional convergence is not examined, because it implies that each country has its own steady state to which to converge.

The application of the beta convergence approach in this article differs from the classical methodology in similar studies, as it examines the convergence of the CEE countries with the euro area (19) as a benchmark using a time series approach and an ordinary least squares (OLS) fixed effects panel regression. Three similar approaches exist in the literature, but they are used to study structural convergence or convergence in certain economic sectors (e.g. Gugler, Pfaffermayr, 2004; Höhenberger, Schmiedeberg, 2008; Stefanova,Peshev, 2021, Raleva et al., 2022). The adequacy of the fixed effects models is confirmed by conducting a Hausman test.

Through the following formal representation of a fixed effects model, four separate models are applied at an aggregate level and for the three economic sectors:

$$Y_{it} = \alpha_i + \beta X_{it-1} + u_{it} \tag{1}$$

where:

Y_{it} is the dependent variable for country "i" at year "t";

α_i – country "I" specific, time-invariant individual factors containing constant and fixed effects;

β – kx1 Matrix of parameters representing the relationship between the explanatory variable (X_{it-n}) and the dependent variable (Y_{it});

X_{it-1} – the explanatory variable for country "i" at year "t-1";

u_{it} – the error term.

For the application of the beta convergence approach, the following equation is used:

$$\frac{LP_{sit}/LP_{sit-1}}{LP_{EAst}/LP_{EAst-1}} = \alpha_i + \beta \, \frac{LP_{sit-1}}{LP_{EAst-1}} + u_{it} \tag{2}$$

where:

LP_{sit}/ LP_{sit-1} is the quotient (annual change) of labour productivity in country "i" in sector "s" at year "t" and labour productivity in country "i" in sector "s" at year "t-1";

LP_{EAst}/LP_{EAt-1} – the quotient (annual change) of labour productivity in euro area in sector "s" at year "t" and labour productivity in the euro area in sector "s" at year "t-1";

LP_{sit-1} – labour productivity in country "i" in sector "s" at year "t-1";

LP_{EAt-1} – labour productivity in the euro area in sector "s" at year "t-1";

α_i – country "i" specific, time-invariant individual factors containing constant and fixed effects;

β – the kx1 matrix of parameters, representing the association between $\frac{LP_{sit-1}}{LP_{EAst-1}}$ and the $\frac{LP_{sit}/LP_{sit-1}}{LP_{EAst}/LP_{EAst-1}}$;

u_{it} – the error term.

The presence of beta convergence generally means that the change in an indicator is negatively affected by its initial value. Thus, a larger earlier value leads to a smaller change. When examining the convergence of labour productivity of the CEE countries with the euro area as a benchmark at aggregate and sectoral levels in this paper, the logic described is maintained. In this sense, the ratio between the annual change in labour productivity in the CEE countries and the annual change in labour productivity in the euro area should be negatively related to the ratio between the value of labour productivity in the previous year in the CEE countries on average and labour productivity in the euro area in the previous year. The ratio, which is the explanatory variable, provides information on the extent of the differences between the CEE countries and the euro area. This approach to measuring the gap is adopted because it avoids negative values of the independent variable.

The application of the beta convergence approach using equation (2) aims to find out whether countries with a higher (lower) labour productivity in year t-1 show a stronger decline (increase) compared to the euro area in year t. In particular, beta convergence occurs if the ratio between labour productivity in the CEE countries and labour productivity in the euro area in year t-1 has a significant and negative impact on the ratio between the annual changes in labour productivity in the CEE countries and the annual change in labour productivity in the euro area.

Applying the sigma convergence approach, this study examines whether labour productivity gaps between CEE countries and euro area have narrowed over the period 2000-2020. To measure the extent of the differences, coefficients of variation (as the ratio between the standard deviation and the mean in percents) are calculated between the values reported in each of the CEE countries and the euro area at aggregate and sectoral levels over the

researched period. In addition, a coefficient of variation between the average for the CEE countries and the euro area is calculated for each year of the period under consideration. The use of coefficients of variation is a standard approach to detect the presence of sigma convergence in income and other economic indicators.

The sigma convergence approach is applied by evaluating the trend line of the coefficient of variation of labour productivity by estimating the following linear trend model:

$$CV_{it} = \alpha_i + \sigma_t + u_{it} \tag{3}$$

where:

CV is coefficient of variation between the country "i" and the euro area at year "t". It is the dependent variable for country "i" at year "t";

α_i – constant;

σ – parameter, representing the association between the explanatory variable (t) and the dependent variable (CV_{it});

t – a time period variable, which is the explanatory variable;

u_{it} – the error term.

For sigma convergence to occur, there must be an inverse relationship between the independent and explanatory variables. Accordingly, the coefficient of variation must be negatively related to the time period and the trend line of CV must have a negative slope. The lower the value of the parameter σ (correspondingly higher its absolute value), the stronger the reported sigma convergence, indicating a larger decrease in the differences between the respective country and the euro area. Forty-four separate equations are estimated – for the CEE countries on average and separately for each of the ten countries at aggregate level and in the three economic sectors. The analysis of sigma convergence is complemented by the derivation of the dynamics of the coefficients of variation over the period 2000-2020.

4. Results and Discussion

The existence of similarities between countries in terms of institutions and their national characteristics can be seen as supporting labour productivity convergence between countries. In this respect, the analysis of labour productivity convergence of CEE countries to the euro area at the aggregate and sectoral levels should take into account the impact of the initial conditions in the countries – qualitative and quantitative characteristics of the factors of production, technology and competitiveness of the economies, etc. The countries examined in this article are characterised by similar conditions at the beginning of the period, with much smaller differences between them than between individual countries or CEE countries on average and the euro area (Figure 1).

In the European Union, there has traditionally been a gap between the Member States in terms of labour productivity, with the CEE countries showing the least favourable trends in the EU.

The value of the indicator is below the EU average in all CEE countries throughout the 2000-2020 period. In contrast, labour productivity in the old Member States (EU-14) is above the EU average with a few exceptions (some Mediterranean countries).

In 2020, Bulgaria had the lowest value of labour productivity both at an aggregate level and in the three sectors of the economy. At the end of the period, the highest labour productivity is reported by the countries that are members of the euro area and Czechia. For some countries, such as Croatia, the position among the other CEE countries deteriorates in 2020 compared to 2000 (Table 1).

Figure 1

Differences (Coefficient of variation) in labour productivity in 2020 (in %)
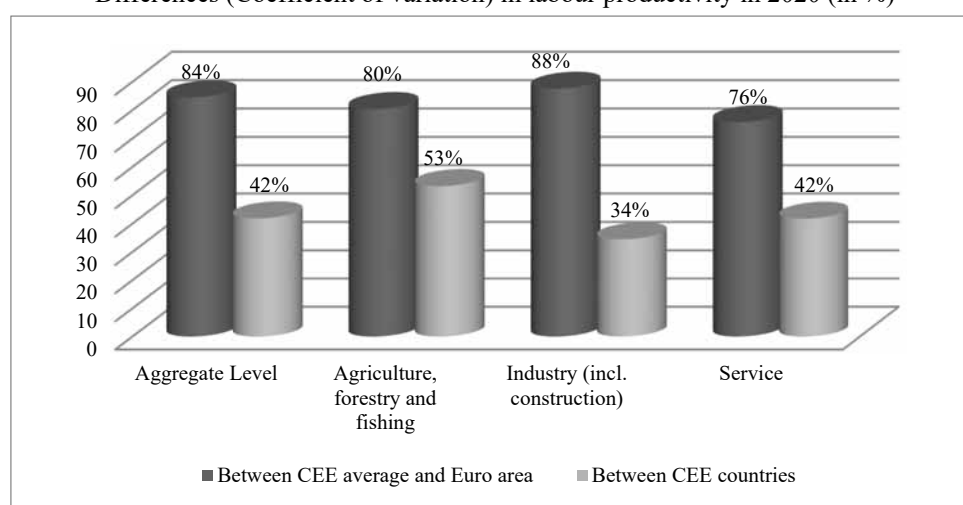
Source: Author's calculations based on Eurostat data.

Table 1

Labour productivity in the countries from Central and Eastern Europe and the euro area

Country	Aggregate Level		Agriculture, forestry and fishing sector		Industry (including construction) sector		Services sector	
	2000	2020	2000	2020	2000	2020	2000	2020
Bulgaria	3.9	6.8	1.8	2.0	3.97	6.6	5.0	8.3
Czechia	11.2	18.5	5.6	10.2	9.42	17.7	13.4	19.4
Estonia	7.9	15.9	4.0	13.0	6.71	15.6	9.2	16.2
Croatia	10.1	13.2	4.0	6.9	9.00	11.7	12.4	14.6
Latvia	5.5	12.7	2.1	7.4	6.17	12.3	6.5	13.5
Lithuania	6.3	14.3	1.8	7.0	6.02	16.5	8.0	14.2
Hungary	8.6	14.1	2.6	7.9	8.61	13.9	10.3	14.8
Poland	7.2	13.2	1.5	3.1	7.19	13.3	9.3	14.8
Romania	3.7	9.9	0.8	2.8	4.88	10.4	7.5	12.3
Slovenia	15.3	23.2	2.6	5.6	13.61	24.3	20.9	25.2
Slovakia	10.2	19.6	2.1	13.3	7.90	20.9	13.0	19.2
CEE average	8.2	14.7	2.6	7.2	7.59	14.8	10.5	15.7
EU-27	26.7	33.3	5.4	10.8	26.17	34.8	30.5	34.6
Euro area (19)	32.4	38.7	9.5	15.5	32.26	43.3	34.7	38.8

Source: Author's calculations based on Eurostat data.

Labour productivity in the three sectors of the economy shows certain differences due to the specific characteristics of the factors of production used, the technological principles applied and the organisation of the production process. In all the countries of Central and Eastern Europe and in the euro area, labour productivity is traditionally lowest in the agriculture, forestry and fishing sector (Table 1). However, this tendency, combined with the limited share of the sector in the economy in all countries, may have a positive impact on the dynamics of labour productivity at an aggregate level.

Despite relatively lower labour productivity, the agriculture, forestry and fishing sector is significantly modernised between 2000 and 2020, with a higher labour productivity growth rate in 2020 (compared to 2000) than in industry and services both in the euro area and CEE countries on average. This trend is also observed in most of the countries considered, with the exception of Bulgaria and Czechia (Figure 2). At the same time, in the countries of Central and Eastern Europe, there is a sharp decline in employment in this sector, which is more pronounced than in the industry sector. This confirms the thesis of Wacziarg (2004) that the relationship between changes in the share of employment in the sector and changes in labour productivity is negative and that when labour productivity increases in a given sector, employment in that sector tends to decrease.

Figure 2

Labour productivity growth rate in 2020 (compared to 2000) (in %)
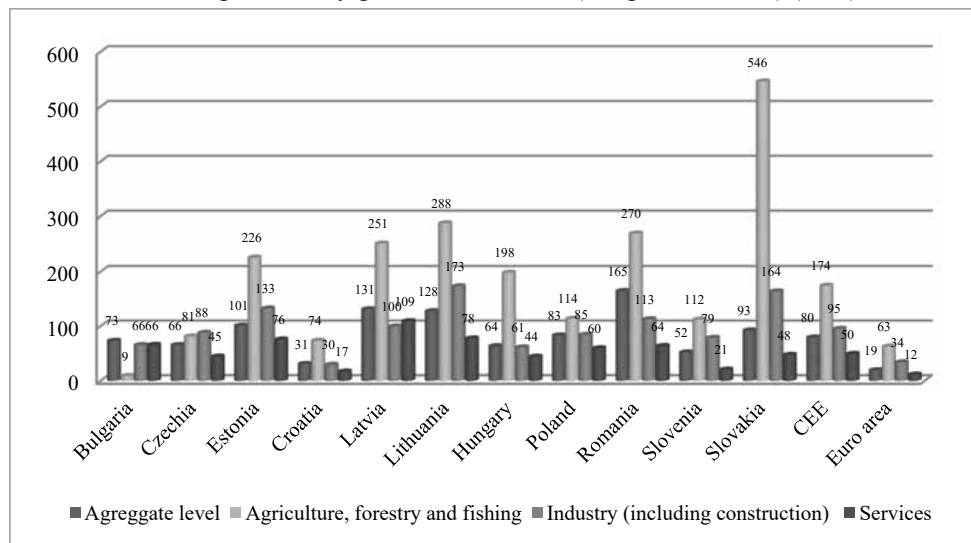
Source: Author's calculations based on Eurostat data.

With the exception of two euro area Member States, Lithuania and Slovakia, labour productivity in 2020 is higher in services than in industry in CEE countries, whereas the opposite trend is observed in the euro area after 2010 (Table 1).

In all CEE countries, the growth rate of labour productivity at the aggregate level is higher than in the euro area, indicating convergence with the euro area. This trend is repeated in the

three sectors of the economy, with few exceptions. In Bulgaria, the growth rate of labour productivity in the agriculture, forestry and fishing sector and in Croatia, the value of the indicator in the industry sector are lower than in the euro area (Figure 2). These are the two countries that joined ERM II in 2020.

The application of fixed effects panel ordinary least squares panel regression proves the existence of beta convergence between the countries of Central and Eastern Europe and the euro area over the period 2000-2020, both at aggregate and sectoral levels. This is evidenced by the coefficients before the explanatory variable (significant at a 1% significance level), which have a negative sign (Table 2). The results show that there is a statistically significant and negative impact on the ratio between labour productivity at time "t-1" in the CEE countries and the same indicator in the euro area on the ratio between the annual change in labour productivity in the CEE countries at time "t" and the similar indicator in the euro area. Therefore, the existence of greater differences with the euro area in labour productivity leads to more significant growth of the indicator in the CEE countries compared to the euro area.

Table 2

Fixed-effects panel ordinary least squares regression results for b-convergence

Aggregate Level				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.139050	0.014273	79.80676	0.0000
X (expl.var.)	**-0.358073**	0.043681	-8.197463	0.0000
CorrelatedRandomEffects – HausmanTest Testcross-sectionrandomeffects				
TestSummary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
Cross-sectionrandom	36.101101	1	0.0000	
Agriculture, forestry and fishing sector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.245666	0.033605	37.06736	0.0000
X (expl.var.)	**-0.547456**	0.084115	-6.508401	0.0000
CorrelatedRandomEffects – HausmanTest Testcross-sectionrandomeffects				
TestSummary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
Cross-sectionrandom	39.374888	1	0.0000	
Industry (including construction) sector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.171908	0.021688	54.03550	0.0000
X (expl.var.)	**-0.498349**	0.070501	-7.068720	0.0000
CorrelatedRandomEffects – HausmanTest Testcross-sectionrandomeffects				
TestSummary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
Cross-sectionrandom	39.897350	1	0.0000	
Services sector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.141491	0.025975	43.94654	0.0000
X (expl.var.)	**-0.349770**	0.072790	-4.805182	0.0000
CorrelatedRandomEffects – HausmanTest Testcross-sectionrandomeffects				
TestSummary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
Cross-sectionrandom	15.501108	1	0.0001	

Source: Application of the models in E-views based on Eurostat data.

According to the results of the study, the strongest beta convergence is reported in the agriculture, forestry and fishing sector, followed by the industry sector (including construction). This is reflected in the higher absolute values of the coefficient before the independent variable. Interestingly, beta convergence at the aggregate level is weaker than in these two sectors. The weakest convergence is observed in the services sector.

The reasons for the greater convergence in the agriculture, forestry and fishing sector between CEE countries and the euro area can be attributed to the impact of the EU's Common Agricultural Policy and the significant modernisation of the sector in CEE countries due to EU funding. This could be seen as an aspect of the Europeanisation effect. The higher convergence of labour productivity in the industry compared to services could be due to the stronger and more successful transfer of innovations and production technologies to the CEE countries in this sector, as well as the lower share of services in trade within the EU. At the same time, the starting position of labour productivity is important, as the value in the industry sector in the CEE countries is lower than in the services sector. The data in Figure 2 also show that labour productivity in the CEE countries increased more in the industry sector than in the services sector during the period, reflecting, to some extent, the modernisation of the sector.

For the convergence of labour productivity at an aggregate level, the structural change in the economies (measured by the shares of hours worked in one of the sectors in the total number of hours worked) of the countries of Central and Eastern Europe and the euro area is important. It consists in the increase in the share of the services sector and the decrease in the share of the agriculture, forestry and fishing and industry sectors over the period $2000 - 2020$.

The presence of β-convergence is a necessary but not a sufficient condition for the differences between the CEE countries and the euro area to narrow. For this reason, the existence of sigma convergence between the CEE countries and the euro area is assessed by estimating the linear trend model of the coefficient of variation.

The results of the study support the hypothesis of the existence of labour productivity sigma convergence between CEE countries and the euro area at aggregate and sectoral levels. Furthermore, the differences in the degree of convergence between the three sectors derived by applying beta convergence are confirmed. The results of the sigma convergence analysis also show the strongest convergence in the agriculture, forestry and fishing sector, followed by the industry sector, and the weakest convergence in the services sector. The degree of convergence at an aggregate level is lower than that reported in the agriculture, forestry and fishing sector (Table 3).

It is important to investigate the degree of sigma convergence with the euro area in the different countries of Central and Eastern Europe. Table 4 summarises the estimates for the parameter σ, which represents the relationship between the explanatory variable (t) and the dependent variable in equation (3). All coefficients are significant at a 1% level of significance. Applying the sigma convergence approach at the aggregate level shows that there is a sigma convergence trend in labour productivity between each CEE country and the euro area.

Table 3

Linear trend model of coefficient of variation results for σ-convergencebetween CEE countries on average and euro area

Aggregate Level				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	81.97960	0.810563	101.1391	0.0000
time (expl.var.)	**-0.920867**	0.064553	-14.26528	0.0000
Agriculture, forestryandfishingsector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	75.01507	1.513816	49.55362	0.0000
time (expl.var.)	**-1.152924**	0.120560	-9.563073	0.0000
Industry (includingconstruction) sector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	84.04173	1.105894	75.99436	0.0000
time (expl.var.)	**-0.808514**	0.088073	-9.180029	0.0000
Services sector				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	74.37517	0.594794	125.0436	0.0000
time (expl.var.)	**-0.674543**	0.047369	-14.24010	0.0000

Source: Application of the models in E-views based on Eurostat data.

The comparison between the countries that are in the euro area and those that are not, in terms of the degree of sigma convergence, is in favour of the first group. Of course, there are some exceptions, but the general trend is clear. Estonia, Latvia, Lithuania and Slovakia show the strongest sigma convergence with the euro area, while in Croatia, Czechia, Bulgaria and Hungary, the narrowing of the gap with the euro area is relatively weaker. These trends largely continue at the sectoral level. At the same time, it is important to note that some countries show a sigma divergence at the sectoral level. Again, these are countries outside the euro area – Bulgaria and Czechia in the agriculture, forestry and fishing sector and Croatia in the industry sector. This reflects a lower Europeanisation effect in these Member States.

Table 4

Linear trend model of coefficient of variation results for σ-coefficient

Country	Aggregate Level	Agriculture, forestry and fishing sector	Industry (including construction) sector	Services sector
Bulgaria	-0.587587	0.889301	-0.341288	-0.715771
Czechia	-0.786253	0.631245	-0.802544	-0.598397
Estonia	-1.138585	-2.162314	-1.259166	-0.909300
Croatia	-0.260843	-0.012876	0.227024	-0.169517
Latvia	-1.371851	-1.987163	-0.681712	-1.345740
Lithuania	-1.288426	-1.773775	-1.440285	-0.899182
Hungary	-0.521380	-1.247223	-0.207274	-0.383063
Poland	-1.014648	-0.299082	-0.894701	-0.761492
Romania	-1.380844	-0.851738	-0.890131	-1.068765
Slovenia	-0.651037	-0.530573	-0.663868	-0.215114
Slovakia	-1.238846	-3.886534	-1.733631	-0.696349

Source: Application of the models in E-views based on Eurostat data.

There are other differences between euro area and non-euro area CEE countries. For example, in the countries of CEE on average and in almost all CEE countries that have adopted the euro (with the exception of Latvia), convergence is stronger in the industry sector than in the services sector. In the other CEE countries outside the euro area (with the exception of Czechia), the trend is reversed.

Throughout the period under review, the differences with the euro area in terms of labour productivity at the aggregate level are largest in Bulgaria and Romania and smallest in Slovenia, Slovakia and Czechia (Figure 3).

Figure 3
Coefficients of variation between CEE countries and euro area at an aggregate level (in %)
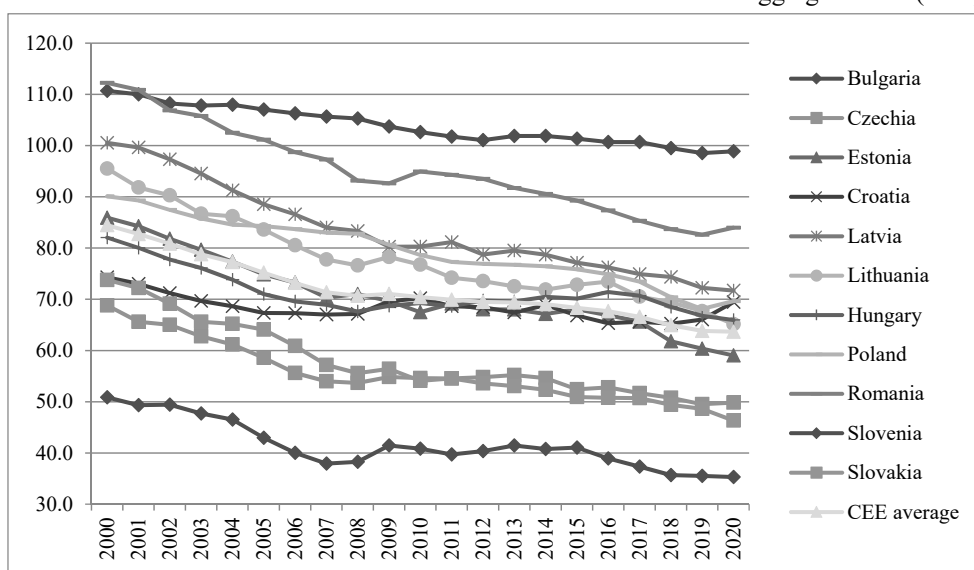
Source: Author's calculations based on Eurostat data.

The coefficients of variation in 2020 in the countries outside the euro area, with the exception of Czechia, are above the average for the countries of Central and Eastern Europe and have higher values than that in the countries that have adopted the euro (excluding Lithuania) (Figure 3). This reaffirms the differences between these two groups of CEE countries.

The global economic crisis slows down the sigma convergence between the countries of CEE and the euro area, as a greater reduction in differences, as measured by the coefficient of variation, is observed in most countries until the crisis is reflected, after which the process slows down (Figure 3). The influence of the economic crisis on convergent averages in the CEE countries is also confirmed in studies on real and structural convergence (e.g. Matkowski, Próchniak, Rapacki, 2016; Coutinho, Turrini, 2020; Velichkov, Damyanov, 2021; Raleva, 2021).

Despite the reported convergence in the CEE countries on average at the end of the period, the differences with the euro area in terms of labour productivity remain significant, with

coefficients of variation above 50% at aggregate and sectoral levels, being most significant in the industry sector, followed by agriculture, forestry and fishing sector, and least significant in the services sector. This shows that although there is convergence, it is not yet very far advanced and the process must be continued and accelerated in the coming years.

5. Conclusion

The findings of the study support the hypothesis of the existence of beta and sigma convergence of labour productivity in the countries of Central and Eastern Europe with the euro area in the period 2000-2020, both at the aggregate and sectoral levels. The analysis reveals certain differences in the degree of convergence between economic sectors, reflecting their specific characteristics and providing insight into the drivers of labour productivity dynamics and convergence at the aggregate level. The results of the application of fixed effects panel regression show that the strongest convergence is in the agriculture, forestry and fishing sector, followed by the industry sector (including construction). Moreover, convergence in these two sectors is stronger than at the aggregate level. The weakest convergence is registered in the services sector. The ranking of sectors according to the degree of convergence between the average level of labour productivity in the CEE countries and the euro area on average is also confirmed by the results obtained by applying the linear trend model of the coefficient of variation.

The convergence of labour productivity between the countries of Central and Eastern Europe and the euro area in the period 2000-2020 is an indicator and facilitating factor for the real convergence of incomes. The Europeanisation effect supports this process through the transfer of knowledge and technology, the existence of common policies, institutions and regulations within the European Union, the functioning of the Single Market and the Monetary Union, the identical structural changes in the economies, the impact of EU structural and investment funds, etc. The strength of the Europeanisation effect may vary from one Member State to another. The results of the analysis allow such a conclusion. The comparison according to the degree of sigma convergence with the euro area in the different countries of Central and Eastern Europe shows a stronger convergence in the countries that have adopted the euro than in the countries outside the euro area. The reported trend manifests itself largely at the sectoral level, as even some of the non-euro area countries show a divergence trend – Bulgaria and Czechia in the agriculture, forestry and fishing sector and Croatia in the industry sector.

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Mihail Yanchev[1]

DEEP GROWTH-AT-RISK MODEL: NOWCASTING THE 2020 PANDEMIC LOCKDOWN RECESSION IN SMALL OPEN ECONOMIES[2]

Accurate forecasting of the timing and magnitude of macroeconomic recessions caused by unexpected shocks remains an area where both statistical models and judgmental forecasts tend to perform poorly. Inspired by the value-at-risk concept from financial risk management, a growing body of research has been focused on developing a framework to model and quantify macroeconomic risks and estimate the likelihood of adverse macroeconomic outcomes, which has become known as growth-at-risk assessment. The current study proposes an improvement to an established two-step procedure for empirical evaluation of the future growth distribution, which involves directly modelling the parameters of the conditional distribution in one step within an artificial neural network. The proposed procedure is tested on macroeconomic data from four small European open economies covering the coronavirus pandemic lockdown period and the recession related to it. The model achieves a better performance across the four countries compared to the established two-step procedure.
Keywords: Forecasting; Macroeconomic Risks; Artificial Neural Networks; Density Forecasts; Recessions
JEL: C53; E17; E27; E32

1. Introduction

Recessions are not rare events, according to An et al. (2018). The authors analyzed data on 153 recession episodes across 63 countries between 1992 and 2014, and found that countries, on average, are in a recession 12% of the time. However, recession events and their timing and magnitude remain hard to predict for both experts and statistical models (Lewis, Pain, 2014). On the other hand, more impactful events like the great recession that occurred between 2007 and 2009 and the recent recession caused by the coronavirus pandemic lockdown are an even greater challenge for forecasters and decision-makers as they represent realizations of low probability risks (Makridakis et al., 2009; Chen, 2019; Antipova, 2020). While the great recession was caused by a build-up of systemic risk, which in retrospect turned out to be visible in the data (Altunbaz et al., 2017), the coronavirus pandemic

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lockdown was caused by an unusual and unexpected shock. Therefore, this latest crisis can be considered one of the biggest challenges for the forecasting profession in recent decades.

In answer to such challenges, the International Monetary Fund (IMF), among other institutions, has been using a framework for quantifying macroeconomic risks to growth, which has become known as growth-at-risk (Prasad et al., 2019). Since models designed to forecast a central feature of the distribution of interest, like the mean or the median, are unable to capture asymmetries between upside and downside risks, the assessment of the uncertainty surrounding point forecasts becomes necessary (Clemens, 2004). One way to address this necessity, which is supported by a growing body of research recently and is at the core of the IMF growth-at-risk framework, is to model empirically the future growth distribution on the basis of current macroeconomic and macro-financial conditions. While different models have been used to achieve this task, including Bayesian VAR models (Carriero, 2020), stochastic volatility models (Iseringhausen, 2021) and GARCH models (Brownlees, Souza, 2021), this paper focuses on methods based on quantile regression.

In an influential paper, Adrian et al. (2019) use a two-step procedure of constructing conditional quantiles using a quantile regression model and consequently fit a probability distribution to the estimated quantiles. The authors studied the conditional US growth distribution with an emphasis on financial conditions. They identified several stylized facts about the conditional distribution of growth for the USA, among which a strong negative correlation between the conditional mean and variance and a significant relationship between current financial conditions and future shifts in the lower tail of the conditional distribution. The same conclusion was confirmed by De Santis and Van der Veken (2020), who performed a similar exercise, including data from the beginning of 2020 and a separate dataset covering the Spanish flu pandemic period across a number of countries. Figuerez and Jarociński (2020) confirm the same stylized facts identified by Adrian et al. (2019) for the Euro Area.

The current paper proposes an improvement upon the semi-parametric two-step procedure used by Adrian et al. (2019) and De Santis and Van der Veken (2020) by proposing a one-step model, which is based on artificial neural networks and directly outputs the parameters of the conditional growth distribution. The model still depends internally on the estimation of conditional quantiles and for this purpose, it is based on two separate loss functions, which are being dynamically weighted. The improvements proposed here lie in four separate areas:

1. a simultaneous generation of quantiles, as proposed by Rodriguez and Pereira (2020), in order to alleviate the quantile crossing problem;

2. the introduction of quantile crossing loss to the tilted loss function, which further prevents quantile crossing as proposed by Bondell et al. (2010);

3. using artificial neural network architecture based on long short-term memory (LSTM) layers (Hochreiter, Schmidhuber, 1997) to model non-linear relationships between the predictors and the target variable and better capture the recession related to the pandemic lockdown compared to a linear model;

4. combining the two steps of the procedure into a single model, which is being optimized by minimizing two loss functions simultaneously – the tilted absolute loss function used

for estimating the conditional quantiles and a least squares loss for evaluating the final conditional distribution parameters.

This combination of improvements is called deep growth-at-risk model or DeepGaR in short for the purposes of this paper. Initially, the focus of the study was on the macroeconomic developments in Bulgaria, but after preliminary results were generated, it was decided to test the proposed approach on three other small open European economies, relatively similar in terms of the size and structure of the economy. Therefore, the proposed procedure was tested on data for Bulgaria, Estonia, Lithuania and Romania, covering the coronavirus pandemic lockdown period and the recession related to it, and achieved a better out-of-sample performance across four of them compared to the established two-step procedure.

The paper is structured as follows. The next section covers the methodology, including an overview of the established procedure, as well as the proposed improvements. The third section covers the data used in this study, while the fourth section summarizes the performance test results. The last section contains a discussion of the results and the conclusions of the study.

2. Methodology

A central idea underlying the quantile regression model, as defined by Koenker and Bassett (1978), is that a task of sorting can be turned into an optimization problem. Just as finding a sample mean can be done by minimizing the sum of squared errors, finding the median can result from minimizing the sum of absolute errors. They further elaborate to show that an asymmetrical loss function which gives different penalties to positive and negative residuals, can yield any quantile for a given sample. Solving for the following equation (1) yields the τ-th quantile as its solution:

$$min_{\xi\in\mathbb{R}} \sum_{i=0}^{n} \rho_\tau(y_i - \xi) \qquad (1)$$

Where $0 < \tau < 1$ and $\rho_\tau(\cdot)$ is the titled absolute value function, which can be seen on figure 1, for a sample of size n. In this equation, if τ is set to equal 0.5, the equation will yield the median. Therefore, if the scalar ξ in equation (1) is replaced with a parametric function $\xi(x_i, \beta)$ and τ is set to equal 0.5, one could obtain the estimate of the conditional median function.

$$min_{\xi\in\mathbb{R}} \sum_{i=0}^{n} \rho_\tau(y_i - \xi(x_i, \beta)) \qquad (2)$$

Setting τ to different values will lead to the estimation of different conditional quantile functions.

Figure 1

Tilted absolute value function

Source: Author.
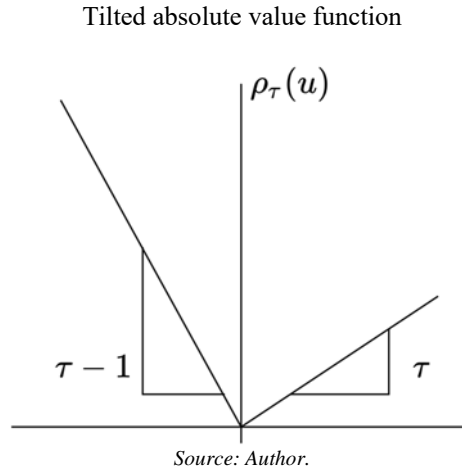
Applying this idea to modelling the conditional quantiles of GDP growth (similarly to Adrian et al., 2019), we would model the relation between the conditional quantile of y_{t+h} and a vector of predictors X and optionally their lags, for a given time period t and a forecasting horizon h. In order to estimate the quantile regression of y_{t+h} on X, the regression coefficients β_τ for a given τ is chosen to minimize the weighted absolute value of errors:

$$\hat{\beta}_\tau = \text{argmin}_{\beta_\tau \in \mathbb{R}^k} \sum_{t=1}^{T-h} (\tau \cdot 1_{(y_{t+h} \geq X\beta_\tau)} |y_{t+h} - X\beta_\tau| + (1-\tau) \cdot 1_{(y_{t+h} < X\beta_\tau)} |y_{t+h} - X\beta_\tau|) \qquad (3)$$

where $\mathbf{1}(\cdot)$ is the indicator function, which subsets negative and positive errors, and T is the total length of the time series. The output value from the model is the quantile of y_{t+h} conditional on the model input X:

$$\hat{Q}_{y_{t+h}|X}(\tau|X) = X\beta_\tau \qquad (4)$$

Rodriguez and Pereira (2020) propose a multi-output deep learning approach for modelling several conditional quantiles jointly to address the problem of crossing quantiles, which often occurs when quantiles are estimated separately. The authors' suggestion is to aggregate the loss function for the separate quantiles and evaluate it for all conditional quantiles at once at every step of the optimization process. Bondell et al. (2010) propose a further addition to the tilted absolute loss function, which deals with the notorious problem of the tendency of separately estimated conditional quantiles to cross. This additional penalty for crossing can be expressed in the following way:

$$\sum_{j=1}^{J-1} max(0, X\hat{\beta}_{\tau_j} - X\hat{\beta}_{\tau_{j+1}}) \qquad (5)$$

where J is the number of quantiles sorted by the increasing value of τ. This term can be added to the loss function described in equation (3). Both of these suggestions have been incorporated into the newly proposed procedure.

Quantiles of the conditional distribution of GDP growth can be expressed either as linear or non-linear functions of the observed predictors. This framework allows one to study the skewed and fat-tailed distribution of GDP growth documented by multiple authors in the past, like Fagiolo et al. (2008), Adrian et al. (2019) and De Santis and Van der Veken (2020). Also, the predictive power of different independent variables possibly exhibits heterogeneity across different quantiles of GDP growth, as was suggested by Giglio et al. (2016), and Adrian et al. (2019), among others.

After constructing the quantiles, one could fit a probability distribution function to them in order to generate a density forecast. Adrian et al. (2016) propose using a skewed t-distribution for this purpose. In order to estimate the four parameters related to the skewed t-distribution (following Wurtz et al., 2006), the problem can be formulated as a least squares optimization problem, using the estimated conditional quantiles[3] and the inverse cumulative probability function:

$$\{\hat{\mu}_{t+h}, \hat{\sigma}_{t+h}, \hat{v}_{t+h}, \hat{\alpha}_{t+h}\} = \text{argmin}_{\mu,\sigma,v,\alpha} \sum_{j=1}^{J} (\hat{Q}_{y_{t+h}|X}(\tau_j|X) - F^{-1}(\tau_j; \mu, \sigma, v, \alpha))^2 \qquad (6)$$

where $\hat{\mu}_{t+h} \in \mathbb{R}$ (mean or location shift), $\hat{\sigma}_{t+h} \in \mathbb{R}^+$ (standard deviation or scaling parameter), $\hat{v}_{t+h} \in \mathbb{R}$ (skewness parameter), and $\hat{\alpha}_{t+h} \in \mathbb{R}^+$ (kurtosis or tailweight parameter). F^{-1} is the inverse cumulative distribution function and $\hat{Q}_{y_{t+h}|X}(\tau_j|X)$ is the estimated quantile of y_{t+h} for a given τ and conditional on *X*. This method can be used to estimate a density based on the conditional quantiles, as well as the unconditional or observed quantiles of the actual GDP growth.

The established procedure used by Adrian et al. (2019) and partly described in the previous paragraphs is illustrated on the top of the diagram. Its first step consists of a linear regression model with a loss function similar to equation 3, which is used to generate conditional quantiles. The second step uses the conditional quantiles as an input and performs a least squares optimization between the input and the inverse CDF of the distribution of choice (in this case, the skewed t-distribution) as in equation 6. Adrian et al. (2019) follow two alternative approaches to show that the results from the two-step procedure are robust across methods. They employ fully parametric and fully non-parametric approaches to the same task and find very similar characteristics of the resulting conditional distributions. However, the authors use a fully parametric specification, which explicitly indicates the relationship between the conditional mean and the conditional variance and skewness.[4] In this sense, the

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[3] The .05, .25, .75 and .95 quantiles are used for the estimation of the conditional distribution.

[4] In preliminary experiments for this study it was attempted to model the conditional distribution features without such explicit parametrization, but unfortunately such models fail to converge towards a loss minimization and often exhibited exploding gradients.

two-step procedure is less parametric, less hard-coded and perhaps superior in terms of its flexibility.

A departure from this procedure can be seen in the lower segment of Figure 2 – a combined approach that unites the two steps. This method would directly estimate the parameters of the distribution similarly to probabilistic regressions (for a deep learning application, see Salinas et al., 2020), but retaining the internal consistency of the original approach. The proposed procedure relies on an intermediate estimation of conditional quantiles in order to estimate the parameters of the conditional distribution. For this purpose, the model uses two separate loss functions – an intermediate tilted absolute loss function (as in equation 3 in combination with equation 5) and a final least squares function (as in equation 6).

Figure 2

Comparison between the two approaches for estimating the conditional distribution
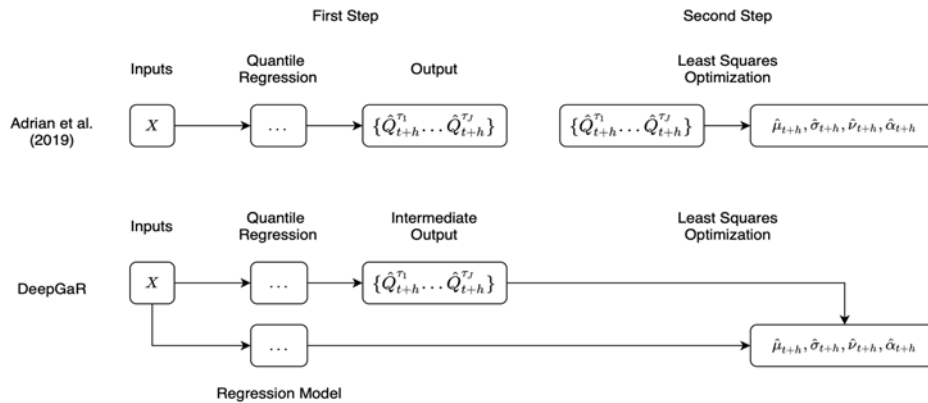
Source: Author.

Figure 3 presents an overview of the architecture used for the artificial neural network (ANN) model. Since the network is built to model time-series – a temporal sequence problem – it is more precise to call it a recurrent neural network. The first dimension of the various layers is the batch size used for the model training[5], but here it is kept equal to 1, which means that the training is performed on the whole dataset at once. Therefore, this dimension is omitted from the diagram. The length of the input time-series is denoted by t, while m denotes the number of predictor variables. J denotes the number of quantiles, which in this exercise equals to 4 and h denotes the time-horizon of the forecast in quarters, which is set to 1.

The model has multiple branches. The bottom branch starts out with a long short-term memory layer (LSTM). Each quantile is generated in a separate sub-branch and therefore, there are J number of sub-branches for all quantiles. There is another branch (on top) which contains an LSTM layer and leads to the final output of the model. The final output is the result of the quantile branches and the top branch being combined through the use of the least

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[5] In the machine learning terminology, model training is similar to model estimation as is understood in the realm of econometrics. Different values of the batch size can be applied to optimize the training process, especially if one works with larger datasets.

squares loss function (equation 6). The total number of trainable parameters within the model is in the range of 150 and 200 thousand, depending on the number of input predictors.

Figure 3

Proposed neural network architecture
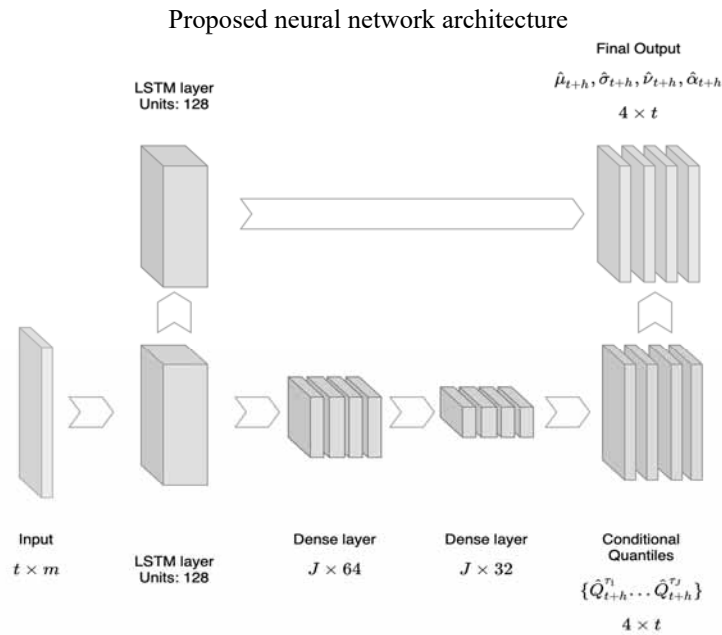
Source: Author.

The proposed architecture is reliant, to a great extent, on the LSTM layers. It is outside of the scope of this paper to explain why these layers are well-suited for time-series modelling and how they handle the task, but a good overview of the current state and implementations of these models can be found in Hewamalage, Bergmeir and Bandara (2021). Another good overview of different artificial neural network architectures in the context of economic forecasting is done by Cook and Hall (2017). The proposed model was implemented using the Tensorflow library and the ADAM optimizer was used for the model training (Kingma, Ba, 2014). The Tensorflow library uses automatic differentiation and gradient descent through time for recurrent neural networks (Rumelhart, Hinton, Williams, 1986; Williams, Zipser, 1992).

Another departure from the established procedure lies in the choice of the family of distributions, used to model the risks to growth. Instead of the skewed t-distribution an alternative distribution was used – the Sinh-Arcsinh distribution introduced by Jones and Pewsey (2009). This is a four-parameter distribution, which can account for location, scale, skewness and tailweight and is a generalization of the normal distribution. The reason for choosing it was its convenient implementation in Tensorflow and similar properties to the skewed t-distribution.

It was tested if there would be a statistically significant difference in using this family of distribution compared to the skewed t-distribution when fitting them to the GDP q-o-q data for the selected countries. The two types of distributions were fitted to the data using the unconditional quantiles and the inverse CDF functions, and then the Kolmogorov-Smirnov two-sample test was performed on randomly generated samples consisting of 1000 observations from each of the estimated distributions. The test results[6] failed to reject the null hypothesis of no differences for all four countries.

Figure 4

Comparison between the Sinh-Arcsinh distribution and skewed t-distribution
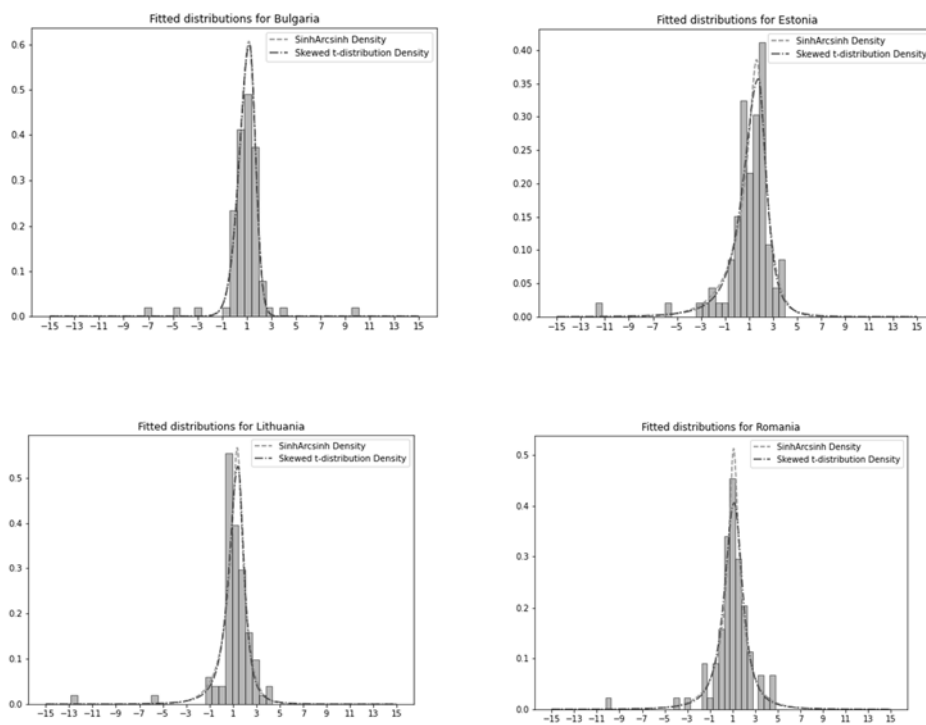
Source: Author, Eurostat.

The final output dense layers of the model architecture (marked as final output in Figure 4) uses specific parameterization in order to ensure that the scale and tailweight parameters are positive numbers, which is a prerequisite for the implementation of the Sinh-arcsinh distribution. The parametrization is the exponential linear unit plus 1 in order to ensure non-negativity.

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[6] KS test results: Bulgaria (KS statistic: 0.054, p-value: 0.108), Estonia (KS statistic: 0.028, p-value: 0.828), Lithuania (KS statistic: 0.038, p-value: 0.466), Romania (KS statistic: 0.053, p-value: 0.121).

$$\begin{cases} x + 1 & x \geq 0 \\ -(e^x - 1) + 1 & x < 0 \end{cases} \tag{7}$$

This parametrization is necessary and ensures convergence of the optimization algorithms, as well as the ability to generate a conditional distribution of the Sinh-Arcsinh family.

Finally, in order to combine two loss functions into the model, a type of dynamic weighting was implemented. Different versions of the weighting were tested, but the final version relied on a high weight (95%) for the tilted absolute value function for 90% of the training epochs (model training duration) and low weight (5%) for the remainder of the training. Respectively, the weight for the second least squares function, which defines the conditional distribution parameters, stays low (5%) during 90% of the duration of the training and switches to a high value (95%) for the last 10% of the duration of the training. This scheme yielded the best results, since it took more epochs for the tilted loss function to reach an optimal level of loss, compared to the least squares loss function, which usually reached optimum very quickly. The model results were robust to changes in the various parameters of the weighting.

3. Data

One of the main challenges in forecasting GDP growth is the time lag associated with the quarterly releases of the indicator. For most EU countries, the GDP flash release for a specific quarter would be published around the middle of the subsequent quarter. If one would like to use the first lag of GDP (in terms of quarterly frequency), one is already within the time frame of real-time forecasting or nowcasting. However, this time lag also presents the opportunity to use the current values of short-term indicators, which are released at a higher frequency for the purposes of real-time forecasting. Moreover, since short-term indicators are released on a monthly or daily basis, one could use intermediate values for a nowcasting exercise (e.g. use the average of the first two months of the quarter to get an earlier input to the model).

For this analysis, the target variable of interest is the quarterly growth rate of the seasonally and calendar-adjusted chain-linked volumes of GDP. The available final release of the GDP data is used as of the writing of this article. Apart from the lags of the target variable, a list of leading indicators of financial conditions and economic activity was compiled in order to be used as candidate predictors. The choice of leading indicators was following an approach similar to Adrian et al. (2019), De Santis and Van der Veken (2020), Figuerez and Jarociński (2020) and Prasad et al. (2019). It was imperative that they are available for a longer time frame and an initial choice for a starting year of the samples was the year 2000 as this ensured a long enough training sample and the opportunity to put aside a test sample. Currently, there are a lot of interesting leading indicators which can be used for similar macroeconomic forecasting tasks, but their main disadvantage is the lack of accumulated historical data. Moreover, it was decided to include only indicators, which are available for a specific quarter by the end of the same quarter, in order to be able to use the current values of the predictors in time reference to the GDP growth values, which are released later on. Therefore, short-term indicators which are released with a significant delay were not included in the modelling

data set, despite their relevance, because they have limited use in the nowcasting of GDP growth. A full list of predictors can be found in (Table 1).

Table 1

Selected Leading Indicators

Indicator	Description and Source
Country-specific sentiment indicator	Economic sentiment index collected by the Directorate-General for Economic and Financial Affairs (DG ECFIN) of the European Commission, Monthly frequency, Eurostat
Country-specific 10-year Government Bond Yield	Monthly average of daily frequency, Investing.com
Country-specific Stock Price Index Close Value (SOFIX, BET, OMXTGI, OMXVGI)	Monthly frequency, Investing.com
Dow Jones Composite Index Close Value	Monthly frequency, Yahoo Finance
Dow Jones Composite Index Volume	Monthly frequency, Yahoo Finance
DAX Index Close Value	Monthly frequency, Yahoo Finance
DAX Index Volume	Monthly frequency, Yahoo Finance
10-year US Government Bond Yield	Monthly average of daily frequency, Nasdaq Data Link
PMI Composite – Euro Area	Monthly frequency, Nasdaq Data Link
Brent Oil Price	Monthly average of daily frequency, Thomson Reuters

Source: Author.

It is important to make several clarifications regarding the country-specific financial indicators used. Estonia emitted 10-year bond yields for the first time in June 2020, and therefore the indicator was not used due to the very short length of the time series. Unfortunately, no suitable substitute was found for Estonia, as it seems that the government historically emitted only short-term government debt. For each of the other countries, the indicators were available for varying periods: October 2002 for Bulgaria, February 2003 for Lithuania, and September 2007 for Romania. Using these indicators necessitates shortening the sample and, in the case of Romania, significantly. With respect to the country-specific stock price indices, the choice was based on maximum data availability: SOFIX for Bulgaria, BET for Romania, OMXTGI for Estonia and OMXVGI for Lithuania. For each country, the indicators were available for varying periods: September 2003 for Bulgaria, May 2013 for Lithuania, and June 2002 for Romania. Due to the very short history for Lithuania, it was decided to exclude the index from the shortlist of indicators. For Estonia, the OMXTGI index has been available since before 2000.

Initially, the focus of the study was on the macroeconomic developments in Bulgaria, but after preliminary results were generated, it was decided to test the proposed approach on three other small open European economies relatively similar in terms of the size and structure of the economy. After performing a backward selection for each country individually, three leading indicators emerged as suitable candidates to be used in the forecasting models. The backward selection was based on the performance indicators discussed in the next section.

The study does not claim to use an exhaustive list of factors which influence growth. The link between the country-specific sentiment indicator and GDP could be thought to carry some degree of causality. On the other hand, the global financial indicators are exogenous in nature in reference to the countries of interest and can be considered leading indicators of financial stress. The country-specific financial variables are also leading indicators of

financial stress and although they are more relevant to the specific economy, there is no justification to claim any causal relationship with respect to economic growth.

All variables were normalized with a mean 0 and standard deviation of 1 prior to use in the model. The total sample covers the period 2000Q1 to 2021Q4 and was divided into a training and a testing sample. The first 64 quarters were used for model training (2000Q1 to 2016Q2) and the last 22 quarters were used for validating the model performance (2016Q3 to 2021Q4). A rolling window approach was followed to construct the training and test samples. The final specifications are depicted in a stylized way in Table 2.

Table 2

Final Model Specifications

Country	Specifications
Bulgaria	$GDP_t = f(GDP_{t-1}, SENTIMENT_t, SOFIX_t, US\ BOND\ YIELD_t)$
Estonia	$GDP_t = f(GDP_{t-1}, SENTIMENT_t, OMXTGI_t)$
Lithuania	$GDP_t = f(GDP_{t-1}, SENTIMENT_t, LT\ BOND\ YIELD_t)$
Romania	$GDP_t = f(GDP_{t-1}, SENTIMENT_t, US\ BOND\ YIELD_t)$

Source: Author.

In the listed specifications, the left-hand side describes the target variable and the right-hand side the set of predictors. For Bulgaria and Estonia, the inclusion of the domestic stock price indices leads to optimal performance. In the case of Bulgaria, the inclusion of the US 10-year government bond yield carried additional predictive power. Similarly, for Lithuania, using the Lithuanian 10-year government bond yield results in the best model performance. For Romania, the use of the US 10-year bond yield leads to better performance compared to using domestic indicators.

With the given specifications and after all data transformations, the model training sets start at 2000Q3 for Estonia and Romania, at 2003Q4 for Bulgaria and at 2003Q2 for Lithuania. The test sets used for the estimation of the out-of-sample performance start at 2016Q4 for Estonia and Romania and 2017Q3 for Bulgaria and Lithuania. These sample lengths are a result of using 75% of the total sample size as a training sample size.

4. Results

The DeepGaR model was tested against a benchmark based on the established two-step approach, with the exception of two differences. The benchmark uses a linear quantile regression, but the conditional quantiles are generated simultaneously and use the crossing loss, similarly to the DeepGaR model. The skewed t-distribution is used for the generation of the conditional distribution of the benchmark. The performance of the two models is based on the out-of-sample performance over the test sample covering the pandemic lockdown recession occurring in 2020Q1 and/or 2020Q2. The main indicators which were used to measure and compare the performance were RMSE between actual GDP and the conditional median, the predictive score, which is the value of the PDF of the conditional distribution at the value of the realized GDP. Additional indicators were recorded to study the characteristics of the generated distributions. Detailed results can be found in Appendix tables 3 to 10.

Figure 5 presents the .05, .5 and .95 conditional quantiles generated by the DeepGaR model and the realized GDP for each of the four counties. Figure 6 is similar, but presents the conditional quantiles generated using the benchmark model.

Figure 5

Out-of-sample conditional distributions generated by the DeepGaR model
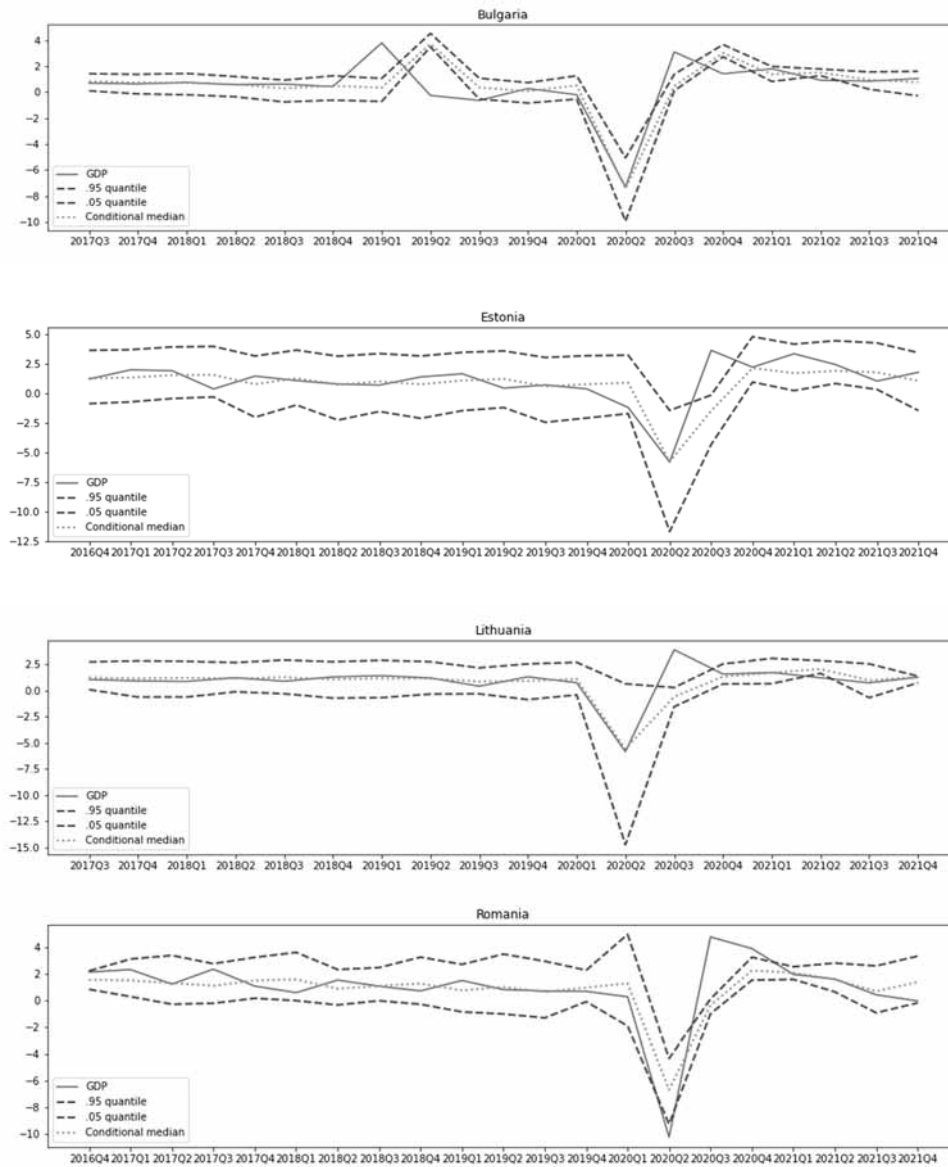
Source: Author, Eurostat.

Figure 6

Out-of-sample conditional distributions generated by the benchmark
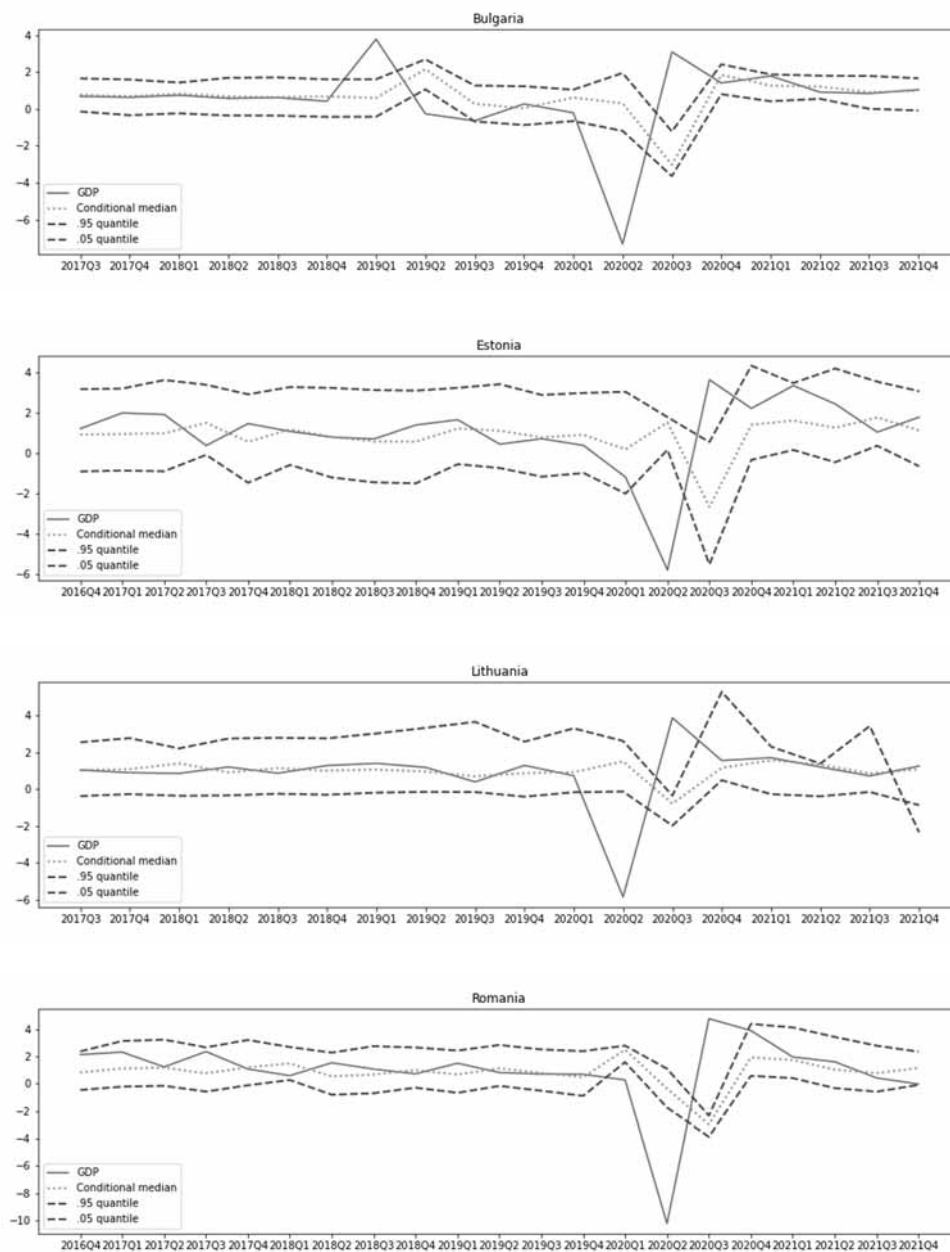
Source: Author, Eurostat.

It is evident that the DeepGaR model achieves superior accuracy compared to the benchmark, during the negative growth period which every country experiences between 2020Q1 and 2020Q2. The model also recognizes the downside risks reliably, given the increased spread of the distribution during periods of negative growth. The benchmark fails at recognizing downside risks across all countries. However, it seems to perform satisfactory during upturn periods. Both models perform poorly when it comes to forecasting the recovery after the initial slump and at recognizing upside risks. Both models perform well during non-recession periods, but the DeepGaR model is better in modelling the recession caused by the unexpected shock of the global pandemic lockdown. By utilizing a high number of LSTM units the DeepGaR model manages to recognize a highly non-linear relationship between the predictors and the target. During part of the initial experimentation, it was observed that reducing the number of LSTM units reduces its performance during the recession periods.

The DeepGaR model consistently produces conditional distributions, which confirm some of the findings of Adrian et al. (2019). Both symmetric conditional distributions during expansions and negative skewness during periods of recession can be observed. Additionally, a negative correlation between the conditional mean and variance of the growth distribution is evident as well. These results were confirmed for all four of the countries in the sample, both in-sample (on the training set) as well as out-of-sample (on the test set).

5. Discussion

The COVID-19 pandemic and the recessions many countries experienced due to implemented lockdowns posed an unprecedented challenge to decision-makers and forecasters. Both private enterprises and government institutions had to adapt to this shock quickly and implement policies to tackle the consequences, based on limited foresight. While, it is virtually impossible to anticipate such an event like the coronavirus pandemic and its consequences ahead of time, one could forecast or nowcast its effects on the economy through leading indicators, which could help the decision-making process.

The current study demonstrates that a parsimonious model using country-specific sentiment indicators as well country-specific and global financial variables can successfully nowcast recessions caused by unexpected shocks like the coronavirus pandemic. The comparative performance of the artificial neural network DeepGaR model proves that it is a useful tool in modeling macroeconomic risks related to the 2020 coronavirus pandemic lockdown in four small open economies in Europe. Its ability to model highly non-linear relationships makes it superior to a linear benchmark in this case.

For Bulgaria and Lithuania, the DeepGaR model manages to predict very accurately the negative growth of GDP in 2020Q2, when the strongest economic effects of the lockdowns were felt. In the case of Estonia, the DeepGaR model does not accurately predict the start of the recession in 2020Q1, but manages to predict very accurately the negative growth in 2020Q2. However, it is not clear whether the growth dynamics in this quarter are not a result of seasonal adjustment. For Romania, the DeepGaR model fails to predict the full extent of the lockdown recession in 2020Q2, but still outperforms significantly the linear benchmark. Apart from its disadvantage in much lower prediction accuracy with respect to predicting the

pandemic crisis, the linear benchmark achieves satisfactory performance in nowcasting growth during upturn periods.

A disadvantage shared by both the proposed DeepGaR model as well as the linear benchmark is their limited ability to predict the upturn after the initial decline in economic growth. This result is observed across all countries and at first glance, the problem is with the so-called shape of the 2020 recession, which in all countries of interested seems to have a V-shape. The models are trained on the recessions caused by the global financial crisis, which had either a U or a W-shape for the countries of interest, which might be why the models fail to anticipate a quick and strong recovery after only a quarter or two of decline in growth.

With respect to the indicators used across the four countries of interest, it is evident that both country-specific and global factors of financial stress carry predictive power with respect to economic growth and specifically in the task of predicting the pandemic lockdown recession. For Bulgaria and Estonia, it was shown that the use of domestic stock price indices' close values leads to optimal results. In the case of Bulgaria, the inclusion of the US 10-year government bond yield carried additional predictive power. For Lithuania, the inclusion of the Lithuanian 10-year government bond yield resulted in the best-performing model specification. For Romania, the US 10-year bond yield carried more predictive power with respect to predicting the pandemic recession, compared to the country-specific financial indicators. Additionally, across all four countries, it is demonstrated that a parsimonious model containing few indicators yields optimal performance.

The DeepGaR model combines a couple of recent improvements proposed by researchers working on quantile regression models, which allows it to mitigate known problems like the crossing of the quantiles. The first improvement is the simultaneous estimation of quantiles, which allows one to estimate an arbitrary number of quantiles within one estimation procedure and using a single loss function. This both speeds up the process of generating the conditional quantiles, but also is shown to alleviate the crossing problem. Indeed, the only datapoint where this problem occurs can be found in the benchmark results for Lithuania in 2021Q4. The second improvement is the explicit inclusion of a crossing loss term within the loss function, which additionally mitigates the issue. Moreover, combining the two steps of the original procedure into a single model creates one internally consistent procedure without sacrificing its flexibility. Working in the context of an artificial neural network allows one to construct a custom model with two loss functions and combine the two steps of the original estimation procedure into a one-step procedure. Combining the two steps leads to an internally consistent procedure without sacrificing the flexibility of the original approach. This new model representation is the main novel contribution of the current study.

Additionally, the current analysis confirms that there is a negative correlation between the conditional mean and variance of the distribution of growth as well as symmetric conditional distributions during expansions and negative skewness during periods of recession for the four economies analyzed in this study, similarly to the stylized facts Adrian et al. (2019) identified for the US and which were also confirmed for the Euro Area by Figuerez and Jarociński (2020).

Future work on the subject can focus on both the applications of the model and its design. It would be interesting to study the performance of the model using data from larger economies.

Both the proposed and original procedures struggle with anticipating upside risks and rapid recoveries as the one seen after the initial recession episode in 2020 across many countries, which is certainly a disadvantage which requires further attention. Lastly, despite using a complex neural network architecture, one could use Shapley values to perform a sensitivity analysis between the inputs and output of the model. This would be a useful addition to the procedure as it would provide additional transparency into how the inputs affect each of the parameters of the generated conditional distribution.

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APPENDIX

This appendix contains the tables with the detailed results which are referenced in the results and discussion sections.

Table 3

Performance Comparison for Bulgaria

Time Period	GDP Actual	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR
		Median		RMSE		Predictive Score		Probability of recession	
2017Q3	0.685	0.768	0.817	0.083	0.132	0.837	1.196	0.501	0.436
2017Q4	0.628	0.691	0.727	0.063	0.098	0.781	1.133	0.556	0.551
2018Q1	0.743	0.823	0.697	0.080	0.046	0.807	1.207	0.460	0.577
2018Q2	0.572	0.681	0.584	0.108	0.012	0.751	1.211	0.560	0.705
2018Q3	0.615	0.634	0.283	0.019	0.333	0.757	0.827	0.589	0.899
2018Q4	0.416	0.677	0.484	0.260	0.068	0.661	0.893	0.563	0.739
2019Q1	3.790	0.595	0.336	3.195	3.454	0.000	0.000	0.617	0.848
2019Q2	-0.263	2.156	3.711	2.419	3.974	0.001	0.000	0.013	0.000
2019Q3	-0.642	0.275	0.354	0.917	0.997	0.215	0.121	0.802	0.853
2019Q4	0.270	0.043	0.070	0.227	0.200	0.636	1.063	0.858	0.960
2020Q1	-0.206	0.617	0.503	0.823	0.709	0.268	0.284	0.622	0.741
2020Q2	-7.324	0.302	-7.453	7.625	0.130	0.000	0.237	0.707	1.000
2020Q3	3.095	-3.024	0.460	6.119	2.635	0.000	0.003	1.000	0.798
2020Q4	1.407	1.842	3.016	0.435	1.609	0.556	0.000	0.035	0.000
2021Q1	1.786	1.264	1.366	0.522	0.421	0.527	0.415	0.161	0.042
2021Q2	0.916	1.210	1.502	0.294	0.587	0.829	0.036	0.146	0.002
2021Q3	0.837	0.905	0.941	0.067	0.104	0.851	1.295	0.399	0.296
2021Q4	1.045	0.988	0.746	0.057	0.299	0.867	0.757	0.349	0.520

Source: Author, Eurostat.

Table 4

Performance Comparison for Estonia

Time Period	GDP Actual	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR
		Median		RMSE		Predictive Score		Probability of recession	
2016Q4	1.198	0.906	1.261	0.293	0.063	0.646	0.727	0.482	0.363
2017Q1	1.972	0.930	1.317	1.043	0.655	0.458	0.564	0.474	0.340
2017Q2	1.899	0.967	1.526	0.931	0.372	0.449	0.668	0.466	0.270
2017Q3	0.358	1.479	1.544	1.121	1.186	0.481	0.400	0.267	0.255
2017Q4	1.446	0.541	0.761	0.905	0.685	0.490	0.540	0.591	0.524
2018Q1	1.062	1.158	1.266	0.096	0.205	0.733	0.681	0.394	0.368
2018Q2	0.776	0.780	0.713	0.004	0.063	0.634	0.551	0.520	0.535
2018Q3	0.685	0.564	0.995	0.121	0.310	0.603	0.605	0.580	0.457
2018Q4	1.377	0.551	0.752	0.825	0.624	0.487	0.544	0.583	0.526
2019Q1	1.637	1.206	1.073	0.431	0.564	0.671	0.572	0.376	0.435
2019Q2	0.426	1.088	1.204	0.662	0.778	0.653	0.516	0.424	0.394
2019Q3	0.697	0.765	0.581	0.067	0.116	0.706	0.543	0.528	0.568
2019Q4	0.365	0.890	0.759	0.525	0.395	0.674	0.526	0.486	0.524
2020Q1	-1.207	0.173	0.882	1.380	2.089	0.413	0.196	0.664	0.490
2020Q2	-5.812	1.503	-5.795	7.314	0.017	0.000	0.225	0.162	1.000
2020Q3	3.619	-2.685	-1.490	6.304	5.109	0.002	0.000	0.972	0.997
2020Q4	2.197	1.386	2.123	0.811	0.074	0.443	0.938	0.351	0.040
2021Q1	3.331	1.597	1.693	1.734	1.638	0.222	0.228	0.213	0.161
2021Q2	2.419	1.242	1.884	1.177	0.535	0.376	0.591	0.391	0.055
2021Q3	1.025	1.751	1.762	0.725	0.737	0.741	0.687	0.155	0.139
2021Q4	1.766	1.108	1.044	0.658	0.723	0.622	0.537	0.408	0.443

Source: Author, Eurostat.

Table 5

Performance Comparison for Lithuania

Time Period	GDP Actual	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR
		Median		RMSE		Predictive Score		Probability of recession	
2017Q3	1.036	1.042	1.240	0.006	0.204	0.976	1.360	0.416	0.260
2017Q4	0.897	1.083	1.135	0.186	0.238	0.983	0.931	0.397	0.373
2018Q1	0.855	1.399	1.194	0.544	0.339	0.714	0.861	0.280	0.345
2018Q2	1.205	0.915	1.139	0.291	0.066	0.818	1.292	0.475	0.330
2018Q3	0.867	1.136	1.257	0.269	0.390	0.964	0.896	0.374	0.305
2018Q4	1.284	1.004	1.054	0.280	0.230	0.859	0.956	0.434	0.409
2019Q1	1.403	1.069	1.144	0.334	0.259	0.783	0.915	0.408	0.374
2019Q2	1.181	0.954	1.139	0.227	0.042	0.743	1.150	0.462	0.352
2019Q3	0.397	0.698	0.837	0.301	0.440	1.061	0.964	0.565	0.514
2019Q4	1.290	0.870	0.901	0.420	0.389	0.813	0.873	0.495	0.480
2020Q1	0.732	0.923	1.087	0.191	0.356	0.882	0.946	0.475	0.380
2020Q2	-5.864	1.505	-5.604	7.370	0.260	0.001	0.152	0.163	0.959
2020Q3	3.882	-0.785	-0.612	4.667	4.494	0.000	0.000	1.000	0.991
2020Q4	1.555	1.157	1.299	0.398	0.256	0.611	1.242	0.372	0.126
2021Q1	1.708	1.566	1.682	0.141	0.026	1.009	1.709	0.239	0.082
2021Q2	1.202	1.340	2.040	0.137	0.838	1.132	0.068	0.259	0.002
2021Q3	0.720	0.852	0.959	0.132	0.238	0.919	0.980	0.502	0.449
2021Q4	1.254	1.087	1.273	0.167	0.020	0.294	8.498	0.467	0.072

Source: Author, Eurostat.

Table 6

Performance Comparison for Romania

Time Period	GDP Actual	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR	Benchmark	DeepGaR
		Median		RMSE		Predictive Score		Probability of recession	
2016Q4	2.119	0.816	1.535	1.303	0.583	0.229	0.368	0.548	0.070
2017Q1	2.304	1.093	1.495	1.211	0.809	0.282	0.379	0.430	0.203
2017Q2	1.213	1.156	1.295	0.057	0.082	0.583	0.611	0.405	0.350
2017Q3	2.341	0.746	1.090	1.595	1.251	0.180	0.227	0.569	0.412
2017Q4	1.062	1.187	1.485	0.125	0.423	0.632	0.680	0.389	0.231
2018Q1	0.571	1.464	1.569	0.893	0.998	0.385	0.358	0.218	0.246
2018Q2	1.517	0.522	0.868	0.995	0.649	0.353	0.489	0.663	0.529
2018Q3	1.054	0.659	1.074	0.395	0.019	0.504	0.969	0.596	0.401
2018Q4	0.704	0.980	1.255	0.277	0.552	0.707	0.554	0.472	0.360
2019Q1	1.483	0.650	0.738	0.833	0.745	0.410	0.411	0.611	0.569
2019Q2	0.803	1.104	1.004	0.302	0.201	0.704	0.460	0.416	0.475
2019Q3	0.693	0.782	0.626	0.089	0.066	0.677	0.466	0.559	0.588
2019Q4	0.668	0.458	0.956	0.210	0.287	0.573	0.908	0.671	0.475
2020Q1	0.258	2.479	1.264	2.221	1.006	0.001	0.266	0.003	0.437
2020Q2	-10.249	-0.378	-6.694	9.871	3.554	0.000	0.022	0.948	1.000
2020Q3	4.764	-3.001	-0.386	7.765	5.150	0.000	0.000	0.999	0.999
2020Q4	3.888	1.913	2.236	1.976	1.652	0.138	0.040	0.121	0.006
2021Q1	1.946	1.727	2.074	0.219	0.128	0.492	1.960	0.196	0.004
2021Q2	1.594	1.017	1.560	0.577	0.034	0.395	1.194	0.468	0.112
2021Q3	0.408	0.757	0.672	0.349	0.263	0.638	0.594	0.562	0.594
2021Q4	-0.053	1.136	1.373	1.188	1.425	0.219	0.194	0.382	0.312

Source: Author, Eurostat.

Table 7

Conditional Distribution Parameters Generated by DeepGaR – Bulgaria

Time Period	Standard Deviation	Skewness	Tailweight	.05 Quantile	.95 Quantile	IQR
2017Q3	0.384	-0.082	1.582	0.090	1.414	1.325
2017Q4	0.425	-0.139	1.511	-0.141	1.363	1.504
2018Q1	0.468	-0.098	1.484	-0.212	1.431	1.643
2018Q2	0.426	-0.214	1.447	-0.366	1.194	1.560
2018Q3	0.443	-0.276	1.331	-0.764	0.920	1.684
2018Q4	0.507	-0.207	1.335	-0.626	1.247	1.873
2019Q1	0.479	-0.219	1.327	-0.726	1.052	1.778
2019Q2	0.260	0.340	2.173	3.480	4.519	1.039
2019Q3	0.452	-0.111	1.443	-0.538	1.063	1.601
2019Q4	0.433	-0.173	1.394	-0.847	0.722	1.569
2020Q1	0.498	-0.166	1.428	-0.546	1.250	1.796
2020Q2	1.179	-2.026	0.134	-9.944	-5.073	4.871
2020Q3	0.328	0.321	1.826	0.100	1.370	1.270
2020Q4	0.271	0.210	2.080	2.714	3.654	0.940
2021Q1	0.345	0.033	1.725	0.814	1.970	1.156
2021Q2	0.166	0.027	2.197	1.258	1.774	0.515
2021Q3	0.385	-0.075	1.575	0.216	1.546	1.330
2021Q4	0.529	-0.101	1.375	-0.290	1.598	1.888

Source: Author.

Table 8

Conditional Distribution Parameters Generated by DeepGaR – Estonia

Time Period	Standard Deviation	Skewness	Tailweight	.05 Quantile	.95 Quantile	IQR
2016Q4	0.660	0.055	1.274	-0.884	3.617	4.501
2017Q1	0.647	0.079	1.296	-0.735	3.675	4.410
2017Q2	0.638	0.104	1.312	-0.450	3.906	4.356
2017Q3	0.621	0.141	1.327	-0.318	3.949	4.267
2017Q4	0.741	-0.112	1.143	-2.027	3.142	5.169
2018Q1	0.677	0.029	1.239	-0.995	3.635	4.630
2018Q2	0.761	-0.163	1.093	-2.268	3.122	5.391
2018Q3	0.710	-0.050	1.194	-1.544	3.347	4.891
2018Q4	0.750	-0.135	1.123	-2.123	3.143	5.266
2019Q1	0.712	-0.046	1.174	-1.472	3.447	4.919
2019Q2	0.696	-0.015	1.205	-1.214	3.567	4.781
2019Q3	0.771	-0.172	1.084	-2.457	3.016	5.473
2019Q4	0.750	-0.125	1.118	-2.094	3.165	5.259
2020Q1	0.714	-0.073	1.193	-1.722	3.211	4.932
2020Q2	1.159	-1.321	0.454	-11.677	-1.453	10.224
2020Q3	0.538	-0.403	1.398	-4.339	-0.160	4.179
2020Q4	0.506	0.364	1.540	0.938	4.775	3.836
2021Q1	0.555	0.251	1.435	0.220	4.146	3.926
2021Q2	0.472	0.373	1.592	0.815	4.429	3.614
2021Q3	0.551	0.266	1.439	0.318	4.243	3.925
2021Q4	0.709	-0.036	1.186	-1.465	3.419	4.884

Source: Author.

Table 9

Conditional Distribution Parameters Generated by DeepGaR – Lithuania

Time Period	Standard Deviation	Skewness	Tailweight	.05 Quantile	.95 Quantile	IQR
2017Q3	0.405	0.101	1.542	0.068	2.721	2.653
2017Q4	0.523	-0.027	1.412	-0.643	2.818	3.461
2018Q1	0.517	-0.071	1.463	-0.639	2.770	3.409
2018Q2	0.426	0.076	1.496	-0.143	2.654	2.796
2018Q3	0.491	0.016	1.454	-0.327	2.897	3.224
2018Q4	0.524	-0.035	1.400	-0.743	2.729	3.471
2019Q1	0.537	-0.033	1.393	-0.696	2.869	3.565
2019Q2	0.469	0.030	1.436	-0.358	2.733	3.091
2019Q3	0.380	0.053	1.486	-0.335	2.153	2.489
2019Q4	0.513	-0.046	1.393	-0.882	2.527	3.409
2020Q1	0.472	0.019	1.429	-0.438	2.673	3.111
2020Q2	1.796	-0.965	0.602	-14.763	0.618	15.381
2020Q3	0.283	-0.035	1.536	-1.568	0.269	1.837
2020Q4	0.281	0.225	1.647	0.605	2.523	1.917
2021Q1	0.374	0.106	1.673	0.642	3.053	2.411
2021Q2	0.192	0.180	2.135	1.627	2.843	1.215
2021Q3	0.488	-0.027	1.398	-0.700	2.531	3.231
2021Q4	0.073	-0.387	2.794	0.719	1.353	0.633

Source: Author.

Table 10

Conditional Distribution Parameters Generated by DeepGaR – Romania

Time Period	Standard Deviation	Skewness	Tailweight	.05 Quantile	.95 Quantile	IQR
2016Q4	0.303	-0.027	1.618	0.818	2.207	1.389
2017Q1	0.580	0.147	1.341	0.274	3.097	2.823
2017Q2	0.738	0.174	1.195	-0.302	3.374	3.676
2017Q3	0.607	0.139	1.260	-0.227	2.750	2.978
2017Q4	0.628	0.151	1.296	0.147	3.227	3.080
2018Q1	0.734	0.151	1.220	-0.031	3.597	3.628
2018Q2	0.548	0.098	1.264	-0.358	2.312	2.670
2018Q3	0.515	0.118	1.335	-0.038	2.455	2.493
2018Q4	0.716	0.155	1.205	-0.307	3.241	3.547
2019Q1	0.715	0.143	1.118	-0.874	2.697	3.571
2019Q2	0.894	0.157	1.048	-1.035	3.470	4.505
2019Q3	0.844	0.147	1.012	-1.328	2.938	4.266
2019Q4	0.491	0.108	1.345	-0.109	2.258	2.367
2020Q1	1.346	0.158	0.893	-1.934	4.956	6.890
2020Q2	0.890	-1.055	0.269	-9.281	-4.339	4.942
2020Q3	0.239	-0.113	1.602	-1.020	0.094	1.114
2020Q4	0.369	0.129	1.628	1.512	3.237	1.725
2021Q1	0.214	-0.042	1.836	1.568	2.519	0.951
2021Q2	0.455	0.131	1.489	0.631	2.797	2.166
2021Q3	0.707	0.126	1.100	-0.946	2.582	3.528
2021Q4	0.714	0.137	1.213	-0.199	3.321	3.521

Source: Author.

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DYNAMIC CORRELATION AND CAUSALITY BETWEEN INVESTMENTS AND SALES REVENUES: AN ECONOMETRIC ANALYSIS OF MANUFACTURING ENTERPRISES IN KOSOVO[4]

Purpose: This research aims to analyze the correlation and causality between investments and sales revenues through an econometric analysis of manufacturing enterprises in Kosovo. Since investments are essential for enterprises, studying their impact and sales revenues on manufacturing enterprises is crucial.

Methodology: Empirical data to be used in the research is secondary and will be based on the annual reports of the Minister of Finance. This paper will also refer to many studies by different authors that have analyzed the relationship between investments and sales revenues. The years that will be analyzed in this research are 2018-2019.

Expected results: Through the analysis of this research conducted between investments and sales revenues and other variables, we expect to get some positive results which can tell us that the investments made by a company will positively affect sales income in manufacturing enterprises.

Practical implications: Through the analysis made between these variables, different manufacturing companies in Kosovo can see the effect that investments have on sales revenues and other variables, i.e., the correlation between them. The results of this study will also serve as good scientific and empirical evidence for future studies to be conducted in investments or economics.

Originality: This scientific paper presents actual and consistent results about the relevant conclusions. The analyzed period (2018-2019) is a convincing period for drawing competent conclusions and recommendations.

Keywords: investments; sales revenues; capital; firm size; manufacturing enterprises
JEL: E22; H32; L11; L22

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1. Introduction

An investment is the actual commitment of money or other resources to achieve future benefits. For example, an individual may buy securities by predicting that future income from investing in securities will justify the time his money is invested and the investment risk (Bodie et al., 2018). Based on economic science, today, investments are one of the main factors contributing to the development of the economy in both developed and developing countries. The manufacturing industry is the driver of its growth.

Given that this paper deals with the correlation and causality between investments and sales revenues to manufacturing enterprises in Kosovo, the panel data from a sample of 40 manufacturing enterprises will be applied during the period 2018 – 2019. Initially, we construct an econometric model where sales revenues are taken as the dependent variable. The independent variables are investments, capital, firm size, short-term liabilities, long-term liabilities, retained earnings, cash flow from operating activities and cash flow from financial activities. The STATA software program was applied to analyze the data included in this econometric model. Statistical tests were performed, including linear regression, random effect, fixed effect, Hausman – Taylor Regression, and Generalized Estimating Equations (GEE Model).

The structure of this paper will consist of several parts. The first part will include an overview of the investment and its impact on the various elements of a firm. The second part reviews the literature on investments and their impact on sales revenues, productivity, profitability, research and development, and a firm's technology. The third part describes the research methodology and the specification of the econometric model. The fourth part includes the econometric analysis and the study's findings, where all the results obtained through the STATA program will be explored. Finally, the last part of this research presents the discussions, conclusions and recommendations related to this research.

2. Literature Review

A study conducted in South Africa by author Olawale et al. investigated the impact that investment valuation techniques had on the profitability of small manufacturing firms. According to the study, the owners of small manufacturing firms do not use sophisticated investment appraisal techniques when evaluating their proposed projects. Multiple regression analysis was also used during the research to confirm the impact of investment valuation techniques on the profitability of small manufacturing firms. As a result, the study concluded that the use of non-sophisticated investment valuation techniques negatively impacts the profitability of small firms (Olawale et al., 2010).

The objective of the research conducted by Vaisanen et al. (2007) was to determine how investments in Intellectual Capital (IC) affect the productivity and profitability of a company. The study is based on a large set of information from the financial statements presented over three years. In addition, correlation and regression analyses are used to study relationships within the entire data set in different industries, including SMEs and large companies. The study findings suggest that the short-term impact of IC investments on productivity and

profitability turns out to be negative. However, the findings also support previous research evidence suggesting that investing in IC brings benefits, but they may come too late.

Johansson and Lööf (2008), in their study of Swedish manufacturing firms, found that the impact of physical capital (investment) on the profitability of an enterprise is significant and has a positive impact, and is also systematically greater than comparable estimates of labour productivity (Johansso & Loof, 2008).

Kapelko et al. (2015), analyzing research on the case of Spanish manufacturing firms, found that initially, capital investments produce a significant loss of productivity in the first year after the investment is made. However, productivity then improves, resulting in the model of a U-shaped relationship. The impact of investment growth on the firm's productivity remains a question mark for everyone. Investment growths that are expansionary or replacement investments are not expected to affect the firm's productivity in the long run. In contrast, reorganization investments are expected to improve the firm's productivity. Also, the short-term impacts of investment growth are expected to differ from the long-term impacts (Klenow, 1993; Power, 1998; Yorukoglu, 1998).

(Russell, 2011) analyzes the relationship between investment and productivity in US manufacturing industries and shows that time during investment growth is not associated with improved labour productivity. Instead, the impacts of various IT investments made within a firm improve production efficiency on product quality, production costs, profits and productivity. Therefore, IT investments should be claimed to impact productivity positively, and improvements in the quality of the product or service enabled by IT investments should also positively impact the firm (Matt and Jim, 2001).

(Baumann & Kritikos, 2016) examined the relationship between R&D investment, innovation and work productivity based on company size. Their research found that the link between companies' investment in Research and Development and labour productivity in small companies does not differ much from larger ones. Investments in fixed assets represent an essential factor that can serve as a good signal in predicting the future profit of the firm and the return of shares (Lev & Thiagarajan, 1993). However, assessing the impact of investments at the firm level has not always been a consistent research topic because, for many years, it was hampered by a lack of investment data. Only recently have researchers begun to analyze and document the nature of firm investment behaviour (Grazzi et al., 2016).

Sustainable development of manufacturing firms is closely related to the realization of capital investments, or investment projects, whether it is a replacement, modernization, expansion or any other type of investment. Furthermore, sustainable production depends mainly on selecting and implementing investment projects, as they must be selected and implemented based on an assessment of their environmental and social impact. This needs to happen in addition to the assessment of other associated risks – which may are systematized as investment, financial, organizational, technical, technological, technological, operational and informational risks (Shpak et al., 2018). Power (1998), in his study of US manufacturing firms, found no evidence of a robust positive relationship between productivity and tangible investment, which warns against the effectiveness of fiscal policy based on the premise that investment causes high productivity. The authors (Grabowski & Dennis, 1972) also cited that

poor quality investments and low productivity can result if managers maximize their profitability rather than firm profits.

According to the author's results (Govori, 2013), the factors that influence the growth and development of SMEs in Kosovo, including the realization of investments in these enterprises, are: access to finance, lack of capital market, competition, corruption and government policies. The portfolio of the banking sector in Kosovo for manufacturing enterprises reaches up to 25%, which means that the sectors that are very important for the economic development of the country (production, industry and agriculture) face financing difficulties for the realization of real and financial investments.

According to the author (Morina, 2016), investments in technology in manufacturing enterprises in Kosovo will positively affect their financial performance, increase their annual turnover and improve access to external financing for these enterprises through bank loans. Therefore, if investments in technology increase by 1% in production enterprises in Kosovo, then the annual turnover of these enterprises will increase by 0.145%. According to the author (Bajçinca, 2015), the main factors that influence the investments of enterprises in Kosovo are: the age of the firm, the size of the company, and access to bank loans, among others. According to this study, service enterprises in Kosovo decide more easily to invest, while manufacturing enterprises have more difficulties in this process, since they need higher amounts of funds to invest. Based on the study of the authors (Sahiti & Smith, 2017) we can emphasize that factors from the business environment have a very important role in the growth and development of Kosovar firms. The empirical evidence of this study shows that the business environment in Kosovo is characterized by low adaptability, high cost of capital and low volume of investments. In her study, the author (Latifaj, 2018) analyzed the impact of innovative activities on the performance of enterprises in Kosovo. According to the results of this study, we can conclude that investments in the field of innovation have positively influenced the performance of enterprises in Kosovo.

The authors (Morina, Komoni, & Selmonaj, 2022) in their study have analyzed the impact of the capital structure on the credit risk of manufacturing enterprises in Kosovo. According to the findings of this study, if the size of the firm increases by 1 unit, then the credit risk of manufacturing enterprises will decrease by 0.864 units. Such a result means that manufacturing companies in Kosovo have lower exposure to credit risk and these companies can get loans from commercial banks intended for investments, which will positively affect the increase in sales revenue and financial performance of these companies. In their study, the authors (Peci & Shabani, 2020) have found a positive correlation between the variables: age, firm size, business plan with financial performance and increased investment in small and medium enterprises in Kosovo. Firms that make higher investments and operate with more owners have a greater chance of obtaining bank loans. According to the authors' study (Ismajli & Shkodra, 2012) the factors that have caused the failure of businesses in Kosovo are: unfavourable business environment, lack of investments, lack of adequate economic policies, neglect of the compilation of the business plan, which helps in forecasting business risk, and lack of application of cash flow and commercial analysis. In their study, the authors (Shabani, Morina, & Berisha, 2021) have concluded that small and medium-sized enterprises in Kosovo are very liquid and these companies carefully manage their cash flow in order to

carry out their activities in the future, protect their investment and ensure an optimal capital structure.

3. Meta-Analysis of Scientific Research

This part of the paper will review a series of articles. Then, the meta-analysis of the research will be built based on works by different authors who have analyzed works similar to the topic that we have analyzed and will look at the findings taken from this research.

Table 1

Meta-analysis of the research

Author	Year	Variables	Methods	Findings
(Santoso, 2019)	2010-2017	Firm performance, firm value and financial performance.	Path analysis technique	The results of the data analysis show that investments in Indonesia's consumer sector have a positive impact on company performance and firm value.
(Hashmati & Loof, 2006)	1992-2000	Sales, R&D, investments, CF, capital structure, tangible investment stock etc.	CDM-mode	The results based on the SME sample showed evidence of different relationships between investment and performance variables where we see that we have a positive effect.
(Grozdic et al., 2020)	2004-2016	ROA, Capital investment, firm size, investment overdue capital, leverage, total turnover of assets.	OLS model	The relationship between capital investment and firm performance is positive because of the definition, nature and timing of capital investment – they may bring losses to the firm in the short term. However, they should enhance the firm's performance in the long run.
(Lee et al., 2016)	2011-2014	Firm purchases, industry, capital, workers, growth, firm size.	RBV method	The investment in wireless technology has contributed significantly to the growth of the business over the years. On the other hand, data centre technology investment affects business growth after two years, while collaboration is found paradoxically in 2 years.
(Kapelko et al., 2015)	2000-2010	Fixed assets, cost of employees, the cost of the material, investments, outputs.	Method of impulse responses by local Projection	The results of the impulse response analysis show that an increase in investment has a significant negative effect on dynamic productivity growth and dynamic technical change in the first year after growth.
(Kotsina & Hazak, 2012)	2001-2009	Investments and returns on assets (ROA).	Regression Analysis (OLS)	Based on the preliminary results obtained from the current phase of the study, no strong negative (or positive) impact of the companies' investment intensity on the future rate of return on assets has been identified yet, compared to some previous studies.

Author	Year	Variables	Methods	Findings
(Li, 2004)	1962-2002	Investments, ROA, sales growth, industry.	OLS regression	From the results, we see a positive relationship between these variables. However, this relationship worsens when firms have high free cash flow and low leverage, in line with building the empire of managing incentives.
(Jun, 2006)	1991-2001	Investments, debt ratio, the loan-deposit rate spread, the equity ration, reserve ratio, credit/deposit ratio	Panel cointegration testing and evaluation techniques	In the analysis of the group of banks based on IT investments, IT investments in both high and low IT banks have positive effects on improving profitability, but that in low IT banks show a slightly stronger impact on bank returns.
(Indjikian & Siegel, 2005)	2003	Increase total factor productivity, Investments in R&D and rate of investment in computers.	Multiple regression model	The empirical findings on IT and economic performance examined in this paper are pretty strong, in the sense that the vast majority of researchers have found a positive correlation between some approximations for IT investments and some approximations for economic performance at each level of aggregation (e.g., plant, firm, industry and country)
(Nguyen & Nguyen, 2020)	2014-2017	Firm size, liquidity, payment, financial leverage, financial sufficiency, ROA, ROE and ROS.	Multiple regression model	From the results obtained, the authors concluded that the firm's size has a positive impact on ROA but a slight impact on ROS and a negative impact on ROE. The adequacy ratio positively affects ROA and ROS but negatively affects ROE. Liquidity is an indicator with a positive impact on ROA and ROE, while financial leverage has a strong positive impact on ROA compared to a significant negative impact on others. Finally, solvency positively impacts ROA and ROS but has a negative impact on ROE.
(Babalola, 2013)	2000-2009	Firm size, profitability, total assets, total sales, financial leverage, liquidity.	Fixed effect method	According to the results, in terms of total assets and total sales, the firm's size positively impacts the profitability of Nigerian manufacturing companies. However, a negative correlation was found between the ratio of total liabilities to total assets and profitability regarding control variables. In addition, a high level of debt has a negative effect on profitability. This result may be due to the relatively high-interest rates in Niger.
(Mule et al., 2015)	2010-2014	Firm size, profitability and firm value.	Data panel	From the results obtained, the authors concluded that firm size is a significant positive predictor of profitability measured in terms of ROE.

Source: Data analyzed by the authors (2022).

Following the meta-analysis, we will provide some convincing arguments as to why the correlation and causality between investments and sales revenues have been studied in this scientific paper. In the context of all the studies that have been analyzed in the literature review and in the meta-analysis, one can notice that investments have influenced the financial performance, productivity and efficiency of these enterprises.

In their study, the authors (Capon, Farley, & Hoenig, 1990) concluded that the variables that positively affect the performance of companies in different sectors of the economy are: sales revenues, asset growth, capital structure, investments in research & development, quality of products and services, vertical integration and corporate social responsibility. Whereas, the variables that have had a negative impact are: capital investments, debt, diversification and export/import of the industry. In this study, an important significant relationship was found between investments, sales revenues and financial performance. Therefore, the authors have analyzed approximately 88 studies by other researchers that have found a significant positive relationship between sales revenue growth, investment and financial performance of companies. Considering the result obtained in these studies, we have been very interested in analyzing the correlation and causality between investments and sales revenues in manufacturing enterprises in Kosovo. Manufacturing enterprises make real long-term investments in machinery, equipment, information technology, and research and development, which allows them to generate sales revenues for many years by adding or improving production facilities and increasing operational efficiency. A business does not see an immediate increase in sales revenues when it makes investments in capital goods. Therefore, based on this fact, the focus of this study is the causality and dynamic correlation between investments and sales revenues.

According to the study, carried out by the authors (Doh & Prince, 2015), they concluded that investments in research & development in information technology corporations will generate more revenue from sales. So, through the increase of investments in these corporations, the value of these firms will also increase and it is expected that higher profits will be generated in the future.

The author (Stubelj, 2014) found in his study that investment determines profits in a national economy. It is indisputable that investment, sales revenues and profits are important for the economic system and the investments – sales revenues correlation is very high. The authors (Abel & Blanchard, 1988) in their study found that there is a significant positive correlation and causality between investment, sales revenues and capital stock in various manufacturing industries in the US economy.

In this study, the authors have based their calculations and referred on the econometric model, used by the following authors: (Stubelj, 2014), (Hashmati & Loof, 2006), (Gala & Julio, 2016), (Baumol & Wolff, 1983), (Lev & Thiagarajan, 1993), (Santoso, 2019).

4. Scientific Research Methodology and Specification of the Econometric Model

This research aims to analyze the correlation and causality between investments and sales revenues in manufacturing enterprises in Kosovo. For this research, various scientific works

and books of different authors have been analyzed. In addition, they have themselves analyzed the issues related to investments and other variables included in the research and other materials from electronic sources and websites such as that of the Ministry of Finance.

The data included in the paper are secondary data. The period included in this study is two years (2018 – 2019); the number of enterprises included in the analysis is 40. Given that the Ministry of Finance has not yet published all the annual financial statements for the last two years (2020 – 2021), this study will focus on the published annual financial statements for the time period (2018-2019). Based on the statistical reports of the Statistics Agency of Kosovo for the year 2022, there are 10 large manufacturing enterprises and 71 medium manufacturing enterprises in the economy of Kosovo. Our main focus in this study is to include in the sample the 10 largest manufacturing enterprises in the economy of Kosovo, and from 71 medium-sized manufacturing enterprises, we have selected 30 of them, whose audited financial statements were easily accessible. Econometric results and conclusions are valid, consistent, scientifically and empirically proven. Also, these study findings represent almost the entire manufacturing enterprise sector in Kosovo, because the sample includes all large manufacturing enterprises and approximately 50% of the medium-sized manufacturing enterprises.

The data included in the research were processed in the STATA program, and we applied the following statistical tests: linear regression, random effect, fixed effect, Hausman – Taylor Regression, General Assessment Equations (GEE Model), Johansen Cointegration Test, Autoregressive Vector Regression (VAR) and Granger Causality Wald Tests. In this study, more statistical tests are applied through panel data and time series models. The main purpose that all these statistical tests have been applied is to have greater consistency and significance in the econometric results and findings for this study. Since the main focus of this study is to analyze the dynamic correlation and causality between investments and sales revenues, we have also applied some other statistical tests through time series models, which have given an added value in view of the comprehensibility of the results of this study.

The application of all these statistical tests in this study was carried out with the sole intention of having higher reliability and so that there can be comparability between the econometric results through different statistical tests.

The research questions of this study are:

1. How have investments affected sales revenues in manufacturing enterprises in Kosovo?

The main hypotheses of this study are:

H1: *Investments positively impact sales revenues in manufacturing enterprises in Kosovo.*

Quantitative methods based on the secondary data of the annual reports of the Ministry of Finance have been applied to test the hypotheses. However, to analyze the effect of investments, it is necessary to consider many other factors that explain these variables' correlation. Therefore, for the specification of the econometric model, we have based our research on several studies by different authors who have analyzed the effect of investments on different firms in the world.

Table 2

Description of the variables included in the econometric model

Variables	Description of variables	Data source
Dependent variable (Y)	Sales revenues (SR)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_1)	Investments (INV)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_2)	Equity (E)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_3)	Firm Size (FS) – The natural logarithm of total assets	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_4)	Short-term liabilities (SHTL)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_5)	Long-term liabilities (LTL)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_6)	Retained Earnings (RE)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_7)	Cash flow from operating activities (CFO)	Annual Reports of the Ministry of Finance (2018 – 2019)
Independent variable (X_8)	Cash flow from financial activities (CFF)	Annual Reports of the Ministry of Finance (2018 – 2019)

Source: Data analyzed by the authors (2022).

The econometric model of this research is as follows:

$$SR = \beta_0 + \beta_1 I_{it} + \beta_2 E_t + \beta_3 FS_t + \beta_4 ShTL_{it} + \beta_5 LTL_t + \beta_6 RE_t + \beta_7 CFO_t + \beta_8 CFF + \gamma_{it} \quad (1)$$

The dependent variable in this study is **sales revenues**, which is the revenue received by a company from the sale of goods or the provision of services. It is important to note that income does not necessarily mean money received. Part of the sales revenues can be paid in cash, and part can be paid on credit through accounts receivable.

The primary independent variable is **investment,** which is important because it means investing financial assets in various investments, whether in securities, investment projects, or anywhere. The rate of return from this investment is greater than the amount invested or at least the same. Data on investments as the main independent variable in this study were obtained from audited financial statements of manufacturing enterprises in Kosovo. These financial statements are audited by the Office of the Auditor General and published by the Ministry of Finance. The investment data are based on the balance sheet of 40 manufacturing companies, more specifically on the balance sheet assets, where all types of investments made by these manufacturing companies are calculated and taken into account. These investments are as follows: investments in machinery and equipment, investments in securities, investments in information technology, investments in real estate, investments in partnerships, investments in research and development, investments in the field of innovation, etc.

The second independent variable is **equity**, which usually represents cash or liquid assets held or received for expenses. Alternatively, equity includes all active assets in a company with monetary value.

The third independent variable is the **firm**'s size, determined by the turnover limits, the total balance sheet, the average number of employees, and the quality factors taken into account. In this study, firm size is determined based on total assets.

The fourth independent variable is **current liabilities**, which are current liabilities, meaning debts or liabilities that are expected to be settled within a year. These include short-term debts, accrued expenses and customer deposits.

The fifth independent variable is **long-term liabilities**, which have been outstanding for the last 12 months or the company's operating cycle if it is longer than one year.

The sixth independent variable is **retained earnings**, which means retaining the firm's profits, i.e. reinvesting them in the company and not distributing them as dividends to shareholders.

The seventh independent variable is the **cash flow from operating activities**, which indicates the amount of money a company brings from its ongoing, regular business activities, such as producing and selling goods or providing a service to customers.

The eighth independent variable is the **cash flow from financial activities**, representing a part of a company's cash flow statement, which shows the net cash flows used to finance the company.

Figure 1

Linear trend of investment and sales revenues
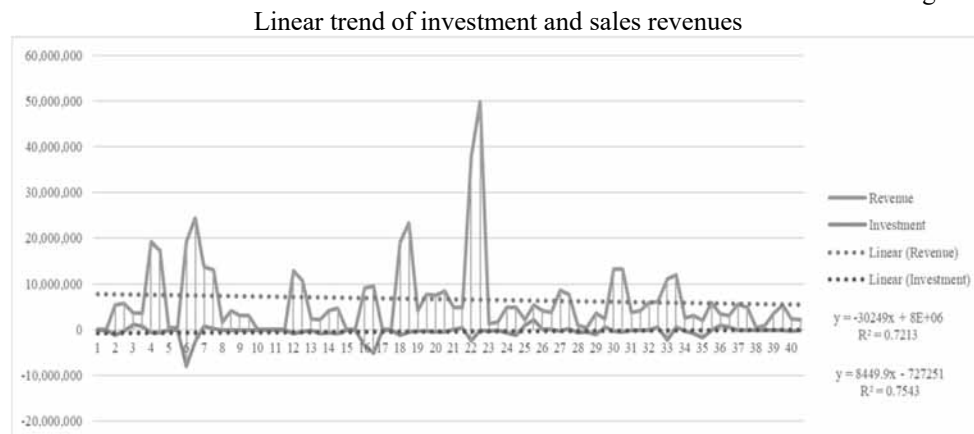
Source: Authors' calculations (2022)

Figure 1 shows the linear trend between investments and sales revenues for the 40 manufacturing enterprises analyzed in this study. The investments variable during the 2018-2019 time period for all these enterprises has a positive downward trend and the coefficient of determination of this linear trend is high in the value of $R^2 = 75.43\%$. The income variable for this time period consists of a positive downward trend and has a coefficient of determination in the value of $R^2 = 72.13\%$. Taking into account the fact that during this time period, there is a downward trend in investments and a positive downward trend in sales

revenues, these enterprises are faced with an increase in short-term liabilities and long-term liabilities.

Such an increase in the liabilities of these manufacturing enterprises has influenced all the activities of the enterprises to focus on the operational and financial level, so that the enterprises show a good degree of liquidity and solvency. Therefore, such a fact has influenced these companies to orient their financial policies in order to preserve liquidity and solvency, and for this fact, we have a downward trend in investments and sales revenues. Manufacturing companies in Kosovo need to orient financial policies to investments that will generate higher income from sales as a function of increasing the productivity and efficiency of the company. These investments seem to be realized in production machinery, information technology, research & development and innovation.

5. Econometric Analysis and Study Findings

This part of the econometric analysis will present the results of descriptive statistics, correlation coefficient and hypothesis testing through statistical tests for variables included in econometric models. In addition, this part of the study will verify the validity of the hypotheses and the interpretation of the study findings.

Table 3

Descriptive statistics for the variables included in the econometric model

| Variables	Obs.	Mean	Std. Deviation	Minimum	Maximum
Sales Revenues	80	6652816	8268747	819	5.00e+07
Investments	80	-385031.6	1292662	-7865089	2274838
Equity	80	1727040	5715714	0	5.00e+07
Firm Size	80	14.68278	2.205527	7.805882	17.26748
Short-term liabilities	80	1699711	1688163	2840	6022114
Long-term liabilities	80	1402328	2824706	0	1.56e+07
Retained earnings	80	1986694	3655074	-734734	2.33e+07
CFO	80	638922.1	1381267	-1042847	7676887
CFF	80	274038.7	839346.3	-1547584	4056971

Source: Authors' calculations (2022).

The data obtained through descriptive statistics analysis shows that the research included 80 observations. Each variable has presented an average that differs from each other, as in investments with a negative average value. The standard deviation, the minimum and the maximum of each variable are incorporated in the research.

Based on the graphical representation of the histogram, we see that between the dependent variable sales revenues and the independent capital variable, there is an almost normal distribution of these variables included in the analysis.

Figure 2

Graphic presentation of the histogram
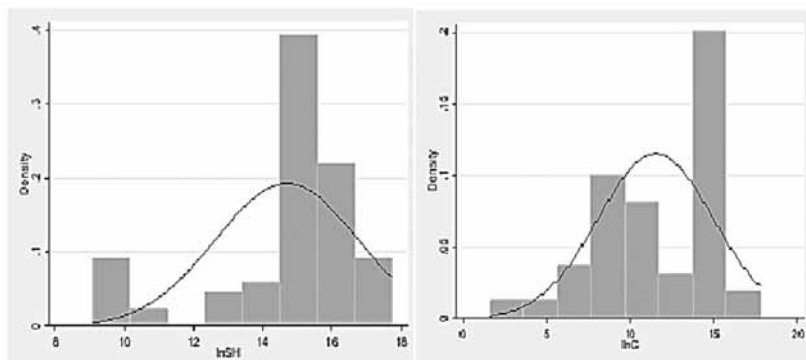
Source: Authors' calculations (2022).

Table 4

Correlation analysis for the variables included in the econometric model

Variables	SR	INV	E	FS	SHTL	LTL	RE	CFO	CFF
SR	1.0000								
INV	0.3341	1.0000							
E	0.2752	-0.7186	1.0000						
FS	0.451 6	-0.2292	0.2490	1.0000					
SHTL	0.6221	-0.0776	0.0639	0.5533	1.0000				
LTL	0.0353	-0.2327	0.1855	0.3525	0.0989	1.0000			
RE	0.5305	-0.4710	0.5498	0.3930	0.1840	-0.271	1.0000		
CFO	0.3717	-0.5478	0.6223	0.3311	0.2362	0.1189	0.6333	1.0000	
CFF	-0.0142	-0.3327	0.2069	0.1427	-0.0334	0.1920	0.0623	0.0070	1.0000

Source: Authors' calculations (2022).

From the data presented in the correlation analysis table, we notice that all the variables included in the econometric model are correlated. For example, if we analyze the correlation between sales revenues and investments, these two variables have a very weak correlation of (0.3341), but this still means that investments, in most cases, have a positive effect on sales revenues in an enterprise.

The value of the correlation between sales and capital has a very weak correlation of (0.2752), which means that with the increase of capital of an enterprise, the revenues from sales also increase. However, if we analyze the correlation between sales revenues and firm size, we see that these two variables have a positive average correlation (0.4516). This means that the enterprise will also increase sales revenues by increasing firm size, including the share of total assets.

Revenues from sales and short-term liabilities have a positive average correlation (0.6221), which means that with the increase in short-term liabilities of the enterprise, revenues from sales will also increase. In addition, the correlation between sales revenues and retained earnings is positive (0.5305), which means that sales revenues will also increase as retained earnings increase. We also have a positive average correlation between sales revenues and CFO variables in the amount of (0.57170), which means that with the increase of cash flow from operating activities, we will also have sales revenues. We find a very weak negative correlation of (-0.0142) between CFF variables and Revenues from sales, which means that with the increase in cash flow from financial activity, we have a decrease in sales revenues.

There is an average positive correlation between the variables capital and cash flow from operating activities in the value of R = 62.23%, which means that with the increase in the capital of these enterprises, the cash flow from operating activities will increase. Such a correlation means that these manufacturing enterprises will experience a positive effect on the generation of cash flows from operating activities, especially when they inject real and financial investments into the company.

Another important correlation between independent variables is between capital and investments. Between these two variables, there is a high negative correlation in the value of R = -71.86%. Therefore, with the increase of investments, the amount of capital of these production enterprises will decrease. Such a correlation is justified by the fact that there is a positive downward trend of investments for these enterprises and the financial policies of these enterprises during the analyzed time period (2018-2019) have been focused on maintaining a position of liquidity and solvency.

Between capital and retained earnings, there is an average positive correlation of R = 54.98%. So, with an increase in the amount of capital, a lot of retained profits will be generated, which will also positively affect the financial performance of the manufacturing companies in Kosovo. An increase in retained earnings creates the possibility of reinvesting these amounts in different forms in order to contribute positively to sales revenues, but also to the productivity and performance of these manufacturing enterprises in Kosovo.

A moderate positive correlation exists between short-term liabilities and firm size. As the size of the firm increases, short-term liabilities will also increase. This means that when manufacturing companies carry out business activities that affect the increase in total wealth, then consequently, such an effect also affects the increase in short-term liabilities of these companies and an increase in cash outflows from operating, financial and investment activities. Between the variables retained earnings and cash flows from operating activities, there is an average positive correlation of R = 63.33%. So, an increase in retained earnings will have positive effects on cash flows from operating activities due to the increase in sales revenues.

The following is the analysis of statistical tests performed through the STATA program, such as linear regression, random effect, fixed effect, Hausman – Taylor Regression, GMM Model – Arellano Bond Estimation, Generalized Estimating Equations (GEE Model), Johansen Test for Cointegration, Autoregressive Vector Models (VAR) and Wald Granger Causality Tests.

$$SR = \beta_0 + \beta_1 INV + \beta_2 E_{it} + \beta_3 \ln FS_{it} + \beta_4 SHTL_{it} + \beta_5 LTL_{it} + \beta_6 RE_{it} + \beta_7 CFO + \beta_8 CFF + \gamma_{it}$$

$$SR_{it} = 850494 + 1.330357 INV_{it} + 0.1664133 E_{it} - 85545.81 FS_{it} + 1.175876 SHTL_{it} - 0.1476992 LTL_{it} - 1.271019 RE_{it} - 0.1233481 CFO_{it} + 0.4343036 CFF + \gamma_{it}$$

Table 5

Econometric results and empirical findings of the study

Variables	Linear Regression	Random Effects – GLS Regression	Fixed–Effects Regression	Hausman – Taylor Regression	GEE Model
SR	-	-	-	-	-
INV	-1.318831* (0.089)	1.266254*** (0.006)	1.69068*** (0.007)	1.726243*** (0.000)	1.330357*** (0.002)
E	-0.117887 (0.509)	0.1587564** (0.025)	0.3556463*** (0.004)	0.2153118*** (0.001)	0.1664133* (0.010)
FS	-81426.85 (0.843)	90973.7 (0.748)	-0.86950.71 (0.776)	44252.97 (0.855)	85545.81 (0.741)
SHTL	2.772377*** (0.000)	1.283837*** (0.002)	0.0975121 (0.847)	0.7072028 (0.061)	1.175876*** (0.002)
LTL	-0.0603019 (0.815)	0.121141 (0.713)	0.6574753 (0.358)	0.3856779 (0.331)	0.1476992 (0.642)
RE	.9960797*** (0.000)	1.246567*** (0.000)	2.713095*** (0.004)	1.452513*** (0.000)	1.271019*** (0.000)
CFO	-0.5584583 (0.412)	-0.1416822 (0.703)	0.1412959 (0.709)	0.0019064 (0.995)	-0.1233481 (0.715)
CFF	-0.1173869 (0.891)	0.4240956 (0.303)	0.4335449 (0.345)	0.5224858 (0.135)	0.4343036 (0.246)
Const.	1326591 (0.805)	676166.7 (0.866)	1279333 (0.780)	1434117 (0.738)	850494 (0.819)
R Square	0.5871	0.4311	0.5474	-	-
Adj.R^2	0.5406	0.4464	0.2571	-	-

Explanation: P-values are shown in parentheses: *** indicates statistical significance at the level of 1%; ** indicates statistical significance at 5% level, and * indicates statistical significance at 10%.
Source: Authors' calculations (2022)

Based on the econometric results in the table above, we can conclude that some of the independent variables (CFI, Retained Earnings. Equity, Short-Term Liabilities) are significant at the levels of 1%, 5% and 10%. For the interpretation of the econometric results, we have only applied the GEE model and this has facilitated the understanding of these econometric results of this study.

β₀ – If all other factors are constant, then the value of sales revenues will be 850494 units.

β₁ – If the net investment flow increases by 1 unit, keeping the other independent variables constant, sales revenues will increase by 1,330 units. This statement turns out to be correct since the significance value is within the range of statistical significance (p-value = 0.002 < 0.05). This means that the moment an enterprise makes investments within its business, whether in machinery, portfolio, research, development or anywhere else, it will affect its increase in the share of sales revenues.

β₂ – If equity increases by 1 unit, keeping the other independent variables constant, sales revenues will increase by 0.1664 units. This statement is correct since the significance value (p-value = 0.010 < 0.05) is at the level of statistical significance. Therefore, an enterprise's increase in capital will also positively secure profit from sales revenues.

β₃ – If the firm size increases by 1 unit, keeping the other independent variables constant, sales revenues will increase by 8554 units. This statement is not correct since the significance value (p-value = 0.741 > 0.05) is not in the range of statistical significance. The firm's size, which represents the total wealth of an enterprise, plays a big role. The firm's size can positively impact sales revenues. This is because the enterprise's wealth increases the turnover within the enterprise and even increases sales revenues.

β₄ – If current liabilities increase by 1 unit while keeping the other independent variables constant, sales revenues will increase by 1,175 units. This statement turns out to be correct since the significance value is within the range of statistical significance (p-value = 0.002 < 0.01). If we have an increase in any of the components of short-term liabilities, such as accounts payable, we automatically increase the operating money cycle. When this cycle is extended, the possibility of using the assets for the entity increases, and the probability increases that the sales revenues increase.

β₅ – If long-term liabilities increase by 1 unit while keeping the other independent variables constant, sales revenues will increase by 0.147 units. This statement is not correct since the significance value (p-value = 0.642 > 0.05) is not in the range of statistical significance.

β₆ – If retained earnings increase by 1 unit while keeping the other independent variables constant, sales revenues will not increase by 1,271 units. The significance value is within the range of statistical significance (p-value = 0.000 < 0.001) and the statement is correct.

β₇ – Whereas when the net cash flows from operating activities increase by 1 unit, sales revenues will decrease by -0.123 units. The statement is incorrect as the values are not within the confidence interval because (p-value 0.715 > 0.05).

β₈ – If the net cash flow from financial activities increases by one unit keeping other factors constant, sales revenues will increase by 0.434 units. However, the values are outside the level of statistical significance (p-value = 0.246 > 0.05). The financing activities also include long-term loans, which tend to extend for more than one year. Therefore, the entity's financial statements, in this case, the sales revenues, which are presented on the balance sheet in annual periods, may have caused discrepancies between the variables and led to the non-significance of these variables.

To verify the validity of the hypotheses presented in this study and give more support to the econometric results, we have performed some additional tests related to the analysis of the VAR model (Vector Auto-Regression Model). In these analyzes, we have also used the models of time series.

The results of three statistical tests will be given in this section:

1. Johansen Test for Cointegration

2. Vector Auto-Regression Model (VAR)

3. Wald Granger Causality Tests

The Johansen Cointegration Test analyzes whether the key variables in this study, "sales revenues" and "investments", are integrated. At the same time, the second VAR analysis shows whether the main variables explain each other or not. Furthermore, the third test, the "Granger Causality Wald Test", was analyzed as part of the time series model. Through this test, the authors analyzed whether these variables have long-term or short-term causality with each other.

The following table shows the results of the first test, where two hypotheses are constructed:

H_0 – *There is no dynamic correlation and cointegrating link between "sales revenues" and "investments".*

H_A – *There is a dynamic correlation and cointegrating link between "sales revenues" and "investments".*

Table 6

Johansen Tests for Cointegration

Johansen Tests for Cointegration					
Trend: constant			Number of OBS = 81		
Sample: 4 – 84			Lags = 3		
Maximum rank	Parms	LL	Eigenvalue	Trace statistic	5% critical value
0	10	-2522.1003	.	42.8168	15.41
1	13	-2507.9448	0.30766	14.5059	3.76
2	14	-2500.6919	0.17171		
Maximum rank	Parms	LL	Eigenvalue	max statistic	5% critical value
0	10	-2522.1003	.	28.3110	14.07
1	13	-2507.9448	0.30766	14.5059	3.76
2	14	-2500.6919	0.17171		

Source: Authors' calculations (2022).

Since the value of trace statistics is greater than the critical value of 5%, we can say that there is a cointegration between these two variables (sales revenues and investments). So, in this case, the H1 hypothesis is accepted. Also, since the value of "statistics max" is greater than the "critical value 5%", we can say that there is cointegration between these two variables.

Given that the variables "sales revenues" and "investments" are integrated, we can conclude that there is a long-term cause between sales revenues and investments in manufacturing enterprises in Kosovo.

Table 7

Vector Auto-Regression Model (VAR)

Variables	Coef.	Std. Err.	Z	p > |z|	95% Conf. Interval	
Sales Revenues L1.	.6318769	.1118042	5.65	0.000	.4127447	.8510091
Sales Revenues L2.	.476366	.1206511	-3.95	0.000	-.7128378	.-239842
Sales Revenues L3.	.1694372	.1080762	1.57	0.117	-.0423883	.3812627
Investments L1.	-.9243182	.6313532	-1.46	0.143	-2.161748	.3131113
Investments L2.	1.21606	.6473662	1.88	0.060	-.0527545	2.484874
Investments L3.	-1.708962	.6328762	-2.70	0.007	-2.949377	-.4685476
cons	4041421	1206688	3.35	0.001	1676356	6406486

Source: Authors' calculations (2022).

Referring to the data in the table above, we can conclude that sales revenues depends on itself in the time distance 1 in the long run, as the significance values are at the standard level of 5%.

Revenues from sales – Lag_1: (P- value = 0,000 < 0.05)

Revenues from sales – Lag_2: (P- value = 0,000 < 0.05)

Revenues from sales – Lag_3: (P- value = 0,117 > 0.05)

If the sales revenues in the previous year increase by one unit, then the sales revenues in the current year will increase by 0.631 units, so this in the time distance 1 has causality because the sales revenues from the previous year will affect revenues from the current year's sales. This is also important based on the level of significance since 0.000 < 0.05.

Suppose the sales revenues in the previous year increase by one unit. In that case, the sales revenues in the following year will increase by 0.476 units, so this in the time distance 2 has causality because the sales revenues of the previous year will affect the revenues from next year's sales. This is also important in the statistical range after 0.000 <05.

Suppose the sales revenues in the previous year increase by one unit. In that case, the sales revenues in the following year will cause a negative effect because the sales revenues decrease by 0.169 units, so there is causality in the time distance 2. However, based on the statistical aspect, this is not significant after 0.117 > 0.05.

Based on the table above, we can conclude that the variable "sales revenues" does not depend on the values of the variable "investments" in previous periods (lag_2) in the long run, as the values are not within the statistical level anymore, except for time period 3.

Revenues from sales – Investments Lag_1: (P-value = 0.143 > 0.05)

Revenues from sales – Investments Lag_2: (P-value = 0.060 > 0.05)

Revenues from sales – Investments Lag _3: (P-value = 0.007 < 0.5)

In time distance 1 we have no statistical significance since 0.143 > 0.05, so here we have no causality between investments and sales revenues as different factors in long periods of time can have an impact and this also affects the share of investments and sales revenues.

At time distance 2, we have no statistical significance between these variables at the significance level of 5%, but at the significance level of 10%, it has statistical significance because 0.060 < 0.10. So, if investments increase per unit, sales revenues will increase by 1,216 units.

If investments in time distance 3 increase per unit, then these will cause negative effects in reducing sales revenues by -1.708, while at the statistical level, this statement is important because 0.007 < 0.05. Investments made in advance will positively impact sales revenues but may have a negative impact, as in our case. However, the financial benefit of any company is from the investments they make to accumulate or earn more revenue.

Based on the results of the VAR analysis, an increase in investments, which is an essential component of the balance sheet, will have a significant impact on sales revenues because it

is a catalyst for money generation and acceleration of the operating cycle. However, the impact of investments on sales revenues can be both short-term and long-term. For example, when real estate is bought, its impact on sales revenues may be slower. However, investments such as upgrading the production line, expanding it, investing in research and developing easier and faster methods of production may reduce the costs while increasing the quality.

To verify the hypothesis of whether there is any long-term causality between the variables "sales revenues" and "investments" for manufacturing enterprises in Kosovo, we have applied the Granger Causality Wald Test.

H0: There is no long-term causality between sales revenues and investments in manufacturing enterprises in Kosovo.

H1: There is a long-term causality between sales revenues and investments in manufacturing enterprises in Kosovo.

Table 8

Granger Causality Wald Tests

Equation	Excluded	Chi2	Df	Prob > Chi2
Sales Revenues	Investments	9.7247	3	0.021
Sales Revenues	ALL	9.7247	3	0.021

Source: Authors' calculations (2022).

Based on the Granger Causality Wald Tests results, we can conclude that there is a long-term causality between sales revenues and investments. So, we say there is a long-term causality between sales revenues and investments, so H1 is accepted (p-value = 0.021 < 0.05). The chi-square value between the two variables is 9.7247. Thus, all companies should be careful because their investments in advance will affect subsequent sales revenue periods. Cash flow from investing activities represents how expenditures have been made on resources intended to generate income in a future period.

Based on the three analyzed tests: Johansen Test for Cointegration, Vector Autoregressive Test and Wald Causality Granger Test, it is confirmed that the two main variables of this study (sales revenues and investments) are integrated, explicable, and between them have a causality expressed in the long run. This implies that manufacturing enterprises in Kosovo must have prudent investment management so that all those investments they make can positively impact enterprise sales.

6. Discussions

According to the econometric results of this study, we can conclude that an increase in investments has had a positive effect on the increase in revenues from sales in production enterprises in Kosovo. The authors can also conclude that during the current period of study, manufacturing companies in Kosovo that invested in their business (investments in machinery, portfolio, research & development, innovation, real estate, etc.) saw higher sales overall. Such an effect shows a causality in the long term between investments and sales, because investments have influenced the increase in productivity and efficiency in these

enterprises, enabling wider sales in several different market segments and an increase in the number of units produced and sold in local and international markets. These econometric results are comparable to some of the studies of other authors that are presented in the next section of the discussion.

(Stubelj, 2014) analyzed the links between investments and profit in businesses and concluded that these two variables have a positive relationship. While this relationship could not be proven in some cases, our research shows that the variables of investments and sales income are related and have a positive relationship.

(Hashmati & Loof, 2006) analyzed the correlation and causality between investments and firm performance. They used the same variables, namely investments and sales, and they also concluded that these variables positively impact each other and are automatically related to profitability. Moreover, most of the statistical tests carried out in this research have confirmed a positive relationship between these two variables.

(Gala & Julio, 2016) analyzed the firm's size and investments, which are variables similar to those in our paper. They found a negative relationship between firm size and investments, aligning with our research findings.

(Baumol & Wolff, 1983) analyzed investments and firm performance. They concluded that these two variables had a causality between them because they affected each other positively. So when we look at our two main variables – investments and revenues from sales – these directly affect performance. Therefore we concluded that we also have causality or a positive effect on these two variables.

(Lev & Thiagarajan, 1993) analyzed the relationship between investments in fixed assets and enterprise profitability. They concluded that these two variables provided more value and positive impact since they can predict the future profit of the firm and the return of shares. This aligns with our research because the investments made by manufacturing companies in Kosovo, in most cases, had a positive impact on enterprises.

7. Conclusions and Recommendations

This study focused on analyzing the correlation and causality between investments and sales revenues through an econometric analysis of manufacturing enterprises in Kosovo. This section of the paper presents the conclusions and recommendations of this research. Given that the research was fundamental, especially for the companies analyzed, we saw that the variables were generally interrelated, especially the two main variables, sales revenues and investments. These were seen to positively impact each other, were correlated and had causality. While some of the research variables were not significant, this can be due to the limited number of years that directly affected the results and the Covid-19 pandemic, which might have influenced companies to change their profits. However, in general, the work was productive and provided reasonable results. Our recommendations are as follows:

Based on the results obtained, we can recommend that to increase sales revenues, we should increase the investments, capital and short-term liabilities of the entity.

Throughout the process of increasing long-term and short-term liabilities, we recommend that the entity be extra careful not to have liquidity problems in the short run and solvency problems in the long run.

We recommend that the entity focus more on the increase of share capital because the results show that the increase of share capital has the highest impact on the increase of sales revenues.

For the manufacturing enterprises, they must identify the factors that affect the profitability of their operations. Otherwise, they will not be able to achieve their financial goals.

Enterprises are required to contribute to the growth part of the firm. This enables the advancement of competitive advantage and the enterprise's dominance of the target market.

It is also recommended that companies analyze the investments element very carefully because it is an essential factor that affects the growth of profits.

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WORK MOTIVATION OF BANK EMPLOYEES IN CASE OF IMPLEMENTING AI AND ROBOTS IN THE BANK ACTIVITIES: COMPARATIVE ANALYSIS OF RUSSIA AND KAZAKHSTAN[4]

The dynamic changes in the banking industry as a result of the AI application and robotisation lead to substantial organisational changes and redefining the roles of bank employees. This, of course, has an impact on bank employees' work motivation. In 2020-2021 the businesses, including banking, encountered one more influencing factor – the Covid-19 pandemic and related quarantine and lockdown measures, leading to forced move to remote work. This research aims to find out if the work motivation of the bank employees has changed, and if yes – in what directions.

The analysis is based on the findings of a survey, conducted in the two countries in the period November 2020 – February 2021 and the results show some significant differences between the work motivation in the banking industry in the two countries. The questionnaire items target the main work motivation factors. Two working hypotheses were studied in this research: H1: The intensive implementation of AI in the banking sector positively affects the work motivation of bank employees in Russia and Kazakhstan. H2: The age of the employees matters for appreciation of the AI implementation, as younger employees 18-40 are more positive compared to employees beyond 40. H1 was confirmed, while H2 was confirmed regarding the difference in the opinions and motivation of the two age groups (under 40 and above 40 years of age), but not in regard to the appreciation of the changes by the two age groups.

The main beneficiaries of the results of this research are the bank managers, both HRM and line managers, who are directly responsible for supporting the work motivation in the process of intensive implementation of AI and robotisation, e.g., chatbots, in the sector. It is also believed that the managers in the other sectors of the economy may benefit from these findings as well.

Keywords: Work motivation; Hertzberg theory; motivators; Equity theory; Expectancy theory; intrinsic motivation; financial and non-material motivation; banking
JEL: O15; E24; G20; J24

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Introduction

The dynamic changes in the banking industry as a result of the AI application and robotisation lead to substantial organisational changes and redefining the roles of bank employees. This, of course, has an impact on bank employees' work motivation. In 2020-2021 the businesses, including banking, encountered one more influencing factor – the Covid-19 pandemic and related quarantine and lockdown measures, leading to forced move to remote work. This research aims to find out if the work motivation of the bank employees has changed, and if yes – in what directions. It is considered that if the bank managers understand which factors have effects on work motivation, they will be able to apply better human resource management in their banks.

The analysis is based on the findings of a survey, conducted in the two countries in the period November 2020 – February 2021 (125 respondents in Russia and 122 respondents in Kazakhstan), and the results show some significant differences between the work motivation in the banking industry in the two countries.

Theoretical Background and Framework

There is a plethora of research in this area, including for example Drive theory (Cherry, 2021; Mangena, 2021; Hull, 1952), Reinforcement theory (Skinner, 1969), Expectancy theory (Vroom, 1964; Chopra, 2019) which is one of the most popular as it focusses of the impact on the individual by the expected outcomes of their actions, Equity theory (Adams, 1963) describing motivation as based on comparison of one's compensation versus those of the colleagues or rivals, Self-Determination Theory and the Facilitation of Intrinsic Motivation (Ryan, Deci, 2000; Deci, Ryan,1985; Cherry, 2022; Woolley, Fischbach, 2018; Munir, 2022), Herzberg et al. (1959) theory and different views including criticism on it, e.g., relationship between satisfaction and performance and the effect on work motivation (Gawel, 1996; Lawler, 1970; House, Widgor, 1967; Dunaway, 2009; Shmailan, 2015; Maidani,1991; Tileston, 2004; Weinberg, et al, 2010), Personality Systems Interactions (PSI) theory (Baumann, Kazen, Quirin, Koole, 2017) and other. Jones and George (2004) define motivation as the psychological force which frames the person's efforts used to overcome the perceived obstacles and achieve their goals in the organisation. Latham (2007) argues that the motivation is a process of deciding what kind and what level of efforts will be allocated to achieve their goals depending on the "importance of motives or tasks". Locke and Latham (2004, p. 388) argue that the motivation "refers to internal factors that impel action and to external factors that can act as inducements to action". Robins (2005) argues that the type and level of motivation differ over time, depending on the situation. The employees behave in different ways depending on their positions and functions in the organisation, as well as on the assigned tasks (Beardwell, Claydon, 2007).

Out of all theories, we will concentrate on Herzberg's Hygiene theory and motivators vs dissatisfiers (Herzberg et al., 1959; Chiat, Panatik, 2019), Equity theory (Adams, 1963), the Expectancy theory of Victor Vroom (1964), Deci and Ryan (2004; Ryan, Deci, 2000) three factors model and Kuhl, Quirin & Koole's effects of contingent and noncontingent rewards

and controls on intrinsic motivation (Kuhl et al., 2020). The reasons to concentrate on them is their focus on work motivation and their relative simplicity, as well as our attempt to study such relationships in our survey.

Herzberg Motivator and Hygiene Factor Theory

With all critical views on Herzberg's Motivator and Hygiene Factor Theory (e.g. Ewen, Smith, Hulin, 1966; House and Widgor, 1967; Maidani, 1991; Tan, Waheed, 2011), his Dissatisfiers vs Motivators model seems to be of interest in the bank industry, as these are the main factors which the bank employees consider at the stage of applying for the job, and later – deciding what to do if the dissatisfiers change on comparative basis versus what was considered acceptable work motivators. However, under the combined influence of AI-robotization implementation in combination with the accelerators of the process – the anti-Covid-19 measures, including remote work, change of operations and work performance measurement, some of these factors may change their importance, or even categorisation. For example, the AI implementation leads to a new interpretation of supervision from technological and organisational points of view, and what has been considered in the previous time periods may have become simply inconsistent (e.g. Anatomy of change, Oracle, 2021).

Figure 1

Herzberg's Dissatisfiers vs Motivators

Herzberg's Dissatisfiers vs Motivators	
Dissatisfiers (Hygiene)	Motivators (Job satisfaction)
Supervision	Achievement
Interpersonal relations	Recognition
Physical working conditions	The work itself
Salary	Responsibility
Company policy and administration	Advancement
Benefits	Personal growth
Job security	

Source: Herzberg, 2003.

The physical working conditions are the clearest example of such inconsistencies, which are changing their substance and interpretation from the point of view of work motivation. Herzberg's suggestion that if an organisation wants its employees to do a good job, it has to give them a good job to do (Giancola, 2010) gets new dimensions if the work architecture and working conditions change significantly. This is not the only view on this matter. For example, Lawler (1970) has a different view on the relationship between satisfaction and performance as it is not possible to increase the motivation of all employees by giving them a good job to do. There are not so many "good jobs" in the organisation to satisfy everybody. More than that, in difficult times, the motivation and morale of the employees limit the success of the organisation, provided that they are given real chances to prove themselves. The important question before the bank management is to understand and redefine well the new real chances and to communicate them to the bank employees. The motivation theories underline the values and long-term goals set by employers as motivating factors. Simons and Enz (2006), for example, argue that the employees do their assigned jobs with the aim to be

satisfied from their performance, and as a result – increase their own value. This argument is valid now as it has been valid before. What is unclear is to what extent the changes in the environment change the analytical process and the importance of the specific factors, e.g., Herzberg's dissatisfiers and motivators.

Equity theory

For the same reason, the Equity theory (Adams, 1963), which is regarding the motivation based on how the employee finds their compensation compared to one of the colleagues, also becomes good-as-theory, still inconsistent in the new working conditions. Huseman, Hatfield & Miles (1987), for example, have criticised the application of Equity theory as being a laboratory product. Dittrich & Carrell (1979) argue that employees have different views for equity – one may think it a fair compensation approach, while others might consider it unsatisfactory and unfair. Mullins has argued that any employee is unique and the way their task is performed is based on their mental abilities and how they are involved in the work process. In general, if the performance and dedication of an employee are appreciated, it is more likely to expect higher motivation for better performance (Mullins, Christy, 2007; Ryan, 2016). As to motivate the employees is an important role of the managers, they have to be capable of giving employees reasons to believe in their own abilities, and in the company where they are working (Baldoni, 2005). When this is not done, the employees become dissatisfied and less motivated. However, if the work architecture changes as result of AI implementation, and the anti-Covid measures lead to significant changes of the market conditions, the ability of the employee to judge the equity of their compensation becomes an intellectual exercise only, as there is not enough objective information on which to stand any kind of such analysis.

Vroom's Expectancy theory

The Vroom's expectancy theory (1964) considers the individual's motivation as based on their goodwill for achieving certain goals and their belief that the motivation will lead to expected performance. Robbins (2003, p. 173) defines expectancy theory as "the strength of a tendency to act in a certain way [which] depends on the strength of an expectation that the act will be followed by a given outcome and on the attractiveness of that outcome to the individual". Vroom's expectancy theory considers the following relationships:

- *Effort-performance relationships*: the probability that an extra effort of the employee will lead to higher performance.

- *Performance-reward relationship*: the extra efforts will lead to the desired outcome.

- *Reward-personal goal relationship*: the organisational rewards, personal goals, and is the individual personally considered for rewards? Robbins (2003) argues that organisations with more satisfied workers perform better, compared to those with less satisfied workers.

The effects of contingent and noncontingent rewards and controls on intrinsic motivation

Munir (2022), for example, states that extrinsic motivation is "not enough enough". Mac and Sockel (2001) argue that internal motivators are related to the intrinsic needs of the employee, while external motivators are environmental factors, normally provided by the organisation. Cherry (2020) argues that intrinsic motivation influences a person's effectiveness as it comes within them. Deci & Ryan (1985) and Ryan & Deci (2000) consider a person is intrinsically motivated when they engage in an activity which gives pleasure and satisfaction, while the extrinsic motivation relates to an activity, performed not for pleasure or satisfaction but for achieving the required result or to avoid a negative outcome. In most cases, the extrinsic rewards include financial rewards and verbal appreciation, always decided outside of the person, whereas intrinsic rewards are interpreted and stated within the person (Sprigg HR, 2020). For example, Kuhl et al. (2020) argue that a person is intrinsically motivated to perform an activity if there is no apparent reward except the activity itself or the feelings which result from the activity. It seems obvious that the effects of the two are complementing each other. In our research, we study the relationships and the effects of external rewards and controls on intrinsic motivation. As Kuhl et al. (2020) argue, the intrinsic motivation to perform an activity decreases when the employee expects or is subject of "contingent monetary payments, threats of punishment for poor performance, or negative feedback about his performance". The intrinsic motivation does not change in the case of noncontingent monetary payments, and verbal reinforcements stimulate intrinsic motivation. What needs additional research is to study to what extent the ongoing changes in the bank environment support the previous research findings. The process is quite complex as, for example, Woolley & Fishbach (2018) have found that immediate rewards increase intrinsic motivation. They predict that "more immediate rewards increase intrinsic motivation by creating a perceptual fusion between the activity and its goal (i.e., the reward)". This sounds like common sense, still from research, as well as from a management point of view, it is important to consider the different effects of intrinsic vs extrinsic motivation (e.g., Cherry, 2022; Itri et al., 2019; Kuvaas et al, 2017).

There are other theories, such as Alderfer's ERG – Existence, Relatedness and Growth model (Kumar, 1998, p. 230), which attempt to develop Maslow's theory with an accent on the soft psychological factors. They have been argued for using categories such as "Respect for the organisation" and "respect for one's supervisor" (Wilcove, 1978, p. 305). In our survey, we tried to study the importance of respect for the organisation (bank) as a motivation factor, and we think it works well. Other writers argue that it is not universally applicable as a result of the national culture specifics (Song, Wang, Wei, 2007).

Method

This research is based on the results of a survey through non-probability convenience sampling of bank employees in the two studied countries – Russia and Kazakhstan. As there is no previous research of the work motivation of Russian and Kazakhstani bank employees, known to us, we decided to apply the inductive approach. We are going from the specific to the general, where arguments are based on experience and observation (e.g., Trochim, 2006;

Soiferman, 2010; Young et al., 2020). We presume that our research considers the knowledge, beliefs and cultural specifics, which, although specific for the respondents (e.g., Ryan, 2018), altogether interpret the bank employees' general views on the studied matters in a meaningful way, which allows correct analysis.

The survey population (Saunders et al., 2009; Dibb, Simkin, Pride, Ferrell, 2016) is formed by bank managers and employees, all of them above 18 years of age. The sampling frame is formed by bank employees in Russia and Kazakhstan approached using their personal emails, which the researchers have from consulting different banks in the two countries, especially in Novosibirsk and Barnaul in Russia and Semey and Pavlodar in Kazakhstan. The sample size included 125 respondents from Russia and 122 respondents from Kazakhstan. We used the non-probability sampling method using the convenience sampling technique to get a sample (Burns, Bush, 2014) which can address the research questions and hypotheses (Bryman & Bell, 2015), both as a number of respondents from the two countries, and as their quality – all being bank managers and employees. Chi-square analysis was used to check the validity of the observations if the two samples were significantly larger. In most of the cases, the p-values were pretty small and the results are significant at $p < .01$.

The questionnaire targeted the main work motivation factors. It contains 20 questions, of which 5 are focusing on the AI application in bank activities, 2 address the effects of the anti-Covid measures, including work from home, and 5 demographic questions. The questions about AI are complex, as the interviewed bank officers consider any form of software – both facilitating the bank operations (e.g., digitalisation of the operations) and communications with clients (e.g., chatbots, robots), to belong to the general category artificial intelligence application. This is not correct from a technical and technological point of view, but as far as our task is to study the effects on the motivation of employees, it is correct to the extent that the bank officers interpret them as factors with similar effect.

All questions are multiple-choice. Questions which could interfere with the anonymity of the respondents were avoided (Bernard, 2011). The Google Forms platform was used, which allowed contacting the participants of the survey by email and private messages and, of course – obtaining a statistical analysis of the results. This prevents distortion of results, as the questionnaire was sent and available only to people included in the sampling frame.

Hypotheses

The above-mentioned publications analyse the work motivation from different angles, considering extrinsic and intrinsic factors. Based on their analysis, we stated two working hypotheses in our research, namely:

H1: The intensive implementation of AI in the banking sector positively affects the work motivation of bank employees in Russia and Kazakhstan.

H2: The age of the employees matters for appreciation of the AI implementation, as younger employees 18-40 are more positive compared to older employees beyond 40.

The working hypotheses are directly focusing the possible changes in work motivation of the studied bank employees in the period of systematic accelerating substitution of work positions with AI of a different kind and the post-COVID-19 effects on the motivation, if any.

Research validity

The survey questionnaire is self-administered. This minimises the risk of manipulating collected information. The research provides appropriate answers to the research questions, leading to confirmation or rejection of the research hypotheses (Crowther, Lancaster, 2012).

Ethical issues

The primary data collected for this research is obtained from individual respondents working in banks in the two countries, who filled in the questionnaires in an anonymous and voluntary way (Bryman, Bell, 2015). All respondents are above 18 years old, with significant professional experience in the banking sector and their opinions, with all differences which they show, altogether represent a correct picture of the banking sector in the studied areas.

Results and Discussion

The primary research included 125 respondents in Russia, and 122 respondents in Kazakhstan, all of them belonging to the research population as they are bank employees. The results of the survey are quite interesting. We will discuss them following the hypotheses, which are stated above.

The analysis of the results will be done following the two hypotheses, stated above.

Hypothesis 1: The intensive implementation of AI in the banking sector positively affects the work motivation of the bank employees in Russia and Kazakhstan

Hypothesis 1 was tested based on the research results. A similar percentage of the respondents in the two countries (61.7% in Russia and 62.2% in Kazakhstan) are aware of the AI and/or digitalisation and/or robotisation implementation in the banks where they are working (Figure 1). Obviously, a higher percentage of knowing respondents would add value to the results in Fig. 1, but even this result – two-thirds of the respondents being aware of the technological changes – is a good basis for analysis of how AI and robotisation affect the work-motivation. The p-value of the Chi-square test (.479) shows that there are no significant statistical differences in the answers of Kazakhstani and Russian respondents.

Figure 1

Are you aware of AI/robotisation implementation in your bank?
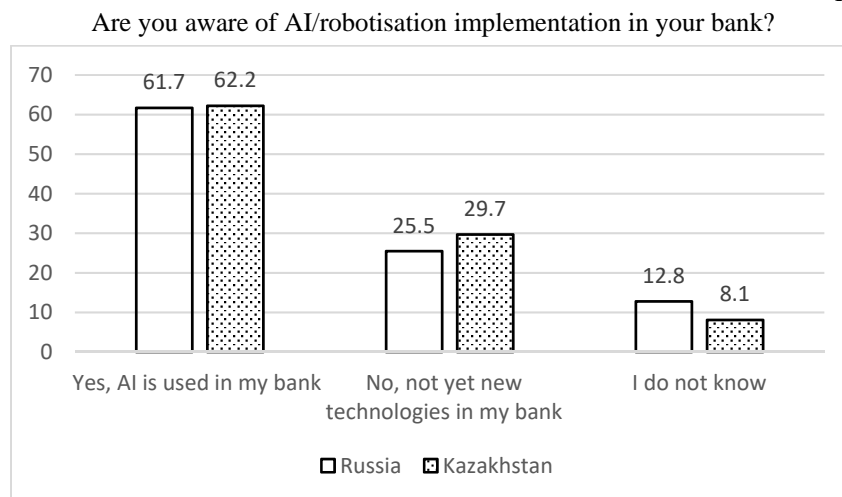
We studied the effect of financial stimuli on motivation, as this is considered to be one of the main dissatisfier (Hygiene) factors according to Herzberg's theory (Herzberg, 2003). The results are in the range of expected, as 98% of the Russian respondents and 100% of the Kazakhstani respondents claim that the financial stimuli are the main or probably the main factors. This also corresponds to the theory of the effects of contingent and noncontingent controls on intrinsic motivation (Kuhl et al., 2020; Cherry, 2020).

The non-material motivation factors play significant importance as well (Figure 2). There is a big difference between the two countries regarding the work satisfaction, while the other factors are of similar importance, all except the bank's image being above 50%. This corresponds to the Equity theory (e.g. Mullins, Christy, 2007; Baldoni, 2005).

Figure 2

What types of non-material motivation are most important in your view?

It should also be mentioned that the performance-reward relationship of the Expectancy theory (Robbins, 2003), marked here as promotion options, is of high importance as well (Figure 3: 76% and 67.6%, respectively). The Chi-square p-value here is p=0.050652, and as a result, is not significant at p< .05, we cannot expect a replication of the findings in the case of larger samples. Still, as we see, the differences will probably manifest in the work satisfaction as a motivating factor. Interestingly, the corporate culture seems to be equally effective in the two countries.

Figure 3

How does AI implementation affect your work motivation?
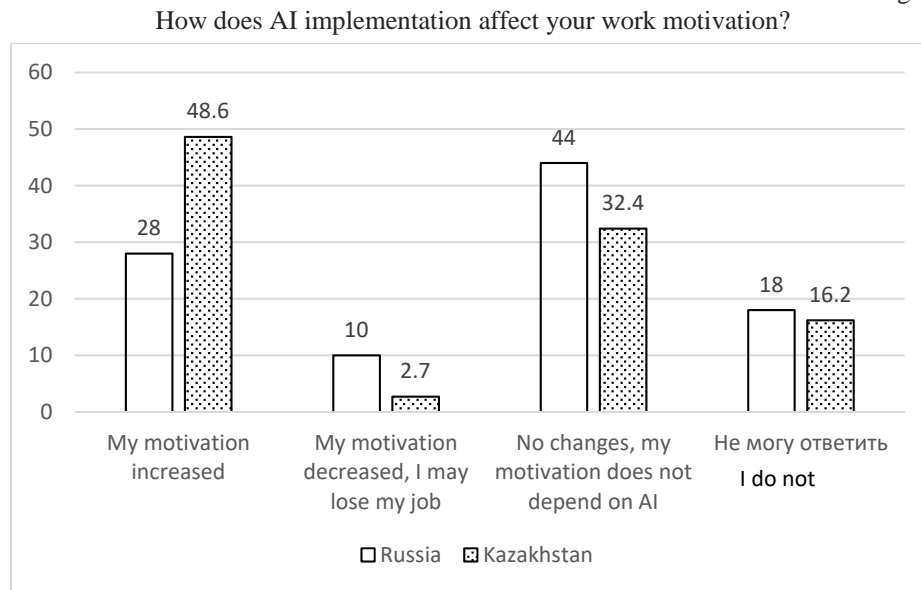
To our surprise, Figure 3 shows a significant difference in the respondents' attitude to the effects of the AI/robotisation implementation on the work-motivation in the two countries. The percent of Kazakhstani respondents who believe that the AI/robotisation implementation positively affects their attitude to improve as valuable specialists in the bank (48.6%) is about 73.6% higher than that of the Russian respondents (28%).

The p-value of the Chi-square test (p=0.009) is significant at p<.01. There is a significant difference in those who think that their job positions do not depend on the new technologies: 44% in Russia vs 32.4% in Kazakhstan (Fig.4). As Fig. 4 shows, only 10% of the respondents in Russia and 2.7% of those in Kazakhstan claim that AI/robotisation negatively affects their work-motivation as they believe they may lose the job being "substituted by robots". As the percentage of positive motivation is significantly higher than the percentage of negative expectations, e.g., 48.6% to 2.7% for Kazakhstan and 28% to 10% for Russia, we can say with a high degree of confidence that ***H1 is confirmed***: *The intensive implementation of AI in the banking sector does not negatively affect the work motivation of the bank employees in Russia and Kazakhstan.*

An interesting question is to what extent the national culture causes such a big difference of the responses in the two neighbouring countries (e.g. Hofstede, Hofstede, Minkov, 2010; Minkov, Blagoev, Hofstede, 2013; Sun, Yoo, Park, Hayaty, 2019), and this will be addressed further in the cross-cultural analysis.

Hypothesis 2: The age of the employees matters for appreciation of the AI implementation, as younger employees 18-40 are more positive compared to older employees beyond 40.

The H2 hypothesis is also confirmed. The results of the survey show that age matters, although to our surprise it matters not in the way we expected. The Russian respondents of age over 40 show a higher percentage of negative expectations of the effect of AI/robotisation on their job positions (Fig.4: 35.7% for age over 40 vs 27.7% for the younger respondents). The p-value of the Chi-square test for Russia (p=0.009) shows that the differences in the responses of the different generations are statistically significant at p< .01. The Kazakhstani respondents show similar results for the two age groups (13.3% and 14.3%) and the differences are also significant (p<0.001). We expected that in the two neighbouring countries, the percentage of those being afraid of the technological changes would be similar. Instead, we see that the Russian respondents are significantly more afraid of the AI/robotisation implementation than their Kazakhstani colleagues (27.7% vs 13.3% for those under 40 years old, and 35,7% vs 14.3% for those over 40) (Figure 4).

Figure 4

Will AI/robotisation change job positions?
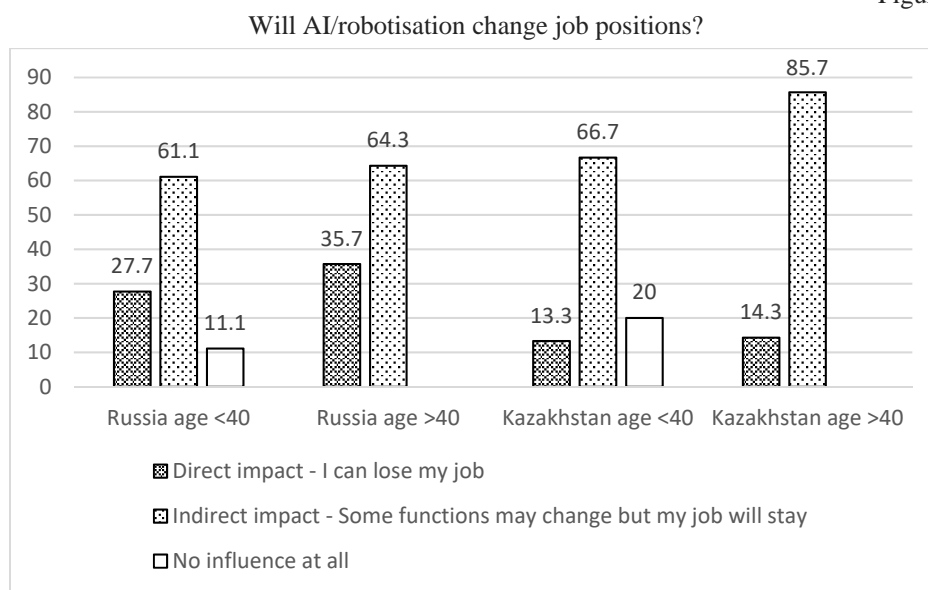
Interestingly, a relatively very high percent of the respondents do not expect significant negative effects for themselves, as they believe that the AI/robotisation will have a minor

effect on their jobs, and only some functions may change, with no threat to their job positions. About 85.7% of the Kazakhstani respondents of age over 40 (Figure 4) believe that the technological changes will not affect their job positions to the extent to lose their jobs and 64.3% of the Russian elderly respondents believe the same. The Chi-square p-value for Kazakhstan is p<0.001 and for Russia p=0.009, and both are significant at p< .01. Our expectation was that the younger respondents (below the age of 40) would be more positive on that question, as they are more educated and flexible. Surprisingly, the respondents over 40 are less afraid of losing their jobs as a result of AI/robotisation: 85.7% vs 66.7% for Kazakhstan, and 64.3% vs 61.1% for Russia (Fig.4). A possible explanation is that the elderly respondents are more experienced and higher positioned, while the younger employees feel that they will be the first to be released, if the work positions for humans will be reduced.

H2 was also tested with a question about the effect of the implementation of AI/robotisation on the bank results, based on the expectations of the respondents as they interpret the effects of the technological changes. The results show a significant difference between the opinions of the two studied age groups (Figure 5). In Russia, 64.3% of the age group over 40 believe the technological changes will positively affect bank results, while only 50% of those of age below 40 share this view. The Chi-square p-value for Russia is .000481, and for Kazakhstan is <0.00001, and the two results are significant at p< .01. As we see, there is 28.6% difference. In Kazakhstan, the difference is even much higher – 71.4% vs 33.3%.

Figure 5

Will AI/robotisation improve bank results?
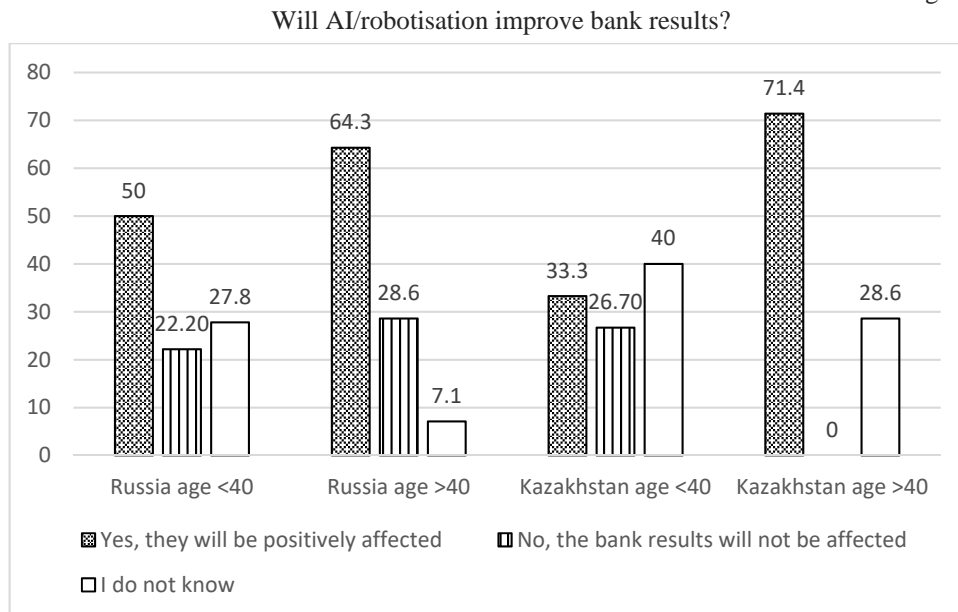
In combination, the results from Figure 4 and Figure 5 **confirm Hypothesis 2**: the age matters in terms of understanding the effects of the technological changes in the banks. The expected risks of losing the job position (Figure 4) are manifested more in Russia, while the

Kazakhstani respondents do not expect reduction of their jobs or changes which can make them unfit for the job after the technological changes.

We also studied the opinion of the respondents about the effects of the implementation of AI and robotisation in the bank. The Kazakhstani respondents show a significantly higher positive impression of the results of that implementation (Figure 6). About 70% of those under 40 and 100% of the respondents over 40 years share the view that AI and robotisation help bank employees work faster and more efficiently. Interestingly, the differences are significant for the Kazakhstani respondents ($p<0.001$) but not for the Russian respondents ($p=0.189$).
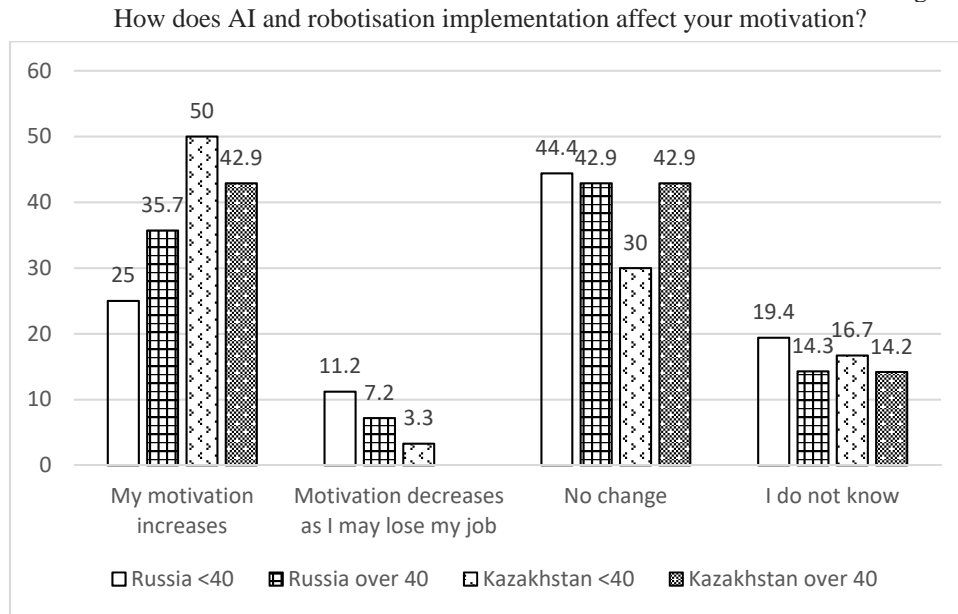
Figure 6

What is your impression of the effects of the implementation of AI and robotisation in the bank?

We also studied the effects of AI and robots' implementation on the motivation of the respondents (Figure 7). The Kazakhstani respondents show a higher positive effect for the two age groups compared to their Russian colleagues (50% vs 25% for those under 40, and 42.9% vs 35.7% for those over 40 years old). The Chi-square p-value for Kazakhstan ($p=0.248$) and for Russia ($p=0.303$) show that there are no statistically significant differences in the answers of the Kazakhstani and Russian respondents. We hypothesise that these significant differences could be explained with cross-cultural analysis, and this will be our task for the next stage of the research.

Figure 7

How does AI and robotisation implementation affect your motivation?

Thus, the analysis of the results of the research above confirmed Hypothesis 2. The age of respondents affects the interpretation of the effects of AI implementation on work motivation in the banking sector in Kazakhstan and Russia. Interestingly, the respondents above 40 are more convinced that the implementation of AI and robotisation in the banking sector leads to positive results (Figure 6).

Effect of Covid-19 on Work Motivation

The effect of Covid-19 on work motivation was also studied. We did this with the aim to find out if the changes in the banking sector (e.g., AI, robotisation) were linked to the changes to home-office and do the bank employees report significant effects on their motivation. A survey of 2000 workers, for example, found that remote (home-office) work makes the employees better organised and feel more trusted by their organisations (Brown, 2021). Wang, Weaver & Revels (2021) discuss the issue of burnout as an effect of overload. Such an overload has not been reported in the case of banking, but as a factor which can affect work motivation, it is also a point to consider.

On the other side, it could be expected that the combination of home-office with AI implementation might produce negative effects based on the risk of losing a job in the bank. In our research, the Kazakhstani respondents report 54.1% increase in their work motivation as a result of protecting the job positions in the pandemic development, which lead to the many closing of businesses, vs 34% for their Russian colleagues. About 54% of the Russian

and 32.4% of the Kazakhstani respondents did not change their attitude. Together there is about 90% positive attitude, which is probably based on the feeling that the bank is a very reliable employer during the pandemic times (Figure 8). The p-value of the Chi-square test (p=0.009), which is significant at p< .01, shows that there are no significant statistical differences between the answers of the respondents in the two countries.

Figure 8

How did COVID-19 affect your motivation to work in the bank?
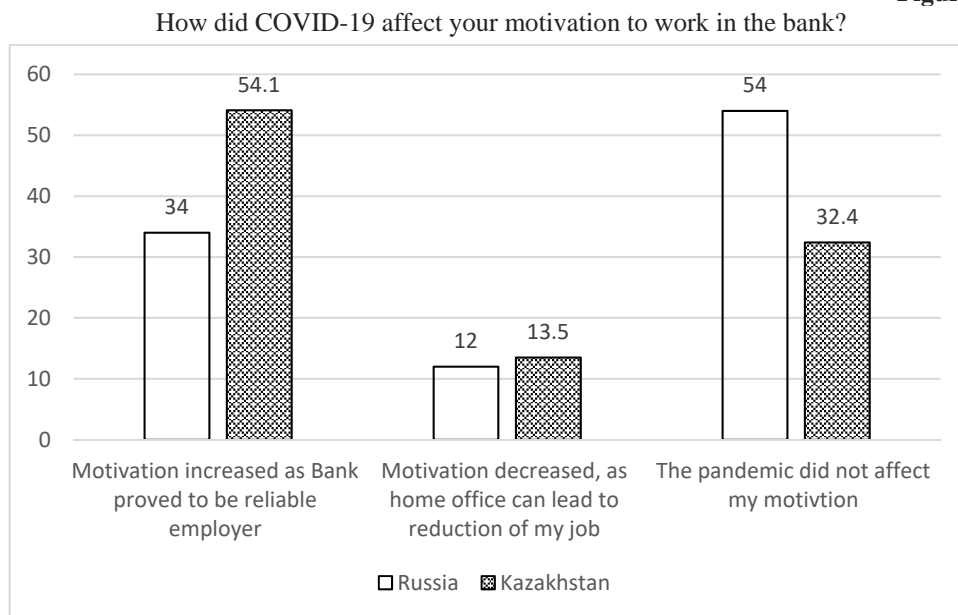
Conclusions

The dynamic changes in the banking industry as a result of the AI application and robotisation lead to substantial organisational changes and redefining the roles of bank employees. This, of course, has an impact on bank employees' work motivation.

The research was done based on the results from a non-probability survey of the opinions of bank employees in Russia and Kazakhstan, all of age above 18, conducted in the two countries in the period November 2020 – February 2021.

We stated 2 working hypotheses in our research, namely:

H1: The intensive implementation of AI in the banking sector positively affects the work motivation of bank employees in Russia and Kazakhstan.

H2: The age of the employees matters for appreciation of the AI implementation, as younger employees 18-40 are more positive compared to older employees beyond 40.

Hypothesis 1 is confirmed. While the high weight of the financial stimuli in the work motivation was expected, it was very important to find out that the non-material motivation

factors play significant importance as well (Figure 2). There is a big difference between the two countries regarding work satisfaction (94% for the Russian respondents), while the other factors are of similar importance, all except the bank's image being above 50%. This corresponds to the Equity theory (e.g., Mullins, Christy, 2007; Baldoni, 2005; Mangena, 2021).

Hypothesis 2 is confirmed regarding the difference in the opinions and motivation of the two age groups (under 40 and above 40 years of age), but not in regard to the appreciation of the changes by the two age groups. For example, it was expected that the younger respondents would consider more positive the AI implementation helping to improve bank operations, while it turned out that the elderly colleagues had a more positive attitude (Figure 6). There are differences between the age groups in the two countries regarding their personal motivation (Figure 7). The differences between Russia and Kazakhstan are significant and this will require a special cross-cultural analysis to be done to explain what causes them.

A similar point can be raised regarding the effect of Covid-19 on work motivation. There is a significant difference between the percent of increased motivation in Kazakhstan (54.1%) vs 34% in Russia (Figure 8). a cross-cultural analysis will be needed to explain the difference.

Altogether, the findings show that with the exception of the cases discussed above (Figure 6, 7 and 8), there are no significant statistical differences between the answers of the respondents in the two neighbouring countries. Most of them find the implementation of AI and robotisation as a positive factor, which either affects their work motivation positively, or they think it does not concern them at all (Figures 6 and 7). The effect of the pandemic is different in the two countries, as the Kazakhstani respondents declare a significantly higher increase in their work motivation as a result of valuing higher the importance of the bank as a stable employer in such difficult times, compared to the Russian respondents (Figure 8).

The sample size of respondents from the two countries is obviously not too big. Still, considering the p-values of Chi-square analysis, we can claim that the results of the survey have statistical value and an analysis of much larger samples will probably not differ much from the results shown above, e.g., to lead to significant statistical differences. We believe that the findings of this research can be used to improve work motivation management in the banking sector, as well as in other sectors of the economy, where the AI and robotisation implementation is taking place in the recent years.

In the future, the research has to include samples from other countries in Asia and possibly Europe and concentrate on finding if there are significant statistical differences based on the cultural factors.

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Rumen Angelov[1]

ASSESSMENT OF CHALLENGES AND RISKS FOR THE BANKING SECTOR IN THE TRANSITION TO A GREEN ECONOMY THROUGH A SAMPLE SURVEY[2]

The study aims to register the attitudes of managers and experts from banking institutions on the specifics of the green economy by identifying and assessing challenges facing the financial sector of Bulgaria, in the context of the European Green Pact, at the main stages of its implementation. The focus of the study on the financial sector is the development of the banking sector and the capital market in the context of the green transition, and the study includes an empirical study of changes in the banking sector in the transition to a green economy.
Keywords: green economy; green finance; green banking
JEL: O38; O44; Q01; Q28; Q56; Q58

1. Introduction

The banking sector has always been and remains to this day a relatively closed structure, whose representatives do not always seek to overcome this closure, even due to the fact that it is part of the national security system of any economy. In our opinion, however, some of the reasons for this are mostly psychological. For a significant part of those working in the banking sector and the institutions controlling them, internal banking relations are extremely important and confidential compared to any contacts and relationships with the "outside world", i.e. other economic, research and other structures and "hide" in the answers with the lack of permission from those higher in the banking hierarchy. It should be noted that the representatives of the lower echelons of the banking hierarchy, e.g. at the expert level, are sufficiently candid and provide more complete information and assessment. The survey conducted showed that different banking and control institutions are characterised by different levels of openness or information "blackout". Before the preparation of the questionnaire with questions to the respondents, a review and study of the quantitative research concerning the transition to a green economy, incl. in the banking sector (Miteva, 2017), in order to be able to prepare and refine the issues included in the study.

This study is a kind of assessment of activities related to the adaptation of financial institutions in the transition to a green economy, risk assessment of environmental and climate change banks, the regulation and control of these processes.

The study aims to register the attitudes of managers and experts from banking institutions on the specifics of the green economy by identifying and assessing challenges facing the financial sector of Bulgaria, in the context of the European Green Pact, at the main stages of its implementation. The focus of the study on the financial sector is the development of the banking sector and the capital market in the context of the green transition, and the study includes an empirical study of changes in the banking sector in the transition to a green economy.

In this regard, the broader objective of this research is to determine the role of greening in the modern financial system, as seen through the eyes of the Bulgarian financiers participating in the survey, with a view to solving two complex aspects of the global environmental problem:

• on the one hand, this is the financial-economic aspect, where global imbalances and negative financial effects of the cross-border movement of capital flows can be highlighted;

• on the other hand – natural resources, climate and ecological problems.

At the beginning of the century, two important events took place in the history of the modern world financial system, which determined new trends in its development and laid the foundation for all subsequent processes in international economic relations. The first such significant and intrasystemic factor was the global financial and economic crisis, which had a negative impact on the global financial system (2008-2009). The second event – the global financial reforms initiated by the G-20, which were initially an external response to the global financial and economic crisis, marking the beginning of a transformational "wave" throughout the system. Today, the challenges are even greater in connection with the outbreak of the pandemic and a new financial and economic crisis since the beginning of the current decade. Despite their very good liquidity, banks refrain from credit due to the high risk arising from the low level of capital and assets of the Bulgarian companies (Moravenov, 2021, p. 283).

2. Materials and Methods

An attempt has been made within the study to focus on the evaluation and regulation of these processes.

In accordance with the goals and objectives of the research, the survey has the following instrumental and cognitive goals:

• To identify the main problems faced by banking institutions in implementing the transition to a green economy;

- To register the attitudes and readiness of the representatives of the banking institutions for successful inclusion in the campaigns in favour of cleaner nature, incl. expanding the share of the green loan portfolio and increasing support for carbon reduction investments;

- To assess the institutional and regulatory environment regarding the changes in the banking regulations related to the criteria in the financial sector for the financing of "green" projects in the transition to a green economy;

- To establish the extent to which the positive experience in the formation and implementation of the so-called "green finance" and "green banking" in the banking sector of Bulgaria has been adapted in view of the emerging prospects for the development of the concept of the green economy.

In particular, the object of the study are the banks operating on the territory of the Republic of Bulgaria (Table 1).

Table 1

Distribution of banks (by groups as of November 30, 2021)

First group	Second group	Third group
Unicredit Bulbank	Raiffeisen bank (Bulgaria)	ING Bank-Sofia Branch
DSK bank	Central Cooperative Bank	Citi Bank Europe-Bulgaria Branch
UBB bank	Allianz Bank Bulgaria	BNP Pariba Personal Finance S.A-Bulgaria Branch
Eurobank Bulgaria	Bulgarian Development Bank	BNP Pariba S.A- Sofia Branch
First Investment Bank	Procredit Bank Bulgaria	T.C Ziraat Bankasi- Sofia Branch
	Investbank	Varengold Bank AG- Sofia Branch
	Minicipality Bank	Bigbank AS-Bulgaria branch.
	Bulgarian American Credit Bank	
	International Asset Bank	
	TBI Bank	
	DBank	
	Texim Bank	
	Tokuda Bank	

Source: Own Source.

For the purposes of the study, the updated version of the list of banks and control and supervisory institutions was used (adjusted as of November 30, 2021).

On this basis, a two-stage nesting sample with a volume of 50 units (50 respondents from the banks listed in Table 1. It was constructed, ensuring representativeness for all surveyed units in the community.

The collection of information was carried out by the method of the survey. First, a preliminary desk study of the state of the institutional units and the available institutional and statistical sources was made, after which, for the purposes of field collection of primary empirical information, a questionnaire was developed, which is structured in one version:

- Consultation among the management staff, including directors of directorates and heads of departments, and experts from banking institutions, etc.

Thematically, the questionnaire is structured so as to gather empirical information on all issues of interest to the researcher, incl. and for future analysis and research. The questionnaire contains a total of 95 variables.

The collection of primary information itself was carried out in the period December – January 2021/2022, on the territory of the Republic of Bulgaria:

The collected empirical information was processed with the help of the program for statistical and mathematical analysis of data from sociological research SPSS.

The obtained one-dimensional zero distribution and the subsequent statistical-mathematical analyses are the basis for the following exposition. All research materials can be used for subsequent secondary analyses at the discretion of the author or other assignors.

3. Results

The place of work and the place where the respondents perform their main activity (the respective group, according to the BNB classification) are one of the main observed indicators. The survey data (Figure 1). Show that according to the place of their main activity, the persons are distributed as follows:

- 36% of the surveyed bank employees/managers work in the banks of the first group (the 5 largest banks according to their assets);

- 48% are employed in the banking institutions of the second group (including 13 banks);

- 16% are employed in the third group, which includes branches of foreign banks in Bulgaria.

The picture of the social and labour status of the surveyed units is presented in Figure 2. The data allow us to conclude that the surveyed persons represent proportional shares of the actual hierarchical structure of the banking institutions.

- 30% are experts;

- 22% are directors of directorates;

- 28% are heads of departments;

- 20% are people from the management staff.

The structure of the statuses thus established is a good precondition for performing the analysis, as sufficient accuracy of the sample is guaranteed. This means that the results obtained in the study can be extrapolated to the whole population. Accordingly, the conclusions and findings are valid for the whole population and present the opinions, assessments and expectations of all units constituting the general population.

Figure 1

Place of performance of the main activity (the respective group, according to the BNB classification)

Indicate the place, where you perform your main activity (the respective group, according to the BNB classification)?

Third group	8
Second group	24
First group	18
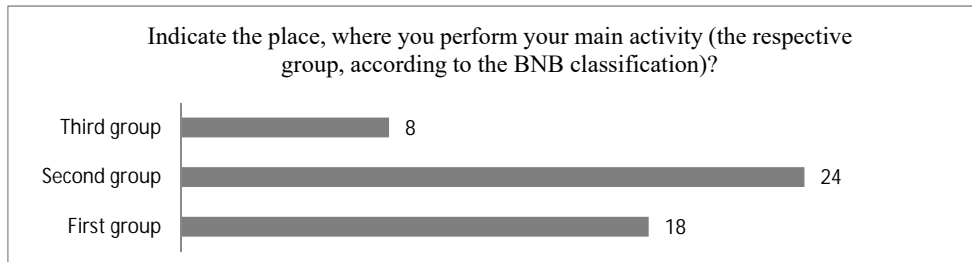
Source: Own Source.

Figure 2

Social and labor status in the respective administrative hierarchy of a given banking institution

Indicate your social and labour status in the relevant structure

Expert	15
Head of departments	14
Directors of directorates	11
Management staff	10
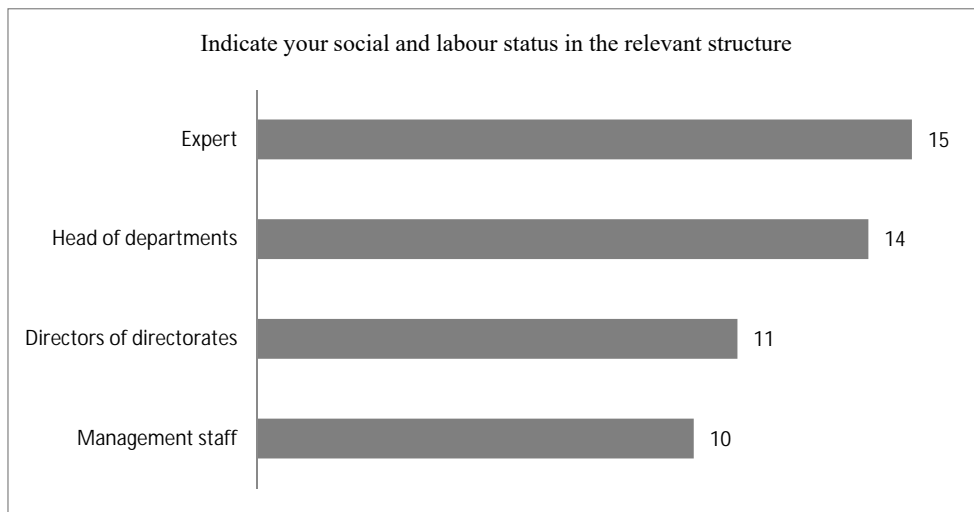
Source: Own Source.

An additional guarantee for the relevance of the collected information and the subsequent analyses and findings regarding the processes of implementation of the so-called "green finance" and "green banking" in the banking sector of Bulgaria is the fact that the study covers individuals with extensive life experience and many years of work in banking structures and supervisory and supervisory institutions. The individuals were asked to indicate how many years they have been working in the banking sector. The aim of this question was to establish the degree of objective predisposition to know the socio-economic agenda of the processes of transformation in the banking sector, including the processes of realisation of the so-called "green finance" and "green banking" in the banking sector of Bulgaria and around the world. Generally speaking, the preliminary hypothesis of the study was that respondents with more years of experience would know in more detail the socio-

economic aspects of the studied processes, respectively. the situation and the problems, and will be able to introduce the element of comparability in their assessments.

The data show that among the respondents from banking institutions, those with many years of experience and experience (over 5 years) predominate – a total of 80% of them have experience over 5 years. 16% of the respondents have between 1 and 5 years of experience, and 4% of the respondents have up to 1 year of experience.

Figure 3

Internship in the structures of the banking sector
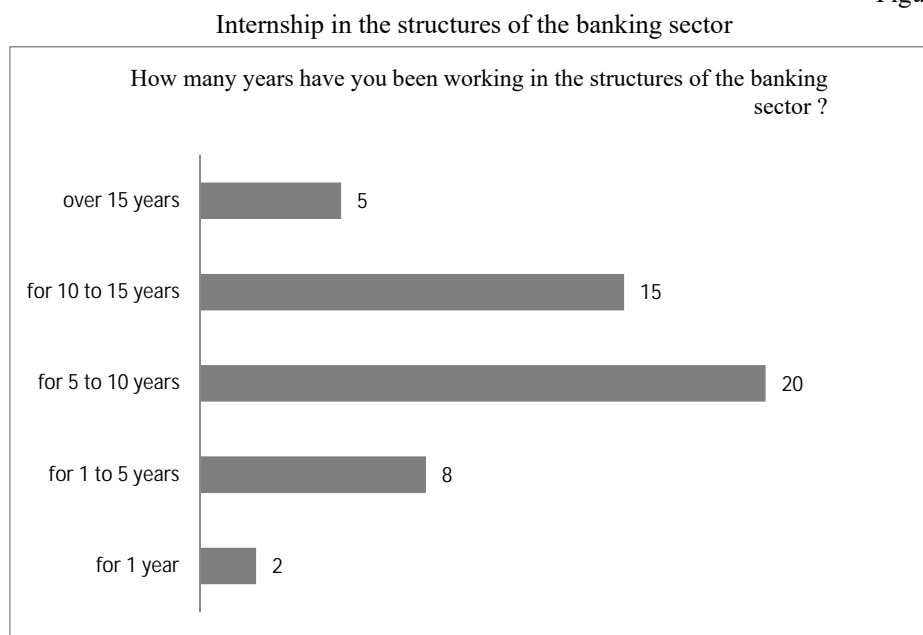
Source: Own Source.

Usually, processes and phenomena with an ecological orientation are denoted by the term "green". When these processes and phenomena are related to economic life, we talk about the so-called "green" economy, taking into account the fact that it is a sustainable economy that improves the quality of life for all people within the ecological limits of our planet (Green Economy Coalition, 2011). Green projects are implemented to protect the environment, reduce pollution and improve resource efficiency. Investing in environmentally friendly and resource-saving technologies is conventionally called "green" investments, and financing activities that provide environmental benefits to society is called "green" financing. In this way, it is possible to define the general term "green" finance.

"Green" financing is a set of relations in connection with the formation of monetary funds and their use in order to ensure ecologically sustainable development.

Currently, the development concepts of most countries in the world include the formation and maintenance of a "green" financial system, the purpose of which is to combine public and private financial resources for the implementation of economic activities that are aimed

at protecting the environment, mitigating the effects of change of the climate and more efficient use of resources.

In this sense, the question of whether the respondents are familiar with the definition and principles of green finance and green banking is reasonable. The affirmative answer to this question by 96% of respondents allows for objectivity and adequacy of all other questions related to these processes.

Figure 4

Degree of familiarity with the definition and principles of green finance and green banking
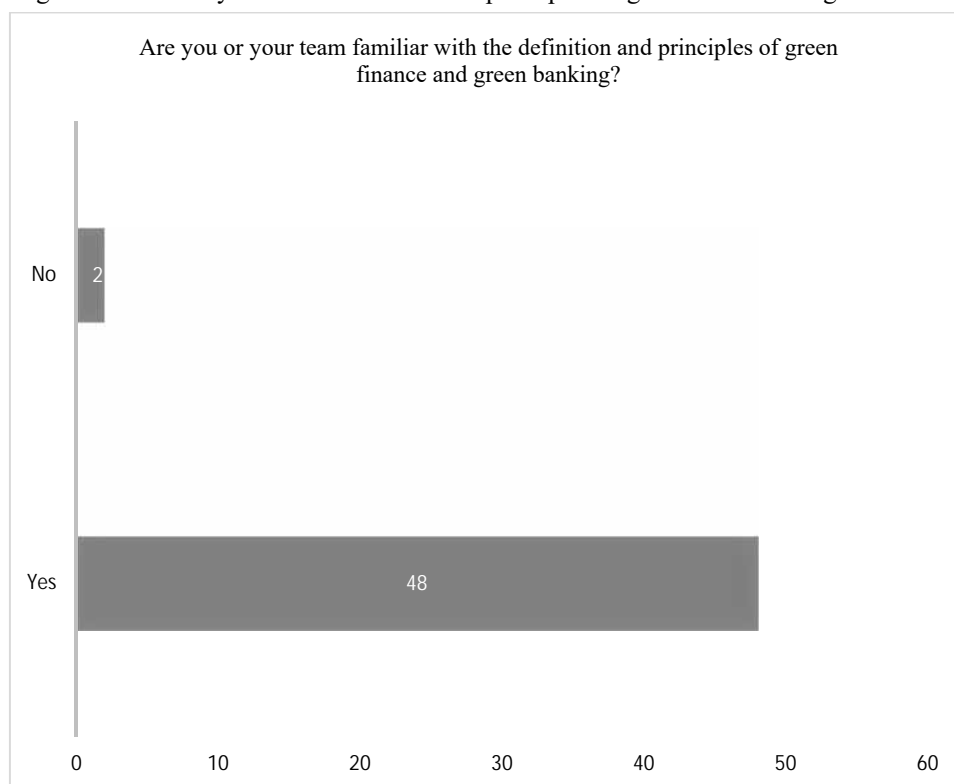
Source: Own Source.

The question of the factors influencing the dynamics and development of the processes of entering and applying the principles of green finance and green banking in the banking sector is extremely interesting (Figure 5). The vast majority of respondents share that economic changes and trends in the world economy, incl. and in the banking sector they are a factor for catalysing and reorienting banking technologies to green banking and financing. The process of universalisation of banks is mentioned by 24% of respondents as such a factor. Another 10% noted the factor "specialisation of banks". Financial and economic crises and recessions are the basis of the orientation towards green finance and banking, in the opinion of 24% of respondents, and another 42% cite "banking digitalisation processes" as such a factor.

However, when it comes to the role of environmental and climate change, everyone is unanimous – 100% of respondents believe that this is the main factor influencing the dynamics and development of the processes of entering and applying the principles of green finance and green banking in the banking sector.

Figure 5

Factors influencing the dynamics and development of the processes of entering and applying the principles of green finance and green banking in the banking sector
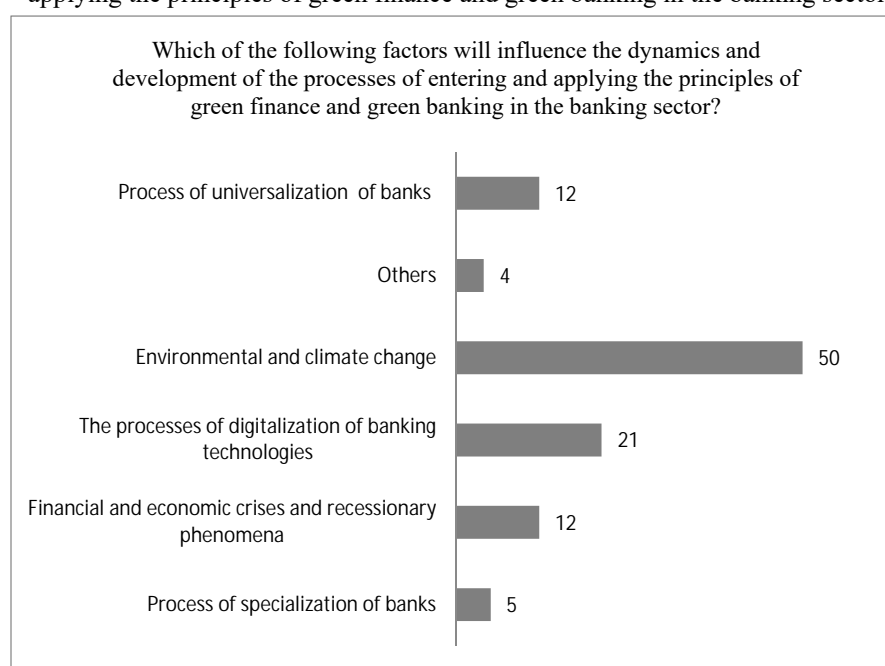
Source: Own Source.

There are four respondents who indicate other factors influencing the dynamics and development of the processes of entering and applying the principles of green finance and green banking in the banking sector, which can be summarised in two main areas:

- First, some believe that many countries use a range of measures to address environmental issues, such as government subsidies and fiscal incentives, and take appropriate legislative initiatives that contribute to the transition to sustainable development models. These actions have a significant contribution to the development of the green economy and create additional opportunities in the financial sector for private and public actors;

- Secondly, these are the regulatory framework that is being created at a national and supranational level in relation to the development of sustainable and green finances. This is especially true in the EU, where a common classification system has been introduced to encourage private investment in sustainable growth and contribute to building a climate-neutral economy. A regulation defining the pan-European classification system

has been adopted taxonomy[3] which will provide businesses and investors with a common terminology for identifying those economic activities that are considered environmentally sustainable (EU TEG group 2020).

However, it should be taken into account the fact that the analysis of the impact of European policies through European funds shows that absolutely all of them have an indirect effect, incl. regarding the green economy and green finance, because in one way or another, they influence employers, the workforce, labour productivity, etc. Moreover, the main goal of European funds is to complement national policies (Angelov, 2015, pp. 88-89).

In Bulgaria, "green banking" is at an early stage of its formation. In this position settings are created at a national and corporate level. The environment and its protection has been a leading topic around the world for several years. Both globally and in our country, many individual and joint efforts are made to use the use of plastic, to get out of cars and live more environmentally friendly, to use environmentally friendly chemicals, to use energy-saving household appliances, etc. The banking sector is also successfully involved in campaigns in favour of cleaner nature. In recent years, there has been an increase in the share of the green loan portfolio and increased support for investments to reduce carbon emissions. Companies that make such investments are representatives of all industries and invest in new machinery, improved building stock, invest in waste management, electric vehicles, photovoltaics and organic farming.

The financing of green and ecological projects has accelerated significantly in recent years. The proof of this is the disbursements for hundreds of millions of euros from the leading banks in Bulgaria. Their focus is on the global trends in this area. At the regional conference for renewable energy RE-Source Southeast, which was reported in "Sofia Tech Park", it was stated that our profitability is several times higher than in other countries in this sphere. Therefore, the topic of green energy and energy efficiency occupies a central place in the National Plan for regeneration and sustainability. The Electric Power System Operator points out that only ESO, for example, must allow for the possibility of combining more than 4,500 megawatts of green plants at the front of the building. Details of the trends to accelerate the "green" financing and the activities of two of the main banks of the Bulgarian reserve.

In this regard, Bulgarian banks are ready to make both financial and time expenditures to finance the green transition of the economy, adopting the value principles of green management. Almost 98% of the respondents expressed this readiness, with only one representative of a banking institution answering negatively (Figure 6). This is probably due to the fact that he is at the lowest hierarchical level of the bank and is not familiar with the dynamics and development of the processes of entering and applying the principles of green

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[3] The taxonomy will enable investors to refocus their investments on more sustainable technologies and economic activities. It will help the EU to become climate-neutral by 2050 and achieve the goals of the Paris Agreement for 2030. These goals include a 40% reduction in greenhouse gas emissions, which the Commission believes the EU needs to meet. there is a shortage of investments of around 180 billion EUR a year. The taxonomy on climate change mitigation and adaptation is already in place. For the other four purposes, the taxonomy should be implemented by the end of 2022.

finance and green banking in the banking sector, specifically in the bank where he works, as the other two respondents from the same banking institution gave an affirmative answer.

Figure 6

Willingness of Bulgarian banks to incur costs for "green" activities
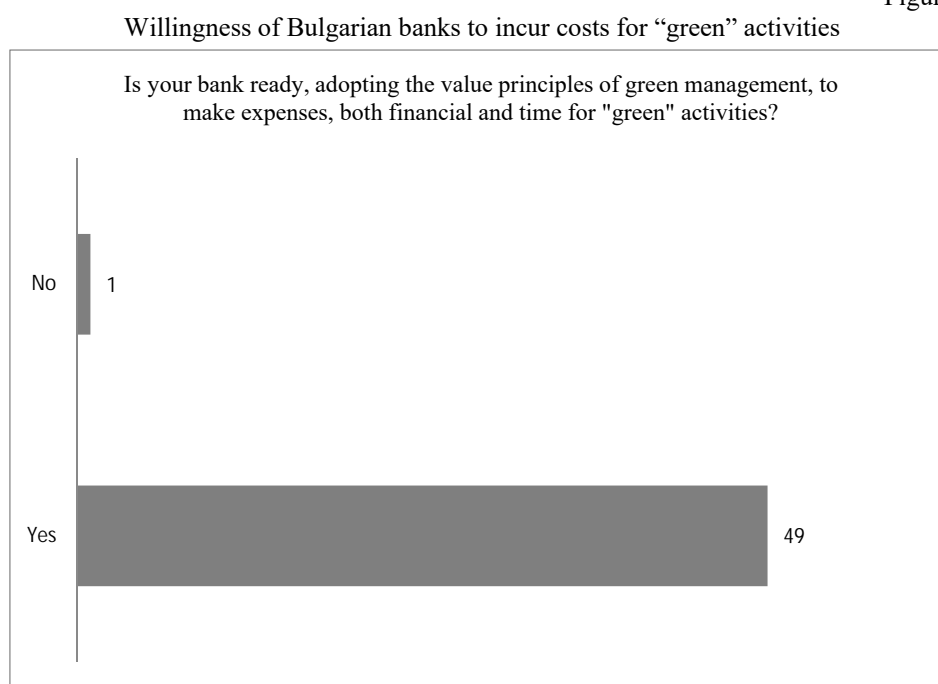
Source: Own Source

The general conclusion is that after the Bulgarian companies, incl. Bulgarian small and medium enterprises (SMEs) are motivated to participate in a green and sustainable transition of the economy, the financial system is the one without which there is no way to direct resources to green projects. This is a new niche in the banking sector that banks will focus on and use to expand their portfolios.

The observed trend of globalisation of "green" finance is often associated with the so-called greening of the international financial system. This implies that appropriate "green" institutions and instruments will be built into each component of the system and that the necessary financial infrastructure will be created. In our opinion, however, it is fair to talk about the emergence of a global market for "green" financial instruments as a new component of the international financial system, associated with the stage of systemic transformation.

Characteristic of this global financial market are its bilaterally binding parameters:

1) Ensuring mutual penetration between all components of the international financial system (as the global market for green financial instruments combines different types of financial instruments);

2) Close interaction between the financial and real sectors of the world economy through the implementation of "green" projects and programs.

The costs of transforming the transition to the global use of green finance are considered low, as it is not a matter of creating fundamentally new financial instruments and institutions in technical terms, but of adding a "green" component to the structure of issued financial products, through which their new quality is produced.

Therefore, the readiness of Bulgarian banks to use the instruments of green financing in their activities is of interest (Figure 6). In terms of time, green finance and banking instruments do not have a long history.

One of the most common green finance instruments is climate or environmental/green bonds. In issuing these securities, in addition to the basic characteristics such as coupon income, price, and maturity, the environmental assessment of the project is taken into account.

"Green" bonds are an innovative financial instrument aimed at providing financial support for the implementation of environmental programs and projects.

The structure, risks and repayment of green bonds are almost the same as traditional bonds, but the proceeds are spent exclusively on the implementation of green projects. Issuers of "green" bonds can be not only corporations and financial institutions, but also the state, which carries out a strategic issue of bonds to ensure liquidity in the market and attract investors. For these purposes, "green" sovereign, municipal bonds, as well as bonds of development institutions, can be issued.

The first issue of green bonds was carried out by the World Bank in 2007. As this segment of the financial market has developed, the Green Bonds Principles have been developed, which are accepted benchmarks that are followed in most countries. Compliance with these principles guarantees investors that the issuer meets certain standards and allocates funds from the issue of bonds specifically for environmental protection projects. In addition, there are national rules that legislate the criteria for classifying bonds as green.

The Climate Bond Initiative was established in 2009 to unify and standardise the issuance of climate bonds(Climate Bond Initiative n.d). If initially the issue of climate bonds was aimed at financing projects related to climate change, later, this list was expanded to include various environmental projects. In September 2016, the Luxembourg Stock Exchange (LuxSE) created the world's first trading platform for companies investing in environmental and environmental projects – the Luxembourg Green Exchange (LGX) (bonds worth 63 billion euros traded on LGX Euro in 12 months). (Green Bonds: Country Experiences, Barriers and Options, 2016; Global Progress Report February 2018, International Finance Corporation, 2018).

Areas of financing through the issuance of green bonds include transport, agriculture and forestry, construction and industry, waste management and recycling, energy, water resources and other border industries. Among the most popular investment areas are projects aimed at the development of alternative energy sources, low-carbon transport and energy efficiency (Frolova, 2020, pp. 43-48).

Interestingly, despite the underdeveloped green bond market in Bulgaria, 44% of respondents said that Bulgarian banks would use this instrument of green finance – "climate or environmental/green bonds" (Figure 6).

One of the most important components of the developing global financial market is the emerging "green" banking system, which is gradually emerging as a multi-level "network" of financial intermediaries, including, on the one hand, created from scratch (but not on production and organizationally, and functionally) global, regional and national green and development banks, and on the other hand, separate eco-financing units set up within existing commercial and green development banks (Establishing China's Green Financial System, 2015, pp. 13-15).

The development of the green bond market led to the emergence of another special financial instrument – the green loan. This is a loan of any type provided exclusively for the financing of "green" projects that meet the established requirements. The Credit Market Association has issued the Green Lending Principles, the purpose of which is to create a unified system of standards to maintain the integrity of the green loan market. Green lending is not only lending to corporations for green investments. It also includes mortgages for personal housing, auto loans, the issuance and maintenance of "green" credit cards, as well as "green" leasing.

According to international estimates, the total volume of syndicated loans maturing (closing date) in 2014 – early 2015, serving "green" projects, amounts to 82% of the total number of such loans and only 15% (or 164.7 billion dollars in absolute terms) of the total amount of allocated funds. (Green Finance: A Bottom-up Approach to Track Existing Flows, 2016).

In Bulgaria, according to 28% of respondents, Bulgarian banks would use this instrument of green financing – "green lending", including green mortgages (Figure 6).

But it should be borne in mind that According to the G20 Green Finance Process Working Group, only 5-10% of bank loans in a small number of countries can be classified as green (G20 Green Finance Synthesis Report, 2016, p. 6).

The third important tool for green finance is green investment accounts and green investment portfolios.

If we look at the corporate sector, there is more than one investment platform in the financial world specialising in sustainable projects. For example, the American platform EarthFolio offers investors to form portfolios that have a social, managerial or environmental focus (The Good Trade [online], n.d). Open Invest Investment Corporation also works in the field of responsible investing. To work on the electronic platform OpenInvest, the investor only needs to open a brokerage account, transfer funds there and indicate the areas of investment (environmental protection, social equality, etc.). The formation of the investment portfolio and its management is carried out by financial advisers through the technical capabilities offered by the platform (OpenInvest, [online]).

At most, 72% of the respondents from the banking sector indicated that Bulgarian banks would use this instrument of green financing – green investment accounts and green

investment portfolios, the lowest score as ready for use by all green financial instruments (Figure 6).

Special applications and tools to help investors work on sustainable/green financing are part of green financing. In this regard, when evaluating green/sustainable projects, investment banks and financial companies usually seek the help of experts in the field of sustainable financing. For example, Sustainalytics provides ratings, research and analysis in the field of environmental, social and governmental (ESG) factors. Sustainalytics offers bond issuers/ borrowers the opportunity to purchase a license for their ESG rating, which facilitates the attraction of financial resources, including in the form of sustainable loans (Systainalitycs, n.d).

Recently, there has been a penetration of ESG initiatives in the fintech sector. Some banks and financial institutions offer special applications and tools to help investors navigate the market for sustainable financing. For example, the IMP + ACT Alliance has launched a special application, IMP + ACT Classification System (ICS), which allows asset managers to independently generate reports on the classification and management of ESG factors, implement strategies to reduce financial risks and contribute to achieving of the UN Sustainable Development Goals (Finextra, 2020 [online]).

Special applications and tools to help investors work on sustainable/green finance as part of green finance are also in the sights of Bulgarian bankers. 36% of the surveyed bank employees at all levels expressed interest in using them in the activities of their banking institution (Figure 7).

32% of respondents also indicated other green finance instruments that can be integrated into the following few instruments known in the financial markets:

- The main green stock indices of the global market for green financial instruments, which include Global Clean EnergyIndex Standard & Poor's (it brings together the 30 best clean energy companies in the world), NASDAQ Clean Edge Green Energy Index and FTSE Japan Green Chip 35 (Establishing China's Green Financial System: Report of The Green Finance Task Force, 2015, p. 9).

- A special role in the global market for green financial instruments is assigned to the segment of derivative financial innovations (derivatives), used mainly for hedging purposes. They mainly serve large environmental projects in the field of infrastructure, development of a low-carbon economy and energy saving. These include green asset-backed securities (green ABS, green asset-backed securities), weather derivatives, carbon futures, options and forward contracts (Establishing China's Green Financial System, 2015, pp. 9-11). The size of the analysed segment of the global market for green financial instruments, taking into account securitised financial products, is also quite modest and does not exceed 1% of the global derivatives market (Porfiryev, 2016, p. 10).

- Special bank cards also belong to green financial instruments. For example, some banks offer the issuance of a bank card (Green World) to a savings account, and when paying with this card for a certain amount spent, for example, 1,000 euros. The bank finances the planting of a tree in one of the national parks of a country. At the same time, the client receives an electronic certificate indicating the location of the planted trees.

- Green banking instruments also include digitalisation products such as the Internet and online banking. E-banking reduces paperwork, which shrinks paper consumption during transactions. Customers also visit bank branches less frequently, which affects the frequency of personal and public transport use and therefore reduces carbon emissions.

Figure 7

Willingness of Bulgarian banks to use green financing instruments in their activities
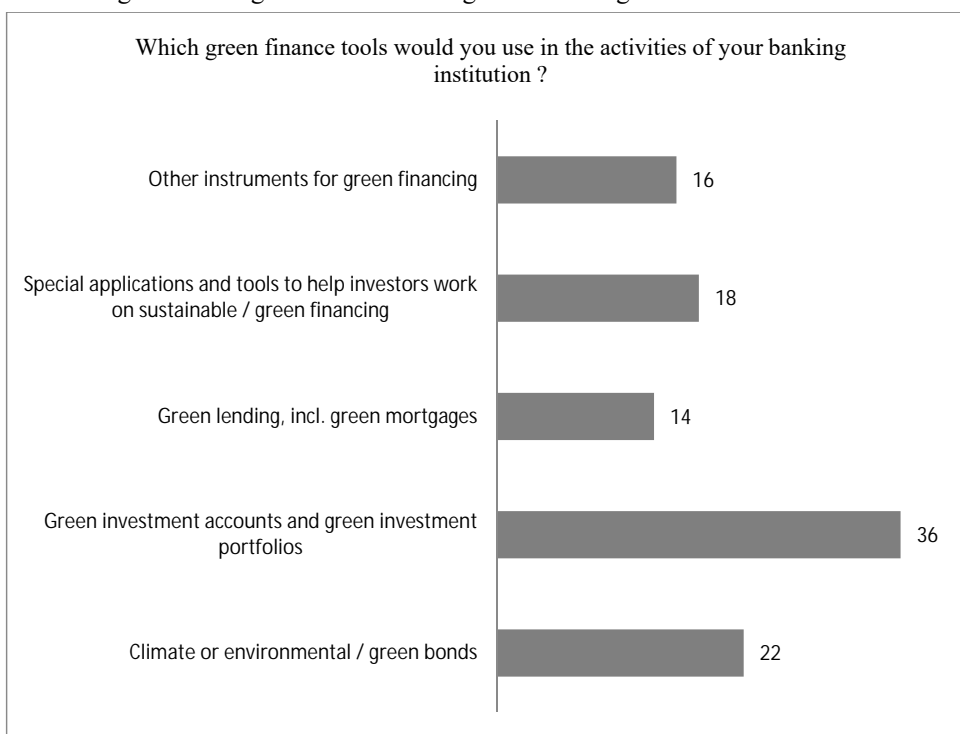
Source: Own Source

When asked which green finance instruments listed in Figure 7 you use in your bank's business, respondents indicated mainly those that gravitate around "green investment accounts and green investment portfolios" and "green loans". In summary, these answers can be classified into the following areas:

- For example, some banks offer their business customers new credit products related to transport and green energy. They are designed for micro, small and medium-sized enterprises and corporate clients in order to implement the policy of reducing the carbon footprint and investing in a sustainable future. In practice, these are:

  ➢ Loans for the purchase of new electric vehicles with lower interest rates and a management fee, as well as the lack of a commission for early repayment with the borrower's own funds.

➢ Loans related to investments in the construction of photovoltaic installations for the production of electricity for sale on the free market, which have a longer term – up to 15 years and a grace period until the commissioning of the photovoltaic installation. Collateral requirements are relaxed, and in most cases, this is only the newly built photovoltaic park. Interest rates and commissions are lower than market loans for this type of loan. Another important feature is the seasonal repayment plan, consistent with the production of electricity.

➢ Loans also related to investments for the construction of photovoltaic installations, but for the purpose of producing electricity for own consumption and sale. The financing is up to 100% of the construction costs accepted by the bank. The repayment plan is flexible and seasonal. The maximum term of the loan is 10 years, but estimates show that at the expected market prices of electricity, with the saved electricity costs, the loan will be repaid over a period of 3 to 5 years.

In general, the answers show that some banking institutions have long focused on supporting small and medium-sized companies, including in their projects to improve energy efficiency, and in addition, offer very good conditions to any company that needs financing for a business engaged in environmental issues. At the same time, a number of banks also enable individuals to benefit from and invest in energy-efficient solutions for their homes so as to sustainably reduce their electricity costs. Even some of the respondents declare an individual approach of their bank to the clients – individuals, related to specific activities and sectors.

Some respondents said they did not support investing in environmentally friendly solutions and encouraged their customers to take further steps towards environmental friendliness by using the bank's services entirely online, which reduces its carbon footprint. In this regard, some banks also support sustainable family solutions aimed at reducing carbon emissions and increasing energy efficiency, such as buying a home in a building with a certificate of energy efficiency or installing a photovoltaic system for own consumption.

Some respondents point out that they are offering another innovative step forward in favour of nature by launching a so-called green current account for their environmentally oriented customers. The funds in this type of account are used entirely for green investments, and customers can be sure that their money is flowing into the economy in the form of financing projects with a clear and meaningful purpose. One respondent points out that along with the current green account, customers are provided with a biodegradable debit card of biological origin – made of corn, which allows the card to degrade in 6 months instead of 400 years, as this process takes ordinary plastic cards. After the validity of the card expires after 4 years, it can be composted and its decomposition will not harm nature. Moreover, the envelope in which the card reaches the customer is made of recycled paper, and with each card, the customer is provided with a cardboard package with seeds of honey plants. They can be sown in the garden or on the balcony and provide nutritious food for the bees. The account gives its customers the freedom to withdraw money from ATMs of all banks in the country free of charge, to make free payments at POS terminals in Bulgaria and abroad, as well as an unlimited number of free transfers in BGN via internet banking and many other preferential conditions for different types of loans – from overdraft to mortgage. In addition, the opening of a current green account is mainly done online, i.e. need a computer or mobile device, the

Internet, which in addition to being fast and easy, most importantly – environmentally friendly.

Respondents from almost all banking institutions declare their participation and involvement in charitable "green initiatives and projects" as part of their active, socially responsible policy related to the creation of sustainable models and solutions that change the natural environment. The purpose of such initiatives is to invest in causes that build green self-awareness, which is part of the corporate culture of banks. This provokes, once again, responsible behaviour towards natural resources, motivating as many people as possible to take conscious actions to protect the environment. According to Mastercard data from a study in 14 European countries, the pandemic in the last year has led to more consumer-oriented consumer behaviour, as well as greater interest in causes and businesses involved in sustainable development, the fight against climate change and biodiversity conservation. More than 83% of respondents confirmed that they would personally participate in actions and activities with care for nature, and 52% said that after the Covid-19 crisis, they paid attention to how their daily choices affect the health of the entire planet (Postbank, 2021).

One of the most important components of the emerging global market is the emerging "green" banking system, which is gradually emerging as a multi-level "network" of financial intermediaries, including both global, regional and national "green" banks and development banks, individual eco-finance departments set up within existing commercial banks and green development banks, as well as generally accepted standards in the field of green finance. The majority of respondents are familiar with these standards, or some of them – 62% of respondents answered in the affirmative.

Figure 8

Are you familiar with any of the generally accepted standards in the field of green finance
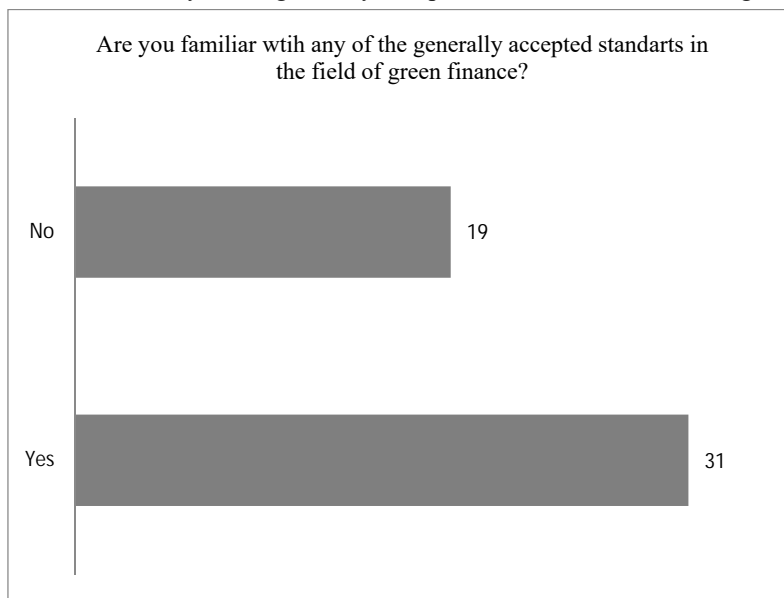
Source: Own Source

Not all those who answered in the affirmative whether they were familiar with the main generally accepted standards in the field of green finance indicated specific standards. The listed standards can be grouped in the following several areas:

One of the main generally accepted standards in the field of green finance is the so-called "Equator Principles" (EP), which was indicated by 12% of respondents who answered yes to the previous question. The Equator (EP) Principles are a set of recommendations for managing environmental and social risks in project financing and lending. EPs can be used for project financing, project financing consulting services, project-targeted corporate loans, bridge loans and project-targeted refinancing. These principles are based on the standards developed by the International Finance Corporation (IFC) in the field of environmental and social sustainability. In practice, this is a risk management framework adopted by financial institutions for identifying, assessing and managing environmental and social risk in project financing. Its main purpose is to ensure a minimum standard of due diligence in support of responsible risk decision-making. As of February 2019, 94 financial institutions in 37 countries have officially adopted the Equator Principles, covering most of the international debt on project financing in emerging and developed markets. The principles themselves were first published and signed by ten major banks in 2003 (the Equator Principles, officially published in Washington on June 4, 2003) and build on the existing environmental and social policy frameworks established by the International financial corporation. Subsequently, the standards are periodically updated in the International Finance Corporation's so-called performance standards for social and environmental sustainability and in the World Bank's Environment, Health and Safety Guidelines. The last, fourth update was made in November 2019 and became mandatory for all organisations following these principles from October 1 2020. Currently, 116 financial institutions from 37 countries have officially adapted the EP in their work. The Equator Principles apply worldwide to all sectors of industry and (within EPIII) cover four financial products:

1) Consultancy services for project financing;

2) Project financing;

3) Corporate loans related to projects;

4) Bridge loans.

The relevant thresholds and application criteria are described in detail in the Equator Principles section (UNEP, 2016).

- The second group of basic generally accepted standards in the field of green finance is related to the regulators of the European Union, which in recent years have taken a number of steps to strengthen the sustainable development of financial institutions:

  ➢ First of all, this is indicated by 6% of respondents who answered in the affirmative to the question of familiarity with the main generally accepted standards in the field of green finance, Action Plan (EBA – Action Plan on Sustainable Finance). Adopted in December 2019 by the European Banking Authority (EBA) for sustainable financing. The main objectives of this document are:

- o improving the regulatory framework to encourage financial institutions to develop in accordance with the principles of sustainability;

- o inclusion of sustainability provisions in the development and risk management strategies of financial institutions; providing regulators with the necessary set of tools to monitor and assess the social, managerial and environmental risks that financial institutions may face (EBA Action Plan on Sustainable Finance, 2019). The Action Plan contains not only the main directions of work in the field of sustainable finance, and its powers within the current legislative framework, but also a plan for the adoption of regulatory documents for sustainable finance, covering the period from the fourth quarter of 2019 to the first half of 2025. Based on this document, the EBA published a Discussion Paper on the Management and Supervision of Social, Environmental and Management Risks for Credit Institutions and Investment Firms, which describes how risks and factors for ESG can be taken into account in the regulatory framework (EBA 2020).

➢ Secondly, 8% of respondents answered in the affirmative to the question of familiarity with the main core standards in the field of green finance, in order to indicate the Guidance on Climate and Environmental Risks developed by the European Central Bank (ECB) environmental risks: supervisory expectations related to risk management and disclosure, the first latest version was published in November 2020. This document is of a recommendatory nature and describes the current risk management current practices, provides a classification and also reveals their impact on traditional banking risks. In particular, climate and environmental risks are divided into physical risks and transition risks. Physical risk manifests itself as a negative financial result of gradual climate change, deterioration of air quality, water quality and other environmental problems. At the same time, transitional risks may materialise in the form of financial losses for the bank as a result of taking into account the principles of economic sustainability. This may take the form of reputational risks if the bank continues to finance polluting industries, or results in an increase in the share of insolvent borrowers who are unable to pay their debts due to the rising costs of implementing new environmental standards. The ECB's management describes in detail the regulator's expectations regarding environmental and climate risk management. In particular, banks are encouraged to take into account their impact on the business environment when developing strategic and business decisions. The ECB also considers it desirable to identify those responsible for managing climate and environmental risks in the bank's internal structure, and recommends that banks collect data and generate special reports assessing the exposure to such risks and other issues. The ECB notes that banks are still not disclosing enough information on climate and environmental risks (ECB, Guide on climate-related and environmental risks (Supervisory expectations relating to risk management and disclosure), November, 2020). It should be borne in mind that, in addition to the Guidelines, the ECB also publishes the "ECB report on institutions' climate-related and environmental risk disclosures". With this report, the European Central Bank (ECB) seeks to provide a snapshot of the level of disclosure of climate and environmental change risks in the SSM (Single Supervisory Mechanism) countries. The assessment was made in light of the supervisory expectations set out in the ECB's Guide to

Climate and Environmental Risks. To this end, the comprehensiveness of climate and environmental risk disclosures were assessed for 107 significant institutions (SIs) and 18 less significant institutions (LSIs) in the reference year 2019 (ECB report on institutions' climate-related and environmental risk disclosures, 2020). Following the final publication of the Guide by the ECB on November 27 2020 (following the comments in the public consultation), the following steps have been identified:

o Banks had to conduct a self-assessment of the ECB's expectations in early 2021, which resulted in the report on "The state of climate and environmental risk management in the banking sector – Report on the supervisory review of banks' approaches to climate and environmental risk management (ECB,2021);

o The ECB will completely review the practices of banks in 2022;

o The next supervisory stress test in 2022 will also focus on climate risks. (ECB 2020)

➢ Thirdly, 12% of respondents answered in the affirmative to the question of familiarity with the main generally accepted standards in the field of green finance, said the report developed by the expert group of the European Commission (EC) "Taxonomy: Final report of the Technical Expert Group on Sustainable Finance", 2020. Significant private investment is needed for the EU to achieve climate neutrality by 2050. The EU taxonomy is designed to direct private investment to the activities needed to achieve climate neutrality. The taxonomic classification does not determine whether or not a technology will be part of the Member States' energy sources. The aim is to strengthen the transition by finding all possible solutions so that we can meet our climate goals. Based on scientific advice and current technical progress, the Commission considers that private investment should play a role in natural gas and nuclear energy activities during the transition. The selected activities in this area are in line with the EU's climate and environmental objectives and will enable us to accelerate the transition from more polluting activities, such as coal energy production, to a more climate-neutral future based mainly on renewable energy sources. In early February 2022, the EC presented an Additional Delegated Act on Climate Change under the Taxonomy Regulation, related to climate change mitigation and adaptation and covering certain activities related to natural gas and nuclear energy. In this way, additional energy economic activities are introduced into the EU taxonomy (European Commision 2022).

When asked whether they are familiar with the instruments and mechanisms of state support for green investments, whether they know those that could be used and indicate them, most of the respondents (88% of respondents) did not answer or stated that they did not become familiar with the topic.

The inevitability of state regulation of the green economy and the development of green finance is obvious. The financing of the green economy must be carried out as a matter of priority by the business itself. The task of the state is to create and implement incentive tools for the development of "green" industries, incl. green finance and banking, to discourage projects that do not fall under green priorities. In this regard, first of all, the philosophy of

taxation must be changed, since taxes perform not only fiscal functions, but through them regulate consumption and investment activity, which is related to the dynamics of economic development and the well-being of society (Iliev, 2003, p. 97). If we have to summarise the responses of the respondents who indicated certain measures (these are measures rather than instruments and mechanisms) by the state/governments in support of green investments, we can say that they largely correspond to The best world practices that exist in the field of implementation of the developed mechanisms for state support for "green" investments are as follows:

- Use of environmental taxes and fees with differentiated rates – with increased coefficients for these types of activities, which are classified as "carbon-intensive" and with preferential lower rates for the representatives of the "green" business. Environmental taxes are not only used to compensate for the damage caused to the environment by pollutant emissions, but are also an element of corrective pricing (for example, the size of a carbon tax should correspond to the social costs caused by such emissions). The Paris Agreement of the UN Framework Convention on Climate Change recommends the adoption of a tax on carbon dioxide emissions, in connection with which all countries that have signed the agreement are considering introducing it. If the tax is adopted, industries such as metallurgy, the chemical industry, transport and energy will bear a significant additional tax burden. Carbon tax revenues should be directed to the development of renewable energy and energy efficiency;

- Existence of direct state financing of investments in "green" projects;

- State guarantees are given to creditors of persons investing in "green" technologies and consist in the fact that if the investor fails to fulfil its obligation to the creditor, the state will pay the amount of the debt at the expense of the budget;

- "Green" public procurement is an informal term applied to the procurement of goods, works and services for public needs, in which, along with price, quality and availability, the environmental characteristics of the purchased product, work or service are taken into account. Thus, priority is given to producers of more environmentally friendly products or manufacturers using environmental technologies;

- Existence of direct state lending to "green" businesses;

- State subsidies for green business structures of a certain share of the costs of these loans, which provide for the implementation of "green" projects;

- Reimbursement of part of the project costs implies that the state bears some of the investor's costs when implementing a "green" project (for example, the cost of an independent assessment of projects to obtain the status of "green", the cost of acquiring new eco-equipment);

- Subsidisation by the state to lending institutions of part of the borrowed resource allocated for green projects;

- Risk reduction means that the state seeks to reduce the risks inherent in any investment project for "green" projects, which are classified as high-risk. Risk mitigation is being

done in a variety of ways, including scaling up green projects and securitising loans at the design stage;

- The initiation of public-private partnership projects is the formation by the state of a proposal to potential investors for the joint implementation of an investment project in the area that is a priority (for example, the introduction of environmentally friendly technologies in the industry).

54% of the respondents (Figure 9) believe that the development and strengthening of the green financial infrastructure are necessary (development of the low-carbon economy, the rating system, the "green" stock indices, the global network of institutional investors, etc.). The subject of these measures is the development of a low-carbon economy, the rating system, green stock indices, non-trading databases and cost analysis systems, and the global network of institutional investors. Examples are:

- US Carbon Efficient Index (S&P), iPath Global Carbon ETN (Barclays);

- EU Emissions Trading System (EU-ETS) – up to 3/4 of world emissions trading;

- Chicago Climate Struggle;

- Methodological approaches to UN rankings (UNEP) and Barclays;

- Investor Network of Climate Risk: established in 2003, with over 100 investors with managed assets of more than $ 11 trillion;

- The Institutional Investor Group of Climate Change, which has been operating since 2001, has 772 investors managing assets worth over $ 87 trillion. (Establishing China's Green Financial System, 2015, pp. 8-13; Mapping Channels to Mobilise Institutional Investment in Sustainable Energy, 2015, pp. 45-47; Green Finance for Developing Countries: Needs, Concerns and Innovations, 2016, pp. 27-34).

40% of respondents (Figure 9) say that the development and support of specialised institutional investors ("green" development banks, funds, etc.) is a necessary measure that would stimulate the expansion of the perimeter of green finance and green banking. Examples of this are the Green Investment Bank in the UK, the practice of so-called YieldCos companies, Real estate investment trusts, and Master Limited Partnerships (MLPs).[4] In the United States, the market niche of these institutions exceeds $ 1 trillion. (Establishing China's Green Financial System, 2015, pp. 8-13; Mapping Channels to Mobilise Institutional Investment in Sustainable Energy, 2015, pp. 45-47; Green Finance for Developing Countries: Needs, Concerns and Innovations, 2016, pp. 27-34).

The development of the "green" regulatory framework/infrastructure (insurance parameters/ requirements, creditors' liability, mandatory requirements for disclosure of environmental information, etc.) are necessary measures for "greening" the financial system, which is preferred by 40% of surveyed bank employees (Figure 9). The object of intervention of these

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[4] MLPs are a business venture , which exists in the form of a publicly traded limited partnership. They combine the tax breaks of a private partnership (profits are taxed only when investors receive distributions) with the liquidity of a publicly traded company.

measures for insurance, the responsibility of creditors, the mandatory requirement for disclosure of environmental information, etc. There are many similar examples of practice in developed countries and emerging and emerging markets, such as the International Principles of the Equator mentioned earlier (since 2003); EU Environmental Responsibility Directive 2004 (UN Directive 2004/35/EC; UN Principles for Responsible Investment [UN Responsible Investment Principles) (PRI) is an international organisation working to promote the inclusion of environmental factors, Social and Corporate Governance (ESG) in the investment decision-making process, launched in April 2006 with the support of the United Nations (UN), PRI has over 2,300 participating financial institutions as of January 2020. These institutions are participating by signing the six basic principles of the PRI and then submitting regular reports on their progress] in green activities, etc. (European Commision 2013).

Figure 9

Necessary measures for "greening the financial system" according to Bulgarian banks
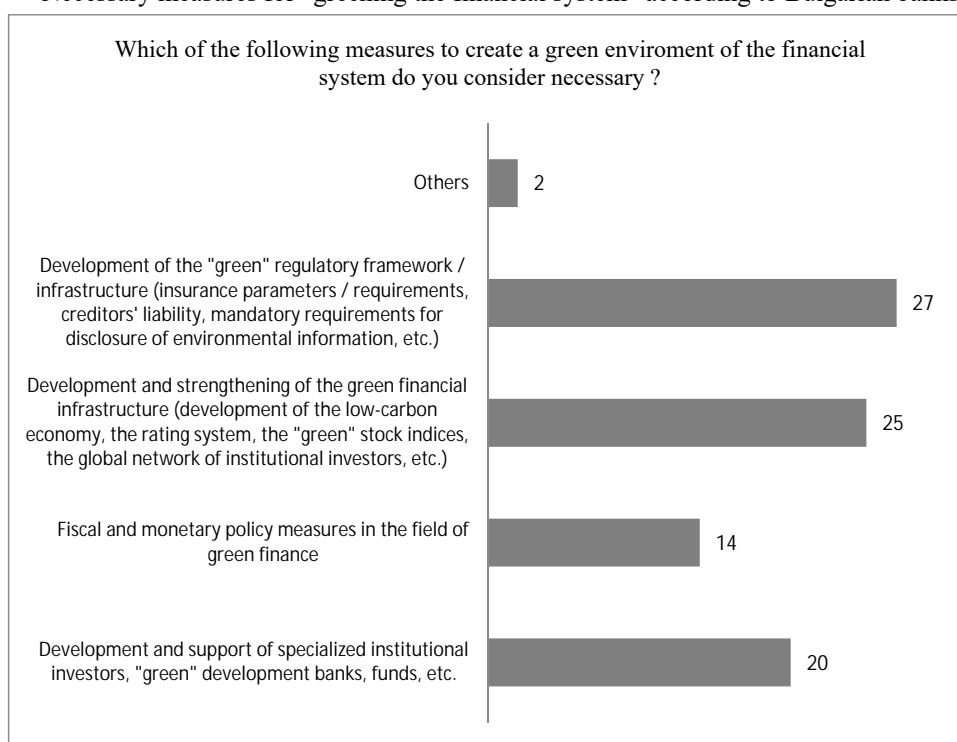
Source: Own Source

One respondent also mentioned "other" measures, but they are not described in the questionnaire.

Only six respondents answered the question about proposing recommendations for the formation of green finance and green banking, as well as for the development of

environmental/green management in the banking sector. The recommendations made by them are grouped in the following areas:

- Establishment of guarantee mechanisms at a national level for lending to high-risk green projects;

- Development at the national level of ideology and concept for the establishment of regulatory bodies related to the development of green finance and green banking;

- Establishment of a methodological centre for management of activities, measures and enforcement of principles in the field of "green" finance;

- Formation and approval of principles, standards and taxonomy;

- Development of a system for verification, control and verification of "green" financial instruments;

- Formation and development of the infrastructure of the "green" financial market;

- Establishment and promotion of a system of measures for state support of "green" instruments, as well as of green banking.

In principle, these administrative tools to support green projects are based on the mechanisms of action of state power, which include:

- Legislative consolidation of requirements for compliance with environmental parameters means that regulatory legal acts of authorities at all levels can establish special environmental requirements that allow, protect or enforce certain requirements (for example, the obligation to assess the impact of industrial processes on the environment is established);

- Legislative regulation of the green finance market, in addition to general regulatory goals, such as maintaining systemic stability, security and sustainability of financial institutions, has special tasks – ensuring the high quality of services provided by financial organisations in terms of achieving "green" goals and creating a favourable investment climate that allows investors to be more courageous make green investment decisions;

- The creation of development institutions is carried out to stimulate innovation processes, ensure sustainable economic growth and diversify the economy. Development institutions act as a catalyst for private investment in priority sectors and sectors of the economy by being able to act as co-investors in projects, issue guarantees for the investor's debt obligations, support the project with long-term loans and otherwise facilitate the implementation of projects that cannot be fully financed by private business, but are significant to society;

- The formation of a portfolio of "green" projects should be carried out by the authorities in order to overcome the barriers that hinder investment in them. The novelty of such projects, lack of understanding by investors of the level of their risk and profitability, and blurring of the criteria for classifying investment initiatives as "green" lead to low credit ratings of "green" projects and insufficient interest of potential investors in them. The state, compiling a register of "green" projects, guarantees the accuracy of information

about them and declares the support measures provided for them, which has a stimulating effect on investors;

- Information and advisory assistance to "green" investors on the application of legislation, the choice of financial instruments, etc., as well as the development of human resources for participants in environmental initiatives through the organisation of employee training and assistance in the selection of qualified personnel, are also an important area of state support for potential investors in the conditions formation of the market of "green" projects.

I must say that the system of support for "green" investment includes not only the above measures, but also differs by country.

The question of whether there are actual and potential threats and challenges related to the globalisation of green finance and green banking was answered negatively by 94% of respondents (Figure 10). Only three of the respondents gave a positive answer, indicating the following potential threats and challenges, grouped in the following areas:

- Financial threats and challenges – They are related to the fact that the process of greening the international financial system must be balanced, i.e. this means that the various measures supporting the implementation of green finance and green banking should be developed and implemented in parallel and, as far as possible, managed by developing and implementing universal definitions, principles, accounting and reporting standards, etc. If these conditions are not met, not only will global financial, economic and green problems not be solved, but a new source of global financial instability will emerge in the form of a global market for green financial instruments, which is also not immune from the emergence of financial bubbles. The global market for financial instruments must combine not only green financial instruments, but also take into account the relationship with the assets of real sectors of the economy, such as the real estate market. There are already concrete examples of overheating in this market and "inflating the bubble", which initiates a specific financial threat. Currently, despite the fact that the global market for "green" financial tools has just started to appear, it is already noticeable that some of its segments have started to grow rapidly and have reached the stage of "self-combustion" (UNEP, 2016) and is extremely important to coordinate the development of the different segments of this market. In addition, there are many difficulties with the methodology for defining green bonds and other green finance instruments. According to the International Finance Corporation, bonds of this type could be written as much as you want, as a volume, in the absence of a universal approach to their identification and global databases detailing environmental projects (IFC, WBG, 2016).

- Technical threats and challenges – Definitions and identification mechanisms are needed not only from a financial but also from a technical and technological point of view. For example, there are difficulties in assessing the green component in projects in different areas and sectors of the economy;

- Institutional threats and challenges – New institutions in the form of profit-oriented trading companies, such as Real estate investment trusts, Master Limited Partnerships (MLPs, etc.), are considered to have a number of significant shortcomings, such as high

management cost separation of liquidity from the underlying asset and tendencies to work with a high level of leverage (OECD, 2015) All the above characteristics of the analysed structures increase the risks to their operation. Therefore, there is a growing need for control, regulation and regulatory support for the activities of these institutional investors;

- Psychological threats and challenges – Due to the fact that green projects require large investments, and green financing is a relatively new activity and practice for the international financial system, the various subjects of financial and economic activity are quite cautious when working with relevant financial instruments. Therefore, it is necessary to increase the level of knowledge and awareness in this area and to stimulate the activity of economic agents in this direction.

Figure 10

Existence of actual and potential threats and challenges related to the globalisation of green finance and green banking

In your opinion, are ther actual and potential threats and challenges related to the globalization of green finance and green banking?

No   47

Yes   3
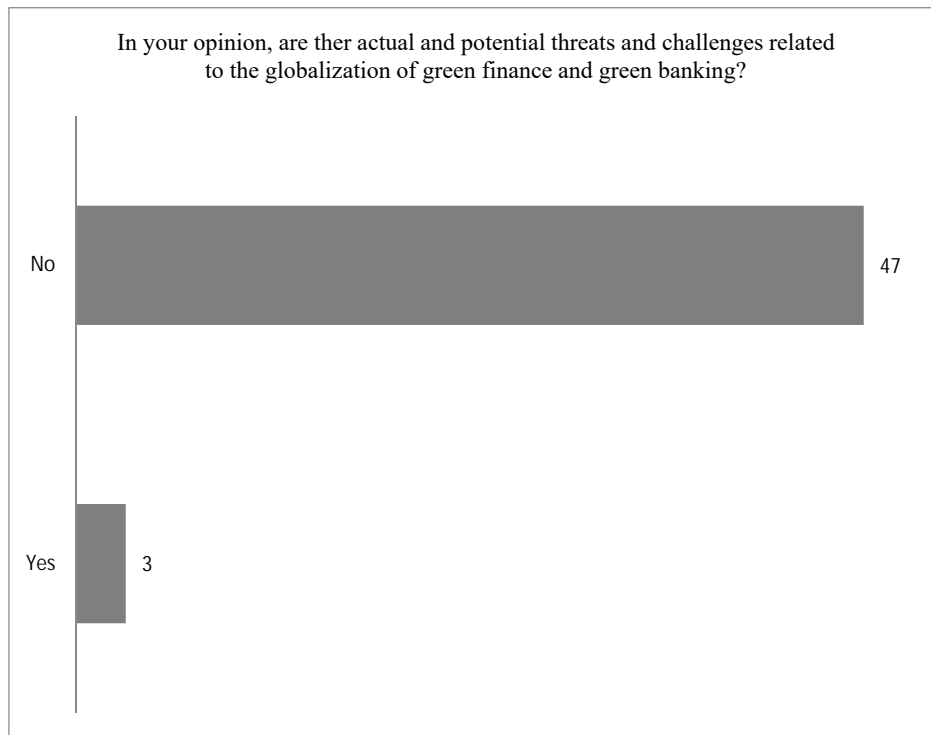
Source: Own Source

The reaction of the respondents to the answers to the various questions from the survey shows good information, which is evident from Figure 11. 88% of respondents said they were well informed on issues and topics related to green finance and green banking. 8% say they have limited access to information on these issues and topics, and only one respondent states that it is very difficult to access this information or cannot access it at all. The last 12% of

respondents who have difficulty with awareness of these issues are experts at the expert level and it is normal to be less informed or have difficulty finding it.

Figure 11

Availability of access to information related to green finance and green banking

What access do you have to information related to green finance and green banking?

We cannot get access to this information	1
Its very difficult to get access to this information	1
We have limited access	4
We are well informed	44
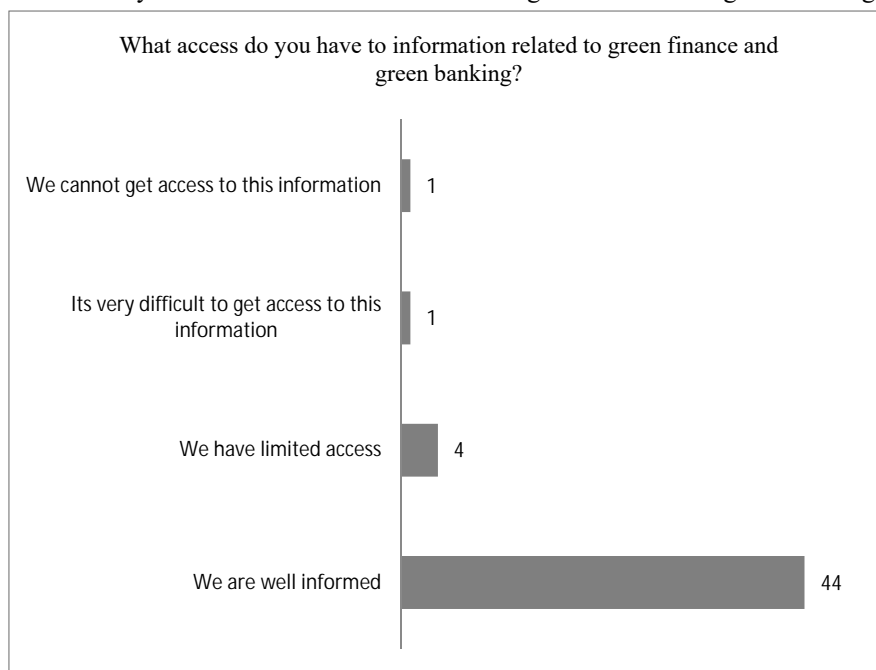
Source: Own Source

4. Conclusion

Green finance has become widespread around the world and now provides investment resources for projects that contribute to the greening and decarbonisation of the economy. The main tasks to be solved by the governments of countries for the development of "green" finance are the standardisation of approaches to assessing the effectiveness of environmental projects, the improvement of "green" financial products, the attraction of funds from a wide range of investors, including the public, in financing regional and municipal "green" projects, as well as the formulation of criteria for defining the very concept of "green" finance.

The main conclusions that can be made based on the results of the survey are the following:

The survey shows that employees in banking institutions are very well informed about green finance and green banking;

- It is obvious the inevitability of state regulation of the green economy and the development of green finance, as the financing of the green economy must be carried out by the business itself. The task of the state is to create and implement stimulating tools

for the development of "green" industries, to discourage projects that do not fall into the green priorities;

- Respondents are familiar with the best world practices that exist in the field of implementation of the developed mechanisms for state support for "green" investments ("green" banking – for banks lending to "green" projects is part of a socially responsible investment; "green" bonds, "green" certificates, etc.;

- The respondents, for the most part, are familiar with the main generally accepted standards in the field of green finance, indicating specific standards.

According to experts, investments in green energy create three times more jobs than with the same funds invested in the development of energy based on fossil fuels. In general, the survey gives grounds to conclude that in Bulgaria, it is necessary to create a single methodological centre that combines both economic competencies and the consideration of ESG factors in order to achieve two common goals for the development of society – stable economic growth, preventing the growing deterioration of the planet's natural degradation environment.

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Ventsislava Nikolova-Minkova[1]

THE TRADEMARK APPLICATION ACTIVITY IN BULGARIA ACCORDING TO THE NICE CLASSIFICATION AND ECONOMIC SECTORS FOR THE PERIOD 2010-2020[2]

This study presents the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria as measured by the NICE classes of the trademark applications for the period 2010-2020. The aim of the development is to study the interaction between the Bulgarian and foreign trademark applicant activity in Bulgaria for the period 2010-2020 to identify the priority classes under the Nice Classification and the priority economic sectors, i.e. those with the greatest potential for economic development. The analyses of trademark activity presented in the study show how by using the trademark statistics and by applying the System of Concordance developed for the purposes of this study, priority and most promising economic sectors can be identified, which brings out trademark activity as a valuable and unique information resource. The proposed research can be used for information support of management decisions and to make trademark and brand management strategies more effective.
Keywords: trademark; applicant activity; Nice classification; ISIC; NACE
JEL: O30; O34; O50

1. Introduction

In the context of globalisation, trademarks play an essential role in imposing products in the consumer consciousness and in shaping the competitiveness of enterprises. The importance of trademarks is growing at a sustainable pace, which can be judged by the World Intellectual Property Organization's annual reports. The data show that in 2020 applications for trademarks increased by 16.5% compared to 2019, their number reaching a total of 13.4 million worldwide (WIPO, 2021). This expresses the continuous development of the role of trademarks for business prosperity (Götsch, Hipp, 2012; Millot, 2012; Flikkema, Castaldi, De Man, Seip, 2015; Castaldi, Dosso, 2018; Castaldi, Block, Flikkema, 2020), but it is far from sufficient to reveal the direction of this development, and in particular the economic importance of trademarks.

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This development is motivated by the need to take into account the relationship between trademarks and the economic activity of enterprises. In it, we reveal not only the importance of trademarks applicant activity for the development of the economy, but also, through the applied research methods and approaches, we are looking for an answer to the question: Is there a link between the intensity of the trademarks applicant activity and the development of the economic sectors in Bulgaria?

The **object** of this study is the legal protection of trademarks.

The **subject** of the study is the trademark applicant activity in Bulgaria over the period 2010-2020 and its relationship with the economic sectors and economic activities.

The **purpose** of this study is: to investigate the state and structure of trademark activity in Bulgaria within the period 2010-2020 as measured by the number of classes specified in the applications for registration of trademarks and to establish the priority economic sectors and economic activities in Bulgaria. The study period (2010-2020) allows monitoring of the ongoing changes in the structure of the trademark activity for an extended period of time and provides an opportunity to reveal the existing links and interdependencies between the Bulgarian and foreign trademark applicant activity in Bulgaria. The results of this study can be used to provide information for management decisions, to develop comprehensive business strategies and to increase efficiency in building trademark and brand management strategies, as well as to track the development of economic sectors in Bulgaria in the context of Bulgarian and foreign trademark activity.

With regards to the above, the formulated objective is achieved through the following tasks:

1. Analysis of the existing literature in the field of trademarks and presentation of International Classification of Goods and Services for Registration of Trademarks (Nice Classification), International Standard Industrial Classification of All Economic Activities (ISIC), Statistical Classification of Economic Activities for the European Community (NACE Rev.2), Classification of Economic Activities in Bulgaria (NACE.BG 2008).

2. Derivation of a System of Concordance between the Nice Classification and the International Standard Industrial Classification of All Economic Activities. The necessity of that system is dictated by the fact that, when filing and registering a trademark, a list of classes of goods and services for which the trademark will be used is indicated. They correspond indirectly to the economic activity of enterprises, so it is necessary to establish a methodology for assigning the Nice classes to a specific economic sector or economic activity according to the ISIC.

3. Establishment of trademark applicant activity in the period 2010-2020 by class for each year and in total for the study period. On the basis of the data obtained and by applying comparative analyses, the classes in which Bulgarian and foreign applicants have the greatest interest in the study period stand out.

4. Comparison of the intensity of the trademark activity of Bulgarian and foreign applicants and identification of the priority economic sectors and activities in which the concentration of Bulgarian and foreign trademark applicant activity is the highest. This is

achieved by taking into account the number of filed trademark applications for each Nice class, after which the total number of applications is redirected to a specific economic sector by applying the System of Concordance between the Nice classes and the ISIC.

5. Summarising of the results and formulation of the main conclusions.

The **working hypothesis** is: There is a high degree of coincidence between the concentration of the classes of trademark activity by Bulgarian and foreign applicants by economic sectors and economic activities, i.e. foreign applicant activity is directed to economic sectors and activities in which Bulgarian applicant activity is higher.

The **limitations** in the present study are:

- The study period is limited to 2020 due to the specifics of data collection and processing by the World Intellectual Property Organization (WIPO) and the lack of data for 2021. This prevents the impact of the resulting COVID-19 economic crisis on trademark activity and the development of economic sectors but provides an opportunity for future developments.

- The trademark activity covers the applications of Bulgarian citizens in Bulgaria and foreign citizens in Bulgaria. The trademark activity of Bulgarian citizens abroad remains beyond the scope of the study.

- When applying the System of Concordance between the Nice Classification and the ISIC, the trademark applications by foreign applicants in Bulgaria, not applying the Nice System, remain outside the scope of the study.

This study and the presented System for Concordance of classes of the International Classification of Goods and Services with the economic sectors will enrich the research in the field of industrial property objects and will outline their role in business development. The relevance of the study is to consider the role of trademarks as an indicator of the development of economic sectors and a factor for the sustainable economic development of companies.

2. Literature Review

In order to determine the role of trademarks in the development of modern business, it is necessary to first examine their nature in depth.

2.1. The trademark as industrial property

The definitive features of the trademark as an industrial property are revealed in the first place by legislative acts. At a national level, a key document regulating the rights and obligations of the trademark owners, as well as the terms and procedures for the application and registration of trademarks, is the Trademarks and Geographical Indications Act (ZMGO). Pursuant to Article 9(1) of the Basic Regulation, adopted on 27.10.2020, "*A trademark is a sign, capable of distinguishing the goods or services of one person from those of others and*

may be presented in the State Register of Trademarks in such a way, that it is possible to clearly and accurately determine the subject of the protection, granted by the registration. Such signs may include, for example: words, including the names of persons, letters, numbers, drawings, figures, the shape of the goods or their packaging, colours, sounds or any combination of such signs." (ZMGO, 2020).

Other definitions of a trade mark are found in regional and international directives and treaties. According to DIRECTIVE (EU) 2015/2436 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL: *"A trade mark may consist of any signs, in particular words, including personal names, or designs, letters, numerals, colours, the shape of goods or of the packaging of goods, or sounds, provided that such signs are capable of: (a) distinguishing the goods or services of one undertaking from those of other undertakings; and (b) being represented on the register in a manner which enables the competent authorities and the public to determine that clear and precise subject matter of the protection afforded to its proprietor."* (Chapter 2, Section 1, Art. 3)

The Agreement on Trade-Related Aspects of Intellectual Property (TRIP's) states that the trademark is *"Any sign, or any combination of signs, capable of distinguishing the goods or services of one undertaking from those of other undertakings, shall be capable of constituting a trademark. Such signs, in particular words including personal names, letters, numerals, figurative elements and combinations of colours, as well as any combination of such signs, shall be eligible for registration as trademarks. Where signs are not inherently capable of distinguishing the relevant goods or services, Members may make registrability depend on distinctiveness acquired through use. Members may require, as a condition of registration, that signs be visually perceptible"* (TRIP's Agreement, Section 2, Art. 15, 1).

The trademark is also a subject of in-depth analysis by the researchers. According to Marco & Myers (2015), there are three different but interconnected perspectives in the economic analysis of trademarks. First, in basic economic theory, the trademark is seen as a means of promoting market efficiency. In more recent literature, the trademark is not seen only as a source for identifying the undertaking, it has a number of other functions. For example, according to Beebe (2004), trademarks are a valuable intangible asset that can be used as a barrier to competitors looking to enter the same market niche. Considering the importance of the trademark as an intangible asset and in the context of the COVID-19 pandemic, we must point out that over the last 25 years, the value of intangible assets owned by companies has increased by more than 1000% (Brand Finance, GIFT 2021) and even during the economic crisis due to the COVID-19, the value of intangible assets continues to increase. This proves the economic importance of trademarks for companies as they are a crisis-resistant asset that, through effective management, can increase the competitiveness of enterprises and, on this basis, increase economic benefits.

The second perspective sees trademarks as the basis for developing the value of the brand (Nikolova-Minkova, 2021a). From a marketing point of view, two concepts are known: the former is tied to consumer-based brand equity (Aaker, 1996; Keller, 2013; Ahirao, Patil, 2017), and the second concept – financial, considers the brand equity as a result of efforts to create a positive image among consumers and the impact of this image on the value of the brand to shareholders (Kerin and Sethuraman, 1998). Accepting the importance of the

financial concept, however, we will point out that the social significance of trademarks and brands is revealed precisely through the concept of Customer-Based Brand Equity (CBBE). Well-established brands based on registered trademarks have a social responsibility to society as a whole and to their customers, which was particularly evident during the COVID-19 pandemic. A number of studies in this period reveal the relationship between the value of companies' brands and the sustainability of their results amid the deepening economic crisis (Knowles, Ettenson, Lynch, Dollens, 2020; Alexa, Apetrei, Sapena, 2021; Verlegh, Bernritter, Gruber, Schartman, Sotgiu, 2021; Nikolova-Minkova, 2021b, 2021c). Moreover, COVID-19 commits companies to promote socially significant causes and to impose and demand responsible consumer behaviour to reduce the spread of the virus and limit the serious consequences in society. Consumers, in turn, expected a reaction from the brands and switched to those who clearly stated their socially responsible position.

The third perspective focuses on the relationship between trademarks and innovation or company performance (Fink, Javorcik, Spatareanu, 2005; Helmers, Rogers, 2008; Davies, Davies, 2011). This is also the direction that has developed at a rapid pace in recent decades. According to research by Schautschick & Greenhalgh (2012), trademarks in combination with other forms of intellectual property, are a useful indicator of innovative activity. Castaldi & Dosso (2018) are also exploring the relationship between trademark activity and companies' R&D costs. Empirical literature reveals a link between trademark activity and innovation in knowledge-intensive business services – KIBS (Schmoch, 2003; Hipp, Grupp, 2005). The review of research focusing on the relationship between trademarks and innovation, or corporate performance, proves the need to use trademark activity as a complementary and in some cases even as a key indicator of innovation activity. In recent years, under the influence of COVID-19 and in parallel with the development of the knowledge economy, the share of innovation in intangible products in the field of technological knowledge, education, administrative and organisational processes, whose legal protection cannot be provided by patenting, but on the other hand, it can be done through the registration of a trademark, has increased. This determines the use of trademark activity as an appropriate indicator for measuring non-technological innovation at the company, sectorial or national level.

All of the above determines the need for trademark management as an asset for the company and an object of intellectual property (in particular – of industrial property). As Borisova (2018) points out, the management of intellectual property for the purposes of companies is expressed in the management of the objects themselves and the management of the rights over them. The management of the rights on the objects of intellectual property is carried out by exercising the powers in the composition of the exclusive right, as the main goal is the economic realisation of the objects of intellectual property (trademarks) through their use.

Intellectual property management makes intellectual property a strategic asset for companies. Trademarks are subject to the intellectual property of economic importance, especially as mentioned above, due to the rapid development in recent years of non-technological innovations that remain beyond the scope of patenting. Market-established and well-established trademarks are becoming a competitive advantage and generating additional profits for companies, as consumers tend to pay more for a branded product than for a similar "non-branded" product. Trademarks/brands can attract additional cash flow through their

licensing (franchising), can be used in advertising campaigns and branding strategies to build a positive image of companies by linking the brand image with socially significant causes for society, etc.

The above stated justifies the growing economic importance of trademarks for modern companies. Despite the wide range of these areas of research interest in trademarks, not all interdependencies have been explored and not all links have been revealed. One of the areas where there are still gaps and insufficient research has been carried out is the link between the intensity of trademark activity and the development of economic sectors. In order to reveal this link, it is necessary to pay attention to the Nice Classification of Goods and Services for the registration of trademarks and the relationship of that classification with economic activities.

2.2. *International Classification of Goods and Services for Trademark Registration (Nice Classification)*

In order to establish the specialisation of trademarks and their individualisation in relation to the goods and services for which the trademark is applied, the International Classification of Goods and Services for Registration of Trademarks, adopted after the signing of the Nice Agreement in 1957, is used. Bulgaria has been a member of the Agreement since 12.07.2000. The Nice Classification (see Table 1) was introduced to harmonise national classifications in the field of trademarks and geographical indications and after the last revision on 1 January 2022, it contains a list of 45 classes: 01 to 34 for goods and 35 to 45 for services (WIPO, NCL 11-2022).

The structure of the Classification is divided into three parts:

- Class Headings – the list of classes briefly describes their content;

- Explanatory Notes – describe in detail which goods and services fall within or remain outside the scope of the relevant class;

- Alphabetical List – the most detailed describes each good and service that can be assigned to the relevant class.

The Classification also contains general notes explaining how the classification of the goods or services concerned are classified to a particular class and the principles to be followed by applicants in determining the scope of the trademark applied for.

The Nice Classification is subject to periodic revision by a special committee to keep it up-to-date with regard to innovative goods and services offered on the market. In view of the above, Marco & Myers (2015) point out that research using the Nice Classification should be conducted with caution due to: the periodic revision of the Nice Classification, which involves supplementing/replacing/dropping certain goods and services from classes; the ability of a specific class to reflect the channel through which goods and services are delivered and offered to consumers, rather than the primary activity of the trademark owner; aggregated into large classes goods and services are obtained through activities of different nature.

Table 1

Nice classes: General structure

Class	Goods	Class	Services
1	Chemicals	35	Business Services
2	Paints	36	Financial and Insurance Services
3	Detergents	37	Construction
4	Industrial Oils and Greasers	38	Telecommunications
5	Pharmaceuticals	39	Transportation and Travel
6	Metals	40	Treatment of Materials
7	Machinery	41	Education
8	Hands Tools and Implements	42	Scientific and Technological Services
9	Scientific Equipment	43	Food Services
10	Surgical Equipment	44	Medical Services
11	Illumination	45	Legal services
12	Vehicles		
13	Firearms		
14	Precious Metals		
15	Musical Instruments		
16	Paper Products		
17	Rubber		
18	Leather		
19	Constructions		
20	Furniture		
21	Household Utensils		
22	Ropes and String		
23	Yarns and Threads		
24	Textiles		
25	Clothing		
26	Dressmaking Supplies		
27	Rugs		
28	Toys		
29	Meat, Fruit, Oil, and Other		
30	Coffee, Sugar, and Other		
31	Agriculture		
32	Non-Alcoholic Beverages		
33	Alcoholic Beverages		
34	Tobacco		

Source: INTA, 2017.

Taking into account the above (Marco, Myers, 2015), we seek to develop a methodology for concordance between the Nice Classification and the Classification of Economic Activities, which will limit the manifestation of these considerations by combining different economic activities in a way that compares them with the aggregated classes of goods and services according to the Nice Classification. Thus, the change in the composition of the classes of goods and services (by dropping or supplementing goods and services in a separate class) should not affect the proposed methodology, as the Nice Classification classes themselves include meaningfully related to a certain attribute goods/services.

2.3. Classification of Economic Activities – International Standard Industrial Classification of All Economic Activities (ISIC), Statistical classification of economic activities in the European Community (NACE Rev.2) and Classification of economic activities in Bulgaria (NACE.BG 2008)

According to the United Nations publication, *"The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilised for the collection and reporting of statistics according to such activities"* (United Nations Publication, ISIC, Rev.4, 2008).

The first version of ISIC was established in 1948, which is why a large number of countries worldwide use the classification as national, or develop one on the basis of ISIC. This allows the classification to be used as a tool for comparing statistics on economic activities at an international level.

ISIC is also subject to periodic updating, with four revisions so far (United Nations). The latest version is structurally more detailed and meets the need to identify new industries, especially in the services sector.

Table 2

High-level ISIC Rev.4/ NACE Rev.2 aggregation A*10/11

	ISIC Rev. 4/ NACE Rev. 2 sections	Description
1	A	Agriculture, forestry and fishing
2	B, C, D and E	Manufacturing, mining and quarrying and other industry
2a	C	*Of which: manufacturing*
3	F	Construction
4	G, H and I	Wholesale and retail trade, transportation and storage, accommodation and food service activities
5	J	Information and communication
6	K	Financial and insurance activities
7	L	Real estate activities*
8	M and N	Professional, scientific, technical, administration and support service activities
9	O, P and Q	Public administration, defence, education, human health and social work activities
10	R, S, T and U	Other services
* which includes imputed rents of owner-occupied dwellings		

Source: Eurostat (2008).

Table 3

Intermediate ISIC Rev.4/ NACE Rev.2 aggregation A*38

	A*38 code	ISIC Rev. 4/ NACE Rev. 2 sections	Division
1	A	Agriculture, forestry and fishing	01 to 03
2	B	Mining and quarrying	05 to 09
3	CA	Manufacture of food products, beverages and tobacco products	10 to 12
4	CB	Manufacture of textiles, apparel, leather and related products	13 to 15
5	CC	Manufacture of wood and paper products, and printing	16 to 18
6	CD	Manufacture of coke, and refined petroleum products	19
7	CE	Manufacture of chemicals and chemical products	20
8	CF	Manufacture of pharmaceuticals, medicinal chemical and botanical products	21
9	CG	Manufacture of rubber and plastics products, and other non-metallic mineral products	22+23
10	CH	Manufacture of basic metals and fabricated metal products, except machinery and equipment	24+25
11	CI	Manufacture of computer, electronic and optical products	26
12	CJ	Manufacture of electrical equipment	27
13	CK	Manufacture of machinery and equipment n.e.c	28
14	CL	Manufacture of transport equipment	29+30
15	CM	Other manufacturing, and repair and installation of machinery and equipment	31 to 33
16	D	Electricity, gas, steam and air-conditioning supply	35
17	E	Water supply, sewerage, waste management and remediation	36 to 39
18	F	Construction	41 to 43
19	G	Wholesale and retail trade, repair of motor vehicles and motorcycles	45 to 47
20	H	Transportation and storage	49 to 53
21	I	Accommodation and food service activities	55+56
22	JA	Publishing, audiovisual and broadcasting activities	58 to 60
23	JB	Telecommunications	61
24	JC	IT and other information services	62+63
25	K	Financial and insurance activities	64 to 66
26	L	Real estate activities*	68
27	MA	Legal, accounting, management, architecture, engineering, technical testing and analysis activities	69 to 71
28	MB	Scientific research and development	72
29	MC	Other professional, scientific and technical activities	73 to 75
30	N	Administrative and support service activities	77 to 82
31	O	Public administration and defence, compulsory social security	84
32	P	Education	85
33	QA	Human health services	86
34	QB	Residential care and social work activities	87+88
35	R	Arts, entertainment and recreation	90 to 93
36	S	Other services	94 to 96
37	T**	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	97+98
38	U**	Activities of extra-territorial organisations and bodies	99*
* including imputed rents of owner-occupied dwellings ** All of U and part of T (division 98) are outside the SNA production boundary, and will be empty for SNA data reporting, but are included for completeness.			

Source: Eurostat (2008).

The Statistical Classification of Economic Activities for the European Community (NACE Rev.2) is based on ISIC Rev. 4. *„NACE Rev. 2 has been created based on ISIC Rev. 4 and adapted to the European circumstances by a working group of experts on statistical classifications from the Member States, candidate Countries as well as EFTA Countries, with the support and guidance of the classification section at Eurostat"* (Eurostat, 2008). In addition to the classification developed *„introductory guidelines containing the main concepts, a historical background and the methodological guidelines for understanding and applying NACE Rev.2 as well as a detailed description of the different items of the classification"* are proposed. NACE Rev.2 is generally a classification standard on the basis of which national classifications of the Member States of the European Union are developed, updated and applied. According to the Regulation, statistics on EU countries are classified by economic activity and collected by NACE or by the corresponding derivative national classification. The Statistical classification of Economic Activities for the European Community is also revised over a given period in order to correspond to the technological developments and structural changes in the economy.

NACE Rev.2 presents the relationship between the two classifications at the highest level (see Table 2) and at an intermediate level (see Table 3).

Based on the Statistical Classification of Economic Activities for the European Community, a Classification of Economic Activities was also developed – version NACE.BG 2008. NACE.BG 2008 ensures the direct application of NACE Rev. 2 in the Republic of Bulgaria, as it is unambiguously compatible with the International Standard Industrial Classification of the United Nations (ISIC, Rev. 4), which, as we have pointed out, is the basis for the establishment of NACE Rev. 2.

The above shows unequivocally that the harmonisation of classifications at global, European and national levels ensures comparability of the statistics obtained at each of those levels. On the other hand, as Luini & Mangani point out, *„Unfortunately the Nice Classification of products and services adopted by all Trademark Offices does not correspond to the standard classification of economic activities used by Statistics Offices for analysing the main economic aggregates"* (2004, p.5).

Nevertheless, like other researchers, we are trying to establish concordance between the classes of goods and services and the economic sectors and activities, the presentation of which requires first to consider the existing empirical studies in this regard.

3. Method

The need to develop a System for concordance between the classes of goods and services according to the Nice Classification and the Classification of Economic Activities and Sectors arises from:

- the growing importance of trademarks as a business asset and their wide use for the protection of non-technological innovations, creating a need to study the relationship between trademark activity and the economic activity of companies;

- the wide availability of data on the trademark activity of companies and at the same time, difficult assignment of this activity to a specific economic sector to establish innovation activity at the company, industry and national level;
- the monitoring the development of companies on the basis of intellectual property management strategies and, in particular, for building competitiveness and differentiation of the products offered on the basis of established brands;
- the study of the links and dependencies between the owned intellectual property rights (trademarks) and the resilience of companies to unpredictable economic shocks and crises;
- the establishing a link between the product specialisation of the companies and the export specialisation of the country in which they operate.

In order to derive a methodology applicable to the Bulgarian practice, through which the issues of interest to the scientific community can be analysed, we will consider the currently known studies examining the relationship between classes of goods and services in the scope of trademark protection and international classifications of economic activities.

3.1. Existing research comparing the Nice Classification and the economic sectors and activities

As we have pointed out, the relationship between the classes of goods and services within the scope of trademark protection and international classifications of economic activities is the subject of analysis by a number of researchers and organisations. For the purposes of this study, we will consider as a matter of priority those of Luini & Mangani (2004), Fink, Javorcik & Spatareanu (2005), Millot (2009), Zolas, Lybbert and Bhattacharyya (2016), WIPO, while not belittling the research of other authors. This is based on the fact that, when analysing empirical research in the field, the systems cited above are most often used for assigning trademark activity and its scope to the classification of economic activities.

In their study, Luini & Mangani (2004) examined the relationship between trademarks and the economic activity of companies in Italy. They compare the distribution of product classes by national, regional (EU) and international trademarks registered by Italian companies. For their study, the authors sought consistency between the classes of goods and services of the Nice Classification and the Classification of Economic Activities in Italy – ATECO 2002. By comparing the specialisation of trademarks and the country's export specialisation, the authors found that „*Data on Italian trademarks would seem to show that trademark applications and registrations "follow" quite closely the structure of the economy and its evolution. There may thus be a positive relationship between the "size" of economic activity, at different levels of aggregation, and product differentiation, when the latter is estimated by the use of trademarks.*" (Luini, Mangani, 2004, p. 15). By comparing the country's trademark specialisation and export specialisation, the authors found that European data have shown that trademark specialisation significantly reflects countries' export flows, although some exceptions have also been taken into account.

The cited study is one of the first in this field and sets starting points that we can follow in creating a system suitable for the purposes of this study.

Fink, Javorcik & Spatareanu (2005) studied the application of Linder's hypothesis (Rauch, 2010), to which they added a new determinant of the proximity between supply and demand, namely the degree of horizontal differentiation of the product. To verify their hypothesis, the authors set up a system to align the Nice Classification with the ISIC (see Table 4).

Table 4

Concordance between Nice Classification and ISIC Classification

Nice classification	ISIC	ISIC classification
1	351	Industrial chemicals
2,3,5	352	Other chemicals
4	354	Miscellaneous petroleum and coal products
6	371	Iron and Steel
7	382	Machinery, except electrical
8	381	Fabricated metal products
9, 10	385	Professional and scientific equipment
11	383	Machinery, electric
12	384	Transport equipment
13, 15, 28	390	Other manufactured products
14	372	Non-ferrous metals
16	341, 342, 356	Paper and products & Printing and publishing &Plastic products
17	355	Rubber products
18	323	Leather products
19	369	Other non-metallic mineral products
20	332	Furniture, except metal
21	361, 362	Pottery, china, earthenware & Glass and products
22, 23, 24, 26, 27	321	Textiles
25	322, 324	Wearing apparel, except footwear & Footwear, except rubber or plastic
29, 30, 31	311	Food products
32, 33	313	Beverages
34	314	Tobacco

Source: Fink, Javorcik & Spatareanu (2005, p.23).

The empirical analysis uses information on the registration of international trademarks to verify the extent to which richer countries tend to import more from countries whose exports are of higher quality and show a greater degree of product differentiation. The results are confirmed for most consumer goods sectors, but not in the intermediate goods sectors.

We think that the system proposed by Fink, Javorcik & Spatareanu (2005) for aligning the classes of goods under the Nice Classification to ISIC is extremely detailed, but its practical use for the purposes of this empirical analysis is not applicable. This is because the National Statistical Institute (NSI), which processes data on the development of economic activities in Bulgaria, provides information about them at the highest level of data grouping (*aggregation A*10/11; aggregation A*38*).

Then, in his study for OECD, Millot (2009) sought a potential link between trademarks and innovation by looking at their basic statistical properties to establish their relevance as an indicator of innovation. He also points out the shortcomings of the Nice Classification in linking it to economic sectors and statistical analysis activities. He notes: *„Moreover, the trademark classification has been built with a focus on the demand, the customers' side,*

whereas the Sector classifications focus on the firms' side, on the supply" and more *„On the whole, it is generally difficult to associate an industrial sector to a specific trademark class, as some sectors register in various classes and conversely some trademarks are associated to various sectors."* (Millot, 2009, p. 26). However, the author points out that for some classes, a direct link to a specific sector may be established (see Table 5).

Table 5

Clear correspondence for sectors and classes

NACE sector	Nice classes
17, 18 and 19: textile, wearing, leather products	24-25
20: wood and cork products	20
21, 22: paper products, printing and publishing	16
25: rubber and plastic products	17
27: basic metal products	6
30, 31, 32, 33: electrical and optical equipment	9
34, 35: transport equipment	12
60, 63: transport and storage	39
67: financial intermediation	36
72, 73: computer-related activity, research and development	42

Source: Millot, (2009, p. 26).

The presented partial system of alignment does not cover all the Nice classes, which requires us to deepen the analysis of existing empirical studies in search of an adequate approach to aligning the classes between the cited classifications.

Zolas, Lybbert and Bhattacharyya (2016) derive the „Algorithmic Links with Probabilities – ALP" approach, which allows the researcher to relate the data on the scope of trademark activity directly to a particular sector. This creates conditions for tracking in time the dynamics and structure of changes in trademark activity as well as to conducting comparative analyses of trademark activity in individual countries (see Table 6).

Table 6

Concordance between Nice classes and economic categories

Economic categories	Nice classes
Chemicals	1, 2, 3, 4, 5
Metals & machinery	6 to 8, 12, 14
High-tech	9, 38, 42
Textiles	22 to 26
Food & beverages	27 to 34
Other manufacturing	10, 11, 15 to 21, 27, 28
Other services	35 to 37, 39 to 41, 43 to 45

Source: Zolas, Lybbert and Bhattacharyya (2016, p.15).

This system for concordance between the classes of goods and services to the economic categories is one of the most commonly applied in the research in the field (Grazzi, Piccardo, Vergari, 2017; Drivas, 2021; Iversen, Herstad, 2021), so we will adapt it for the purposes of this study taking into account the peculiarities of the other systems cited.

Finally, the annual reports of WIPO (World Intellectual Property Indicators, 2021) apply a methodology for concordance of Nice classes with the economic sectors in order to take into account the structure of trademark activity and dynamics in its development (see Table 7).

Table 7

Concordance between Nice classes and industry sector

Economic categories	Nice classes
Research and technology	9, 38, 42, 45
Health	3, 5, 10, 44
Clothing and accessories	14, 18, 22 to 27, 34
Agriculture	29 to 33, 43
Leisure and education	13, 15, 16, 28, 41
Household equipment	8, 11, 20, 21
Business services	35 and 36
Transportation	7, 12, 39
Construction	6, 17, 19, 37, 40
Chemicals	1, 2, 4

Source: WIPO (2021, p.103).

Of course, in addition to the cited, there are other studies, that offer systems for assigning the Nice classes to the International Classification of Economic Activities, which focus on individual sectors or activities (Máté, Kun & Fenyves, 2016; Kekezi, & Klaesson, 2020; Iversen & Herstad, 2021) and which imply the existence of a link between trademark activity and, in particular, the scope of the trademark protection (classes of goods and services) and the development of economic sectors and activities. The existing empirical studies not only confirm this link but propose to deepen and expand the scope of research in this direction in order to establish the economic importance of the data obtained.

All the above gives us the reason to try to derivate a System of concordance between the Nice classes and the ISIC/NACE classifications. The prerequisites for adapting the existing methodologies of the cited research arise from:

- the lack of a System for assigning the classes of goods and services according to the Nice Classification to the Classification of Economic Activities, which is applicable in Bulgaria and is consistent with the specifics of data submission of the NSI;

- the need to combine the elements of the systems proposed above for the Bulgarian practice and to eliminate the inapplicable ones, due to the specifics of presenting statistical data in the Republic of Bulgaria;

- the lack of empirical analysis of the relationship between trademark activity and economic sectors in Bulgaria, based on which to assess the development of the country.

3.2. New System for concordance between Nice classes and ISIC/NACE divisions

The developed System assumes that when initially assigning classes of goods and services to a specific economic activity, they are disaggregated to the level of reporting of statistical data by the NSI (see Table 8). These sectors and sections of ISIC Rev.4 / NACE Rev. 2 / NACE.BG 2008 are included, which are related to trademark registration classes.

Table 8

Concordance between Nice classes and ISIC/ NACE division

Economic sector	Name of the division	ISIC/ NACE division	Nice classes
C. Manufacturing	Manufacture of food products	10	27, 29, 30, 31, 32, 33, 34
	Manufacture of beverages	11	
	Manufacture of tobacco products	12	
	Manufacture of textiles	13	18, 22, 23, 24, 25, 26
	Manufacture of wearing apparel	14	
	Manufacture of leather and related products	15	
	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16	16
	Manufacture of paper and paper products	17	
	Printing and reproduction of recorded media	18	
	Manufacture of chemicals and chemical products	20	01, 02, 03, 04
	Manufacture of basic pharmaceutical products and pharmaceutical preparations	21	05
	Manufacture of rubber and plastic products	22	17, 21
	Manufacture of other non-metallic mineral products	23	
	Manufacture of basic metals	24	06, 08, 13
	Manufacture of fabricated metal products, except machinery and equipment	25	
	Manufacture of computer, electronic and optical products	26	09, 38, 42
	Manufacture of electrical equipment	27	11
	Manufacture of machinery and equipment n.e.c.	28	07
	Manufacture of motor vehicles, trailers and semi-trailers	29	12
	Manufacture of other transport equipment	30	
	Manufacture of furniture	31	10, 14, 15, 20, 28
	Other manufacturing	32	
	Repair and installation of machinery and equipment	33	
F. Construction	Construction of buildings	41	19, 37, 40
	Civil engineering	42	
	Specialised construction activities	43	
G. Wholesale and retail trade; repair of motor vehicles and motorcycles	Wholesale and retail trade and repair of motor vehicles and motorcycles	45	35
	Wholesale trade, except of motor vehicles and motorcycles	46	
	Retail trade, except of motor vehicles and motorcycles	47	
H. Transportation and storage	Land transport and transport via pipelines	49	39
	Water transport	50	
	Air transport	51	
	Warehousing and support activities for transportation	52	
	Postal and courier activities	53	
I. Accommodation and food service activities	Accommodation	55	43
	Food and beverage service activities	56	
K. Financial and insurance activities L. Real estate activities	Financial service activities, except insurance and pension funding	64	36
	Insurance, reinsurance and pension funding, except compulsory social security	65	
	Activities auxiliary to financial services and insurance activities	66	
	Real estate activities	68	
M. Professional, scientific and technical activities	Legal and accounting activities	69	41, 44, 45
	Activities of head offices; management consultancy activities	70	
	Architectural and engineering activities; technical testing and analysis	71	
	Scientific research and development	72	
	Advertising and market research	73	
	Other professional, scientific and technical activities	74	
	Veterinary activities	75	

Source: Authors' elaboration from various sources.

Subsequently, in order to facilitate the processing of trademark activity information, economic sections are aggregated in separate categories (see Table 9). As stated in NACE.BG

2008, the concept of "economic activity" is a category in which relatively homogeneous and similar productions and services are grouped under certain criteria. Under these circumstances and due to the fact that the classes of goods and services according to the Nice Classification are also consolidated, we apply cross-grouping with which we combine sections of different sectors. The aim is not only to establish the sectors in which Bulgarian and foreign trademark applicants exhibit increased interest but also to detect the specific directions (economic categories) in which it is expressed.

It should be borne in mind that, due to the specificity of NSI data submission, some of the economic sections cannot accurately refer to the most appropriate economic categories[3].

The adapted system (see Table 8 and Table 9) for assigning the classes of the goods and services under the Nice Classification to the ISIC/NACE classifications is applicable to take into account the link between the intensity of trademark activity and the development of economic activities in the Republic of Bulgaria. Its degree of disaggregation depends entirely on the specificity of the presentation of statistics and can be modified depending on the direction and objectives of the specific empirical study.

Table 9

Concordance between Nice classes and economic categories

Economic categories	ISIC/ NACE division	Nice classes
Food & beverages	10, 11, 12	27, 29, 30, 31, 32, 33, 34
Clothing and accessories	13, 14, 15	18, 22, 23, 24, 25, 26
Chemicals	20	01, 02, 03, 04
	21	05
High-tech	26	09, 38, 42
Metals, machinery & equipment	24, 25	06, 08, 13
	28	07
Construction	22, 23	17, 21
	41, 42, 43	19, 37, 40
Household equipment & facilities	27	11
	31, 32, 33	10, 14, 15, 20, 28
Other manufacturing	16, 17, 18	16
Transportation	49, 50, 51, 52, 53	39
	29, 30	12
Business services	45, 46, 47	35
	64, 65, 66	36
	68	
Professional, scientific and technical activities	55, 56	43
	69, 70, 71, 72, 73, 74, 75	41, 44, 45

Source: Authors' elaboration from various sources.

For the present analysis, by applying the concordance system, we strive to identify the existence or lack of a link between the intensity of the Bulgarian and foreign trademark

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[3] Example: When reporting the output or turnover of industrial enterprises, NSI combines sections 16, 17 and 18 in category "Production of timber, paper, cardboard and articles thereof (excluding furniture); Printing" despite the fact that Category 16 can be attributed to the "Production of furniture, production, n.; Repair and installation of machines and equipment" and categories 17 and 18 to the "Professional Activities and Research" sector.

applications on individual classes of the Nice Classification and the development of economic sectors and activities. The link between the Bulgarian and foreign trademark activity has characteristic and specific features, so the following statistical analysis methods are applied:

- Spearman's rank correlation analysis (Rsp) – suitable for determining the strength of the mutual relationship between the Bulgarian and foreign trademark applications (represented by ranks), as the quantitative expression of the stated trademarks on each of the classes of the Nice Classification can range and to establish not only the presence/absence but also the degree of correlation dependence. The calculations for the mutual relationship are carried out by using the formula (Petrov, Veleva, 2000):

$$Rsp = 1 - \frac{6 \, \Sigma d^2{}_i}{n(n^2 - 1)} \tag{1}$$

- Comparison method – gives a real idea of the quantitative dimensions of trademark applications and is appropriate to determine the priorities for Bulgarian and foreign applicants economic sectors and activities.

4. Data and Results

To conduct the empirical analysis, data on the number of classes for which trademarks were applied were used. The scope of the study focuses on two possible ways to apply for trademarks: nationally road through the Bulgarian Patent Office – BPO and international registration through the Madrid system. The information on the number of specified classes when applying for a trademark was obtained using the WIPO database.

4.1. Trademark applicant activity for the period 2010-2020

In order to establish the priority economic activities targeted by trademark applicant activity in Bulgaria, the analysis is structured in the following sequence:

- study of the total trademark applicant activity in Bulgaria (applied trademarks from Bulgarian citizens and foreign citizens);

- study of the Bulgarian trademark activity in Bulgaria;

- study of the foreign trademark activity in Bulgaria.

Information on the Nice Classification classes for which trademarks are applied for each of the years 2010-2020 (see Table 10) is provided. "Other" lists those trademarks applied for in countries which do not apply the Nice Classification of Goods and Services when registering a trademark.

The dynamics of the total trademark application activity (see Figure 1) highlight the classes that applicants are most interested in.

Figure 1

Trademark applicant activity by Nice classes for the period 2010-2020 (Bulgarian and foreign applicants)
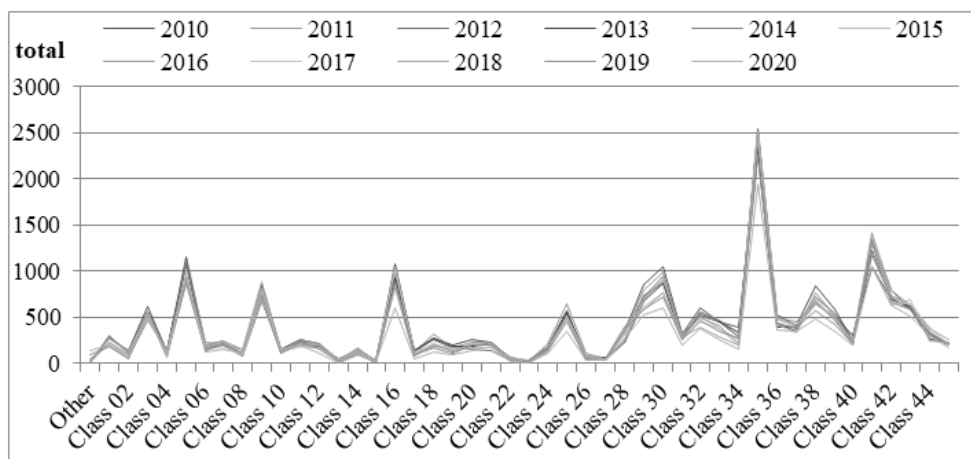
Source: WIPO Database / Authors' calculation.

As can be concluded by the dynamics of the total trademark applicant activity in the period 2010-2020, regardless of the existing fluctuations in the number of applications submitted for a specific year, the interest of the applicants is immutably high/low to specific classes in the study period.

Information is also provided on the total number of Nice classes by which trademarks are applied in the scope of the study (see Figure 2).

It should be taken into account that the cited data (see Table 10, Figure 1 and Figure 2) express the total number of classes applied for without applying an equivalent counting[4].

In identifying the Nice classes in which the trademarks applied for have the highest concentration in total for Bulgarian and foreign applicants, the following 10 classes (see Table 11) stand out.

Four of the top ten classes with the highest intensity are in the service sector (28.1% in total), with the highest proportion being class 35 – Business Services, followed by classes: 41 – Education; 42 – Scientific and Technological Services; 43 – Food Services. The ranking is supplemented by six classes related to the production of goods (total 26.96%), with the highest share of which is class 05 – Pharmaceuticals, followed by: 16 – Paper Products; 30 – Coffee, Sugar, and Other; 09 – Scientific Equipment; 29 – Meat, Fruit, Oil, and Other; 03 – Detergents.

[4] In the equivalent counting, in cases where a trademark is applied by more than one applicant, the application is counted as many times as applicants are listed in it.

Table 10
Trademark applicant activity by Nice classes for the period 2010-2020 (Bulgarian and foreign applicants)

Nice class	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Other	14	14	13	7	8	33	50	6	20	95	139
Class 01	278	223	274	283	306	280	193	224	228	179	198
Class 02	139	93	123	129	117	130	70	70	96	54	79
Class 03	617	543	565	558	557	540	476	535	503	549	549
Class 04	121	112	104	139	106	105	142	101	135	87	69
Class 05	1158	1104	1091	1100	1104	949	953	889	896	879	982
Class 06	195	228	166	136	167	162	194	188	181	138	123
Class 07	249	216	223	211	207	184	237	235	239	211	163
Class 08	96	105	98	105	79	99	139	118	155	108	110
Class 09	855	802	748	717	673	702	807	802	887	746	778
Class 10	153	120	138	121	126	121	133	147	138	105	159
Class 11	266	243	245	229	207	189	262	213	231	234	193
Class 12	222	204	180	190	180	173	217	200	206	153	117
Class 13	43	33	41	51	15	24	17	33	48	27	11
Class 14	161	171	134	141	114	132	123	134	151	95	96
Class 15	15	22	32	22	11	23	19	16	34	20	14
Class 16	1084	982	914	927	1052	1032	871	848	820	882	606
Class 17	137	123	127	143	101	123	98	81	88	89	47
Class 18	274	318	260	281	182	206	217	222	196	165	127
Class 19	206	174	177	192	169	166	132	162	146	116	94
Class 20	258	236	184	182	152	165	203	164	213	194	148
Class 21	225	226	224	213	144	171	220	211	200	207	184
Class 22	58	58	51	70	39	50	52	47	71	37	23
Class 23	22	24	38	22	12	21	25	27	34	15	6
Class 24	183	219	165	162	127	119	160	146	185	134	118
Class 25	575	642	549	555	505	506	521	519	498	460	356
Class 26	66	106	82	66	41	51	66	82	98	52	42
Class 27	46	55	64	73	41	37	56	50	53	39	40
Class 28	345	318	256	230	236	261	387	354	389	358	272
Class 29	854	790	732	672	728	699	713	614	581	591	524
Class 30	1050	986	878	877	950	927	904	762	772	716	599
Class 31	318	290	270	282	317	278	320	262	284	255	193
Class 32	598	551	563	535	513	513	504	448	397	471	374
Class 33	451	471	455	449	468	377	402	383	288	354	258
Class 34	296	297	396	332	341	257	215	200	200	279	149
Class 35	2547	2467	2349	2286	2498	2513	2509	2492	2482	2254	1950
Class 36	530	437	441	397	432	425	501	485	483	427	360
Class 37	412	351	350	398	386	337	450	394	428	397	343
Class 38	845	769	726	642	677	705	658	643	653	570	480
Class 39	594	520	540	511	471	474	479	518	499	423	348
Class 40	250	207	252	301	208	230	223	225	235	217	205
Class 41	1352	1351	1234	1050	1191	1335	1302	1418	1402	1341	1048
Class 42	791	717	708	686	709	632	741	664	802	658	636
Class 43	582	585	598	622	592	692	627	647	639	586	521
Class 44	318	270	301	259	307	247	352	390	380	329	309
Class 45	218	195	219	224	217	231	204	197	256	213	170

Source: WIPO Database / Authors' calculation.

Figure 2

Total trademark applicant activity by Nice classes for the period 2010-2020 (Bulgarian and foreign applicants)
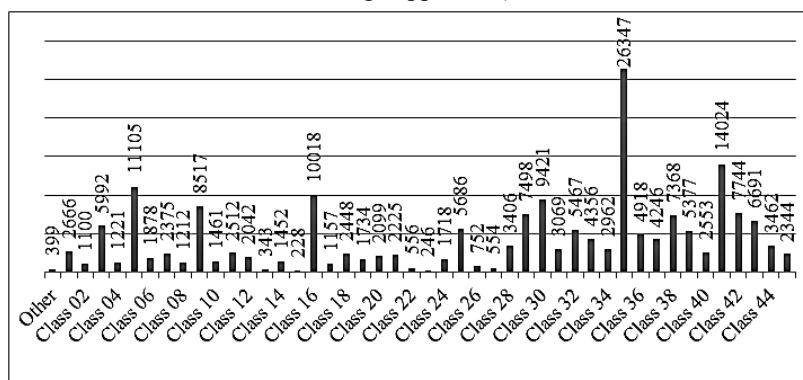
Source: WIPO Database / Authors' calculation.

Table 11

Top 10 Nice classes in total trademark activity for the period 2010-2020 (Bulgarian and foreign applicants)

TOP-10 Nice classes	Description	Total trademark	Share (%)
Class 35	Business Services	26347	13,51
Class 41	Education	14024	7,19
Class 05	Pharmaceuticals	11105	5,70
Class 16	Paper Products	10018	5,14
Class 30	Coffee, Sugar, and Other	9421	4,83
Class 09	Scientific Equipment	8517	4,37
Class 42	Scientific and Technological Services	7744	3,97
Class 29	Meat, Fruit, Oil, and Other	7498	3,85
Class 43	Food Services	6691	3,43
Class 03	Detergents	5992	3,07

Source: WIPO Database / Authors' calculation.

The data on the trademark applicant activity of Bulgarian citizens in Bulgaria (see Table 12, Figure 3 and Figure 4) are indicative of the development of Bulgarian business and outline the priority classes under the Nice Classification for applicants, through which they will offer their products.

The dynamics of the Bulgarian trademark applicant activity (see Figure 3) highlight the classes Bulgarian citizens are most interested in by years of the study period.

Table 12

Bulgarian trademark applicant activity by Nice classes for the period 2010-2020

Nice class	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Class 01	148	116	161	153	196	167	127	153	134	104	135
Class 02	84	48	73	74	60	64	46	51	57	29	48
Class 03	321	290	340	324	315	331	278	353	293	357	326
Class 04	58	51	65	52	43	56	90	62	68	49	39
Class 05	501	549	485	492	523	520	541	492	536	523	516
Class 06	97	130	90	77	96	99	124	121	89	84	76
Class 07	100	70	104	91	105	100	139	130	113	119	86
Class 08	46	37	65	48	37	53	87	69	78	69	60
Class 09	506	480	490	414	442	496	546	506	552	432	501
Class 10	73	57	74	38	68	59	70	77	55	48	76
Class 11	113	108	128	108	111	109	163	116	126	147	102
Class 12	99	85	86	71	75	66	102	82	87	86	51
Class 13	31	26	37	40	14	14	13	25	22	19	10
Class 14	83	102	94	75	76	91	88	78	79	44	64
Class 15	13	14	30	12	9	14	16	13	12	15	12
Class 16	898	765	764	791	911	893	742	728	683	750	510
Class 17	74	50	53	81	70	75	57	47	38	55	25
Class 18	161	195	164	160	114	140	140	151	120	81	86
Class 19	111	101	91	105	87	91	83	98	79	65	69
Class 20	167	153	122	112	107	120	150	121	136	149	106
Class 21	115	120	134	114	95	97	138	131	128	127	105
Class 22	34	38	40	40	26	43	45	30	39	24	17
Class 23	13	12	33	11	9	17	19	17	10	5	4
Class 24	130	147	121	105	92	92	114	104	127	96	89
Class 25	343	384	341	333	354	361	386	361	357	294	261
Class 26	48	71	65	44	36	37	51	63	63	27	34
Class 27	23	29	40	41	22	22	38	23	23	22	20
Class 28	242	236	201	137	165	197	311	275	316	273	217
Class 29	719	611	601	539	597	601	608	487	461	485	426
Class 30	785	712	648	656	731	741	691	582	580	563	464
Class 31	251	220	216	236	266	218	237	207	208	197	167
Class 32	421	401	432	406	392	421	413	359	306	385	300
Class 33	344	351	339	353	366	303	329	331	217	288	205
Class 34	149	182	272	251	253	150	146	88	69	126	65
Class 35	2175	2083	1965	1893	2171	2174	2231	2175	2126	1916	1683
Class 36	431	336	361	299	345	322	424	385	368	337	306
Class 37	310	254	264	273	292	276	351	319	330	324	287
Class 38	738	666	637	560	610	636	613	539	549	480	422
Class 39	508	428	436	389	397	409	419	431	387	340	305
Class 40	203	155	215	247	166	188	193	185	182	179	187
Class 41	1198	1176	1064	903	1079	1209	1184	1279	1241	1144	942
Class 42	610	538	528	488	582	501	631	500	604	489	527
Class 43	512	503	519	524	541	636	588	601	544	517	462
Class 44	259	230	250	202	262	212	309	321	319	270	254
Class 45	179	166	178	178	192	211	172	172	196	170	144

Source: WIPO Database / Authors' calculation

There is high trademark activity in the service sector classes (Nice classes from 35 to 45), out of a total of 144 870 classes mentioned in applications for trademark registration, 71 995 classes (49.7%) are in this sector.

Figure 3
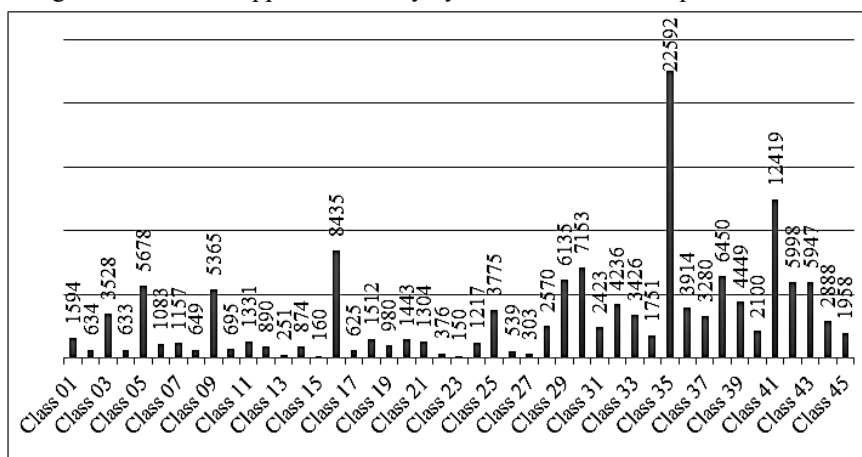Total Bulgarian trademark applicant activity by Nice classes for the period 2010-2020
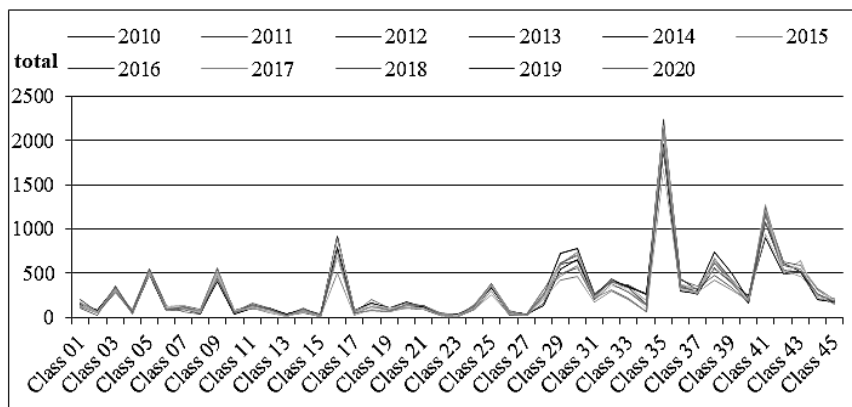
Source: WIPO Database / Authors' calculation.

Information is presented on the total number of classes under the Nice Classification for which trademarks have been applied by Bulgarian applicants (see Figure 4).

Analysing the priority classes for Bulgarian applicants (see Table 13) with the highest overall share among the top 10, the service classes stand out again (36.86%), while the classes related to the production of goods occupy 22.61%. The leading position in services again occupies a class 35 – Business Services followed by: 41 – Education; 38 – Telecommunications; 42 – Scientific and Technological Services; 43 – Food Services. The goods classes in the top 10 include class 16 – Paper Products, followed by: 30 – Coffee, Sugar, and Other; 29 – Meat, Fruit, Oil, and Other; 5 – Pharmaceuticals; 9 – Scientific Equipment.

Figure 4
Bulgarian trademark applicant activity by Nice classes for the period 2010-2020

Source: WIPO Database / Authors' calculation.

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Table 13

Top 10 Nice classes in Bulgarian trademark activity for the period 2010-2020

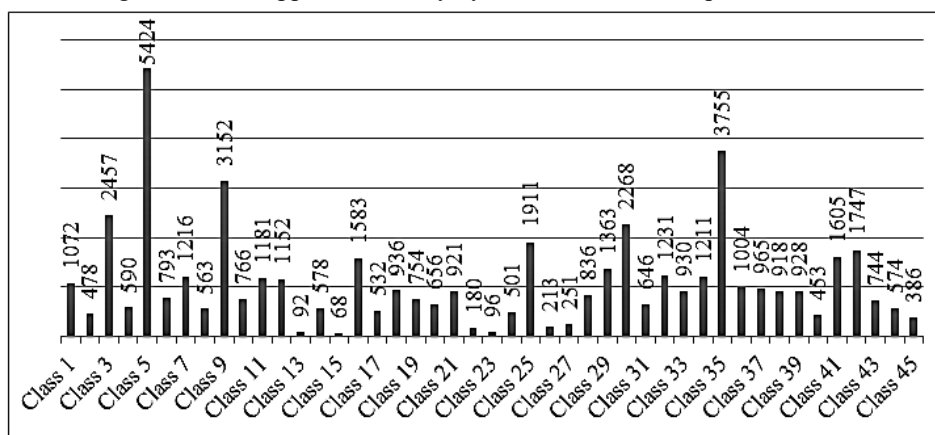| TOP-10 Nice classes	Description	Total trademark	Share (%)
Class 35	Business Services	22592	15,59
Class 41	Education	12419	8,57
Class 16	Paper Products	8435	5,82
Class 30	Coffee, Sugar, and Other	7153	4,94
Class 38	Telecommunications	6450	4,45
Class 29	Meat, Fruit, Oil, and Other	6135	4,23
Class 42	Scientific and Technological Services	5998	4,14
Class 43	Food Services	5947	4,11
Class 05	Pharmaceuticals	5678	3,92
Class 09	Scientific Equipment	5365	3,70

Source: WIPO Database / Authors' calculation.

The analysis of foreign trademark applicant activity in Bulgaria by Nice classes includes all countries and territories (a total of 110) citizens of which have applied for trademarks nationally through the BPO or through the Madrid system (see Figure 5). The presentation of information is limited to the priority 10 classes for foreign applicants (see Table 14).

Analysing the priority classes for foreign trademark applicants (see Table 14), the opposite trend is observed – the classes for goods stand out with the highest overall share among the top 10 (39.79%), while in applications for trademarks, the service classes are indicated in 14.31% of the total number (49680 trademarks applied for).

Figure 5

Foreign trademark applicant activity by Nice classes for the period 2010-2020

Source: WIPO Database / Authors' calculation.

Table 14

Top 10 Nice classes in foreign trademark activity for the period 2010-2020

TOP-10 Nice classes	Description	Total trademark	Share (%)
Class 05	Pharmaceuticals	5424	10.92
Class 35	Business Services	3755	7.56
Class 09	Scientific Equipment	3152	6.34
Class 03	Detergents	2457	4.95
Class 30	Coffee, Sugar, and Other	2268	4.57
Class 25	Clothing	1911	3.85
Class 42	Scientific and Technological Services	1747	3.52
Class 41	Education	1605	3.23
Class 16	Paper Products	1583	3.19
Class 29	Meat, Fruit, Oil, and Other	1363	2.74

Source: WIPO Database / Authors' calculation.

The above gives us reason to conclude that Bulgarian trademark applicants specialise as a priority in the services sector, while foreign applicants focus on the registration of trademarks for the realisation of mainly goods. The largest shares in this respect are pharmaceutical products (Class 5) followed by classes: 9 – Scientific Equipment; 3 – Detergents; 30 – Coffee, Sugar, and Other; 25 – Clothing; 16 – Paper Products; 29 – Meat, Fruit, Oil, and Other. In the service sector foreign trademark applicants are directed to class 35 – Business Services, 42 – Scientific and Technological Services, 41 – Education.

This is in line with the global trend observed in recent years to increase the relative share of the services sector and the deindustrialisation process. At the same time, the limited capacity of production of goods from the "unattractive" economic sectors in Bulgaria makes the national economy dependent on imports.

The preconditions for the mentioned specialisation of Bulgarian and foreign trademark applicants are connected on the one hand with the need for huge investments (costs for technological equipment and know-how) to create competitive products on the market, and on the other hand – investments in marketing communications, advertising and transformation of the registered trademark in a brand recognisable among consumers, which requires a long period of time.

Starting their business with minimal capital, Bulgarian companies do not have the necessary financial resources to develop innovative products or to obtain licenses for the latest technological innovations in a particular sector, the products offered are uncompetitive. This predetermines the enterprises in our country to specialise mainly in labour-intensive industries with low and medium technological intensity. They are most vulnerable to competition from industrialised and emerging economies, which are redirecting their resources to countries with lower labour costs, including Bulgaria.

Foreign companies, on the other hand, enter foreign markets in making economically sound decisions generated on the basis of research on international markets. They have significant financial resources, innovative technologies and an established brand. The foreign trademark

activity testifies to the intentions of the applicants to operate on the territory of the country and use effective ways to protect their intellectual property and future investments. The exports of these companies include competitive and sought-after products on foreign markets, offered under the name of popular brands, guaranteeing quality for the consumer and generating profit for the supplier.

The analysis prepared so far presents data on the specialisation of Bulgarian and foreign trademark applicants. In order to establish the relationship between Bulgarian and foreign trademark applicant activity by economic sector (ISIC/NACE codes) and activities, a System of Concordance between the classes of goods and services under the Nice Classification and the ISIC/NACE classification has been applied.

4.2. Trademark applicant activity by economic sector and economic categories

By applying the derived System of Concordance between the classes of goods and services under the Nice Classification and the ISIC/NACE classification, we direct the Bulgarian and foreign trademark applicant activity to specific sectors (see Table 15) and, as a consequence, to the economic categories specified for the purposes of the study (see Table 16).

In order to examine the degree of match between the Bulgarian and foreign trademark applicant activity, a correlation analysis of the ranks and comparative analysis were applied. The distribution of the total number of classes under the Nice Classification for the trademark applicant activity (Bulgarian – BG and foreign – F) by economic sectors (see Table 15) for the study period 2010-2020 is ranked according to the Bulgarian activity. A total number of classes and a relative share are indicated.

Table 15

Distribution of the classes of the trademark applicant activity of Bulgarian and foreign applicants in Bulgaria by economic sectors for the period 2010-2020 (number and relative share)

Section	Economic sector	BG	%	F	%
C	Manufacturing	84 343	58.22	38512	77.52
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	22 592	15.59	3 755	7.56
M	Professional, scientific and technical activities	17 265	11.92	2 565	5.16
F	Construction	6 360	4.39	2 172	4.37
I	Accommodation and food service activities	5 947	4.11	744	1.5
H	Transportation and storage	4 449	3.07	928	1.87
K L	Financial and insurance activities Real estate activities	3 914	2.70	1 004	2.02
	Total	144 870	100.0	49 680	100.0

Source: WIPO Database / Authors' elaboration and calculation.

The statistical hypotheses verified by correlation analysis are:

H_0 : *There is no link* between the variables studied: classes by economic sector indicated by Bulgarian applicants and classes by economic sectors indicated by foreign applicants for the period 2010-2020

H_1 : *There is a link* between the variables studied: classes by economic sector indicated by Bulgarian applicants and classes by economic sectors indicated by foreign applicants for the period 2010-2020

Spearman's rank correlation coefficient accepts values in the range of -1.00 to +1.00 and can be interpreted using the scale of Hinkle, Wiersma & Jurs (2003).

After calculations are made according to formula 1, a value for **$R_{sp} = 0.857$** is obtained, which determines a **very high degree of correlation between the ranks of the variables examined**, i.e. there is a very large match between the rank positions of the economic sectors by Bulgarian and foreign trademark applicant activity.

The results obtained from the test made it possible to reject H_0, according to which there is no link between the variables examined and confirm H_1 for correlation. The value of $R_{sp} = 0.857$ is statistically significant at a confidence level *p = 0.05*.

Following the application of the System of Concordance between the classes of goods and services under the Nice Classification and the ISIC (see Table 16), a correlation analysis of Spearman's ranks was re-applied. The distribution of the total number of classes under the Nice Classification for trademark applicant activity (Bulgarian and foreign) by economic categories for the study period 2010-2020 is ranked according to the Bulgarian activity. A total number of classes and a relative share are indicated.

Table 16

Distribution of the classes of the trademark applicant activity of Bulgarian and foreign applicants in Bulgaria by economic categories for the period 2010-2020 (number and relative share)

Economic categories	BG	%	F	%
1. Business services	26506	18,3	4759	9,58
2. Food & beverages	25427	17,55	7900	15,9
3. Professional, scientific and technical activities	23212	16,02	3309	6,66
4. High-tech	17813	12,3	5817	11,7
5. Chemicals	12067	8,33	10021	20,17
6. Other manufacturing	8435	5,82	1583	3,19
7. Construction	8289	5,72	3625	7,3
8. Clothing & accessories	7569	5,22	3837	7,72
9. Household equipment & facilities	7073	4,88	4085	8,22
10. Transportation	5339	3,69	2080	4,2
11. Metals, machinery & equipment	3140	2,17	2664	5,36
Total	144 870	100.0	49 680	100.0

Source: WIPO Database / Authors' elaboration and calculation.

The statistical hypotheses verified by correlation analysis are:

H_0 : *There is no link* between the variables studied: classes of economic categories indicated by Bulgarian applicants and classes of economic categories indicated by foreign applicants for the period 2010-2020.

H_1 *: There is a link* between the variables studied: classes of economic categories indicated by Bulgarian applicants and classes of economic categories indicated by foreign applicants for the period 2010-2020.

After calculations are made according to formula 1, a value for **R_{sp} = 0.545** is obtained, which determines a **high degree of correlation between the ranks of the variables examined**, i.e. there is a large match between the rank positions of the economic categories in which Bulgarian and foreign citizens exhibit trademark applicant activity.

The results obtained from the test made it possible to reject H_0, according to which there is no link between the variables examined and confirm H_1 for correlation. The value of R_{sp} = 0.545 is statistically significant at a confidence level *p = 0.1.*

*The results of the correlation analysis of the Spearman's rank to reveal the degree of match between the Bulgarian and foreign trademark applicant activity by economic sectors and economic activities confirm the working hypothesis of the survey, namely: **There is a high degree of coincidence between the concentration of the classes of trademark activity by Bulgarian and foreign applicants by economic sectors and economic activities, i.e. foreign applicant activity is directed to economic sectors and activities in which Bulgarian applicant activity is higher.***

In order to identify the economic sectors and activities with the highest concentration of trademarks, where Bulgarian and foreign trademarks activity are highest, they are compared by shares. According to the data from Table 15, in which the ranking is according to the Bulgarian applicant activity, a foreign ranking (see Table 17) has been compiled.

Table 17

Distribution of the classes of the trademark applicant activity of foreign and Bulgarian applicants in Bulgaria by economic sectors for the period 2010-2020 (number and relative share)

Section	Economic sector	F	%	BG	%
C	Manufacturing	38512	77.52	84 343	58.22
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	3 755	7.56	22 592	15.59
M	Professional, scientific and technical activities	2 565	5.16	17 265	11.92
F	Construction	2 172	4.37	6 360	4.39
K L	Financial and insurance activities Real estate activities	1 004	2.02	3 914	2.70
H	Transportation and storage	928	1.87	4 449	3.07
I	Accommodation and food service activities	744	1.5	5 947	4.11
	Total	49 680	100.0	144 870	100.0

Source: WIPO Database / Authors' elaboration and calculation.

The top four positions in the ranking match. The highest Bulgarian and foreign activity by sector was recorded in *sector C – Manufacturing*: in 84 343 applications for registration of a trademark (58.22%) of Bulgarian applicants, classes under the Nice Classification were indicated corresponding to this sector, and in foreign activity, these were 38 512 applications (77.52%). The next activity is *sector G – Wholesale and retail trade; repair of motor vehicles*

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and motorcycles, but with a much smaller share – 15.59% in Bulgarian and 7.56% in foreign trademark applicant activity. The third activity position is *sector **M** – Professional, scientific and technical activities*. It was targeted by 17 265 applications for registration of a trademark by Bulgarian applicants and 2 565 applications from foreign applicants. The fourth sector, where a match is found between Bulgarian and foreign trademark activity, is *sector **F** – Construction*. Its share is 4.39% of Bulgarian activity and 4.37% of foreign activity.

The above gives us reason to conclude that the most developed sectors and economic activities in Bulgaria are of increased interest among foreign applicants. The sectors in which the highest trademark application activity is reported *(C, G, M, F)* are also those on which the development of the Bulgarian economy is based. However, in order to unleash the potential for sustainable economic growth in these sectors, it is necessary to focus on investments in the modernisation of technological equipment, and increase productivity and added value, which will increase the level of competitiveness of companies. Otherwise, foreign companies established on the market and their intellectual property rights (patents, trademarks, designs, etc.) will hinder the development of local companies.

According to Table 16 data on the distribution of the classes by economic activities, a similar ranking for foreign applicants has been compiled (see Table 18).

Table 18

Distribution of the classes of the trademark applicant activity of foreign and Bulgarian applicants in Bulgaria by economic categories for the period 2010-2020 (number and relative share)

Economic categories	F	%	BG	%
1. Chemicals	10021	20,17	12067	8,33
2. Food & beverages	7900	15,9	25427	17,55
3. High-tech	5817	11,7	17813	12,3
4. Business services	4759	9,58	26506	18,3
5. Household equipment & facilities	4085	8,22	7073	4,88
6. Clothing and accessories	3837	7,72	7569	5,22
7. Construction	3625	7,3	8289	5,72
8. Professional, scientific and technical activities	3309	6,66	23212	16,02
9. Metals, machinery & equipment	2664	5,36	3140	2,17
10. Transportation	2080	4,2	5339	3,69
11. Other manufacturing	1583	3,19	8435	5,82
Total	49 680	100.0	144 870	100.0

Source: WIPO Database / Authors' elaboration and calculation.

The economic categories are compared by their rank in both rankings (see Table 16 and Table 18). Matches are revealed only under headings 2, 7 and 10, which correspond to the activities related to: Food & beverages, Construction and Transportation. This allows us to conclude that although there is a large coincidence between the trademark activity of Bulgarian and foreign applicants by economic sector, the redirection of this activity to certain categories (directions) shows that foreign citizens are oriented towards activities to which the Bulgarian applicants are not of strong interest. The data obtained can also be interpreted in the opposite direction, namely: Bulgarian applicants are directed to activities and market niches not yet

employed by strong foreign trademarks and brands. The correct interpretation of those data requires an analysis not only of all applications for registration of a trademark submitted during the study period, but also of the market niches in which products are offered through the trademarks applied for and registered. This will reveal the absence/presence of strong and market-based trademarks and brands, as well as their owners, and will identify market leaders in the defined categories, which goes beyond the scope of this study.

Excluding the above, *the results of the comparative analysis carried out to reveal the degree of coincidence between the Bulgarian and foreign trademark applicant activity by economic sectors fully confirm the working hypothesis of the study. There is a match between 94.61% of the foreign and 90.12% of the Bulgarian trademark applicant activity by economic sector. As regards the economic categories and their directions, the working hypothesis derived is partially confirmed. There is a complete coincidence between 27.4% of the foreign and 26.96% of the Bulgarian trademark applicant activity by economic categories.*

5. Conclusions

Building on existing trademark research, we analyse the approach of authors including Luini & Mangani (2004), Fink, Javorcik & Spatareanu (2005), Millot (2009), Zolas, Lybbert and Bhattacharyya (2016), Grazzi, Piccardo, Vergari (2017), Iversen, & Herstad (2021), as well as the methodology used by WIPO to account for trademark activity by class and economic sectors. As a result, we adapt and propose for the purposes of this analysis a System of Concordance of the trademark applicant activity by class and the economic sectors and activities in the Republic of Bulgaria. The results obtained reveal the economic sectors in Bulgaria, where there is the highest trademark applicant activity.

On the basis of the analyses carried out, the following conclusions can be summarised:

- The conducted correlation analysis of Spearman's ranks confirms the working hypothesis of the study that there is a coincidence between the Bulgarian and foreign trademark applicant activity by economic sectors and economic categories, i.e. foreign application activity is aimed at sectors in which Bulgarian activity is higher. It follows that the sectors of the Bulgarian economy that are of increased foreign interest, manifested in higher trademark activity, can be identified as priorities for economic development.

- The specialisation of Bulgarian trademark applicants is focused mainly on the services sector, which predetermines the high added value (64%) created by the sector in the share of total added value in the country. In terms of production, it focuses on activities of low and medium technological intensity. Prerequisites for this are the global trend towards deindustrialisation and the expressed desire to increase the productivity of intellectual activity, as well as the limited resource base, the technological backwardness, the lack of state priorities, the loss of established markets typical of the Bulgarian economy. Insufficiently developed and with low trademark activity are economic sectors that require high productivity, innovation, research and development, and highly skilled workforce – sectors which form the long-term competitiveness of the country. Targeted activities are needed to achieve sustainable development of the priority sectors, as well

as activities stimulating the development of Bulgarian production and a strategy for imposing Bulgarian goods on the national and international markets. The measures must also be transferred to the company level – developing strategies to establish the trademark among consumers and achieve wide visibility in order to attract more consumers, generate revenue and invest profits in innovation.

- For the period 2010-2020 foreign applicants have shown the greatest interest in the economic sectors ***C** – Processing industry, **G** – Trade; repair of cars and motorcycles, **M** – Professional activities and research and **F** – Construction*, in which the concentration of Bulgarian applicant activity is highest. This also predetermines the distribution of 94.61% of the foreign and 90.12% of the Bulgarian trademark applicant activity in the specified economic sectors. The sectors with the largest coincidence in the trademark application activity also reflect the flow of investments after 2009, and according to the Innovation Strategy for Smart Specialization of the Republic of Bulgaria 2014-2020 *"nearly 1/3 of the accumulated investments are in the manufacturing industry ..."* as well as *"trade, repair of motor vehicles and motorcycles (15%)"*, and foreign direct investment is focused on *"important elements of the innovation system (education and ICT), as well as on sectors with potential for development as vehicles (83% increase), electrical equipment (51% increase), food and beverages (30% increase), etc."* (Council of Ministers, 2018, p. 23). In order to prove this statement, it is necessary to conduct additional analyses, which are of interest for further developments.

- In the economic categories, the most significant foreign interest is noted in *Chemicals* and the production of chemical products, followed by: *Food and beverages; High-tech; Business Services; Household equipment and facilities; Clothing and Accessories; Construction; Professional, scientific and technical activities; Metals, machinery & equipment; Transportation; Other manufacturing.* This predetermines the strong dependence of the national economy on foreign investment, as the attractiveness of certain economic sectors and categories for foreign applicants is based primarily on relatively low prices of basic factors (labour, resources, energy) during the analysed period. The stated interest in these categories is also indicative of the export orientation of the Bulgarian economy.

The proposed study is the first step towards a more serious and in-depth analysis of the structure of trademark activity in Bulgaria. The concordance of the thematic content of the most developed economic sectors (ISIC / NACE codes) with that of the classes of goods and services according to the Nice Classification, as well as the similarity between the economic sectors with the most pronounced applicant interest and the data on investment activity in the country are proof of the effectiveness of the developed System. The analyses of the trademark activity presented in the study show how by using the maintained statistics for the objects of industrial property and, in particular, for the trademarks and by applying the derived System of Concordance, the priority and most promising for the development of economic sectors can be identified. This brings out trademark activity as a valuable and unique information resource. The System can be used to connect trademarks with different economic indicators, measuring foreign direct investment, gross domestic product, corporate representation, product differentiation, etc.

Subsequently, this analysis may cover other objects of industrial property (patents), seeking a link between the concentration of foreign patent activity (Georgieva & Nikolova-Minkova, 2020) and the concentration of trademark activity, as well as to reveal technological directions and economic sectors and divisions that are priorities for economic development.

The use of the System of Concordance of the classes of goods and services can be expanded in the following directions:

- disclosure of the export and import specialisation of Bulgaria and its connection with the trademark application activity;

- disclosure of the connection between the investment flows, the trademark activity and the development of the priority economic sectors;

- study of the connections and regularities between the intensity of the trademark activity of foreign applicants and indicators such as gross domestic product, foreign direct investment, etc.;

- analysing of the trademark application activity at the company level – formation of the structure of the individual economic sectors in terms of the number and size of companies operating in the sector and their trademark activity.

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Irena Markova[1]

INSURANCE OF ENVIRONMENTAL RISKS IN THE CONTEXT OF THE CORPORATE SECURITY OF THE INDUSTRIAL ENTERPRISE[2]

The study examines the issue of the place and role of environmental insurance in the security concept of the industrial enterprise. The priority importance of liability insurance against the risk of "environmental pollution" in economic entities is outlined. Emphasis is placed on the positioning of environmental insurance among the mechanisms for increasing environmental security in the context of corporate risk management. The results of the marketing research among operating companies in the Bulgarian insurance market are presented and give an idea of the state, problems and guidelines for the development of insurance for environmental risks in our country. The analysed marketing information is supplemented by the results of similar research among companies in the chemical industry as consumers of environmental insurance in order to cover the two elements – supply and demand – in the market of environmental insurance.
Keywords: environmental insurance; environmental risk; risk management; corporate security; insurance company; industrial enterprise
JEL: G22; Q59

Introduction

Global problems related to environmental pollution require economic units to improve their risk management in the direction of conducting environmental assessments and taking measures to prevent and minimise the consequences of environmental risks. In the context of the "green transition", the aim of industrial enterprises is to increase their corporate social responsibility by implementing policies to strengthen environmental prevention (Tonchev, 2022): the use of renewable energy sources, the application of mixed green hydrogen combustion with conventional fuels, purification of carbon and other harmful gases, application of green technologies, etc.

Additional challenges relate to supporting European Union (EU) action on the road to a zero-emission economy by 2050 and the new EU legislative package "Prepared for 55". It

enhances ambition at the EU level in primary and final energy consumption by 2030 through indicative national energy efficiency targets in all sectors (https://www.me.government.bg).

A number of environmental risks and new threats are manifested in the functioning of industrial enterprises in a dynamic external and internal environment. The author systematises the variety of ecological hazards into four main groups: (Markova, 2021, pp. 84-102) ecological risks of natural character, ecological risks of technogenic nature, ecological risks of anthropogenic nature and ecological risks of public nature. We believe that the risks of these groups have an adverse impact on the activities of legal entities, respectively, on the corporate security of enterprises. Therefore, environmental risks must be monitored, studied, overcome and managed in accordance with the possibility of quantitative and qualitative assessment of the consequences of their manifestation. In this sense, "an assessment of the extent of environmental risk can only be made if there is some knowledge of the nature of the risk, because the greater the likelihood of damage, the longer the monitoring period, and the greater the larger the size of the insured population for which the monitoring is made, the more accurate the results obtained" (Draganov, 2017, p. 23).

The most vulnerable to environmental pollution are enterprises with hazardous production, such as existing economic units in the field of nuclear energy, chemical industry and others. On the one hand, the risk of transboundary pollution as a result of environmental risk is an essential prerequisite for increasing corporate social responsibility. On the other hand, the probability of the complex impact of environmental risks implies the accumulation of losses, which reflects on the financial stability of the enterprise. In this sense, the most appropriate compensation among environmental protection mechanisms is the insurance of environmental risks.

In today's socio-economic and market conditions, insurers specialising in environmental insurance are facing new challenges and the need for innovation in terms of environmental insurance products. With the help of the application of adequate marketing tools, insurers can provoke the demand for environmental insurance and stimulate the use of insurance protection among legal entities. In addition, through appropriate marketing research, insurers specialising in environmental insurance can study the formation of new insurance needs and interests among industrial enterprises. The results of marketing research serve as a basis for conducting a flexible market policy of insurers. Today, companies specialising in environmental insurance are increasingly focused on responding to changes in the national insurance market, although in the period of the COVID crisis, they were forced to work in conditions of uncertainty in the market environment.

The aim of the study is to identify the attitudes, barriers and prospects of the insurance sector in relation to covering environmental risks, as well as to derive the effects of environmental insurance for legal entities, respectively to justify the importance of insurance services and products to increase corporate security of large, medium and small enterprises.

To achieve the formulated research goal and substantiate the hypotheses, the author conducts empirical research among insurers, and the results of the survey help the author to justify the role of environmental insurance in the risk management of the business unit and its positioning among other environmental mechanisms in industrial enterprise risk management.

The obtained, analysed and summarised results are supplemented by the results of another marketing research conducted among consumers of environmental insurance, such as industrial enterprises in the chemical industry.[3] The study of the two elements of the market – supply and demand – should give a clear idea of the state and trends in the future development of environmental risk insurance in Bulgaria. We believe that in this way, the attitudes, opinions and behaviour of insurance companies and industrial enterprises as subjects in the insurance relationship, respectively as parties to the insurance contract, will be better studied and analysed.

The main **research thesis** is that there are opportunities to increase corporate security in the industrial enterprise by including environmental risk insurance in corporate risk management in the chemical industry. In connection with the formulated research thesis, the following **hypotheses** can be presented:

First hypothesis. Despite the benefits of insurance protection, the demand for security through environmental insurance by industrial enterprises is still weak, respectively, business units do not take sufficient advantage of the benefits of insurance products in the context of corporate security.

Second hypothesis. Despite the importance of insuring environmental risks for the financial sustainability of the industrial enterprise, the provision of security through environmental insurance is still in the process of development and gaining experience from companies in the Bulgarian insurance market.

Third hypothesis. The effectiveness of the insurance of environmental risks would significantly increase the effectiveness of the risk management of the industrial enterprise in the direction of protecting the economic interests of the legal entity and stimulating corporate responsibility for environmental protection.

In accordance with the purpose of the development, the following **research tasks** are set in the study:

First, to monitor, in general, the dynamics of the market of insurance of environmental risks on the basis of the results of marketing research among non-life insurance companies in Bulgaria and on this basis to make suggestions for improving the activities of companies;

Second, to study the specifics and opportunities of environmental insurance to increase corporate security in industrial enterprises, highlighting the problems in the supply and demand of environmental insurance products.

Third, to outline the challenges and guidelines for the development of environmental insurance in the national insurance market, including to make recommendations for improving the insurance legislation.

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[3] The marketing research was conducted in the period 2019-2020 among enterprises that are members of the Bulgarian Chamber of Chemical Industry (BCCI). The results are presented in the author's monograph: Markova, Ir. (2021). Ekologichno zastrahovane e korporativna sigurnost v himicheskata idustriya. Sofia: Izdatelski kompleks – UNSS.

Fourth, to study the experience of current insurers in the national insurance market, which practice liability insurance against environmental pollution, as the main type of insurance in the insurance branch "Environmental Insurance".

Fifth, to analyse the expert opinion of insurance specialists and to compare with the expert opinion of specialists in the chemical industry on the possibilities and role of environmental insurance in increasing corporate security and its place in corporate risk management.

The wide-ranging issues determine the fact that outside the perimeter of the study remain some issues that the author identifies as **limitations of the study**.

First of all, it should be noted that the role of environmental insurance must be sought at both the macro and micro levels. The nature and importance of environmental insurance and its socio-economic nature are considered in macroeconomic terms and are substantiated in another author's publication.[4] In the present study, the emphasis is on the importance of insuring environmental risks at the micro level, from the position of the industrial enterprise, which is reflected in the effects, respectively, in the benefits of environmental insurance for the legal entity and the ability to increase corporate security.

On the other hand, in the present study, the focus is on the activities of insurance companies specialising in environmental insurance, among which marketing research was conducted. As already mentioned, another author's publication presents the results in detail of marketing research conducted among industrial enterprises on the importance of environmental insurance in the context of corporate risk management. The conclusion of the present study outlines conclusions based on the author's two marketing researches.

Given the wide range of environmental insurance products available on the insurance market, the author focuses on the insurance of liability for environmental pollution as a necessary element in the concept of security of the business unit.

1. Theoretical Substantiation of the Place of Ecological Insurance among the Mechanisms for Corporate Security in the Industrial Enterprise

At the present stage of development of insurance relations, the development of environmental insurance follows the general principles of functioning of the national insurance market in a market economy and depends on the following **conditions:**

• The pursuit of sustainable development of the national economy is related to the achievement of economic and financial security of members of society, which is largely determined by the degree of development of insurance protection.

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[4] The nature and importance of environmental insurance and its socio-economic nature are considered in macroeconomic terms and are substantiated in another author's publication, namely: Misheva, Ir. (2015). The social end economic nature of environmental risk insurance. – Economic Thought, Economic Research Institute at BAS, Sofia, UNWE Printig House, 2/2015, ISSN 0013-2993, pp. 74-91.

- • As part of the financial system in the country, insurance, respectively environmental insurance is influenced by the disparities between the level and scale of development of subsystems, such as – monetary, budgetary, credit, currency, insurance and pension (Dimitrov, S., 2019).

- Improving the quality of life of the population in the country is determined by ensuring effective insurance protection of the property interests of the population.

- The economic growth in the country is determined by the capabilities of financial and credit institutions, including the financial stability of insurance companies.

- Investment and integration processes in the world economy require the orientation of insurance companies to changes in the external environment and the application of adaptive risk management.

- There are difficulties on the part of the state budget in covering the costs of eliminating the consequences of environmental disasters, including technogenic accidents and natural disasters related to environmental pollution in our country, as well as cross-border adverse effects.

- There is a tendency to increase the motivation of legal entities to achieve a high degree of corporate security by including internal and external disruptive factors in the risk strategy of the industrial enterprise. "Moreover, the priority of risk management is growing in conditions of increased uncertainty in both the external and internal environment, as well as the emergence of new risks" and identifies the need for management action to address them (Dimitrov D. a., 2021, p. 179).

- In the era of technological changes and the rapid penetration of information technology in all sectors of the economy, the preconditions are created for greater work efficiency, which determines the need for high specialisation of human resources in the field of environmental insurance (Evgeniev, 2021, p. 62) and the search for opportunities to increase of the emotional intelligence of the insurance specialists in order to improve the organisation of the insurance activity (Evgeniev, 2021, pp. 29-31).

- In a period of enhanced cooperation between EU Member States with a view to aligning the EU's climate and energy legislative framework with the aim of reducing net greenhouse gas emissions by at least 55% by 2030 compared to with 1990 levels, the Fifth Session of the United Nations Environment Assembly (UNEA-5).[5] The general theme of the session is "Strengthening actions for nature protection in order to achieve the goals of sustainable development". In this context, the Commission informs of a new proposal for a directive on the protection of the environment through criminal law, which identifies new crimes against the environment and introduces more detailed provisions on sanctions, enforcement rules and measures to support people who report violations and cooperate with law enforcement. The Commission called on the Member States to take urgent action to ratify the multilateral environmental agreements. In this context, the issue

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[5] The Fifth Session of the United Nations Environment Assembly was held from 28 February to 2 March 2022 in Nairobi, Kenya according to
https://www.consilium.europa.eu/bg/meetings/env/2022/03/17/.

of changes in the insurance legislation regarding the inclusion of the risks related to environmental pollution in the insurance liability comes to the fore.

- Concretization of measures for prevention against environmental risks and mitigation of threats from environmental disasters, compliance with safety standards and clarification of safety criteria are some of the main practical issues that determine the development of corporate risk management today. The search for security through insurance is one of the main measures to increase the economic and corporate security of the business unit.

The process of risk management in the business unit is related to the development of a security concept and the implementation of the best alternative security strategy. The risk strategy includes a set of security measures and defines the methods and mechanisms of risk management. Determining "the correct method or set of risk analysis methods is essential to obtain a satisfactory result on the basis of which a good risk assessment can be made" (Dimitrov D. a., 2021, p. 194).

Practically the most applicable **methods** of corporate risk management are: risk elimination, risk prevention, risk transfer, risk-taking, risk avoidance, risk reduction, risk retention, risk standardisation and risk control. Among them, insurance is the main compensation method, which aims to compensate for accidental losses in the business unit and maintain its financial stability and competitiveness. In this regard, the author believes that the process approach to risk management in enterprises with hazardous production reveals the regulatory potential of insurance on corporate environmental risk management (Misheva I., Environmental insurance – an element of risk management in enterprises utilising hazardous, 2016, pp. 66-80).

The main **mechanisms** for environmental quality management, known in theory and practice, are divided into three groups, namely – environmental, economic and legal (Misheva, I., 2016, pp. 42-44). In the context of corporate risk management, insurance is relevant to all three groups of mechanisms. However, when it comes to seeking security by insuring against environmental risks, the issue becomes complex.

From the point of view of the risk strategy in the industrial enterprise, the insurance of ecological risks is considered as an important ecological mechanism, which has a connection and interaction with the other mechanisms (Scheme 1).
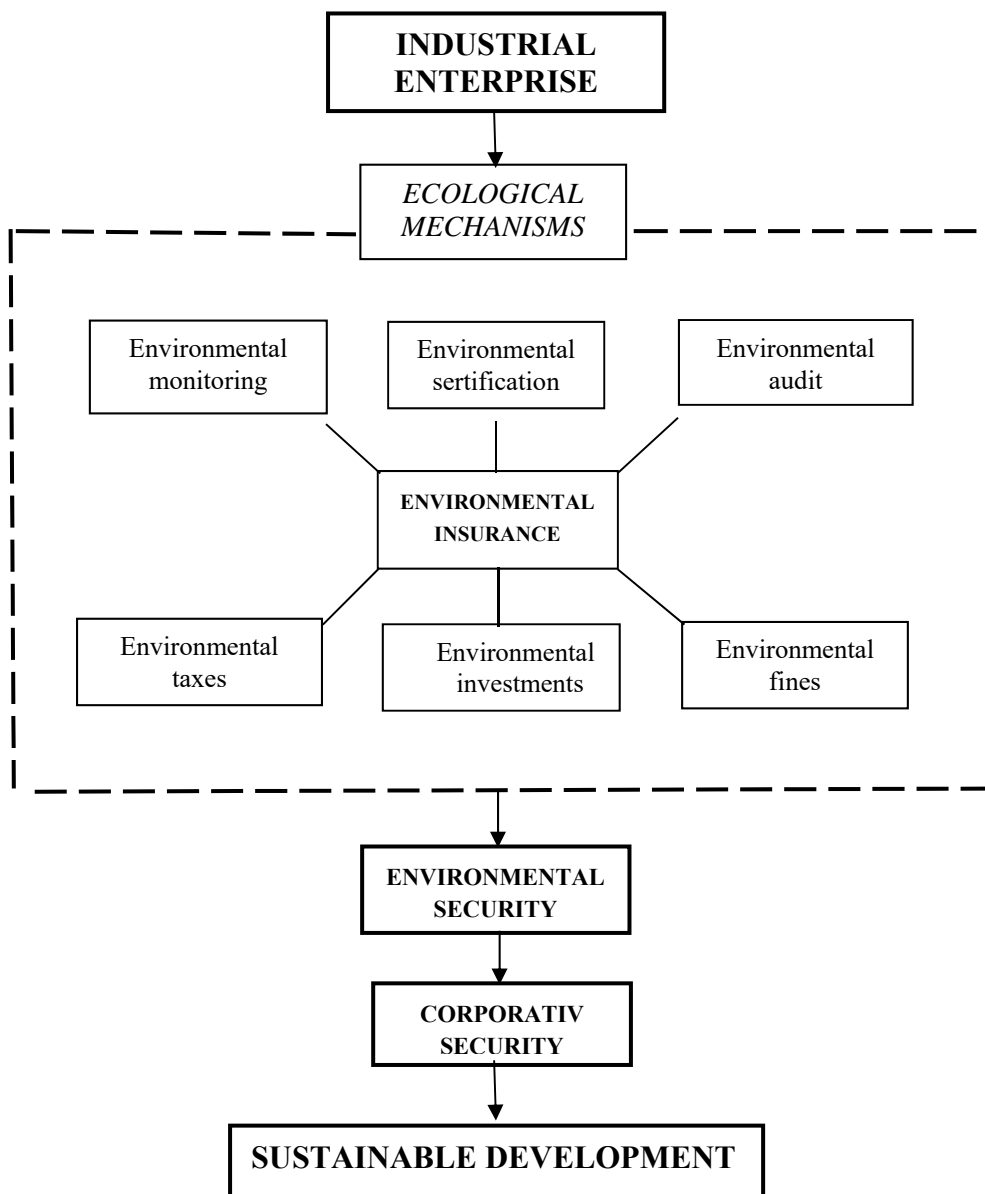
The positioning of insurance, among other environmental mechanisms, determines its growing role as a guarantee and a key element of the modern concept of corporate security. In this sense, the advantages of insurance should be sought in its ability to increase environmental and economic security, in the context of corporate security of the business unit. The dynamics in the demand and supply of environmental insurance products are determined by **the effects** they have on consumer companies.

In the first place, the effectiveness of the use of environmental insurance can be determined by *mapping the environmental risks* depending on the probability of their occurrence and the expected amount of losses, as well as determining „a tolerance line that reflects the company's internal attitude to risk. For example, it is effective to transfer risks outside the tolerance to the insurer. It is better for the business unit to take on the risks of falling into the zone of tolerance" (https://www.raexpert.ru, n.d.). Thus, the risks associated with

environmental disasters and environmental pollution should be transferred to the insurance company.

Scheme 1

Positioning of the ecological insurance among the ecological mechanisms for corporate security in the industrial enterprise

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                    ┌─────────────────────────┐
                    │   INDUSTRIAL            │
                    │   ENTERPRISE            │
                    └─────────────────────────┘
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│                ┌──────────────────┐               │
                 │  ENVIRONMENTAL   │
│                │   INSURANCE      │               │
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│ ┌──────────────┐  ┌──────────────┐  ┌──────────────┐│
  │ Environmental│  │ Environmental│  │ Environmental│
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                    │  SUSTAINABLE DEVELOPMENT│
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Source: the author.

It should be noted that the effects of insurance protection are clear in large industrial enterprises, which have "powerful means of risk management, and their activities are closely related to management decisions by the company's management, both in terms of production and economic activities, such companies such as RUSAL, Aeroflot, Gazprom, Lukoil, etc." (https://www.raexpert.ru, n.d.). Small and medium-sized enterprises lag significantly behind, both in terms of risk management and environmental risk insurance. According to risk management experts, "in medium and small businesses, completely different people are involved in solving insurance issues in this area, such as: lawyers, HR specialists, secretaries, etc. In companies with risk management departments, *a systematic approach to insurance protection* is applied. Specialists from these departments make a real assessment of the need for different types of voluntary insurance" (https://www.raexpert.ru, n.d.). Subinsurance for medium-sized enterprises is estimated at around 50%. Risks for small businesses are usually left unmanaged. The level of sub-insurance of small business risks is close to 100% (https://www.raexpert.ru, n.d.).

In medium and small enterprises, insurers almost always act as consultants on risk management issues, and sometimes in large enterprises. In such cases, *advice is provided on a number of insurance issues* related to: risk exposure analysis, selection of the required amount of coverage, establishing the limits of insurance liability, advising on insurance legislation and the procedure for consuming insurance services and can choose the optimal insurance program. However, the complete transfer of risk management functions to insurers may lead to some negative consequences that need to be taken into account, namely – abuse by the insurer, an increase in the costs of the business unit and others.

When building a risk management system, it is considered justified to use *the services of insurance brokers*, which not only represent the client's interests in relations with insurance companies, but also provide risk management consulting services. Today, the role of insurance brokers as experts in the field of risk management is constantly growing. Specific services of insurance brokers include "advice on alternative risk management options, including the creation of own insurance companies (own funds management), mergers and acquisitions (mergers and acquisitions advice), asset management services, strategic planning and others" (https://www.raexpert.ru/researches/insurance/risk-insurance/., n.d.).

Activities in the chemical industry, such as the production, transformation, distribution, transport and storage of chemicals, generate significant risks that require research and anticipation of the possible effects of these risks on the environment and on third countries. The chemical industry includes areas of activity where the scale of environmental risk can be catastrophic due to the ubiquitous presence of chemicals in everyday life (pharmaceuticals, cosmetics and other industrial chemicals). To this end, multidisciplinary teams of approved experts provide all their experience and technical knowledge for the implementation of *appropriate preventive measures* and better coverage of the risks inherent in the chemical and pharmaceutical industry. The teams support the search for the most appropriate solutions for insuring potential risks. In other words, they develop *a specific insurance program* resulting from the identification and analysis of risks and seek the best insurance conditions with coverage at the lowest cost. At the same time, the client is provided with support in terms of advice, assistance and follow-up of claims throughout the insurance period.

The economic efficiency of the insurance of environmental risks, respectively the benefits in the properties of the insurance products for the consumer enterprises, should be assessed with the help of specific *indicators*, namely: (Rudakov, 2018, p. 14)

- Probability of occurrence of environmental risk;

- Amount of possible loss from the manifestation of environmental risk;

- Amount of the insurance tariff;

- Amount of the insurance premium – determined by basic price factors (Misheva I. , 2016, pp. 94-95).

- Form of insurance;

- Ratio between the payment of the insurer and the amount of the loss from the manifestation of environmental risk;

- Mathematical expectation – is the average expected amount of loss of the enterprise when concluding /not concluding/ an insurance contract;

- Absolute indicator for the effect of the insurance – amount of the received insurance indemnity after deduction of the amount of the paid insurance premium.

The effectiveness of environmental insurance must be sought in the possibility of *increasing the economic security of the industrial enterprise*. Making an adequate management decision in the business unit is impossible „without constant monitoring of potential threats to both the external and internal environment" (http://eav.ru, n.d.) and without adequate insurance protection. In this sense, the effects of insurance protection are reflected in terms of insurance contracts, which are subject to negotiation between the parties. The consumption of environmental insurance products by legal entities depends not only on the value of the insurance contract, but also on the temporarily available free funds, some of which are set aside as insurance costs. Given that the company receives an economic benefit when concluding an insurance contract, it can be said about the economic efficiency of insurance protection. The full effect of the insurance of environmental risks can be achieved if as a result of the payments to the insurer all the negative economic consequences for the enterprise are compensated. In other words, the economic potential of insurance is manifested in the realisation of the insured event, when by compensating for losses, the main goal of the legal entity is achieved – increasing financial security, which is expressed in maximising the market value of the business unit.

The effectiveness of environmental insurance is manifested in the implementation of *the main goal of the insurer – satisfaction of needs*. However, when providing insurance services, insurers are looking for greater benefits. It is possible that a conflict of interest may arise with regard to the price of environmental insurance between the parties to the insurance contract (Misheva, I., 2016, pp. 97-104). Given that a balance is found between the financial interests of the parties in the insurance relationship, one can speak of the effectiveness of insurance protection.

The fulfilment of the goal "satisfaction of needs" can be established with the help of the indicator "completeness" of the insurance protection, i.e. what part of the incurred losses are reimbursed through the payments of the insurer. This summary indicator "can be decomposed by areas of the target areas, obtaining indicators of completeness of insurance protection in relation to: covered risks, covered types of losses, objects of insurance" (Iliev, 2008, p. 44).

Ultimately, the effects of environmental risk insurance are a kind of guarantee of environmental security in the industrial enterprise. The search for security through environmental insurance is an indicator of increasing the environmental responsibility of the business unit and is a key prerequisite for increasing corporate security. The harmonious combination of environmental insurance with other environmental mechanisms in the context of corporate risk management should lead to a sustainable development of the legal entity.

The effectiveness of insurance against environmental risks is manifested in the ability *to protect the environment by carrying out preventive activities*, both by the insured, stimulated by insurance conditions and tariffs and by insurance companies through direct financing of preventive measures. In this sense, environmental insurance indirectly contributes to the implementation of the national environmental strategy and to the establishment of the principles of: sustainable development; prevention and reduction of the risk to human health and the environment; prevention and reduction of the risk for biological diversity; reduction of harmful effects on the components of the environment as a result of natural processes and phenomena; optimal use of natural resources and energy.[6]

The effectiveness of environmental risk insurance in the future will increasingly be determined by *the application of innovative technologies*, such as the use of artificial intelligence in the processing of large amounts of data; financial engineering and mathematical modelling in risk assessment; methods of risk forecasting statistics; expert systems in risk identification; new environmental technologies of enterprises regarding the preventive activity on environmental protection, stimulated by the insurance conditions and tariffs, for example in connection with the disposal and treatment of wastewater, treatment and disposal of waste, etc. (Markova, 2021, p. 42). In this regard, „information and computing technologies and artificial intelligence will be increasingly important for risk analysis. Risk analysis methods will certainly be standardised and the role of the individual in the risk identification process will be minimised" (https://buduysvoe.com/ru/).

2. Methodology and Data

The methodological basis of the research is based on the use of traditional research methods, as well as modern methods of analysis and evaluation, such as comparative method, method of analysis and synthesis, inductive and deductive method, statistical methods and methods of expert evaluation. In other words, both statistical and non-statistical research methods were used in this work, on the basis of which conclusions and summaries were formulated.

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6 Zakon za opazvane na okolnata sreda (ZOOS). Obn. DV. Br. 91 ot 25 septemvri 2002, … izm. DV br. 21 ot 12 mart 2021, chl. 76 (2).

In order to study consumer demand for environmental insurance, a survey was conducted among the insurance companies in the Non-life insurance branch in Bulgaria, covering the period July 2016 – March 2017.[7]

Empirical research is used to analyse the opinion of insurers about the benefits and role of environmental insurance. The author's aim is to study the experience of current insurers who practice liability insurance against environmental pollution in the national insurance market.

The empirical research in the study reveals the main causes, factors and dependencies that shape consumer behaviour in the environmental insurance market. The analysis of the results of the research should serve the insurance practice to detect problems in the development of environmental insurance in Bulgaria, as well as to forecast consumer demand for liability insurance against environmental pollution by industrial enterprises. The conclusions of the author of the study can be used by insurance companies specialising in environmental insurance to improve insurance business and to make marketing efforts to stimulate consumer demand for insurance products.

The questionnaire is composed of 15 questions and is provided to all insurance companies in the field of Non-life insurance branch in Bulgaria.

Several statistical methods such as group methodology, comparative method, descriptive analysis methods and non-parametric methods for analysis of the "factor-result" relationship (correlation analysis and Chi-squared analysis) are used in the analysis of the survey results.

Out of 29 companies licensed in the industry by mid-2016 (Financial Supervision Commission, н.д.), 20 participated in the survey and filled-in survey card were received. Therefore, in a relative share, 69% are surveyed insurers, 14% refuse to participate in the survey and 17% do not respond to the inquiry. Thus, over 2/3 of the insurers in the industry are involved and about 1/3 have not participated in the survey.

Of the surveyed 20 insurance companies, 14 are licensed to practise General Liability Insurance. Of these, only 7 companies carry out operations under the Liability Insurance policy against environmental pollution.

In the process of marketing research and for the analysis of the survey results, statistical methods for the analysis of relationships and dependencies, in particular for the study of relationships and dependencies (correlation analysis) in weak scales, were used. Weak scales are those in which the meanings of the attribute are not represented by a number or measure but verbal, descriptive. The nominal, the dichotomous, the ordinate and the range scale are considered as weak scales. The statistical methods used in the study for analysis of dependencies are the following (Saykova, Stoykova-Kanalieva, & Saykova, 2002) (Goev, 2010) (Pavlova & colleagues, 2009); (Petrov, Angelova, & Slaveva, Statisticheski metodi za izsledvaniya v sotsialnata sfera, 2006); (Petrov, Angelova, & Slaveva, 2004, p. 67); 2004; (Angelova & Slaveva, 2012, pp. 68-69); (Slaveva, 2018, pp. 134-140) correlation analysis, respectively coefficients of four-cell correlation – coefficient of association, coefficient of

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[7] Marketing research was conducted with the institutional support of the Prof. Dr.V. Gavriiski Foundation and with the assistance of the Financial Supervision Commission (FSC) and the Association of Bulgarian Insurers (ABI).

contingency, coefficient of colligation, coefficients of interconnection – coefficients of Kramer, Chuprov and Pearson.

The questionnaires received from the insurance companies were processed and summarised. Of interest to the scientific community, as well as to insurance companies, are both the distribution of answers to individual questions and the possible links between them. The study analyses the results obtained, focusing on the opinion, positions and expectations of insurers about the benefits and role of environmental insurance and common complicating factors in the insurance business.

3. Empirical Results

The current marketing research is conducted in order to analyse the expert opinion of insurers on the need and role of environmental insurance in corporate risk management. The focus of the survey is on the knowledge and use of liability insurance against environmental pollution and the study of consumer opinion on the benefits of the insurance product.

The results show that 70% of the insurance companies participating in the survey have a licence from the Financial Supervision Commission (FSC) for practising the General Liability Insurance (GLI), which is very important for the range and completeness of the study, for the correct characterisation of the conditions for development of this type of insurance, difficulties, possible risks and expectations (Figure 1).

Figure 1
The distribution of insurance companies according to the possession of a licence to practice the General Liability Insurance
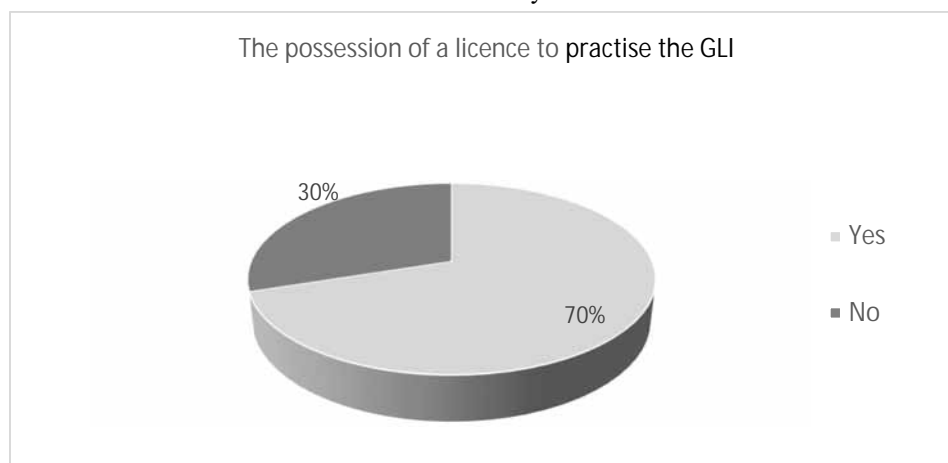

Of the surveyed insurance companies, 35% (7 insurance companies) carried out insurance operations on the Environmental Pollution Liability Insurance (EPLI) and 65% (13 insurance companies) did not carry out operations on this type of insurance (Figure 2). Such are the results if the total number of companies participating in the survey is taken into account. If

the total number of companies participating in the survey refers to the number of companies, which have a licence to practice the GLI, the results differ significantly. It is found that 50% of the companies holding a licence have carried out insurance operations on the EPLI. This gives us enough reason to state that this study covers a sufficient number of insurance companies and the results of the survey will contribute to the revealing of the state, needs, problems and expectations for the development of this type of insurance.

Figure 2

The distribution of insurance companies according to the insurance operations carried out on the Environmental Pollution Liability Insurance
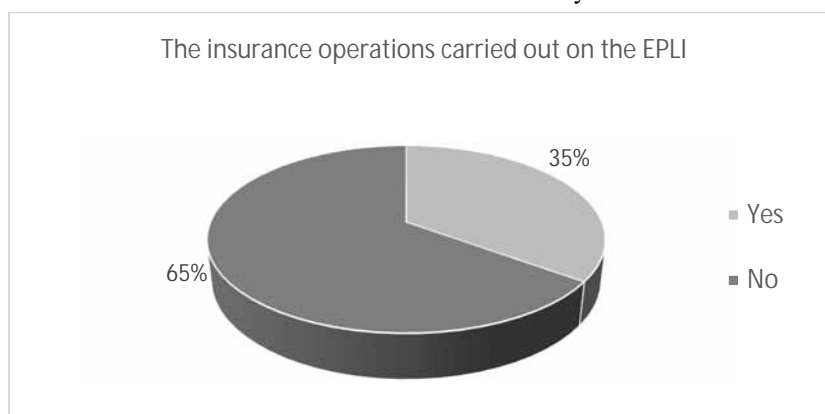
None of the insurance companies has paid an insurance sum or compensation under the EPLI. It should be concluded that this fact is evidence of the lack of insurance cases during the analysed period in Bulgaria.

Answers to the question "Do you think that the Environmental Pollution Liability Insurance (EPLI) must be compulsory?" show that there is no full consensus and striving for a common position on this type of insurance. The results show that 40% do not consider this to be necessary, 35% think that it must be compulsory and 25% cannot decide whether this is necessary (Figure 3).

The statement is also confirmed by the answers to the question "How do you see the development of the Environmental Pollution Liability Insurance (EPLI) within the General Liability Insurance Class?" The largest share of the respondents (40%) think that the development of the EPLI within GLI Class has a good development, 30% cannot give an opinion, 25% identify it predominantly as bad and 5% – as bad (Figure 4). The special point here is that no answer to the questionnaire indicates that EPLI has a very good development.

The reasons for the significant difference in responses are varied and the main ones are: insufficient knowledge of this type of insurance; low interest and insufficient demand for such insurance products; significant difficulties in assessing risks; insufficient popularisation of the advantages of this type of insurance.

Figure 3

The distribution of the responses according to the necessity the Environmental Pollution Liability Insurance to have obligatory character
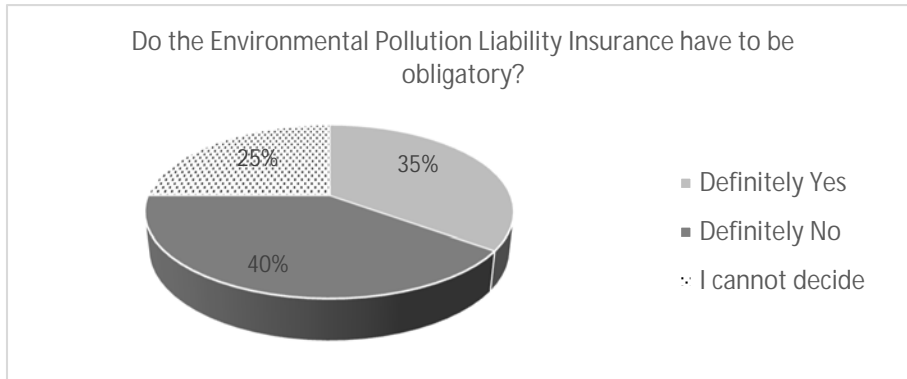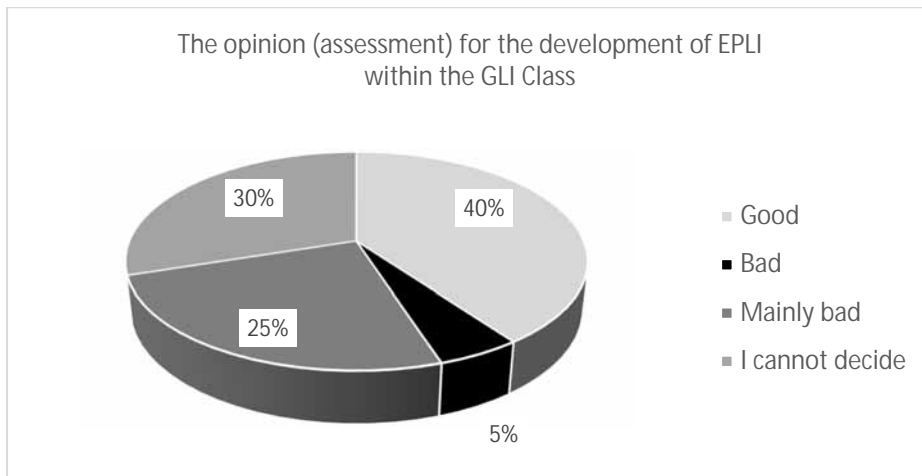

Figure 4

The distribution of the responses according to the opinion on the development of the EPLI within the General Liability Insurance Class


Respondents are adamant about the most significant benefits of environmental insurance, namely:

- Risk transfer removes the "economic burden" of companies paying a relatively low premium on possible large future damage.

- Providing the victims with social and legal guarantees for compensation of damages caused as a result of environmental pollution.

The distribution of respondents' answers, regarding the benefits of environmental insurance, is presented in Figure 5.

Figure 5

Distribution of the respondents' answers on the benefits of environmental insurance in industrial enterprises
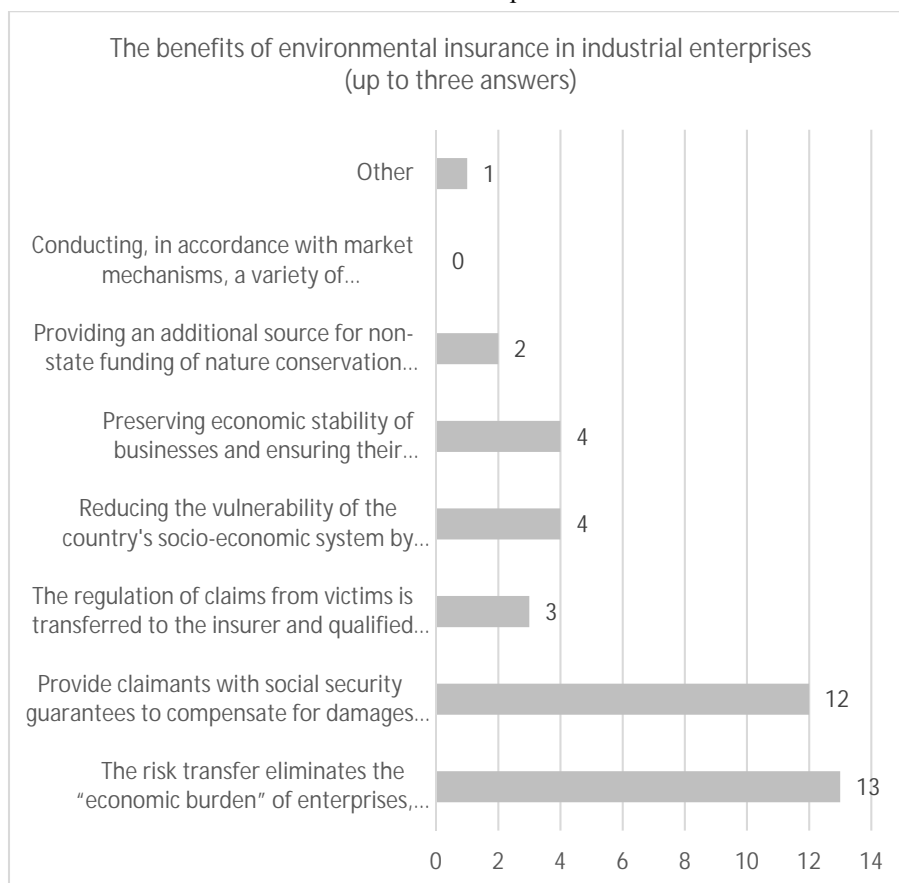
According to 40% of respondents, the development of environmental insurance on the national insurance market is predominantly bad, 25% cannot give an estimate, 25% respond "bad" and only 10% define it as good (Figure 6). The sceptic (negative) attitude towards the development of environmental insurance is impressive and this necessitates the need to look for the causes that have generated them and to influence on them.

According to the respondents, the main factors that hinder the sale of EPLI are: difficulties in risk assessment and they have the highest percentage (24.2%), lack of experience and traditions of insurance companies in such insurance (21%), the imperfections of the legislative base and the lack of insurance interest on the part of industrial enterprises. The distribution of the answers to this question is presented graphically in Figure 7.

Figure 6

The distribution of the respondents' answers about the development of environmental insurance on the national insurance market
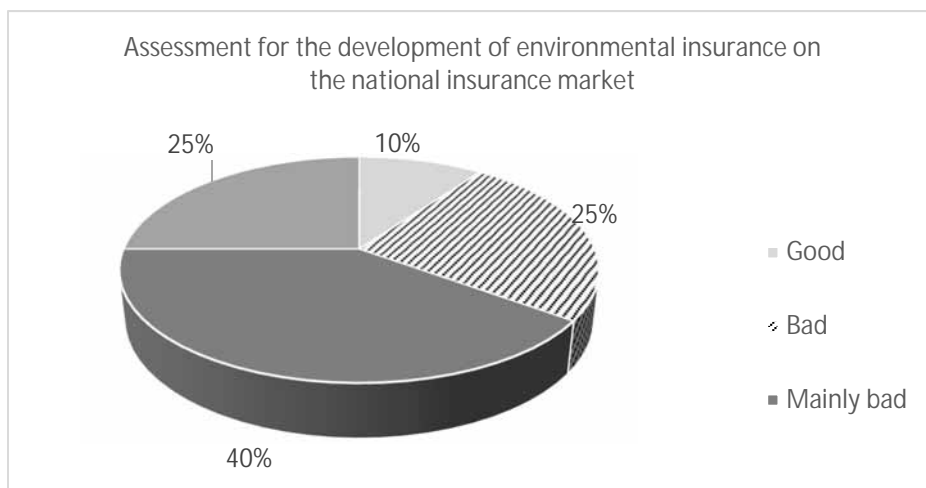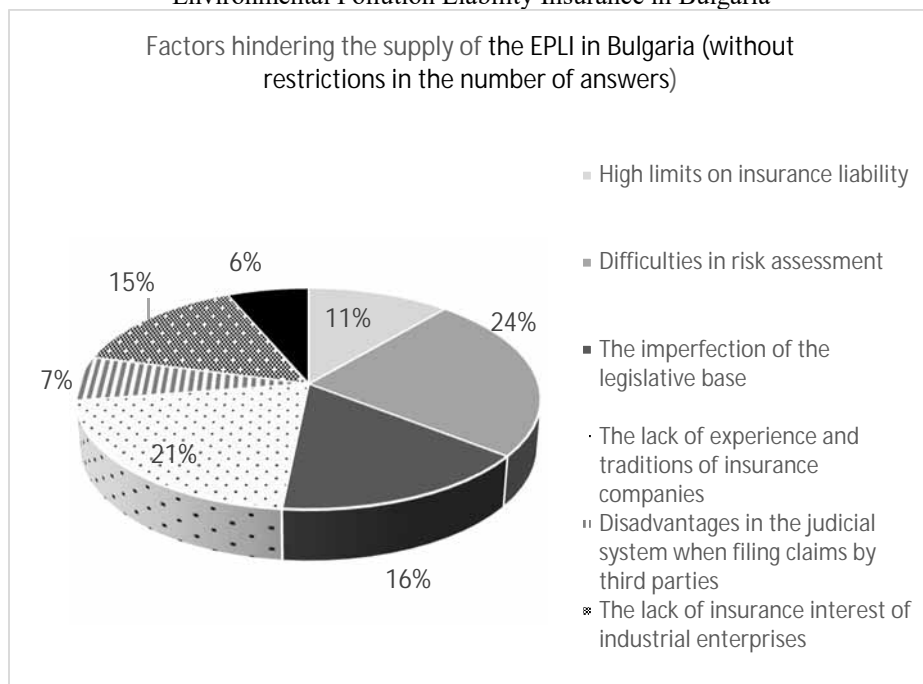

Figure 7

The distribution of the respondents' answers about factors hindering the supply of Environmental Pollution Liability Insurance in Bulgaria

On the issue of the need to create a catastrophic pool to cover the risk of environmental pollution, there is a difference and lack of certainty in the opinions – only 10% answered: "yes", 25% "yes to some extent", 15% indicated "to some extent no", 30% did not consider it necessary and answered "definitely not", and 20% of the respondents "cannot judge" (figure 8.).

Figure 8

The distribution of the respondents' answers about the need to cover the risk of environmental pollution by catastrophe pool in Bulgaria
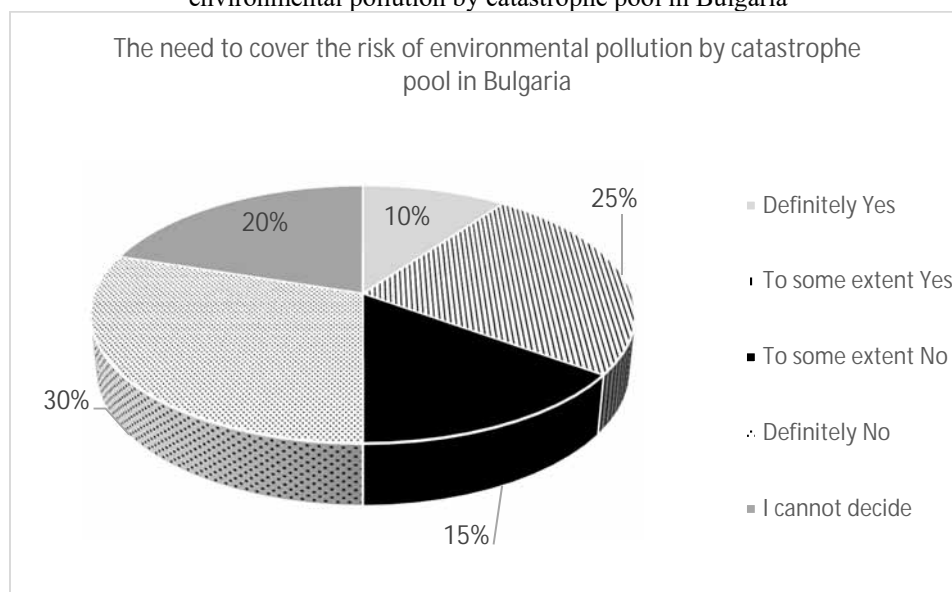
There is also a variety of opinions on the issue of the need for legislative changes in connection with the EPLI. In summary, it can be expressed the opinion that a part of the surveyed representatives of the insurance industry (about 1/3) believe that the EPLI needs legislative changes (figure 9).

When asked about the role of environmental insurance as a tool in corporate risk management of enterprises with hazardous production, 75% of surveyed insurers answered – positive, and only 5% had a negative opinion. 20% of the respondents have a neutral attitude towards the role of environmental insurance in the activities of industrial enterprises (Figure 10).

The answers of the insurers who practice EPLI show that the most insured enterprises are in the mining industry – 46%, followed by the processing industry – 39%, and the least in the energy industry – 15% (Figure11).

Figure 9

The distribution of the respondents' answers about the necessity of legislative changes concerning the EPLI
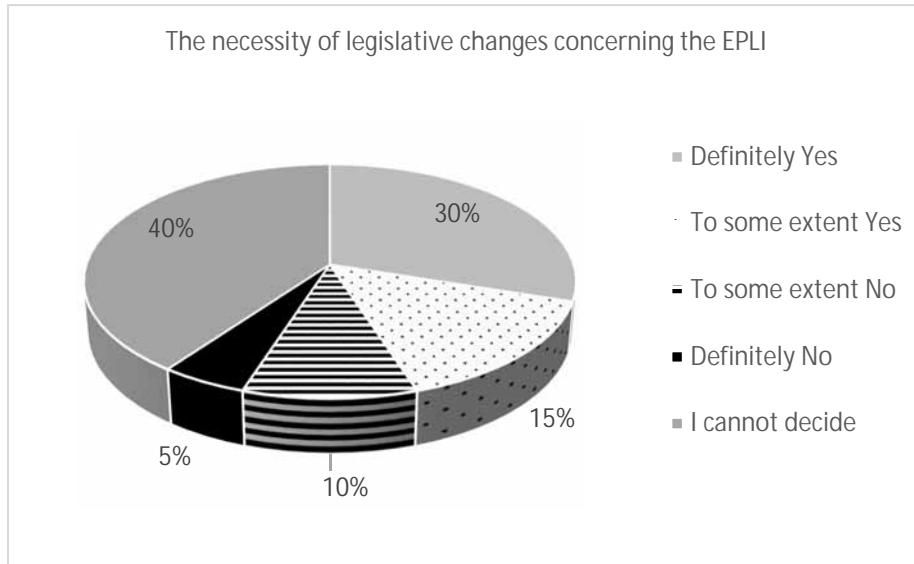

Figure 10

The distribution of the respondents' answers about their assessment of the role of environmental insurance as a tool in the corporate risk management of enterprises
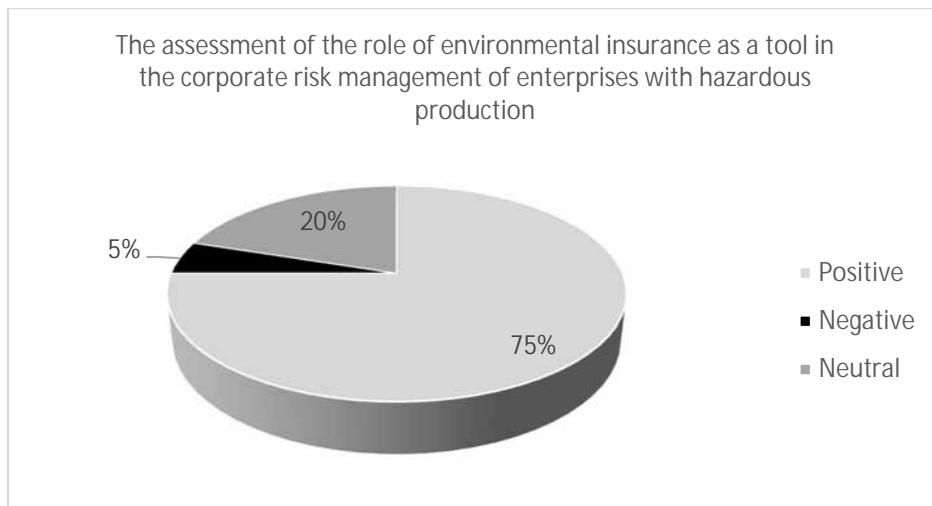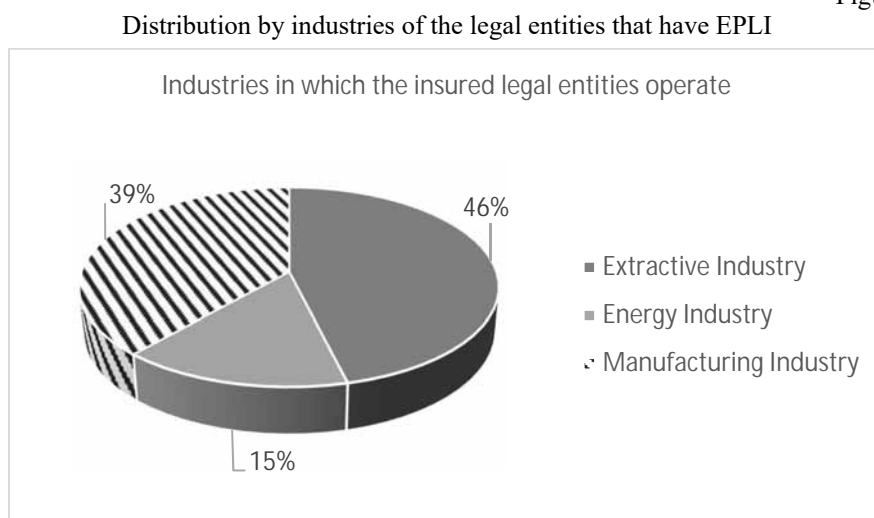
Figure 11

Distribution by industries of the legal entities that have EPLI

Regarding the EPLI, the majority of experts in insurance practice (70% of respondents) definitely believe that there should be a differentiation of the limits of insurance liability in the transfer of risk of "environmental pollution" in enterprises with hazardous production (Figure 12). This is related to making new mathematical calculations, legislative changes and application of new actuarial methods and techniques.

Figure 12

Distribution of respondents according to the necessity to differentiate the limits of insurance liability against the risk of environmental pollution according to the different branches of economics
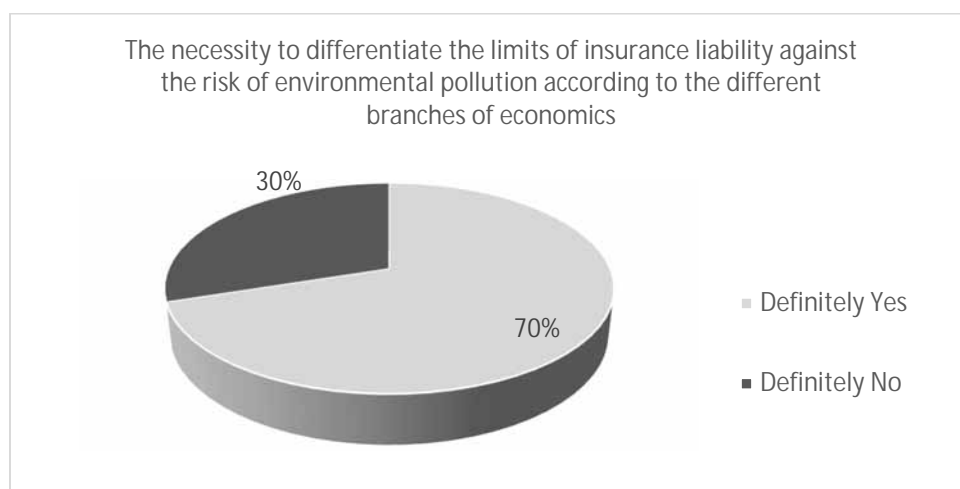
Regarding the factors determining the insurance premium of the EPLI, an arrangement and calculation of the weighted average rank has been performed for each of the price factors. Ranks from 1 to 10 were averaged, and the number of indicated ranks for the respective risk factor was used as weights. From the presented average ranks of risk factors, it is clear that the lowest average rank is the risk class of enterprises (2,2), which makes it decisive, followed by the type of harmful substances in the enterprise, forecasts for the level of possible environmental pollution, storage and storage of hazardous substances. These are the first four most important risk factors that must be taken into account when determining the net premium. In order to make a real risk assessment, it is necessary to use techniques that take into account all ten factors, but with different weights and the obtained average ranks could be used for this purpose. Figure 13 presents the average ranges of the risk factors and their division into four groups is done.

- **First group** which must be taken into account when determining the risk premium – **risk class of the enterprise and type of harmful substances in the production process;**

- **Second group** which consist of – predictions of the degree of a possible environmental pollution and storage and keeping of harmful substances;

- **Third group** – location and earthquake zone, preventive activity of enterprises, recommendations from environmental audits of enterprises and proximity to petrol stations and gas stations;

- **Fourth group** – proximity to the airport and the spatial location of the buildings in the enterprise.

Figure 13

The average ranges of the risk factors
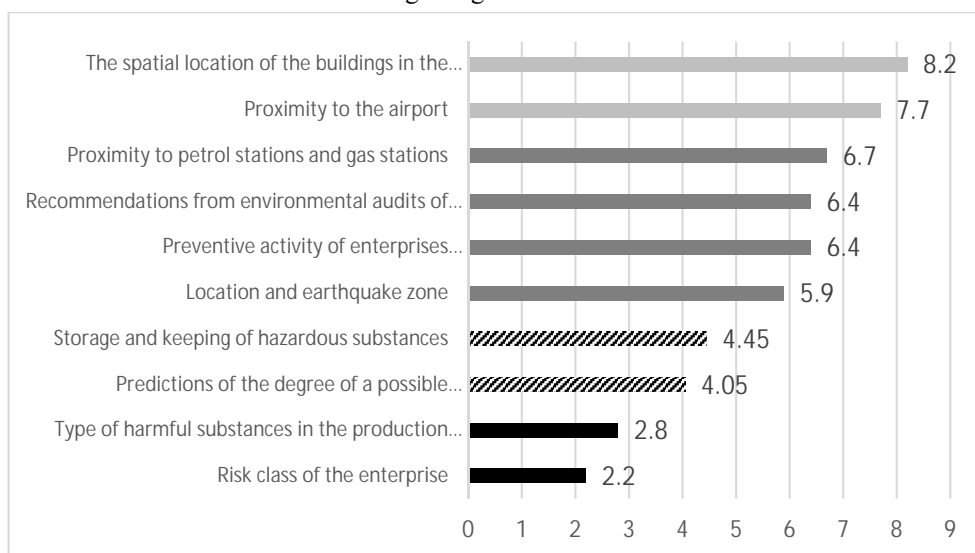
The same approach was used to rank the factors influencing the demand for General Liability insurance (GLI), and then a weighted average rank was calculated.

From the calculated average ranks of the factors influencing the demand for general liability insurance, it is clear that the lowest average rank is the quality of the insurance product, followed by the quality of service, financial stability of the insurer, market image of the insurance company and the professionalism of the marketing authorities. These are the first five most important of the 12 factors, determining the demand for GLI (Figure 14).

Figure 14

The average rank of factors influencing the demand for the General Liability Insurance
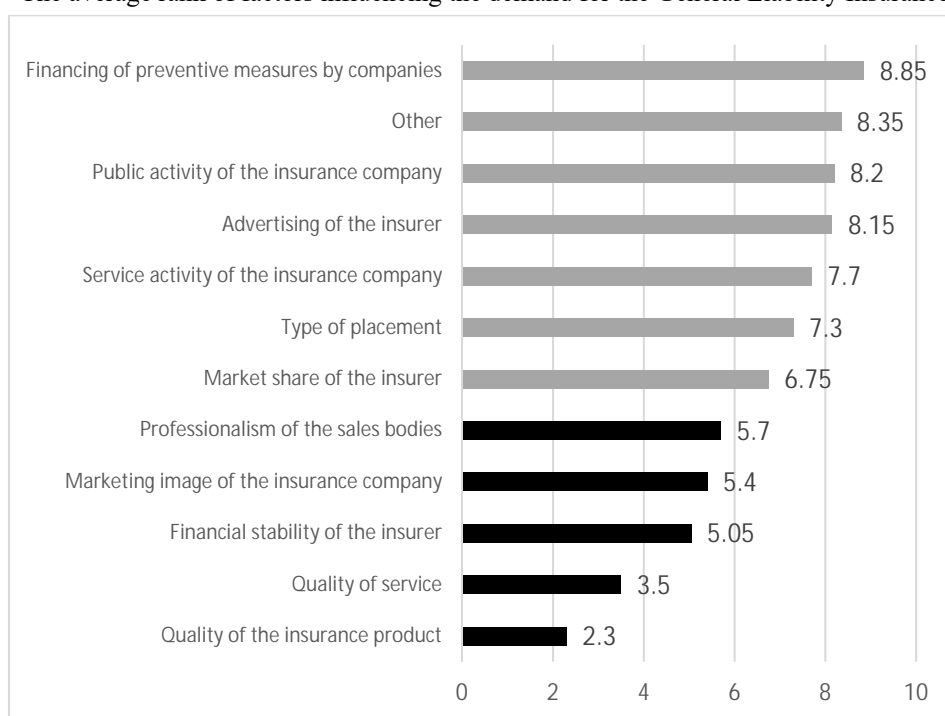
After grouping and summarising the results of the survey, there is a sufficient amount of information on the basis of which a number of connections and patterns between the studied phenomena and processes can be explored. In Appendix 2 of the study, complied correlation tables to analyse the relationships and dependencies among questionnaire responses are presented. On this basis, the following dependencies are examined:

- **First**, *the study of the dependence between the possession of a licence from the Financial Supervision Commission (FSC) for practising the GLI and performing insurance operations under the EPLI.*

The indications among which the relationship is examined are alternative and are represented on the dichotomous scale – two possible responses that represent a simple alternative. Based

on the distribution of the respondents' answers, the coefficients of association, contingency and colligation, known as four-cell correlation coefficients, were calculated.

The presented distribution allows the calculation of the contingency and colligation coefficients, as the requirement that there are no zero values in the cells is less decisive than the association coefficient.

The association coefficient developed by Yule shows the full dependence between the possession of a licence from the FSC for practising the GLI and the performance of insurance operations under the EPLI. The coefficient is equal to 1, because one of the cells of the table is 0, which breaks one of the requirements for applying this coefficient. This problem is not so expressed when calculating the contingency and colligation coefficients.

Pearson's contingency coefficient $\varphi = 0.4804$ and it shows a moderate dependence between the possession of a licence from the FSC for practising the General Liability Insurance and the performance of insurance operations under the EPLI. This is quite logical as the fact that the licence is possessed does not mean that such type of insurance may be taken out automatically because other factors such as – conditions of the insurance and client's trust in the insurer etc., have an impact.

Yule's coefficient of colligation $\gamma = 0.1744$ and it shows little correlation between the possession of a licence from the FSC for practising the General Liability Insurance and the performance of insurance operations under the Environmental Pollution Liability Insurance.

The general conclusion is that it is not enough to possess a licence, but other factors must also be emphasised in order to conclude such an insurance contract.

- **Second**, *study the* dependence *between the possession of a licence from the FSC for practising the GLI and the payment of an insurance sum or indemnity under the EPLI.*

In this case, the studied variables are also alternative, but the four-cell correlation method cannot be applied because it is pointed out that both groups of insurers do not make payments under this insurance.

- **Third,** *study the dependence between the possession of a licence from the FSC for practising the GLI and the need for obligatory EPLI.*

In this case, the variable "the possession of a licence from the FSC for practising the GLI" is an alternative and is presented on a *dichotomous* scale and the variable "the necessity of obligatory EPLI" is presented by the nominal scale and has three definitions. To establish the narrowness of the relationship between them, the correlation coefficients of Chuprov, Pearson and Cramer are used. Due to the small number of units in the population, including licensed non-life insurers in the country, the percentage of *respondents* to the questionnaire, as well as the specifics of liability insurance against environmental pollution, it is necessary to analyse the cross-answers of the first and fourth question. Here again, there are several components, due to which the application of the method has certain conditions. However, due to the importance of the studied relationship, the correlation coefficients of interconnection are calculated and their interpretation is very careful and consistent with the specifics of the applied method.

The value of χ^2 for the studied relationship is 3.6735. The coefficient of Cramer is $V = 0.3622$. Based on the correlation coefficients, this value indicates the presence of a moderate correlation between the possession of a licence from the FSC for practising GLI and the necessity of obligatory EPLI. The interpretation of the results is in accordance with the fact that, in the case of a different number of factors and result determinations, this coefficient never reaches 1, which once again highlights the strength and significance of the studied relationship, exactly that the possession of a licence is crucial for the opinion of the obligatory nature of the EPLI. The coefficient of Chuprov $K = 0.3046$ also shows a moderate correlation dependence, which is also confirmed by the magnitude of the coefficient of Pearson $C = 0.3406$.

- **Fourth,** *the study of the dependence between the possession of licence from the FSC for practising GLI and the assessment for the development of the EPLI within the GLI Branch.*

From the available information, it can be seen that the analysis of the studied dependence can again be performed on the basis of the correlation coefficients of interconnectedness, as in this case, the value of the studied relationship is 2.5397, and the Kramer coefficient is $V = 0.3012$. There is a moderate correlation between the possession of a license by the FSC for the practice of GLI and the assessment of the development of the EPLI within the GLI Branch. As already mentioned, the coefficient again never reaches 1. The results obtained once again emphasise the strength and importance of the studied relationship, namely that the possession of a license is decisive for the assessment of the development of EPLI within GLI Branch. Chuprov's coefficient $K = 0,2532$ also shows a moderate correlation dependence, which is confirmed by the magnitude of Pearson's coefficient $C = 0,2884$.

- **Fifth,** *the study of the dependence between the possession of a licence from the FSC for practising GLI and the assessment for the development of Environmental Insurance on the National Insurance Market.*

Again, the studied dependence is burdened with additional conventions, but in order not to lose analytical information and to adequately reflect the relationships, the results are subjected to *analysis* and comment. For the studied dependence, the value of for the studied relationship is 0.4519, and the coefficients of Kramer, Chuprov and Pearson are respectively, $V = 0,1281$, $K = 0,1077$ and $C = 0,127$. They show a weak correlation between the possession of a license by the FSC for the practice of GLI and the assessment of the development of environmental insurance in the national insurance market. The obtained results are logical since the assessment for the development of the National Insurance Market does not depend only on the possession of a licence from the FSC for practising GLI, but also on many other factors.

- **Sixth,** *the study of the dependence between the possession of a licence from the FSC for practising GLI and the necessity to cover the risk of environmental pollution by a catastrophe insurance pool in Bulgaria.*

The analysis of the studied dependence can again be done on the basis of correlation coefficients of the interconnection of Cramer, Chuprov and Pearson. In order to comply with the requirements for *application* of the method and correctness of the analysis and interpretation of the results, the aggregation of closely related answers is performed. The following results were obtained: the value of the studied relationship is 5.6085. Kramer's coefficient are $V = 0,5295$ and shows the existence of a significant correlation between the possession of a license by the FSC for the practice of GLI and the assessment of the development of environmental insurance in the national insurance market. Chuprov's $K = 0,4453$ and Pearson's $C = 0,4680$ ratios also show moderate to significant correlations. The presented coefficients show well enough the strength and importance of the studied relationship, namely that the possession of a license is decisive for the assessment of the need to cover the risk of environmental pollution from a catastrophic pool in Bulgaria. The obtained results are logical since most insurers are aware that the covering of this risk by the catastrophe pool is necessary and it will have a positive impact on the Insurance Market.

- **Seventh,** *the study of the dependence between the possession of a licence from the FSC for practising GLI and the necessity of legislative changes regarding the EPLI.*

Here again, it is necessary to consolidate the answers into three groups – "yes", "no" and "I can not *judge*". The results of the analysis show that according to Kramer's $V = 0,725$, Chuprov's $K = 0,6097$ and Pearson's $C = 0,587$ coefficients, there is a significant, even strong correlation between the possession of a FSC license for general liability insurance and the view of the need for legislative changes in connection with EPLI.

- **Eighth,** *the study of the dependence between the possession of a licence from the FSC for practising GLI and the necessity to differentiate the limits of liability of EPLI according to the different sectors of the economy.*

The available information warrants the analysis to be based on the four-cell correlation coefficients – the association coefficient, contingency coefficient and colligation coefficient. The results of the analysis show that the association coefficient of Yule $Q = 0.4706$ estimates the dependence as moderate to significant. The contingency coefficient $\varphi = 0.1905$ and colligation coefficient $\gamma = 0.1748$, show that there is low to moderate correlation dependence between the possession of a licence from the FSC for practising GLI and the necessity to differentiate the limits of liability of EPLI according to the different sectors of the economy. This relationship is not strong and the main reasons for this should be sought in the fact that this is a relatively new *risk* covered on the national insurance market.

- **Ninth,** *the study of the dependence between the possession of a licence from the FSC for practising GLI and the assessment of the role of environmental insurance as a tool in the corporate risk management of enterprises with hazardous production.*

The distribution of responses to these two questions, although with some conventions, allows the calculation of correlation coefficients of interconnectivity. The results of the analysis show that according to Cramer's coefficient $V = 0.3839$, Chuprov's coefficient $K = 0.3228$ and Pearson's coefficient $C = 0.3584$, there is a moderate to significant correlation between the possession of licence from the FSC for practising General Liability

Insurance and the assessment of the role of environmental insurance as a tool in the corporate risk management of enterprises with hazardous production. The results show that insurers licensed by the FSC to practise GLI considered this type of insurance as an important determining instrument, in corporate risk management, especially when it concerns *enterprises* with hazardous production.

In the analysis of the official statistical data presented to the FSC, it is generally found that the development of EPLI follows the dynamics in the development of GLI, due to the fact that the results are reported in this class of insurance, according to the Insurance Code. The information shows that in the period 2014-2019, there were no major fluctuations in the premium income of GLI, which averages about BGN 40 million on the national insurance market. A significant increase has been observed in the last two years (2020 – 2021), when the premium income exceeds BGN 50 million. The analysis of the data shows an increase in premium income in the last two years of the analysed period and increased demand for insurance protection, regardless of the impact of the COVID crisis in the country (Table 1.)

Table 1

Premium income in the General Liability Insurance class (in BGN)

Year	Premium income	Including active reinsurance
2014	34 646 294	5 976
2015	37 480 563	144 082
2016	40 225 973	41 180
2017	41 774 523	34 044
2018	37 984 978	70 485
2019	42 213 100	479 492
2020	50 466 871	322 801
2021	57 433 626	294 406

Source: FSC.

There is also no significant change in the relative share of the premium income of GLI Class in the structure of the premium income of the Non-life insurance branch, which amounts to only 2% on average for the analysed period (Table 2).

Table 2

Relative share of the premium income of the GLI class in the structure of the Non-life insurance branch (in %)

2014	2015	2016	2017	2018	2019	2020	2021
2	2	2,5	2,4	1,8	1,7	2,1	2,2

Source: FSC.

In this regard, however, it could be recommended to clarify the submission of statistical information by insurance companies of the GLI class to the FSC. The general reporting of the data in this class of insurance does not allow us to trace the dynamics of the premium income of specific insurance products, for example, of the different types of professional liability insurance, including EPLI.

Conclusion

On the basis of the author's research, as well as on the basis of the summarised and analysed information from the conducted marketing *research*, some **main conclusions** can be highlighted in the study:

First. With regard to *the first formulated hypothesis*, it is proved that business units still demonstrate reserved consumer behaviour in seeking security through environmental insurance. According to insurers, the difficulties in risk assessment and the lack of experience and traditions of companies in offering environmental insurance products, as well as imperfections in insurance legislation, are the main reasons for the insufficient use of the benefits and effects of environmental insurance by legal entities.

This hypothesis is confirmed by the opinion of experts from industrial enterprises in the chemical industry, according to which the factors complicating the offer of EPLI in Bulgaria (ranked first in importance) are the following: imperfections in the legal framework, lack of insurance interest on the part of industrial enterprises, high limits of insurance liability, difficulties in risk assessment.

Second. Regarding *the second hypothesis*, it is stated that environmental insurance at the present stage has not yet become widespread in Bulgaria, and as a reason, there are a number of complicating factors. The insurers themselves, who participated in the survey, share (65% of the respondents) that the state of environmental insurance on the national insurance market is "rather bad" and "bad". The uncertainties surrounding the creation of a national catastrophic pool to cover environmental risks, and the still lack of one, are forcing insurers to refrain from offering environmental insurance.

Regarding the demand for EPLI, the specialists from the chemical industry in Bulgaria indicate the main factors determining the conclusion of insurance contracts, namely: the financing of preventive measures by insurers, the financial stability of the insurer, the market share of the insurer and the qualities of the insurance product. An important complicating factor here is the adequate determination of the limits of the insurance liability. According to the respondents in the enterprises of the chemical industry, the need to differentiate the limits of liability against the risk of "environmental pollution" according to the sub-sectors in the sector is at the forefront.

Third. Regarding *the third hypothesis*, the positive role of environmental insurance on the effectiveness of corporate risk management is proved. This is the opinion of 75% of respondents. Experts in insurance practice are of the opinion that the transfer of risk through insurance removes the "economic burden" of companies whose insurance security costs are relatively small compared to possible major future damage caused by environmental risk. This is one of the main effects of insurance protection in the context of corporate security of the business unit.

Experts in the chemical industry answer in a similar way, as the opinion of the majority of respondents, is that the role of environmental insurance as a tool in corporate risk management of enterprises with hazardous production is positive. According to the respondents, the benefits of environmental insurance should be sought in maintaining the

economic stability of enterprises and ensuring their competitiveness, reducing the vulnerability of the socio-economic system of the country by covering the consequences of man-made disasters and industrial accidents, providing an additional source of non-state funding for environmental protection measures and providing victims with social and legal guarantees to compensate for damage caused by environmental pollution.

According to the conclusions made in the development, several basic **recommendations** can be outlined, which should be important for improving the relations between the entities in the conduct of environmental insurance and for its future development in the Bulgarian insurance market. They are the following:

First, there is a need to apply underwriting (Misheva, I., 2015, pp. 34-46) in the insurance of environmental risks with technogenic nature, taking in account the fact that the successfully applied underwriting business process in the environmental pollution liability insurance leads to increasing the competitiveness of the companies and increasing the demand on the national insurance market.

Secondly, there is a need for the implementation of a full-fledged legal framework and methodological framework at the national level for the introduction of environmental insurance in a mandatory form. For example, unlike a number of countries, where EPLI is mandatory, in Bulgaria, it is voluntary even for industrial enterprises with hazardous production. On the other hand, there are insufficient incentives for the development of voluntary environmental insurance to create more favourable conditions for industrial enterprises as consumers of insurance services.

Third, the consideration of environmental insurance as an element of the economic mechanism to insure environmental security and safety in industrial enterprises requires the development of accurate system approaches and principals for creating an effective system of insurance protection in order to guarantee the property interests of legal entities and individuals.

Fourth, a balanced combination of insurance and prevention in the context of corporate risk management will lead to the preservation of the favourable environmental state, the recovery of the ecological conditions in ecologically unfavourable areas and will guarantee the protection of the population from the negative influence of the anthropogenic and the technogenic impacts.

Fifth, the differentiation of the limits of liability of EPLI, according to the various sectors of the economy, can be a decisive incentive to increase the insurance interests of industrial enterprises in the country.

Sixth, the need for changes in insurance legislation can be justified by the manifestation of cross-border losses caused by environmental risks, which determines the need to create a catastrophic pool at a national and, if necessary, regional level.

Seventh, the results of the conducted marketing research prove that the still poor demand and supply of environmental insurance in Bulgaria are due to the fact that this insurance branch includes relatively new insurance products for the national insurance market. There is a need

to apply the "positioning" strategy by specialised companies for the purpose of imposing the EPLI in specific sectors of the economy.

Eighth, the implementation of marketing research in the environmental insurance market is an essential prerequisite for studying consumer demand, respectively, for undertaking marketing actions to form insurance needs and interests, as well as to increase the insurance and environmental culture of the population.

Based on the research, some findings can be made to solve **basic problems** and **aggravating factors** of conceptual and methodological nature in insuring environmental risks. These are:

- There is a need to improve the insurance protection of the companies, which could be achieved through the implementation of flexible marketing strategies aimed at differentiating, innovating and promoting insurance products of the Ecological Insurance Branch.

- The main focus in implementing the marketing policy of insurers specialising in the environmental insurance should be the conduct of marketing research to study consumer behaviour and consumer satisfaction in the national insurance market. Essential for the successful implementation of marketing research is its organisation. The achievement of the expected results from the study of a specific insurance market is based on the specific preparation for its implementation, taking into account the benefits and competitive advantages of the studied insurance, conditions and dynamics of the selected target insurance market and etc.

- Future marketing research should be carried out on the basis of gathering information and studying the behaviour of all subjects involved in the conduct of environmental insurance in the country. For instance, it is necessary to have specific information not only from insurers, but also about the case law related to claims of third parties affected by environmental technogenic risks, as well as by industrial enterprises as legal entities – consumers of insurance services. Interest in terms of marketing research would be the opinions and assessments of magistrates, lawmakers and experts from the FSC regarding the implementation of future legislative changes concerning the EPLI and the possibility of introducing the compulsory nature of this type of insurance.

- In the last few years, no changes have been made to the Insurance Code with regard to environmental insurance and the elimination of some inaccuracies in specific texts and the use of insurance terminology. There is still no clarity on the issue of creating a catastrophic pool for environmental risks in Bulgaria.

- Difficulties in the author's analyses also stem from the fact that there is no official statistical information on specific indicators related to the dynamics of environmental insurance in the country. The author does not have statistics on the studied liability insurance against environmental pollution, due to the fact that the information provided by supervised entities to the FSC on their insurance contracts is systematised at the level of insurance classes according to Annex № 1 of the Insurance Code (IC), and not according to the insurance products offered by the insurers. In this sense, the studied insurance falls into the GLI class under item 3 of Section II of Annex N 1 and is reported together with the other insurance in this class.

- Another aspect of the research difficulties is the lack of official information on claims by victims of environmental pollution as a result of accidents in industrial enterprises, as well as the manifestation of environmental risks of anthropogenic nature in our country.

We hope that success in conducting the insurance of environmental risks can be achieved by applying the Solvency II Directive (DIRECTIVE, 2009), the implementation of the International Standard ISO 14001:2015 concerning the protection of the environment (ISO, 2015) and Directive 2012/18/EU on the control of major-accident hazards.

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A CRITICAL EVALUATION OF THE CONSUMER CONFIDENCE SURVEY FROM INDIA[3]

This study examines the relevance of the quarterly Consumer Confidence Survey conducted by the Reserve Bank of India by analyzing consumers' spending behaviour vis-a-vis their expectations and perceptions of inflation in the Indian context. The ordered probit regression results demonstrate the positive influence of expected and perceived inflation and the negative influence of expected change in current real income and perceived change in current real income on the expected change in real spending. These results are not commensurate with underlying economic theories, which render the relevance and purpose of these surveys questionable. A few other results and observations from the respondents' demographic profile further strengthened our argument. In an emerging economy such as India, such surveys and their analyses are at a budding stage, and this is the first study to question the validity and relevance of these surveys. The present study also contributes to our understanding of how households expect and perceive inflation and incorporate them into their decision-making, which is pertinent for the efficacy of central banks as inflation targeting is the main objective of monetary policy.
Keywords: Inflation expectations; Perceived inflation; Consumer spending; Real income; Consumer Confidence Survey; Ordered probit
JEL: D12; D84; E20; E70

1. Introduction

The theories on expectations and perceptions about inflation emphasize the impacts of these concepts on the economic behaviour of individuals in terms of their investment, borrowing, and spending decisions (Springer, 1997; Bachmann et al.; 2015; Ichiue, Nishiguchi, 2015; Abaidoo, 2016; Vellekoop, Wiederholt; 2019). Both inflation expectations and perceptions are argued to influence each other, along with price changes in the environment, attitudes, income levels, economic forecasts, and social amplifications that affect either of them or both (Ranyard et al., 2008). Furthermore, inflation perceptions are expected to increase with a higher frequency of price increases of the experienced products, along with the information on past inflation of the product and its accessibility (Huber, 2011; Gärling et al., 2013; Del

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Missier et al., 2016). On the other hand, inflation expectations are anchored on the inflation forecasts of central banks as well as on demographic and socio-economic factors (Szyszko, Płuciennik; 2018; Das et al., 2019).

While numerous studies till date have focused on the formation of inflation expectations and perceptions (Ranyard et al., 2008; Branchinger, 2008; Drager 2015; Szyszko, Płuciennik, 2018), much less attention has been paid to understand how they affect consumers' behaviour in terms of economic decision making. Hence, this paper is focused on one such consequence of perceived and expected inflation, namely consumer spending. A dearth of literature both in the Indian and global context makes it a pertinent topic for further research. It is imperative to examine whether inflation perceptions and expectations and the consequent spending decisions of consumers are made consciously by considering all the available information or if they are merely naive statements. One way of doing so is to check for consistency of the relationship between inflation expectations and perceptions on the one hand and the spending behaviour of individuals on the other. For instance, using consumer survey data, Yadav and Shankar (2014-2015) demonstrated a positive relationship between expected inflation and current consumer spending and a negative relationship between perceived inflation and current consumer spending. The researchers considered data pertaining to the period of March 2011 – September 2014. However, it needs to be reviewed whether such observations hold good in the recent scenario. As inflation perceptions and expectations play a crucial role in determining current spending, which in turn might impact demand and growth in the aggregate economy, the measurement of public beliefs via their responses in the survey conducted by the central bank is important for policymakers and scholars.

Against this backdrop, this study first examines the effects of inflation expectations and perceptions on expected change and perceived change in consumer spending. The development of expected inflation might have some influence on perceived inflation and vice versa. Hence, this aspect is also examined. We also assess the impact of expected (perceived) inflation on expected (perceived) change in real income because the former may impact the expected (perceived) spending of households indirectly through the latter. Finally, the impact of demographic variables on consumer spending is also examined. The study uses quarterly Consumer Confidence Survey data pertaining to the period of March 2015 – December 2018, which are collected and published by the Reserve Bank of India (RBI).[4]

In its attempts to examine the interrelationship between consumers' expectations and perceptions about prices, spending, and income, this study has commented critically on the validity of the surveys conducted by the RBI. Although the same methodology framework applied by previous researchers in the Indian context was used, our analysis also investigates other dimensions for a complete understanding of the consumers' decision-making process. Furthermore, the analyses of our regression-based results are complemented with observations based on descriptive statistics to make our arguments rigorous, along with robustness checks. In a developing economy such as India, such surveys and their analyses are at a budding stage and need to be designed and implemented cautiously for their results to be meaningful in policymaking. Finally, an attempt to compare our findings with those of

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[4] At the time the research was conducted, Consumer Confidence Survey data with the RBI was available only for this period.

Yadav and Shankar (2014-2015) and Ichiue and Nishiguchi (2015) has been made in the conclusion section to consider the generality of the findings across various inflation rates. The study highlights how the lack of knowledge on prices, income, and spending behaviour can lead to unreliable survey data. Respondents' over-reporting of inflation expectations and perceptions, low education levels, hailing from the low and lower-middle-income groups, and getting analysis results that are not in commensurate with the economic theories defies the motive of using the survey information in the monetary policy. The surveys are of utmost importance for anchoring households' inflation expectations and, therefore, consumer welfare. The professionals and experts also rely on this survey data to gauge an economy's inflationary trends and monetary credibility. Overall, the efficacy of the central banks gets impacted when the survey data are not reliable, and hence these surveys need to be structured and analyzed carefully.

The rest of the paper has been organized as follows: Section 2 presents a review of the literature. Section 3 states the objectives, and Section 4 includes a description of the data and the methodology adopted. Section 5 presents the results, and Section 6 discusses the findings. Finally, Section 7 concludes the paper.

2. Literature Review

Among the notable studies in recent years, Brachinger (2006, 2008) outlined a theory on "perceived inflation" and constructed an index for calculating annual perceived inflation based on official data available on price changes rather than on survey data. The researcher applied the theory to Germany at the time of the introduction of Euro notes and coins, and used the Laspeyres formula for calculating the Index of Perceived Inflation. Jungermann et al. (2007) investigated the influence of purchase frequency and loss aversion on individual judgments of price changes. These factors were hypothesized by Brachinger (2008) in constructing the Index of Perceived Inflation.

Ranyard et al. (2008) offered a conceptual framework that started with price changes in the economy and examined how it led to the formation of perceived inflation among people, which was impacted by their attitude in the previous period and their personal income. Along with media and word of mouth, previously held expectations regarding the current period also contributed to inflation perceptions. Furthermore, all these factors led to the development of inflation expectations, which were also influenced by economic forecasts and social amplifications. Ultimately, these perceptions and expectations about prices shaped the economic behaviour of individuals in an economy.

Studies on the interaction between the inflation perceptions and expectations of households and monetary policy have examined the direction of causality from both sides. While Woodford (2005) concentrated on the importance of inflation expectations in monetary policy effectiveness, Dräger (2015) focused on reverse causation. He observed that actual inflation rates did not play a role in the development of inflation perceptions and expectations and that media had a small and asymmetric influence on the linkages among perceived, expected, and actual inflation. The study also showed that if the Swedish central bank wanted to anchor inflation expectations, involving other effective communication channels would

have had a direct impact on the inflation perceptions and expectations of households. Szyszko and Płuciennik (2018) considered a sample of three banks, namely, the Bank of England (BOE), the Bank of Sweden (SR), and the Czech National Bank (CNB), and showed that the central banks' forecasts acted as an anchor for the inflation expectations of the households in these countries.

Springer (1997) showed that with high expected inflation, real income expectations were revised downward and there was less consumer spending in all categories. Bachmann et al. (2015) observed that with an increase in expected inflation, consumer spending on durables did not increase and was also statistically insignificant. The researchers backed these results with the concept of money illusion, i.e., households in the country understood how nominal interest rates impacted spending but did not have an understanding of how inflation expectations did. In Japan, the consumers who expected higher inflation tended to increase their real current spending compared with that one year ago and reduce their real future spending (Ichiue and Nishiguchi, 2015). Abaidoo (2016) observed that inflation expectations had a positive impact on expenditures related to non-durable goods and services but a negative impact on durable goods, i.e., the substitution effect was stronger for durable goods than for non-durables and services. Vellekoop and Wiederholt (2019) examined the relationship between the inflation expectations of households and their consumption–saving decisions. The results indicated that the households expecting high inflation tended to spend more and save less.

Another strand of studies includes those based on experiments. Some of these investigations showed that the inflation perceptions of the respondents increased with the frequency of product purchase and their prices and knowledge about the past inflation of the product. The inflation perceptions were also significantly impacted by the products' accessibility and the attitude of the consumers (Huber, 2011; Gärling et al.; 2013; Del Missier et al., 2016). One experimental study by Gärling and Gamble (2008) conducted in the Euro region revealed that nominal representations of currencies did not have a significant effect on perceived and expected inflation. In a controlled, lab-based experiment involving 50 members, Luhan et al. (2014) showed that the respondents reacted less to expected changes in future prices and interest rates than to their actual changes. Based on this observation, the authors suggested that monetary policymakers must not rely on the announcement effects of future policies. Gärling et al. (2013) showed that the respondents' ratings for the expensiveness of the products and the total expenditures increased when they were informed about past inflation but did not decrease when they were informed about an increment in income.

Several studies have focused on the methodological issues in the measurement of perceived inflation. Hoffmann et al. (2006) observed that European Union consumer surveys provided direct direction and true indications of consumers' perceptions. The researchers reported that the people of Germany perceived high inflation only in January 2002, after which the inflation perceptions fell by the end of that year. This result contradicted the observations of Brachinger (2006, 2008), who argued that even in 2005, the percentage of consumers perceiving higher inflation was greater than that of those perceiving a lower inflation. Dias et al. (2010) indicated the inappropriateness of balance statistics for measuring the perceived inflation by the European Commission, where they showed no substantial difference between observed and perceived inflation at the time of currency changeover in the Euro region and

in individual countries. Meyer and Venkatu (2011) observed substantial demographic differences in inflation expectations in the US because of a mismeasurement of the respondents' average expectations. Following the distribution of the survey responses, the authors suggested that instead of mean, the median should be used for comparing the demographic differences in inflation expectations. Another study by Armantier et al. (2015) discussed the relevance of the questionnaires used by the central bank of the US to analyze the inflation perceptions and expectations. They found that the respondents acted in sync with what they stated in the survey, which confirmed the relevance of the surveys on inflation expectations in the US. Respondents who did not behave according to their inflation expectations had lower education, numeracy skills, and financial literacy. This finding also implies that these surveys are useful for devising monetary policies aimed at targeting inflation.

2.1. Studies conducted in the Indian context

Not many studies have been conducted on inflation expectations and perceptions in the Indian context. To the best of our knowledge, the first study to empirically analyze inflation expectations and consumer spending in India is the one by Yadav and Shankar (2014-2015). They estimated models of "real expected spending one year from now" and "real current spending" using the ordered probit method. The independent variables were expected and perceived inflation, along with control variables such as expectations and perceptions on household circumstances, income, general economic conditions, and employment. The results suggested that the respondents who expected higher inflation were more likely to increase their real current spending compared with the spending one year ago and decrease their real future spending. This finding agrees with the general understanding that expected real spending decreases with expected inflation.

Several RBI reports have been published to shed light on the perspectives of households on inflation and their expectations. In one such report (February 2019), results pertaining to a survey conducted in December 2018 in 18 cities across 5828 households were presented. The findings showed that compared with November 2018, the respondents expected a sharper decline in the general price level for three-month and one-year ahead time horizons in almost all the product groups. The highest current inflation was perceived by self-employed individuals, respondents in the age groups of 40-45, 50-55 and ≥60 years, and those from Ranchi and Kolkata. Another Consumer Confidence Survey report of RBI (February 2019) assessed the expectations and perceptions of households about inflation, their income and spending, general economic condition, and employment scenario. The survey was conducted in December 2018 and encompassed 5347 households across 13 cities in India. A Consumer Confidence Index (CCI) was constructed, which signified that although the respondents were pessimistic, overall, the CCI increased by 2.8 points against the Current Situation Index and by 8.9 points against the Future Expectations Index. Current perceptions about overall economic condition and employment were negative but showed signs of improvement in the future. The respondents were optimistic about the current as well as one-year ahead price situation. Sentiments about current and future spending, as well as current income, were mostly unaltered, while the respondents were optimistic about their future income.

The latest study in the Indian context by Das et al. (2019) analyzed the dynamics of inflation expectations along with their relevance using the Inflation Expectations Survey of Households (IESH) conducted by the RBI. The authors quantified the qualitative values of the survey using HOPIT regression and compared them with the balance statistic published by the RBI. The results indicated that quantifying the expected inflation from the qualitative surveys was a viable alternative to balance the statistics for tracking the actual inflation rate. The study also illustrated that the extreme inflation expectation values reported by the respondents were primarily influenced by their demographic and socio-economic experiences. Furthermore, since the respondents might most often not be able to recall the actual inflation, qualitative surveys are preferred.

A review of the extant literature presented above suggests that studies across many countries, mostly developed ones, have addressed different aspects of inflation expectations and perceptions. However, these investigations have failed to reach a consensus on their economic interrelationship with other variables. The academia has also questioned the relevance of such consumer surveys conducted by the central banks of various countries. Several experimental studies were also conducted to analyze the diverse aspects of inflation perceptions and the impacts of the anticipation effect and income knowledge on inflation expectations. Internationally, studies have also dealt with the problem of how central banks can communicate effectively for a better and more direct impact on inflation expectations and perceptions of consumers. In developing economies, particularly in the Indian context, research on these issues is at a nascent stage. While the RBI analyzes the inflation expectations, perceptions, and consumer spending behaviour in India, the generalization of these results across time could not be confirmed. Hence, the present study attempts to complement the existing research in terms of using more meaningful methodologies and in-depth data analyses for a different time period characterized by differing economic conditions.

3. Objectives, Hypotheses and Models

3.1. Objectives

The previous studies on inflation perceptions and expectations, particularly the one by Yadav and Shankar (2014-2015), motivated us to further analyze the inflation expectations and perceptions with regard to consumer spending in India for a different time period of March 2015 – December 2018. Our study period was less inflationary compared with 2011-2014. Additionally, we attempt to explore a few other dimensions of the interrelationship between the expected and perceived inflation and spending of consumers. The objectives to be addressed in this study are:

Objective 1: To examine the effects of inflation expectations and perceptions on the consumers' expected change in real spending;

Objective 2: To analyze the effects of inflation expectations and perceptions on the consumers' perceived change in current real spending;

Objective 3: To assess the bivariate relationship between expected and perceived inflation;

Objective 4: To examine the effects of expected (perceived) inflation on the change in real expected (perceived) income. This analysis may help us understand whether there is an indirect relationship between expected (perceived) inflation and spending while working through changes in expected (perceived) income;

Objective 5: Based on the above results, we attempt to critically assess the relevance of the Consumer Confidence Survey conducted by the RBI. This objective will be addressed via a detailed discussion of the results obtained for the abovementioned objectives.

3.2. Hypotheses

On the basis of the abovementioned objectives, we formulate six hypotheses: four pertaining to the first two objectives and two related to the third and fourth objectives. Regarding the relationship between inflation expectations and consumers' expected change in real spending, we conjecture that when prices are expected to rise, people plan to spend less in the future. Even if the expenditure on items of necessary consumption and, thus, the overall nominal spending remains unchanged, the expected price hike is likely to reduce the expected real spending. Real spending will increase with the increase in prices only if the increase in nominal spending exceeds the increase in prices. However, the survey data contain information only on the expected direction of change and not the dimension of change. Based on the above argument, Hypotheses 1 is formed as,

H1: *Expected inflation has a negative impact on the expected change in real spending*

Similarly, following Objective 2 on the impact of inflation expectations and perceptions on consumers' perceived change in current real spending, we surmise that when prices are expected to rise, current spending will increase. Therefore, an expected hike in prices for given nominal spending is perceived to increase current real spending. Hypothesis 2 is formed as

H2: *Expected inflation has a positive impact on perceived change in current real spending*

Furthermore, when current prices are perceived to increase, people may spend less in the present. Therefore, a perceived increase in prices for given nominal spending may lower perceived current real spending. Hypothesis 3 is formulated as,

H3: *Perceived inflation has a negative impact on perceived change in current real spending*

Finally, when current prices are perceived to increase, people may spend less in the present and may plan to increase spending in the future. Hence, a perceived increase in prices for given nominal spending is expected to increase expected real spending. Hence, hypothesis 4 is formulated as,

H4: *Perceived inflation has a positive impact on the expected change in real spending*

Ranyard et al. (2008) argued that inflation expectations and perceptions might impact each other with a likely positive effect. They argued that inflationary expectations of the current period formed in some previous period could lead to biased perceptions about the current period, as experienced at the time of currency changeover in the Euro region. Similarly, high

inflation perceptions can lead to high inflation expectations as well. However, the effect could also be negative if the current high inflation is expected to subside in the subsequent periods and vice versa. This bivariate relationship between expected inflation and perceived inflation is tested via hypotheses H5 (a) and H5 (b).

H5 (a): *Expected inflation has a positive impact on perceived inflation*

H5 (b): *Perceived inflation has a positive impact on expected inflation*

Finally, we surmise that expected (perceived) inflation may impact expected (perceived) change in real spending indirectly via expected (perceived) change in real income. When prices are expected to escalate (down), nominal income may not change readily, but real income is impacted negatively (positively). People would adjust their real spending according to the changes in their real income. Thus, we expect an inverse relationship between expected inflation and expected change in real income. To verify our claim, we construct and test the following hypotheses.

H6 (a): *Expected inflation has a negative impact on the expected change in real income.*

H6 (b): *Perceived inflation has a negative impact on perceived change in real income.*

If most economic agents act according to the arguments presented above, their behaviour can be predicted based on their expectations and perceptions. The policies of central banks may be more effective if they are formulated by incorporating these predictions.

Figure 1
Conceptual framework of the relationships hypothesized among the expected (perceived) inflation, expected (perceived) change in real spending and expected (perceived) change in real income
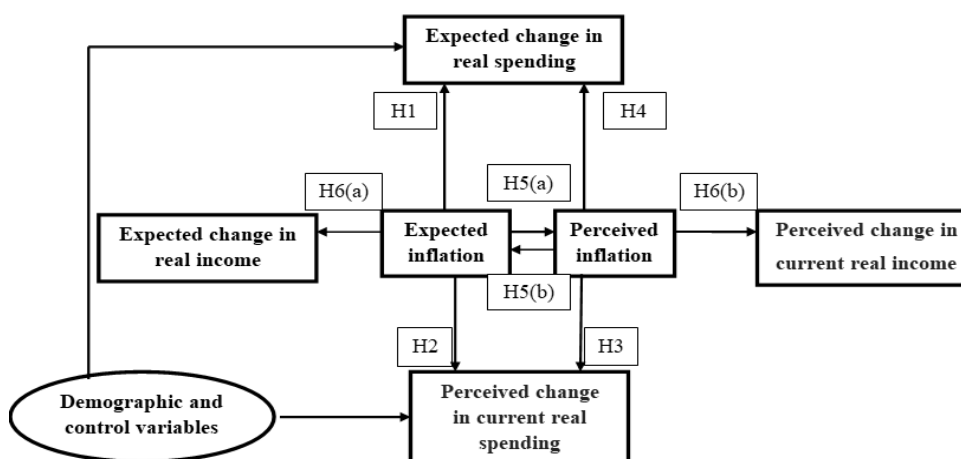
Source: Authors.

3.3. Models

Table 1 presents a description of the models estimated. Hypotheses 1-4 are tested by estimating two models, Model 1 and Model 2. And Model 3 and Model 4 test hypotheses 5 and 6.

Table 1

Description of the Models

Models	Dependent variable	Independent variables
Model 1	Expected change in real spending one year from now.	i) Outlook on general prices one year ahead; we term it as 'expected inflation' or 'prices one year from now'[5] ii) Perception on general prices one year ago; termed as 'perceived inflation' or 'prices compared to one year ago' ii) Control variables, namely, expected general economic conditions, expected employment scenario, and expected change in real income, all one year ahead iv) Demographic variables; refer to Table 3
Model 2	Perceived change in current real spending compared to one year ago.	i) 'Expected inflation' or 'prices one year from now' ii) 'Perceived inflation' or 'prices compared to one year ago' iii) Control variables, namely, perception on general economic conditions, perception on employment scenario, and perceived change in current real income as compared to one year ago iv) Demographic variables, mentioned in Model 1
Model 3(a) Model 3(b)	Expected inflation Perceived inflation	i) 'Perceived inflation' ii) 'Expected inflation'
Model 4(a) Model 4(b)	Expected change in real income Perceived change in current real income	i) 'Expected inflation' or 'prices one year from now' ii) 'Perceived inflation' or 'prices compared to one year ago'

4. Data Description and Methodology

The paper is primarily based on pooled micro-data from the Consumer Confidence Survey conducted by the RBI[6]. The data includes quarterly observations for the period March 2015 – December 2018. This survey was conducted in 13 cities, namely Bangalore, Chennai, Delhi, Mumbai, Ahmedabad, Bhopal, Guwahati, Hyderabad, Jaipur, Kolkata, Lucknow, Patna, and Trivandrum, with a total number of respondents of 87466.

The Consumer Confidence Survey questionnaire deals with a variety of questions and obtains qualitative responses on the expectations and perceptions of consumers on the general price level, household spending, income, general economic conditions, employment scenario, and other economic indicators. Hence these variables made the basis of our study for conducting the analysis. All the variables considered for analysis are suggested by the literature (Yadav, Shankar, 2014-2015; Ichuie, Nishiguchi, 2015; Bachmann et al., 2015). We have also compared the results of our study in conclusion with the studies mentioned above, as the variables used in all these studies are basically the same. These responses are recorded on a

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[5] Expected inflation (perceived inflation) and prices one year from now (prices compared to one year ago) are used interchangeably in the paper.
[6] The possible differences arising out of change in time of the survey collected is not considered in the paper.

three-point scale, i.e., increase, remains the same, and decrease. Following Yadav and Shankar (2014-2015) and Ichuie and Nishiguchi (2015), we calculated the expected and perceived changes in real spending and real income by synthesizing the responses to four questions about expected (perceived) inflation and expected change in nominal spending (change in actual nominal spending compared to one year ago), i.e., Question 14 (12) and Question 9 (7) in the Consumer Confidence Survey, respectively. Similarly, we used Question 5 and Question 6 for change in actual nominal income compared to one year ago and expected change in nominal income, respectively.

The questions are as follows:

Q9: Do you plan to increase or decrease your spending within the next twelve months?

a. Increase

b. Neither increase nor decrease

c. Decrease

Q14: In which direction do you think prices will move one year from now?

a. Will go up

b. Will remain almost unchanged

c. Will go down

Q7: How have you (or other family members') changed consumption spending compared with one year ago?

a. Increase

b. Neither increase nor decrease

c. Decrease

Q12: How do you think the overall prices of goods and services have changed compared with one year ago?

a. Gone up

b. Remained almost unchanged

c. Gone down

Q5: How has your income (or/and other family members' income) changed from one year ago?

a. Increased

b. Remained the same

c. Decreased

Q6: What do you expect your income (or other family members' income) will be one year from now?

a. Increase

b. Remain the same

c. Decrease

Similarly, expectations and perceptions about general economic conditions and employment scenarios are measured through Question 2 (1) and Question 11(ii) (11(i)) in the Consumer Confidence Survey, respectively. The questions are as follows:

Q2: How do you foresee economic conditions one year from now?

a. Will improve
b. Will remain the same
c. Will worsen

Q1: How do you think economic conditions have changed compared with one year ago?

a. Improved
b. Remained the same
c. Worsen

Q11(ii): In consideration of the situation one year from now, what are your views on the employment scenario?

a. Will improve
b. Will remain the same
c. Will worsen

Q11(i): In consideration of the situation as compared to one year ago, what are your views on the employment scenario?

a. Improved
b. Remained the same
c. Worsen

Expectations and perceptions about general economic conditions, employment scenario, and other economic indicators were coded as +1, 0, and -1, for improve, remains the same, and worsen, respectively. We coded the change in nominal spending and coded price as +1, 0, and -1 for increase, remains the same, and decrease, respectively. We further used them to calculate expected and perceived change in real spending and real income.

Expected change in real spending = Expected change in nominal spending – expected inflation;

Perceived change in current real spending = Change in actual nominal spending compared to one year ago – perceived inflation compared to one year ago;

Expected change in real income = Expected change in nominal income – expected inflation;

Perceived change in current real income= change in actual nominal income compared to one year ago – perceived inflation compared to one year ago;

Table 2

Calculation of Expected Change in Real Spending or Real Income[7]

		Prices one year from now		
		Increase	Remains constant	Decrease
Nominal expected spending or income	Increase	Same	Increase	Significant Increase
	Remain constant	Decrease	Same	Increase
	Decrease	Significant Decrease	Decrease	Same

The responses to the question on change in real spending are given in Table 2. These responses were used as a dependent variable in Models 1 and 2. Each of the variables mentioned above comprised five categories, which were explained using a representative matrix, as shown in Table 2. Since the values ranged from −2 to 2, the five categories were identified as significantly decrease (−2), decrease (−1), remains constant (0), increase (1), and significantly increase (2). The categories of the remaining three variables were also formulated in a similar fashion. The survey also provided information on a host of demographic variables, all categorical in nature. We used the following coding for the demographic variables:

- Gender: male = 0, female = 1

- Employment status: employed = 1, otherwise = 0

- Age groups: ages between 22-59 = 0, age ≥ 60 = 1

- Family size (FS): number of family members ≤ 4 = 0, 5 and more = 1

- Annual income: income ≥ ₹ 5 lakhs = 3; income between ₹ 3 lakhs to 5 lakhs = 2; income between ₹ 1 lakh to 3 lakhs = 1; and income ≤ ₹ 1 lakh or less = 0.

Table 3 summarizes the data on demographic variables. As evident from the figures, there was not much of a disparity in the number of males and female respondents. This lack of significant difference also applied to the number of respondents in the categories of family size. However, the categories of age group, employment status, and annual income were substantially different in terms of the percentage of respondents in each category. It should also be noted that the majority of the men and women belonged to the working age group category of 22-59 years and were either self-employed or unemployed. Moreover, nearly 90% of the respondents belonged to the low and lower-middle income classes, with an annual income of less than ₹ 3 lakhs (Mallapur, 2019).

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[7] The respondents mentioned no objective values or the extent of change, hence for simplicity coding assumes that the inflation is of the same size as the nominal change.

Table 3

Details of Demographic Variables

Variables		Total Number	Percent
Gender	Female	41629	47.6
	Male	45837	52.4
Age	22-59 years	78946	90.3
	60 years & above	8520	9.7
Occupation of Respondent	Employed	21455	24.5
	Others	66011	75.5
Number of family members	Equal or less than 4	49957	57.1
	Above 4	37509	42.9
Annual Income	Rs. 5 lakh or more	2480	2.8
	Rs. 3 lakh to 5 lakh	6524	7.5
	Rs. 1 lakh to 3 lakh	39830	45.5
	Rs 1 lakh or less	38632	44.2

The models (except for Model 3) outlined in Table 1 were estimated using ordered probit because our data were ordered and categorical in nature. The same technique was employed by Yadav and Shankar (2014-15) and Ichuie and Nishiguchi (2015) too; hence, our results could be directly compared with their findings. We also obtained alternative estimates with ordered logit regression. However, the results remained the same. Hence, we have reported only the results pertaining to ordered probit models.

For all the models, the probit function is

$$P_i = \frac{1}{1+e^{-z_i}} = \frac{e^{z_i}}{1+e^{z_i}} \qquad (1)$$
where:
    P_i is the maximum likelihood function,
and $z_i = \beta_{0i} + \beta_{1i}X_{ji} + u_i$
where:
    β_{0i} – intercept term
    β_{1i} – vector of parameters for the ith observation
    X_{ji} – vector of independent variables for the ith observation (including the control variables), and
    u_i – error terms

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5. Results

The estimates of Models 1 and 2 are presented in Tables 4 and 5, respectively. Table 4 shows that most of the variables were statistically significant at 1% and 5%. We observed that the odds of an expected change in real spending for an increase in prices one year from now were 46.43 times higher when compared with a decrease in expected prices. Alternatively, people were more likely to increase their expected spending in the face of an increase in expected prices. Hence, we rejected hypothesis, H1. On the other hand, the expected change in real spending was again more likely to increase with an increase in prices compared to one year ago. Hence, we accepted hypothesis H4.

Among the control variables, expected changes in economic conditions and employment scenarios exerted a positive impact on the expected change in real spending. However, for all the categories, the expected change in real income of the households impacted the expected change in real spending negatively. This finding implies that when real income is expected to increase, real spending is expected to decline and vice versa. Economic theorizing suggests that real spending should increase (decrease) with an increase (decrease) in real income. However, the opposite may occur in certain instances. For example, when there is a significant expected increase in real income, it implies that nominal income is expected to increase and prices are expected to decrease. In such a scenario, expected real spending will decline only if the expected decrease in price exceeds the expected increase in nominal income. Further possibilities can be explained by mapping the entries of real expected spending and real expected income from the matrices presented in Table 2.

An increase in expected real income (described by positive values, 1 and 2 in Table 2) is affected by three alternative combinations:

- Nominal expected income – increase & prices one year from now – remains constant (+1)

- Nominal expected income – increase & prices one year from now – decreases (+2)

- Nominal expected income – remains constant & prices one year from now – decreases (+1)

This refers to two alternative price situations: i) prices one year from now remain constant and ii) prices one year from now decline. Corresponding to these two price situations, real spending will decline (have negative value) only under one possible circumstance; i.e. Expected nominal spending decreases when prices one year from now remain constant.

Therefore, our analysis indicates that when there is an increase in expected nominal income and prices one year from now remain constant, expected real spending may fall because of a fall in the expected nominal spending. This occurrence is counter-intuitive but could be triggered by other factors, such as an increased tendency to save and invest more, although the present research fails to draw any inference about it owing to the unavailability of data.

Most of the demographic control variables were statistically significant at 1%. We observed that women were 0.96 times less likely to expect an increase in real spending compared with men. Similarly, the likelihood of expected real spending decreasing for a household having five and more members was 0.91 times higher than that of a household having four or less

members. This result implies that bigger families are more likely to expect their real spending to decrease in the future than small families. This attitude might be influenced by socio-economic dimensions, such as smaller families expecting an improvement in quality of life or spending more on education. The respondents in the age group of 60 or more than 60 years were found to be more likely to increase their real spending than those in the age group of 22-59 years and above, which implies that respondents in the working age group tend to spend less than those in the older age group. Finally, the odds of expected real spending decreased by 0.96 times for respondents in the annual income group of ₹ 3–5 lakhs, which shows that people with a high annual income are less likely to increase their real spending than those with a low annual income. The high-income class tends to have a low marginal propensity to consume; consequently, this category is less vulnerable to price or income changes and is, therefore, less likely to increase real spending.

Table 4

Estimation results for the impact of expected/perceived inflation along with demographic and control variables on the expected change in real spending

Independent Variables[$]		Parameter Estimates	Exp (B)
Prices one year from now	Increase	3.84**	46.43
	Remain the same	2.09**	8.11
Prices compared to one year ago	Increase	0.59**	1.82
	Remain the same	0.29**	1.33
Outlook on general economic condition one year ahead	Increase	-0.01	0.99
	Remain the same	0.12**	1.13
Outlook on employment scenario one year ahead	Increase	0.04*	1.04
	Remain the same	0.13**	1.13
Expected change in real income	Significant increase	-0.53**	0.59
	Increase	-0.28**	0.76
	Remain the same	-0.19**	0.83
	Significant decrease	-0.09*	0.91
Perception on general economic condition one year ago	Increase	-0.02	0.98
	Remain the same	0.01	1.01
Perception on employment scenario one year ago	Increase	0.06**	1.16
	Remain the same	0.02	1.02

Independent Variables$^\$$		Parameter Estimates	Exp (B)
Perceived change in current real income	Significant increase	-0.13**	0.88
	Increase	-0.03	0.97
	Remain the same	0.05	1.05
	Significant decrease	0.05	1.05
Gender =Female		-0.04**	0.96
Age ≥ 60 years		0.09**	1.09
Occupation of Respondent = Employed		-0.05**	0.95
Number of family members 5 and more		-0.10*	0.91
Annual Income	Rs. 5 lakh or more	-0.01	0.99
	Rs. 3 lakh to 5 lakh	-0.04*	0.96
	Rs. 1 lakh to 3 lakh	-0.01	0.99
Adjusted R square		0.66	
Observations		87466	

*, **: Parameter estimates significant at 5 and 1%, respectively,
$: For all the independent and demographic variables, -1 and 0 has been the reference category, respectively.

Table 5

Estimation results for the impact of expected/perceived inflation along with demographic and control variables on the perceived change in current real spending

Independent Variables$^\$$		Parameter Estimates	Exp (B)
Prices one year from now	Increase	0.36**	1.44
	Remain the same	0.27**	1.31
Prices compared to one year ago	Increase	3.86**	47.40
	Remain the same	1.99**	7.30
Outlook on general economic condition one year ahead	Increase	0.10**	1.10
	Remain the same	0.08**	1.08
Outlook on employment scenario one year ahead	Increase	0.03*	1.03
	Remain the same	0.03*	1.03

Independent Variables[$]		Parameter Estimates	Exp (B)
Expected change in real income	Significant increase	-0.26**	0.77
	Increase	-0.20**	0.82
	Remain the same	-0.21**	0.81
	Significant decrease	-0.09	0.91
Perception on general economic condition one year ago	Increase	-0.05**	0.95
	Remain the same	0.05**	1.05
Perception on employment scenario one year ago	Increase	0.08**	1.18
	Remain the same	0.09**	1.10
Perceived change in current real income	Significant increase	-0.58**	0.56
	Increase	-0.27**	0.76
	Remain the same	-0.10*	0.91
	Significant decrease	-0.03	0.98
Gender = Female		-0.08**	0.93
Age ≥ 60 years		0.05*	1.05
Occupation of Respondent = Employed		-0.05**	0.96
Number of family members 5 and more		-0.10**	0.91
Annual Income	Rs. 5 lakh or more	-0.05	0.95
	Rs. 3 lakh to 5 lakh	-0.02	0.99
	Rs. 1 lakh to 3 lakh	-0.01	0.99
Adjusted R square		0.59	
Observations		87466	

*, **: Parameter estimates significant at 5 and 1%, respectively,
[$]: For all the independent and demographic variables, -1 and 0 has been the reference category, respectively.

Estimates of Model 2 presented in Table 5 show that the odds of perceived change in current real spending for an increase in prices one year from now were 1.44 times more when compared with a decrease in expected prices. In other words, with an increase in prices one year from now, the respondents were more likely to perceive an increase in their current real

spending. Hence, we accepted hypothesis H2. Similarly, a unit increase in prices compared to one year ago increased the odds of perceived change in current real spending by 3.86% when compared with a decrease in prices compared to one year ago. This result implies that the perceived increase in nominal spending will exceed the increase in prices compared to one year ago, thereby resulting in an increase in real spending. Hence, we rejected hypothesis H3. Similar to Model 1, expected and perceived changes in economic conditions and employment scenarios exerted a positive impact on the perceived change in current real spending, except for the perception of an increase in general economic condition. The control variable, the perceived change in the current real income of the households, had a negative impact on the perceived change in current real spending. This observation could be explained in a manner similar to the one offered under Model 1. Table 5 also shows that most of the demographic variables were statistically significant at 1%, except for annual income.

Table 6

Estimation results for the bivariate relationship between expected and perceived inflation

Independent Variables[$]	Model 3(a) Dependent variable: Expected inflation	Model 3(b) Dependent variable: Perceived inflation
Kendall's tau-b (τ_b) correlation coefficient		
Perceived inflation	0.46**	1.00
Expected inflation	1.00	0.46**
Observations	87466	

**Parameter estimates significant at 1 percent.

The relationship between perceived and expected inflation estimated using Models 3(a) and 3(b) are presented in Table 6. A strong and positive correlation was seen between perceived inflation and expected inflation, with $\tau_b = 0.46$. This finding implies that a period of high perceived inflation is expected to be followed by a subsequent period of high inflation and vice versa. Similarly, when consumers expect high inflation in the future, they are more likely to perceive the current inflation also to be high and vice versa. Hence, we accepted hypotheses, H5(a) and H5(b).

Table 7

Estimation results for the impact of expected (perceived) inflation on the change in real expected (perceived) income

Independent Variables[$]		Model 4(a) Dependent variable: Expected change in real income		Model 4(b) Dependent variable: Perceived change in current real income	
		Parameter Estimates	Exp (B)	Parameter Estimates	Exp (B)
Prices one year from now	Increase	3.13**	22.86	-	-
	Remain the same	1.61**	5.02	-	-
Prices compared to one year ago	Increase	-	-	3.43**	30.85
	Remain the same	-	-	1.57**	4.82
Adjusted R square		0.44		0.38	
Observations		87466			

**Parameter estimates significant at 1 percent.
[$]: For all the independent variables, -1 has been the reference category.

Finally, the estimates of Model 4(a) and 4(b) presented in Table 7 show that the odds of expected (perceived) change in real income for an increase in prices one year from now (prices compared to one year ago) were 22.86 (30.85) times more when compared with a decrease in prices one year from now (prices compared to one year ago). Alternatively, expected (perceived) real income increased with the increase in prices one year from now (prices compared to one year ago) and vice versa. Therefore, we rejected hypotheses H6(a) and H6(b). On the face of an increase in prices, real income increased only when the increase in nominal income exceeded the increase in prices. However, since the respondents only expressed their views on the direction of expected and perceived changes in prices, income, and spending, we were unable to verify the above statement. Overall, on the triangular and indirect relationship among expected (perceived) inflation, expected (perceived) real income, and expected (perceived) real spending, we observed that expected (perceived) inflation led to an increase in expected (perceived) real income. In other words, nominal income increased more than the increase in prices, which decreased the expected (perceived) real spending, i.e., nominal spending either remained constant or declined. These connections lacked meaningful economic interpretations and, hence, may imply casual rather than attentive responses.

5.1. Robustness checks

We checked the robustness of the results for Models 1 and 2 by changing the dependent variable. We used nominal spending (expected and actual) instead of real spending (expected and perceived) to help us understand whether our results were impacted by the method used to construct the variables of real spending and real income. Furthermore, we used nominal income (expected and actual) instead of the real income as a control variable with a host of demographic variables. The results presented in Tables 8 and 9 establish the robustness of Models 1 and 2, respectively. We observed that the odds of an expected change in nominal spending for an increase in prices one year from now were 2.54 times more compared with a decrease in prices one year from now. This finding implies that people are more likely to increase their expected nominal spending in the face of an increase in future prices. The expected nominal spending was again more likely to increase with an increase in prices compared to one year ago (Table 8). Similarly, Table 9 shows that the odds of a change in actual nominal spending for an increase in prices one year from now were 1.61 times higher when with a decrease in prices one year from now. A unit increase in prices compared to one year ago increased the odds of change in actual nominal spending by 1.23% when compared with a decrease in prices compared to one year ago. Most of the demographic and control variables were statistically significant in both the models and demonstrated the same relationship with their respective dependent variables as in the case of baseline results presented in Tables 4 and 5. Hence, our results pertaining to the relationship between expected and perceived inflation and expected and perceived change in real spending are reliable and free from bias or any kind of measurement.

Table 8

Robustness check by finding the impact of expected/perceived inflation along with demographic and control variables on the expected change in nominal spending

Independent Variables$		Parameter Estimates	Exp (B)
Prices one year from now	Increase	0.93**	2.54
	Remain the same	0.52**	1.68
Prices compared to one year ago	Increase	0.74**	2.10
	Remain the same	0.39**	1.49
Outlook on general economic condition one year ahead	Increase	-0.02	0.99
	Remain the same	0.12**	1.13
Outlook on employment scenario one year ahead	Increase	0.04*	1.04
	Remain the same	0.13**	1.14
Expected change in nominal income	Increase	-0.26**	0.77
	Remain the same	-0.03	0.97
Perception on general economic condition one year ago	Increase	-0.02	0.98
	Remain the same	0.01	1.01
Perception on employment scenario one year ago	Increase	0.06**	1.06
	Remain the same	0.03	1.03
Change in actual nominal income	Increase	-0.15**	0.86
	Remain the same	-0.09**	0.91
Gender =Female		-0.04**	0.96
Age ≥ 60 years		0.09**	1.09
Occupation of Respondent = Employed		-0.05**	0.95
Number of family members 5 and more		-0.11**	0.89
Annual Income	Rs. 5 lakh or more	-0.01	0.99
	Rs. 3 lakh to 5 lakh	-0.04*	0.96
	Rs. 1 lakh to 3 lakh	-0.01	0.99

Adjusted R square	0.54
Observations	87466

*, **: Parameter estimates significant at 5 and 1%, respectively,
$: For all the independent and demographic variables, -1 and 0 has been the reference category, respectively

Table 9

Robustness check by finding the impact of expected/perceived inflation along with demographic and control variables on the change in actual nominal spending

Independent Variables$		Parameter Estimates	Exp (B)
Prices one year from now	Increase	0.48**	1.61
	Remain the same	0.32**	1.37
Prices compared to one year ago	Increase	1.23**	3.41
	Remain the same	0.60**	1.81
Outlook on general economic condition one year ahead	Increase	0.10**	1.10
	Remain the same	0.07**	1.07
Outlook on employment scenario one year ahead	Increase	0.03	1.03
	Remain the same	0.03	1.03
Expected change in nominal income	Increase	-0.07**	0.94
	Remain the same	0.01	1.01
Perception on general economic condition one year ago	Increase	-0.05**	0.95
	Remain the same	0.06**	1.06
Perception on employment scenario one year ago	Increase	0.09**	1.09
	Remain the same	0.10**	1.11
Change in actual nominal income	Increase	-0.42**	0.66
	Remain the same	-0.14**	0.87
Gender = Female		-0.08**	0.93

Age ≥ 60 years		0.05*	1.05
Occupation of Respondent = Employed		-0.05**	0.95
Number of family members 5 and more		-0.11**	0.90
Annual Income	Rs. 5 lakh or more	-0.05	0.95
	Rs. 3 lakh to 5 lakh	-0.02	0.99
	Rs. 1 lakh to 3 lakh	-0.01	0.99
Adjusted R square		0.43	
Observations		87466	

*, **: Parameter estimates significant at 5 and 1%, respectively,
$: For all the independent and demographic variables, -1 and 0 has been the reference category, respectively

6. Discussion

Objective 5, i.e., the relevance of the Consumer Confidence Survey conducted by the RBI was critically examined. Most of our results on the relationship between expected and perceived inflation on the one hand and expected and perceived real spending on the other contradicted the underlying economic theories explaining the relationship between these variables. The results were also in contrast with the observations of Yadav and Shankar (2014-15). Hence, these findings raise questions on the reliability of these survey responses and the extent to which they can be considered to reflect informed decision-making. Furthermore, we estimated alternative models using data on essential and nonessential spending, and the results were no different. Owing to the paucity of space, they have not been reported. The likelihood of increase was slightly lower for nonessential spending than for essential spending, although all significant at 1%. The responses on income and spending in nominal terms, along with price movements were collected, and their implications in real terms were calculated. If the results are meaningful, we can claim that the responses were based on firm judgment and understanding of economic linkages between the variables and that they have implications for consistent decision-making. However, no such results were obtained. Therefore, it is evident that the surveys have low reliability. The demographic variables presented in Table 3 show that 90% of the respondents belonged to low and lower-middle income classes, the majority of whom were either unemployed or self-employed, which fails to generate optimism regarding the reliability of the survey. Furthermore, the survey contained information on the individual respondents' level of education. Since the data had too many classifications and lacked clarity in categorization, they were not included in regression analysis. However, by grouping them into broad categories, we observed that 30.5% of the respondents were either illiterate or had an education up to the primary level only. Nearly 52% and 80% were educated below 12th grade and graduation, respectively.

Since the respondents' minimum age was 22 years, it is less likely that those who were not even graduates were in the process of completing their degrees. Hence, their low level of education could be another factor for their random or not so well-thought-out responses. Had there been data on the extent of changes in prices, income, and spending perceived or expected by them or on expenditures on durable or non-durable goods, attempts could have been made to elaborate on the inconsistencies observed in the results. In the absence of such information, the obtained results are, at best, merely indicative of a survey with low reliability or validity conducted by the RBI.

Some observations from the survey data may help us in strengthening our argument. We categorized individual responses on perceived and expected inflation into nine categories, as presented in Table 10. For each category, the responses on actual and expected spending are also mentioned and their percentages are given in parentheses. From the figures, it is obvious that a large majority (nearly 73%) perceived as well as expected an increase in prices. Moreover, a whopping 87%–89% of these respondents claimed a rise in their actual as well as expected spending. Again, a vast majority of respondents, i.e., 73%–76%, in the category that expected the prices to remain the same and perceived them to be high reported a rise in their expected as well as actual spending. Similarly, 67%–77% of the respondents in the category that perceived the prices to remain constant and expected them to increase stated a rise in both actual and expected spending. On the other hand, when respondents perceived the prices to be low and expected them to remain the same and vice versa, a majority expressed an increase in both actual and expected spending. In the last case too, i.e., the one in which the respondents perceived and expected no change in the prices, a majority of them reported an increase in their actual and expected nominal spending. Also, barring the case of low perceived and expected inflation, a majority of the responses favoured increased actual as well as expected spending. This finding implies that the respondents do not revise their expenditures in line with their perceived and expected price changes. This result may also indicate that their expenditures consist mostly of necessities and that nominal income is able (or expected) to accommodate increased spending in the face of increasing prices. Alternatively, their real income either remained (or expected to remain) constant or increased, which could not be explained by the obtained data. Therefore, regardless of the implications, such a behaviour nullifies the purpose of considering information on perceived and expected inflation.

Moreover, we analyzed the cross-tabulations between perceived and expected inflation and change in actual and expected change in nominal spending using the chi-square test of independence. The chi-square test demonstrated the presence of a statistically significant association between the categorical variables listed in Table 10. Furthermore, based on CPI data published by the RBI, the average quarterly inflation for the period ranging from Q1 2014-15 to Q3 2018-19 was at −0.11%, whereas the average quarterly year-on-year inflation was at 0.01%. Despite the presence of a low inflation environment, such huge responses in favour of high perceived and expected inflation signify either perception and expectation bias or error in the calculation of CPI. Given that the new CPI series has a revised basket of a rather recent period, the error in its calculation is less likely. Hence, apparently, there is a tendency among individuals to exaggerate perceived and expected inflation along with perceived and expected spending.

Table 10

Summary of responses on inflation and spending

Cases	Change in nominal spending		
	Categories	Actual	Expected
PI: High EI: High Total no. 63533 (72.63)	Increased	55625 (87.55)	56677 (89.16)
	Remain the same	6472 (10.19)	5592 (8.80)
	Decreased	1436 (2.26)	1264 (1.99)
PI: High EI: Low Total no. 3727 (4.26)	Increased	2880 (77.27)	2542 (68.21)
	Remain the same	649 (17.41)	570 (15.29)
	Decreased	198 (5.31)	615 (16.50)
PI: Low EI: High Total no. 1200 (1.37)	Increased	644 (53.66)	906 (75.50)
	Remain the same	273 (22.75)	167 (13.92)
	Decreased	283 (23.58)	127 (10.58)
PI: Low EI: Low Total no. 2798 (3.19)	Increased	906 (32.38)	1066 (38.09)
	Remain the same	553 (19.76)	474 (16.94)
	Decreased	1339 (47.85)	1258 (44.96)
PI: High EI: Remain the same Total no. 5694 (6.51)	Increased	4357 (76.51)	4172 (73.27)
	Remain the same	1140 (20.02)	1328 (23.32)
	Decreased	197 (3.45)	194 (3.40)
PI: Low EI: Remain the same Total no. 957 (1.09)	Increased	446 (46.60)	527 (55.06)
	Remain the same	287 (29.99)	265 (27.69)
	Decreased	224 (23.40)	165 (17.24)
PI: Remain the same EI: High Total no. 3934 (4.50)	Increased	2641 (67.13)	3066 (77.94)
	Remain the same	1147 (29.15)	729 (18.53)
	Decreased	146 (3.71)	139 (3.53)
PI: Remain the same EI: Low Total no. 1106 (1.26)	Increased	575 (51.99)	643 (58.13)
	Remain the same	431 (38.97)	289 (26.13)
	Decreased	100 (9.04)	174 (15.73)
PI: Remain the same EI: Remain the same Total no. 4517 (5.16)	Increased	2327 (51.51)	2474 (54.77)
	Remain the same	1911 (42.30)	1739 (38.50)
	Decreased	279 (6.17)	304 (6.73)

EI: prices one year from now; PI: prices compared to one year ago; percentages are mentioned in the parentheses

7. Conclusion

We conclude our study by comparing our results with those obtained from the two earlier studies by Yadav and Shankar (2014-15) and Ichiue and Nishiguchi (2015) in subsection 7.1. All these studies employed the same methodology framework and measured the real spending with the expected and perceived inflation of consumers across different time periods and inflation rate conditions.

7.1. Comparison of results

The present study examining the relevance of the Consumer Confidence Survey considered one such survey conducted by the RBI from March 2015 to December 2018. In comparison, the previous study by Yadav and Shankar (2014-15) analyzed Consumer Confidence Survey data for the period 2011–2014. The present study identified associations between inflation expectations and perceptions and their link to current and anticipated consumer spending,

which turned out to be quite different from those observed by Yadav and Shankar (2014-15). The results of our study revealed that expected real spending is likely to increase with an increase in prices one year from now. Similarly, prices compared to one year ago were also found to have a positive impact on the perceived change in current real spending. These findings do not conform with either the underlying economic understanding or with the existing studies in the Indian context. We also noted the positive influence of expected and perceived inflation on the perceived change in real spending and expected change in real spending, respectively. However, Yadav and Shankar's (2014-15) results alluded that expected real spending is more likely to decrease with an increase in prices one year from now.

Similarly, in our study, perceived inflation exerted a negative impact on the perceived change in current real spending. Furthermore, we observed the negative influence of expected change in real income and perceived change in current real income on expected and perceived change in real spending. These findings contradict those obtained by Yadav and Shankar (2014-15), except that they did not measure the impact of perceived inflation and perceived change in current real income on the expected change in real spending. Moreover, Ichiue and Nishiguchi (2015) utilized the data from the Opinion Survey conducted by the Bank of Japan, and the results indicated that as the expected (perceived) inflation increases, future real spending (real current spending) is likely to decrease. These results are again contrary to the present findings.

Additionally, the relationship between expected and perceived inflation was positive, thereby implying that low perceived inflation was followed by low expected inflation and vice versa. Finally, the expected (perceived) change in real income was likely to increase with an increase in prices one year from now (prices compared to one year ago) and vice versa, which again questions the relevance of the data because these results are not commensurate with general economic understanding. Yadav and Shankar (2014-15) and Ichiue and Nishiguchi (2015) failed to analyze these relationships. Moreover, the kind of descriptive demographic statistics and cross-tabulations of expected (perceived) inflation and nominal spending, which provided a broad perspective of the data in the present study, were not analyzed by Yadav and Shankar (2014-15) and Ichiue and Nishiguchi (2015).

If we examine the inflation rates in all three studies, the rate was the lowest (i.e., less than 1%) in the study by Ichiue and Nishiguchi (2015), which was conducted from September 2006 to 2008. The inflation was the highest during the period of study by Yadav and Shankar (2014-15), i.e., approximately 10%. However, both studies yielded similar results. On the other hand, our study analyzed the data when the inflation rate was approximately 4% on average, i.e., intermediate to the earlier two studies, and our results differed. Hence, this specific factor, i.e., inflation rate, does not draw any concrete reason for the differences in results at this time.

7.2 Implications for consumer and monetary policy

The findings of the present study have important implications for consumer welfare. For instance, the lack of knowledge on prices and inflation and lack of idea about changes in

income and spending behaviour led to unreliable survey data. The survey data on inflation expectations and perceptions exert a significant impact on the effectiveness of the monetary policy at a macro level (Woodford, 2005). As inflation targeting is the main objective of monetary policy, how the households expect and perceive inflation and incorporate them in their decision-making are pertinent for the efficacy of central banks. However, because most of the results defied our expectations, it is difficult to say whether the responses were made rationally by considering all the relevant information. As argued above, since most of the respondents hailed from low and lower-middle-income groups, we are doubtful whether they were aware of actual inflation and accordingly formed their opinions on inflation and spending. We observed a general tendency to over-report their perceptions and expectations about inflation and spending. All these factors could impact the monetary policy and, hence, consumer welfare in a big way. According to Vellekoop and Wiederholt (2019), consumers expecting high inflation tend to spend more and save less. even when the actual inflation at that time period is lower than that in the preceding year, which leads to a decline in consumer welfare. The results of the present study are also in the same direction. Overall, we deem it reasonable to question the validity of these surveys.

Based on the discussion presented above, we recommend that the surveys must target people possessing basic knowledge and awareness about prices, concepts of inflation, and the general economic environment, as well as ideas about changes in their own income and spending behaviour. The majority of the sample must not consist of respondents who are not even graduates, a substantial portion of whom are either illiterate or merely have elementary education up to the 5th grade. Overall, the demographic profiles of the respondents, along with the results of the ordered probit model, obscure the purpose of conducting such surveys. Furthermore, we suggest that a major communicative role on behalf of the central bank, RBI, should be performed periodically to educate the masses on the objectives of monetary policy, including inflation, consumption, and growth (Dräger, 2015; Szyszko and Płuciennik, 2018).

The implications and suggestions of this study are not limited only to the monetary policy of the RBI but extend to central banks' efficacy in general. As the inflation targeting regime has become the priority of the monetary policy of almost all the central banks, anchoring inflation expectations of households, firms, and professionals have become of utmost importance. To understand and anchor these expectations, the surveys need to be structured carefully to get meaningful results that can be used in policy making and increase consumer welfare. The other potential beneficiaries are the professionals and the experts who utilize these surveys to examine the inflationary trends and monetary policy credibility in the country.

Our analysis has been quite exhaustive in terms of utilizing the specific considered for analysis. Further investigations that consider similar surveys published by the RBI are needed for assessing improvements in terms of having relevant implications for policymaking.

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SUMMARIES

Kristina Stefanova

LABOUR PRODUCTIVITY CONVERGENCE OF CEE COUNTRIES WITH THE EURO AREA – EVIDENCE AT AGGREGATE AND SECTORAL LEVEL

The paper aims to verify the existence of labour productivity convergence of Central and Eastern European (CEE) countries with the euro area over the period 2000-2020 at aggregate and sectoral levels. For this purpose, the study uses the beta and sigma convergence methods. The application of the ordinary least squares fixed effects panel regression proves the existence of beta convergence of the countries of Central and Eastern Europe with the euro area at both aggregate and sectoral levels. Stronger convergence is observed in the agriculture, forestry and fishing sector and in the industry sector (including construction) than at aggregate level. The weakest convergence is observed in the services sector. The results of the linear trend model of the coefficient of variation for the σ-coefficient confirm the hypothesis of sigma convergence between the average level of labour productivity of the countries of Central and Eastern Europe and the average of the euro area at aggregate and sectoral levels. At the same time, the differences in the degree of convergence between the three sectors resulting from the application of beta convergence are confirmed. The comparison according to the degree of sigma convergence with the euro area in the different countries of Central and Eastern Europe shows stronger convergence in the countries that have adopted the euro than in the countries outside the euro area, which is considered to be a consequence of the Europeanisation effect.

Keywords: Labour productivity convergence; Beta and Sigma convergence; countries from Central and Eastern Europe; Euro area; Panel regression model
JEL: E24; F02; L16; O47

Mihail Yanchev

DEEP GROWTH-AT-RISK MODEL: NOWCASTING THE 2020 PANDEMIC LOCKDOWN RECESSION IN SMALL OPEN ECONOMIES

Accurate forecasting of the timing and magnitude of macroeconomic recessions caused by unexpected shocks remains an area where both statistical models and judgmental forecasts tend to perform poorly. Inspired by the value-at-risk concept from financial risk management, a growing body of research has been focused on developing a framework to model and quantify macroeconomic risks and estimate the likelihood of adverse macroeconomic outcomes, which has become known as growth-at-risk assessment. The current study proposes an improvement to an established two-step procedure for empirical evaluation of the future growth distribution, which involves directly modelling the parameters of the conditional distribution in one step within an artificial neural network. The proposed procedure is tested on macroeconomic data from four small European open economies covering the coronavirus pandemic lockdown period and the recession related to it. The model achieves a better performance across the four countries compared to the established two-step procedure.

Keywords: Forecasting; Macroeconomic Risks; Artificial Neural Networks; Density Forecasts; Recessions
JEL: C53; E17; E27; E32

Fisnik Morina, Duresa Kilaj, Aulonë Cenaj

DYNAMIC CORRELATION AND CAUSALITY BETWEEN INVESTMENTS AND SALES REVENUES: AN ECONOMETRIC ANALYSIS OF MANUFACTURING ENTERPRISES IN KOSOVO

Purpose: This research aims to analyze the correlation and causality between investments and sales revenues through an econometric analysis of manufacturing enterprises in Kosovo. Since investments are essential for enterprises, studying their impact and sales revenues on manufacturing enterprises is crucial.

Methodology: Empirical data to be used in the research is secondary and will be based on the annual reports of the Minister of Finance. This paper will also refer to many studies by different authors that have analyzed the relationship between investments and sales revenues. The years that will be analyzed in this research are 2018-2019.

Expected results: Through the analysis of this research conducted between investments and sales revenues and other variables, we expect to get some positive results which can tell us that the investments made by a company will positively affect sales income in manufacturing enterprises.

Practical implications: Through the analysis made between these variables, different manufacturing companies in Kosovo can see the effect that investments have on sales revenues and other variables, i.e., the correlation between them. The results of this study will also serve as good scientific and empirical evidence for future studies to be conducted in investments or economics.

Originality: This scientific paper presents actual and consistent results about the relevant conclusions. The analyzed period (2018-2019) is a convincing period for drawing competent conclusions and recommendations.

Keywords: investments; sales revenues; capital; firm size; manufacturing enterprises
JEL: *E22; H32; L11; L22*

Vesselin Blagoev, Elena Shustova, Nina Protas

WORK MOTIVATION OF BANK EMPLOYEES IN CASE OF IMPLEMENTING AI AND ROBOTS IN THE BANK ACTIVITIES: COMPARATIVE ANALYSIS OF RUSSIA AND KAZAKHSTAN

The dynamic changes in the banking industry as a result of the AI application and robotisation lead to substantial organisational changes and redefining the roles of bank employees. This, of course, has an impact on bank employees' work motivation. In 2020-2021 the businesses, including banking, encountered one more influencing factor – the Covid-19 pandemic and related quarantine and lockdown measures, leading to forced move to remote work. This research aims to find out if the work motivation of the bank employees has changed, and if yes – in what directions.

The analysis is based on the findings of a survey, conducted in the two countries in the period November 2020 – February 2021 and the results show some significant differences between the work motivation in the banking industry in the two countries. The questionnaire items target the main work motivation factors. Two working hypotheses were studied in this research: H1: The intensive implementation of AI in the banking sector positively affects the work motivation of bank employees in Russia and Kazakhstan. H2: The age of the employees matters for appreciation of the AI implementation, as younger employees 18-40 are more positive compared to employees beyond 40. H1 was confirmed, while H2 was confirmed regarding the difference in the opinions and motivation of the two age groups (under 40 and above 40 years of age), but not in regard to the appreciation of the changes by the two age groups.

The main beneficiaries of the results of this research are the bank managers, both HRM and line managers, who are directly responsible for supporting the work motivation in the process of intensive

implementation of AI and robotisation, e.g., chatbots, in the sector. It is also believed that the managers in the other sectors of the economy may benefit from these findings as well.

Rumen Angelov

ASSESSMENT OF CHALLENGES AND RISKS FOR THE BANKING SECTOR IN THE TRANSITION TO A GREEN ECONOMY THROUGH A SAMPLE SURVEY

The study aims to register the attitudes of managers and experts from banking institutions on the specifics of the green economy by identifying and assessing challenges facing the financial sector of Bulgaria, in the context of the European Green Pact, at the main stages of its implementation. The focus of the study on the financial sector is the development of the banking sector and the capital market in the context of the green transition, and the study includes an empirical study of changes in the banking sector in the transition to a green economy.

Ventsislava Nikolova-Minkova

THE TRADEMARK APPLICATION ACTIVITY IN BULGARIA ACCORDING TO THE NICE CLASSIFICATION AND ECONOMIC SECTORS FOR THE PERIOD 2010-2020

This study presents the state and dynamics of Bulgarian and foreign trademark activity in Bulgaria as measured by the NICE classes of the trademark applications for the period 2010-2020. The aim of the development is to study the interaction between the Bulgarian and foreign trademark applicant activity in Bulgaria for the period 2010-2020 to identify the priority classes under the Nice Classification and the priority economic sectors, i.e. those with the greatest potential for economic development. The analyses of trademark activity presented in the study show how by using the trademark statistics and by applying the System of Concordance developed for the purposes of this study, priority and most promising economic sectors can be identified, which brings out trademark activity as a valuable and unique information resource. The proposed research can be used for information support of management decisions and to make trademark and brand management strategies more effective.

Irena Markova

INSURANCE OF ENVIRONMENTAL RISKS IN THE CONTEXT OF THE CORPORATE SECURITY OF THE INDUSTRIAL ENTERPRISE

The study examines the issue of the place and role of environmental insurance in the security concept of the industrial enterprise. The priority importance of liability insurance against the risk of "environmental pollution" in economic entities is outlined. Emphasis is placed on the positioning of environmental insurance among the mechanisms for increasing environmental security in the context of corporate risk management. The results of the marketing research among operating companies in the Bulgarian insurance market are presented and give an idea of the state, problems and guidelines

for the development of insurance for environmental risks in our country. The analysed marketing information is supplemented by the results of similar research among companies in the chemical industry as consumers of environmental insurance in order to cover the two elements – supply and demand – in the market of environmental insurance.

Pooja Kapoor, Sujata Kar

A CRITICAL EVALUATION OF THE CONSUMER CONFIDENCE SURVEY FROM INDIA

This study examines the relevance of the quarterly Consumer Confidence Survey conducted by the Reserve Bank of India by analyzing consumers' spending behaviour vis-a-vis their expectations and perceptions of inflation in the Indian context. The ordered probit regression results demonstrate the positive influence of expected and perceived inflation and the negative influence of expected change in current real income and perceived change in current real income on the expected change in real spending. These results are not commensurate with underlying economic theories, which render the relevance and purpose of these surveys questionable. A few other results and observations from the respondents' demographic profile further strengthened our argument. In an emerging economy such as India, such surveys and their analyses are at a budding stage, and this is the first study to question the validity and relevance of these surveys. The present study also contributes to our understanding of how households expect and perceive inflation and incorporate them into their decision-making, which is pertinent for the efficacy of central banks as inflation targeting is the main objective of monetary policy.