ECONOMIC RESEARCH INSTITUTE
BULGARIAN ACADEMY OF SCIENCES

ИНСТИТУТ ЗА ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ НА БЪЛГАРСКАТА АКАДЕМИЯ НА НАУКИТЕ

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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GOVERNMENT PUBLIC SPENDING EFFICIENCY: A COMPARATIVE ANALYSIS BETWEEN KOSOVO AND EU COUNTRIES, ESPECIALLY WESTERN BALKAN COUNTRIES[3]

Nowadays, it is evident that government public sector activities are one of the significant factors influencing economic and social indicators. The evaluation of public sector performance and efficiency is very important when we evaluate the relationship between public spending and the benefits that society derives from these public resources. The primary objective of this study is to evaluate the efficiency of Kosovo's government public spending in comparison with EU countries and, in particular, Western Balkans countries over the period 2007-2016. The Public Sector Performance Index (PSP) and the Public Sector Efficiency Index (PSE) were used to assess the performance and efficiency of the public sector in Kosovo. Also, this study uses the non-parametric method DEA (Data Envelopment Analysis) to evaluate the input-output efficiency along with the Production Frontier Technique. The study results show that the PSP value ranges from 0.78, the minimum, to 1.39, the maximum. Kosovo ranks 30th out of 35 countries in the sample, with a performance index of 0.86, which is 15 percent below the average of 1.00. In terms of PSE, results vary from 0.76, the minimum to 1.35, the maximum. Kosovo ranks 23th out of 35 countries in this sample with an efficiency index of 0.96, 5 percent below the average, which is 1.00.

Analyzing input-output efficiency results, it is found that the average of the countries included in the study achieves an efficiency of 46.70. This shows that countries are able to reduce total public spending by 54% and maintain the same level of total Public Performance. From the results of the output-oriented efficiency analysis, the countries in the sample achieve an efficiency of 73.64%, which means that the countries in the sample could have increased the level of outputs by 27% if they had used the same level of inputs.

Keywords: Government Public Spending; Public Sector Performance and efficiency Index; Data Envelopment Analysis (DEA)
JEL: H5; D60; D61

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1. Introduction

In the course of life, everyone has come into contact with government activities in one way or another, beginning with registration in the state civil status registers, attended public schools, payment of taxes, employment in the public sector, use of public services, such as highways, electricity, drinking water, garbage collection, environmental regulations, pollution, security, etc. (Stiglitz, 1980). The importance of government public sector activities in economic growth has always been the subject of study by various economists (Tanzi, 2005).

Government activities of the public sector have undergone significant changes during historical development and have adapted to the course of economic development. In the last century, the level of government activities, measured in terms of public spending, has experienced a significant evolution, which can be described as a significant increase. In developing countries, public spending amounted to about 10% of the twentieth and increased so much in the following year that in some countries, it reached 60% of GDP (Tanzi, 2009; Bartik, 1992).

Given this development of the government activities of the public sector, the issue of the relationship between the public sector and economic growth has attracted great interest among economists and policymakers for centuries, and has led to opposing theories that belong to the two main economic schools. Each of these theories attempts to explain the positive or negative role and size of the public sector in economic growth. However, in reality, these schools come to different explanations and conclusions. Some believe that the size of the public sector contributes positively to economic growth, while another group of economists believes that the size of the public sector negatively affects the economy (Buchanan, 1975; Gemmell, Kneller, Sanz, Ismael, 1999; Folster, Henrekson, 1999; Tanzi, Zee, 1997; Kaas, 2003; Ghosh, Gregoriou, 2008; Pula, Elshani, 2017; Angelopoulos, Economides, Kammas, 2007). Nowadays, however, modern theories of public finance no longer focus on the size of public expenditure, but on the efficiency of public spending as a mechanism for better performance of the public sector (Manddl, Dierx, Ilzkovitz, 2008; Zugravu, Sava, 2012).

In recent years the debate over the role of the government has shifted towards the empirical evaluation of public sector performance and efficiency. Therefore, the performance and efficiency of public sector measurement is seen as an important indicator to monitor the public spending efficiency against the set objectives and achieve sustainable economic growth. According to the World Bank[4], good public sector performance improves people's living standards by giving them access to basic services and the opportunity to live and work in peace and security. Therefore, performance measurement is considered an important indicator for monitoring public sector progress in public activities (Barth, Keleher, Russek, 1990; Slemrod, William, Easterly, 1995; Poterba, Hagen, 1999). On the other hand, the concept of efficiency has found a prominent place in the study of public expenditure among many economists, especially in the last decades. Improving the efficiency of public spending not only helps maintain fiscal discipline but also alleviates budgetary constraints by making

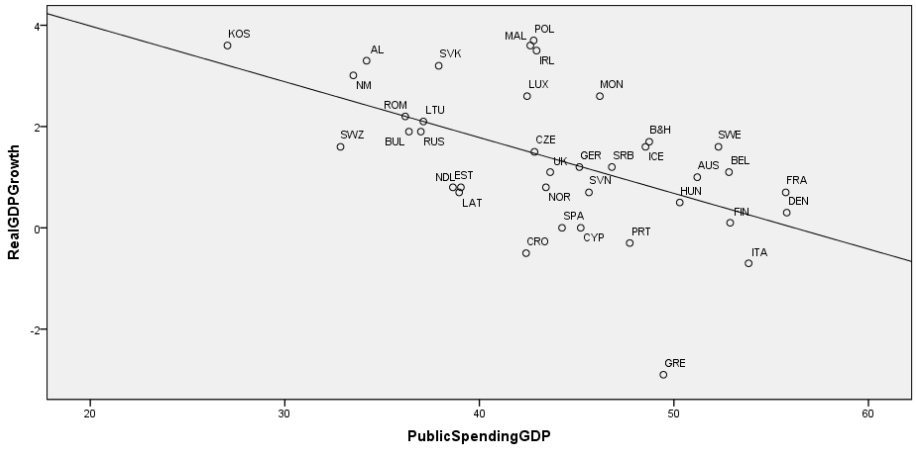
[4] According to the World Bank (2014). See http://data.worldbank.org/topic/public-sector.

it possible to achieve the same results with lower level of spending (Manddl, Dierx, Ilzkovitz, 2008; Pitlik, Schratzenstaller, 2011; Heller, Hauner, 2006).

In 2016, unlike other Western Balkan countries, public spending in Kosovo was below the average, with only 28% of GDP, whereas in Albania and Serbia, public expenditure was 34% and 47%, respectively. While, in EU countries, the average public spending is 44% of GDP. An increase in Kosovo's public spending was prompted by an increase in the social and economic programs used to struggle with poverty, unemployment and improving social welfare and quality of education and health care (Pula, Elshani, 2018). Emphatically, capital investment over the years absorbed most of the public spending by a share of 37.9% or 11% of the GDP (Pula, Elshani, 2018). However, a key hypothesis of this paper is whether large public spending hurting the performance public sector by measuring via public spending. Graph 1 highlights the relationship between public spending and real GDP growth and shows that low public spending is not detrimental to economic growth and meets public interest through government activity.

Graph 1

Economic Growth and Public Spending



Source: Calculation by the author.

Kosovo is a young state and is still in the early stages of consolidating public spending as one of the most important components of the public sector; second, there has been much discussion e recently about the efficiency of public spending as one of the most important determinants of public sector performance; third, public spending in Kosovo is growing. Therefore, the rationale for this study is to assess the relationship between government public spending and social-economic indicators.

Besides the introduction, the study proceeds as follows: In section 2, we describe the empirical evidence of the performance and efficiency of sector public. Section 3 presents the methodology used in the empirical assessment, while section 4 presents the empirical results of the performance and efficiency index. Finally, in section 5 we present the main concluding remarks and recommendations.

2. Literature Review

The most commonly used econometric methods to measure performance and efficiency are parametric and non-parametric methods. Although many studies rely on these methods, the results are quite contradictory. Many different authors and papers have used different methods to measure performance, but the most important tools are socio-economic indicators and it is assumed that the public sector causes desirable changes in socio-economic indicators through public spending (Afonso, Romero, Monsalve, 2013). According to many authors, improving performance depends on changes in the values of these indicators (Afonso, Schuknecht, Tanzi, 2006).

Hauner and Kyobe (2008) used the databases of 114 developed and developing countries for the period 1980-2004 for their empirical analysis. In their analysis, they calculated the PSP, PSE, and DEA methods. The authors focused only on the education and health sectors because they regressed these indicators into potential economic, institutional, and demographic factors. The results of this study show that countries with more developed economies have better public sector performance. However, the most important finding of this study is that higher public sector spending is associated with lower efficiency in the two respective sectors.

Afonso, Schuknecht and Tanzi (2005), in their study, calculated the public sector performance indicators and non-parametric FDH technique for 23 industrialized countries for the years 1990 and 2000. The study finds that countries with a smaller public sector have better performance and efficiency than countries with a larger public sector. According to the authors, this is because countries with a larger public sector experience marginal return to scale. According to the study, public spending by large governments could be about 35% lower to achieve the same level of PSP. Another study by these authors (Tanzi, Afonso, Schuknecht, Veldhuis, 2007) concludes that for the period 1990-2000 (for 23 countries), that countries with a small government are 40% more efficient in achieving higher levels of public sector performance than countries with medium or large governments.

In their study, Gupta, Honjo and Verhoeven (1997) estimated the efficiency of public spending on education and health, using FDH analysis, for 38 African countries for the years 1984-1995. The results of this study show that African countries are inefficient compared to countries in Asia and the West. The main message of this paper is that increasing budgetary allocations to these two sectors (education and health) is not necessarily the only way to improve outcomes in these two sectors, but that the most important thing is to increase the efficiency of public spending. Another paper, compiled by Herrera and Pang (2005) for the same sectors, for 140 countries for the period 1996-2002, using two non-parametric approaches: FDH and DEA, concluded that countries with higher spending level achieve lower efficiency scores. On the other hand, the work of Grigoli (2012) on the efficiency of public spending in the health and education sectors in the Slovak Republic compared to OECD countries, using the method (DEA), concludes that spending in the education sector in the Slovak Republic was used efficiently and achieved desirable results, while public spending in the health sector was unproductive or inefficient, respectively.

In her paper Kazemi (2016) evaluated the efficiency of public spending for 20 OECD countries for the period 2009-2013, using the non-parametric approach (DEA). According to the results, the input-oriented DEA efficiency is 0.732, whereas the output-oriented efficiency is 0.769. In conclusion, countries with a high level of public spending are less efficient than countries with a lower level of public spending.

3. Methodologies

The evaluation of public sector performance and efficiency is very important when we evaluate the relationship between public spending, defined as inputs and the benefits that society derives from these inputs, defined as outputs. In this study, we evaluate the performance and efficiency of the public sector using the indicators and methodology developed by Afonso, Schuknecht and Tanzi (2007). These indicators were developed for public sector performance, defined as an output of public activities and public sector efficiency, defined as the ratio of performance indicators and public spending. These indicators were assessed for all European countries, including the Western Balkan countries. The methodology used in this paper consists of three parts. The first two parts explain how PSP and PSE are constructed, while the third part provides an approach for analyzing input-output efficiency along the production frontier using the non-parametric technique (DEA).

3.1. Public Sector Performance Index (PSP)

Public sector performance is defined as the output generated by public activities and is an important tool to influence quality improvement in public sector management. The estimate of the public sector performance index is based on economic and social indicators that are classified into two groups in terms of evaluating: *Opportunity Indicators* and the *Traditional Musgrave Indicators*.

The opportunity indicators focus on the role of government in ensuring the rule of law and promoting equality for all individuals in a market economy. This indicator consists of four sub-indicators. These sub-indicators reflect the government's performance in four areas: administration, education, health and public infrastructure performance. In other words, a good public administration, with a proper judiciary and a healthy and well-educated population, with a good accompanying infrastructure can be considered a prerequisite for the functioning of a market economy (Afonso, Schuknecht, Tanzi, 2005). The above indicators were more microeconomic in nature and focused on a particular sector. The traditional Musgrave Indicators, on the other hand, are more general indicators that are also well illustrated in the economic literature and are more macroeconomic in nature, focusing more on the impact of public government spending on the economy as a whole. Musgrave indicators measure the outcomes of public sector interactions with market processes and consist of three sub-indicators: revenue distribution, economic stability and economic performance.

Sub-indicators are measured by the composition of the following indices:

Opportunity indicators

Administrative – Corruption, Red Tape, Judicial Independence, size of the informal economy

Education – Primary teacher to student ratio, Primary and Secondary school enrolment

Health – Infant mortality rate, life expectancy

Infrastructure – Infrastructure quality

Musgrave indicators

Distribution – Gini index

Economic Stability – Average inflation rate, Sustainability of economic growth (coefficient of variation)

Economic performance – GDP per capita, GDP growth rate in real terms, Unemployment rate

The table above lists all the sub-indicators that need to be collected to construct the PSP performance index. For the Musgrave sub-indicator, we used the 8-year average (2007-2016), while for the opportunity sub-indicators, we used the only year 2016. Once we have collected all the data, all the measurements are normalized to obtain identical distribution values. This is achieved by dividing the value of one country by the average of the indicator for all countries. This calculation is done to provide a suitable platform for comparing the results. To facilitate comparison, the average for the countries in the sample is set at 1.00 for all indicators. The scores for each country are calculated relative to this average. In summary, after collecting all the data, each indicator (opportunity indicators and traditional Musgrave indicators) is weighted equally, mainly based on the results of Hauner and Kyobe (2008), who found insignificant differences in using different and equal weights to score the PSP index. Then seven sub-indicators contribute 1/7 to the performance index. Assuming that there are *i* states and *j* areas of public activities (indicators) that together determine the overall performance in state *i*, the PSP*i* is calculated (Afonso, Schuknecht, Tanzi, 2005):

$$PSP_i = \sum_{j=1}^{n} PSP_{ij} \ldots\ldots PSP_i = f(I_k),$$

Where $PSP_i = f(I_k)$, where I_k are the *opportunity and Musgrave indicators* on which performance depends. Thus, an improvement in certain values of these indicators affects the public sector performance and is calculated as follows:

$$\Delta PSP_{ij} = \sum_{i=k}^{n} \frac{\partial f}{\partial I_k} \Delta I_k$$

3.2. Public Sector Efficiency Index (PSE)

Public Sector Performance Index does not provide us with any information on the efficient or inefficient use of public spending. Therefore, in order to value the Public Sector Efficiency Index (PSE), it is necessary to consider the cost at which the public sector has achieved a certain level of performance (PSP) (Afonso, Schuknecht, Tanzi, 2005). Therefore, to

determine the value of public sector efficiency (PSE), public sector performance (PSP) is corresponding weighted categories of government public spending (GPS) and calculated as follows:

$$PSE_i = \frac{PSP_i}{GPS_i},\ and\ \frac{PSP_i}{GPS_i} = \sum_{j=1}^{n} \frac{PSP_{ij}}{GPS_{ij}}$$

Table 1

	Input (Public Government Spending)	*Output (performance)*	*Sub-indicators*	*Operationalization*
Opportunity indicators	Public Consumption	Administrative performance	Corruption Index	Number 7 = (low level of corruption), number 1 = (highly corrupt)
			Red Tape	Number 7 = (not burdensome), number 1 = (extremely burdensome)
			Shadow economy index	number 1 = (highly shadow economy), number 9 = (low shadow economy)
			Quality of judiciary index	Number 7 = (entirely independed), number 1 = (heavy influenced)
	Health Expenditure	Health performance	Infant mortality rate	Mortality rate, infant per 1,000 live births
			life expectancy	Life expectancy at birth, total years
	Education Expenditure	Education Performance	Secondary school enrolment	Secondary school enrolment (% of gross). [5]
			Primary teacher to student ratio	Number of primary students divided by the number of teachers in primary school.
	Public Investment	Infrastructure performance	Infrastructure quality	Number 7 = (development), number 1 = (underdevelopment)
Musgrave indicators	transfer and subsidies Expenditure	Gini index distribution	Gini index	Rating scale from 100 (Perfect Inequality) to 0 (perfect equality).
	Total Expenditure	Economic Stabilities	Average inflation rate	Average consumer prices, for the period, 2007-2016.
			Sustainability of economic growth	Sustainability of economic growth (coefficient of variation) average growth of real GDP
	Total Expenditure	Performance Economic	GDP per capita	Average Gross Domestic Product per capita
			GDP growth rate in real terms	Average real GDP rate, for the years 2007-2016.
			Unemployment rate	Average unemployment rate, 2010-2016

Source: Global Competitiveness Report, Transparency International's Corruption Perceptions Index, World Economic Forum, World Development Indicators, World Economic Forum, World Bank, UIS Statistics, European Commission, AMECO, Ourworldindata, IndexMundi, TheGlobalEconomy, OECD database, World Economic Outlook Database, European Commission – Ameco, Eurostat – OECD, WEO Database.

[5] The gross enrollment ratio can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.

However, the marginal product implied as output, falls during the increase in government public spending and is presented as follows:

$$\frac{\partial PSP_i j}{\partial GPS_{ij}} > 0, \frac{\partial^2 PSP_{ij}}{\partial GPS^2{}_{ij}} < 0$$

Here GPS_{ij}, shows the public government spending of states *i* in various areas j, which are sub-indicators of economic performance, and thus together determine the overall efficiency in a state i. According to Afonso, Schuknecht and Tanzi (2006), the inputs for the evaluation opportunities and Musgrave indicators are presented on Table 1.

3.3. Non-parametric technique (DEA)

The DEA method has been widely used in the last decade. It was first used by Farrell (1957) and Charnes, Cooper and Rhodes (1978), who wanted to evaluate efficiency. Technically, the DEA assumes the existence of a convex output frontier constructed using linear programming methods that lies between these observations and the higher output-input ratios (Coelho, Watt, 2006). In this paper, this concept is paraphrased as the maximum performance of the public sector that can be achieved by a given level of public spending as a percentage of GDP, given by the following function (Tanzi, Afonso, Schuknecht, Veldhuis, 2007)*:*

$$y_i = f(x_i), I=1,.....n$$

From where we $Y_i -$ units of output measurement; $X_i -$input measurement unit. If $y_i > f(X_i)$, then we conclude that this country uses inputs efficiently and vice versa if $y_i < f(X_i)$ then a country is showing inefficiencies in the use of inputs.

This paper evaluates the two mathematical equations for estimating DEA analysis, the input and input-oriented equation and the output-oriented equation (Charnes, Cooper, & Rhodes, 1978). According to Kazemi (2016), to specify the input and output-oriented equations, it is assumed that there are comparative units; each comparative units use *K* inputs to produce *M* output. If *X* is the input matrix *KxI* and *Y* is the output matrix *MxI* for all comparative units, then X_i i is a vector input column and Y_i is a vector output column for all comparative units.

Table 2

Input- and output-oriented efficiency

Data Envelopment Analysis (DEA)	
Output oriented	Input oriented
$\text{Max } \rho, \lambda^{\delta}$ $\text{Subject i} - \rho y_i + Y\lambda \geq 0$ $X_i - X\lambda \geq 0$ $n1'\lambda = 1$ $\lambda \geq 0$	$\text{Min } \rho, \lambda^{\delta}$ $\text{Subject i} - y_i + Y\lambda \geq 0$ $\rho X_i - X\lambda \geq 0$ $n1'\lambda = 1$ $\lambda \geq 0$

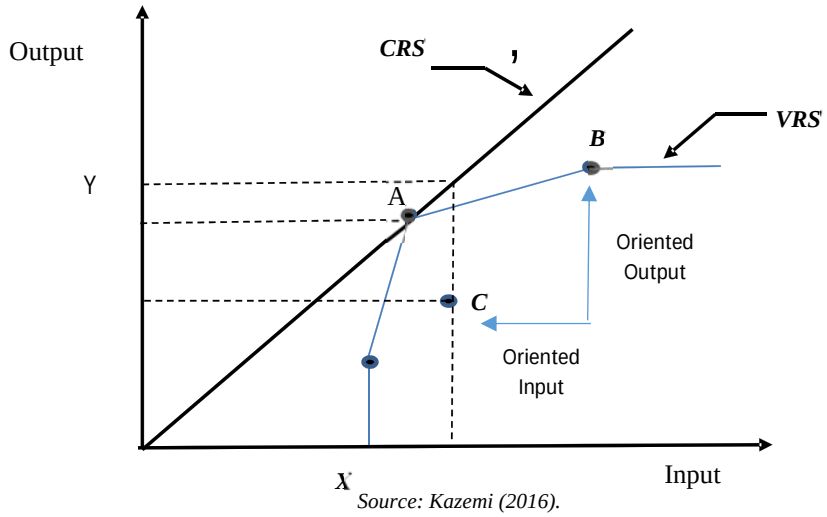
From the above equations, ρ is scalar, while 1/ ρ specifically implies the efficiency outcome and satisfies the assumption $0 < \frac{1}{\rho} \leq 1$. According to (Farrell, 1957), ρ measures the distance from one country to another, in our case, the units of comparison along the efficiency frontier.

If ρ =1, then the comparison unit is efficient, and conversely, if $\frac{1}{\rho} \leq 1$, the comparison unit is inefficient. On the other hand, $\lambda(Ix1)$ is a vector of constants that measures the weight used to estimate the location of an inefficient comparative unit. While the constraint $n1'\lambda = 1$ imposes frontier convexity by calculating the variable return (CRS) in the DEA model, the disappearance of this constraint means accepting that the rate returns are constant (VRS) (Afonso, Schuknecht, Tanzi, 2006).

However, the efficiency model analysis (DEA) evaluates the input-output efficiency analysis assuming that the technology can be with a constant return to scale or variable return to scale (CRS[6] the VRS[7]).

Graph 2

(DEA) Production Frontier Technique



Source: Kazemi (2016).

Therefore, it is important to note that from a modelling point of view, both types of DEA, such as those with input and output orientation, lead to similar identification along the efficiency frontier curve (Afonso, Kazemi, 2016).

[6] Constant return to scale (CRS) and Variable Return to scale (VRS).
[7] Variable return to scale (VRS).

4. Computing PSP Index

The following table shows the summary results of the public sector performance (PSP) for the period 2007-2016. The countries with a better result than the average of the sample countries, which is 1.00 are considered as countries with the best public sector. The countries with a performance index lower than the average 1.00 are considered as countries with lower performance level.

Table 3

Summary Results from Public Sector Performance (PSP)

	Opportunity Indicator				Musgravian Indicatore			
	Administrative	Education	Health	Public Infrastructure	Distribution	Stability	Economic Performance	Total PSP
Max PSP	1.37 (IRL)	1.48 (BL)	1.10 (IS)	1.27 (FRA)	1.27 (NM)	1.57 (IS)	3.05 (LUX)	1.39 (LUX)
Min PSP	0.7 (SVK)	0.43 (SRB)	0.88 (KOS)	0.68 (SRB)	0.80 (SLO)	0.30 (GRE)	0.29 (KOS)	0.78 (GRE)
Kosovo	0.9	0.67	0.88	0.78	0.93	1.39	0.29	0.86
Mean	1	1	1	1	1	1	1	1
Western Balkans	0.94	0.77	0.94	0.77	1.02	1.12	0.39	0.87
EU Countries	0.986	1.053	1.034	1.053	0.991	0.717	1.139	1.026

Source: Calculation by the author.

From the above table, seen that the PSP score range from 0.78, the minimum, to 1.39, the maximum. From the analysis of the results, Luxembourg (1.39), Ireland (1.26) and Iceland (1.21) are ranked as the countries with the best performance, while Greece (0.77), Bosnia & Herzegovina (0.80) and Croatia (0.84) are ranked as the countries with the lowest index of performance from all countries in the sample. Kosovo in this index ranks 30th out of 35 countries in this sample, with a performance index of 0.86, 15 percent below the average of 1.00.

The main contribution to this low level of the performance index is the economic performance sub-indicator which has a score of (0.29), one of the lowest compares to the countries in the sample. This is due to the fact that Kosovo has the lowest level of GDP per capita, with an average of (9,097) euros, and a high unemployment rate. The largest contributor to this level of the performance index is economic stability (1.39). Kosovo performed well in this area, having a stable inflation and a stable coefficient of variation. Among others, Kosovo has low results and sub-indicators in education, this index ranks with a value (0.67), compared to other countries is about 40 percent below the average, which is 1.00. The infrastructure sub-indicator also has very low scores. Although Kosovo has recently invested heavily in road infrastructure, this index has a value of (0.78), 20 percent below average and about 50 percent below the country with the highest level of this sub-indicator, which is the Netherlands (1.31).

In addition, countries such as Ireland and Norway are the best performing in terms of administration, while Slovakia is the country with the lowest administration index, with a score of (0.70). Among the best-performing countries in terms of education is Belgium, with a score of (1.48), while Serbia is considered the worst-performing country on this indicator, with a score of (0.43). The Netherlands (1.31) and France (1.27) are ranked as the countries with the best performing public infrastructure. In the area of public health insurance, Ireland (1.06) and Iceland (1.10) are ranked as the countries with the best performance, while B&H is ranked as the lowest-performing country in this area with an index of (0.97). On the other hand, countries such as Luxembourg (1.68), Ireland (1.30) and Iceland (1.26) achieved the best results in the category of Musgrave indicators. In Particularly, the sub-indicator of economic stability played an important role in the PSP index for countries of the Western Balkan, as these countries were not as affected by recent economic crises compared to the EU countries. In conclusion, this sub-indicator plays an important role in minimizing the differences between the PSP index of the Western Balkans Countries, whose value (0.87), is 20 percent lower than that of the EU Country, whose PSP index is (1.026).

4.1. Computing PSE Index

Table 4 presents the summary results of the public sector efficiency (PSE) for the period 2007-2016.

Table 4

Summary Results from Public Sector Efficiency (PSE)

	Opportunity Indicator					Musgravian Indicatore		
	Administrative	Education	Health	Public Infrastructure	Distribution	Stability	Economic Performance	Total PSP
Max PSE	2.65 (NDL)	1.40 (HUN)	1.82 (NDL)	2.23 (IRL)	3.12 (DEN)	1.31 (LTU)	3.03 (LUX)	1.32 (LUX)
Min PSE	0.65 (GRE)	0.56 (SRB)	0.77 (FRA)	0.68 (ROM)	0.57 (BEL)	0.32 (SPA)	0.30 (B&H)	0.81 (SRB)
Kosova	1.4	0.72	0.99	0.91	1.48	0.72	0.46	0.96
Mean	1	1	1	1	1	1	1	1
Western Balkans	1.06	0.84	1.18	0.85	1.13	0.93	0.43	0.94
EU Countries	0.89	1.03	0.96	1.13	1.07	0.64	1.01	0.96

Source: Calculation by the author.

Table 4 shows that the PSE results range from 0.78, the minimum, to 1.39, the maximum. The analysis of the results shows that Luxembourg (1.39) and Ireland (1.35) are ranked as the countries with the highest efficiency index, while Serbia (0.81), Greece (0.85) and B&H (0.84) are ranked as the countries with the lowest efficiency index. In this sample, Kosovo ranks 23rd out of 35 countries in this sample with an efficiency index of 0.96, which is 5

percent below the average of 1.00. The results also show that there are large differences compared to the results of the public sector performance index.

This is because the cost of achieving this level of performance is higher in some countries than in others. Among others, the efficiency index of the public sector in Kosovo is higher than in some countries that have higher scores in the public sector index compared to Kosovo. For example, Kosovo has a value in the performance index (0.86) that is 10 percent lower compared to Bulgaria (0.95), while it ranks 1 percent higher in the efficiency index. This result shows that Bulgaria has a higher level of average public spending, about 36.6%, compared to Kosovo, which uses about 27% of average public spending. The situation is similar to this in Italy and Cyprus. They have the same values in public sector performance, they have a difference of 20 percent, in the public sector efficiency index. This mean that Italy uses a higher level of public spending (about 53 percent) than Cyprus, which uses almost 43 percent, or 10 percent less to achieve the same results in the performance index. From the data analysis we also conclude that the efficiency of the public sector in Kosovo is lower than average of the countries in sample in all areas except administration (1.40) and revenue distribution (1.48): Education (0.72), Health (0.99), Infrastructure (0.90), Stability (0.72) and Economic Performance (0.46).

4.2. Computing Data Envelopment Analysis (DEA)

The following table shows the results of the data processing using total public expenditure as input, while total public sector performance as output.

Table 5

Summary results of model performed with the DEA method

Input-Public Spending	Input oriented		Output oriented	
Output-TPSP	Assumption CRS	Assumption VRS	Assumption CRS	Assumption VRS
Mean	39.10	46.70	39.10	73.64
DS	12.10	14.88	13.27	14.84
Min	24.92	32.42	24.92	55.52
Max	100	100	100	100
Efficiency Country	NLD	NLD, LUX	NLD	NLD, LUX
Number of efficiency seats out of total	1	2	1	2

Illustration: CRS-Constant Returns to Scale; VRS-Variable Returns to Scale; DS- Standard Deviation; NLD-Holanda; LUX-Luksemburg.

Source: Calculation by the author.

In the analysis of the model evaluation in terms of input-oriented efficiency, it is assumed that countries can achieve the same level of output if they reduce the level of public spending. Based on the results obtained, it can be seen that the average of the countries included in the study achieves an efficiency of 46.70%. This result shows that these countries generally have the potential to reduce total public spending by 54% and keep constant or not reduce the level of total public performance. Output-oriented efficiency assumes that countries can increase the level of output with the same number of resources. Based on the results of the output-

oriented efficiency analysis, it is found that the countries in the sample achieved an efficiency of 73.64%, which means that the countries in the sample could have increased the level of output by 27% if they had used the same level of inputs.

From the analysis of the data on the efficiency of general public expenditure, it can be seen that the countries of the Netherlands and Luxembourg achieved the result of 100% efficiency and are considered the most efficient countries in terms of total public expenditure by all the countries in the sample. The most inefficient country in the input-oriented analysis is Greece, with an efficiency score of 24.92, which means that Greece could have increased its output level by 75% at the same input level. In output-oriented analysis, the most inefficient country is again Greece, which achieves an efficiency score of 55.52. These results show that Greece could have achieved the same level of output if it had reduced the quantity of inputs by 45%.

In the analysis of the first input-output efficiency model, Kosovo is classified as a moderately efficient country. The value for input-oriented efficiency is 46.05, which means that Kosovo can achieve the same level of public sector performance with 54% less than the total public spending, while the values for output-oriented efficiency are 60.5, which means that Kosovo could have increased the level of results by 40% using the same level of public spending. Thus, compared to other countries in the sample, Kosovo is within the Production Frontier Technique.

5. Conclusion and Recommendation

The aim of this study was to analyze public government spending efficiency for Kosovo and EU Countries, especially Western Balkan Countries, for the period 2007-2016, by examining Public Sector Performance (PSP), Public Sector Efficiency (PSE) and the non-parametric approach (DEA). The result obtained shows that the PSP value ranges from 0.78, the minimum to 1.39, the maximum. Luxembourg (1.39), Ireland (1.26) and Iceland (1.21) are ranked as the best performing countries, while Greece (0.77), Bosnia & Herzegovina (0.80) and Ukraine (0.84) are ranked as the lowest-performing countries. Kosovo ranks 30th out of 35 countries in the sample, with a performance index of 0.86, which is 15 percent below the average of 1.00. In terms of PSE results vary from 0.76, the minimum, to 1.35, the maximum. Kosovo ranks 23th out of 35 countries in this sample with an efficiency index of 0.96, 5 percent below the average, which is 1.00. It is also noticeable that significant differences in the performance and efficiency of the public sector between EU countries and Western Balkan were encountered.

Analyzing input-output efficiency along the production opportunity curve, concluded that countries such as the Netherlands and Luxembourg have achieved an efficiency score of 100 percent and are considered the most efficient countries in terms of total public spending of all countries in the sample, noting that these countries lie along the production opportunity curve. Based on the input-oriented efficiency results, it is also found that the average of the countries included in the study achieves an efficiency of 46.70. This shows that countries are able to reduce total public spending by 54% and maintain the same level of total Public Performance.

Based on the results of output-oriented efficiency analysis, it is found that the countries in the sample achieved an efficiency of 73.64%, which means that the countries in the sample could have increased the level of output by 27% if they had used the same level of inputs.

The results obtained show the group of countries that have the highest scores for the value of the performance index, rank below the efficiency index value. The ratio of PSP index and government public spending shows that the countries with the lowest public spending have achieved better public sector efficiency (PSE). Moreover, we can note from the results that PSE is inversely correlated with a level of government public spending. These findings support the hypothesis that a higher level of public spending concludes with a lower efficiency outcome.

Public sector performance and efficiency should be a fundamental objective for all levels of government in Kosovo. To achieve this objective, it will be basic to adopt a systematic approach that will enable the improvement of the results of the economic performance index. The main contribution to achieve this is an improvement in economic growth as an important factor of the two sub-indicators, GDP per capita and high unemployment rate, that have performed at the lowest level and contributed that Kosovo has lower performance and efficiency of the public sector.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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VOLATILITY SPILLOVER EFFECTS AMONG GOLD, OIL AND STOCK MARKETS: EMPIRICAL EVIDENCE FROM THE G7 COUNTRIES[3]

Economic cooperation of countries across the world has led to the integration of stock and commodities markets. The group of seven countries (G7) represents the world's most industrialised and developed economies. In an integrated market, understanding the price discovery mechanism and volatility spillover across markets is crucial for traders, investors and other stakeholders. This paper investigates the return dynamics and volatility Spillover among the stock markets of G7 countries, oil and gold. We apply VAR and GARCH to examine the relationship between the returns and the transmission of volatility between commodities and stock markets. The research is based on the major stock indices of G7 countries for the years between 2009 and 2018. Oil and gold are taken as a proxy for the commodities market. This study begins by examining the cointegration of the stock and commodities market using the Johansen cointegration test. Stochastic volatility models are used to estimate the volatility and its spillover effect. We estimate the volatility spillover index using variance decomposition. The results indicate the presence of an asymmetric volatility spillover effect between the stock and commodities market. The outcome of the study would facilitate the investors and portfolio managers to understand the return dynamics and volatility spillover effect, which is a prerequisite for an investment decision.
Keyword: Return dynamics; Volatility spillover; Cointegration; Commodities market
JEL: C23; O51; O52; O57; Q02

1. Introduction

The economic integration of various countries influences the nature of commodities and financial markets among the member nations. G7, the group of 7 Nations ambition is to promote prosperity through economic integration and market creation through public and private investment. Integrated markets demonstrate patterns of return and volatility spillover effects between the three key economic drivers, namely the price of oil, gold, and the stock market. Traders, investors, and policymakers have all been interested in learning more about the relationship between the price of oil, gold, and the stock market. The unconventional

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wisdom says, the increase in oil price would increase the price of goods and services, therefore, making the consumer spend less on consumption. Vardar et al. (2018) found evidence of shock transmission and volatility spillover between stock and commodities markets from advanced and emerging markets. Furthermore, the gold and crude oil market are the main representatives of the large commodities market (Zhang, et al., 2010). Pandey (2018) investigated the spillover effect between oil and the stock markets of BRICS countries and found evidence of the spillover effect. Ashfaq et al. (2019) concluded the volatility spillover impact of world oil prices on leading Asian energy exporting and importing economies' stock returns. However, few research studies have found there is no significant correlation between oil price and stock price. For example, Hsiao-FenChang et al. (2013) in their study pronounced that the prices of crude oil, gold price and exchange rate remain considerably independent each other so the policy makers should consider separation of energy and financial policy. Andrea Pescatori (2008) studied the relationship between oil price and S&P 500 in 2008. Government levies taxes on gold and crude oil imports on the exchange rate. This will have a cascading effect on the economy of the country and will directly reflect in the stock market index (Jain, 2016). The results could be inferred in two perspectives. One is the period of study and the nature of economy. An increase in oil prices in the US would benefit the oil and shale gas companies and create more job opportunities in the oil sector. S&P500 stock market index congregates to the long-run level with a speed of daily adjustment by a contribution of oil, and gold price and their volatilities (Gokmenoglu, NegarFazlollahi, 2015). Higher oil prices, on the other hand, would drive up the cost of production and manufacturing across the board. The fast growth of international trade since the 1970s, as well as many industrialised countries' adoption of freely floating exchange rate regimes in 1973, marked a new age of rising exchange rate risk and volatility. The economic vulnerability of enterprises to exchange rate risks has increased, which is unsurprising. The increased volatility and excessive fluctuation of currency rates should induce stock markets to react. Because of the rising integration and deregulation of international financial markets in the 1980s, cross-border cash flows have been easier and faster; currency rates have also become more sensitive to stock market movements and global portfolio investments.

The fundamental theory presumes a direct relationship between oil price and corporate performance. A drop-in oil price means a lesser price of essential items, fuel and transportation costs which leaves more disposable income. According to Patel (2013) the gold price includes a few crucial information to forecast nifty returns. In future, it would be meaningful to develop a model by using econometric modelling techniques which can forecast gold and stock market indices. Priya et al. (2008) examined volatility spillover among gold, silver crude oil futures and spot market in emerging markets and found bidirectional volatility spillover for all commodities except for crude oil in Multi Commodities and Derivatives Exchange in India.

1.1. Gold and exchange rates

The link between gold and currency exchange rates stretches back to the 1870s, when the gold standard was established by the vast majority of countries. The gold standard was considered as a domestic benchmark that slowed the expansion of a country's money supply.

Later on, the gold standard was accepted as an international standard for assessing the value of a country's internal currency with respect to the currencies of other countries. The exchange rate between the currencies related to gold had to be regulated since the market participants to the standard maintained a predetermined price for gold. As a result, a tremor in one country affected domestic money supply and demand, price levels, and real income in another. Although currency exchange rates are no more directly linked to gold, gold is still considered as a safe haven and inflationary hedge. Thus, during high inflation, investors buy gold, and the value of buying currency falls as gold prices rise. Also, when the investors lose confidence in the domestic economy, gold prices rise, and the domestic currency falls in value.

Gold remains a safe haven for centuries and an inflationary hedge, despite the fact that currency exchange rates are no longer tightly tied to gold. As a result, investors buy gold during periods of high inflation, and the purchasing currency's value falls as gold prices rise. Gold prices rise and the value of the domestic currency falls when investors lose faith in the domestic economy. The International Monetary Fund (IMF) estimated in 2008 that the dollar was responsible for 40-50 percent of price movements in gold since 2002. A 1% increase in the effective external value of the US dollar causes a 1% increase in the price of gold. To begin with, a sinking dollar raises demand for commodities such as gold by increasing the value of other local currencies. Second, as the US dollar's value falls in respect to its trade partners, investors seek alternate investment options, such as gold, to protect their capital. Despite the fact that the links and interactions between exchange rates and stock prices have been studied, only a small amount of research has looked into the possibility of volatility transmission or a volatility spillover effect between the stock and currency markets. Understanding how information is transmitted between stock prices and currency rates is aided by studying the volatility spillover mechanism. The current economic globalisation and integration of world financial markets have strengthened the transnational transmission of returns and volatilities among financial markets, thanks to technological advancements.

1.2. Oil and gold

Gold is widely regarded as a safe refuge as well as a monetary replacement. Oil can be used as an inflation hedge for asset portfolios because it is a primary driver of inflation, even if developed countries have improved their energy efficiency and reduced inflation risk. Although both oil and gold are expected to rise in response to a weaker dollar, their relationship is more convoluted because oil is regarded as a hazardous asset, whilst gold is regarded as the inverse. Oil will be acquired at times of trade risk, while gold will be sold, implying that the two should have a negative correlation.

An economically integrated region is prone to spillover effects. The effect could be unidirectional or bidirectional, or with no causality. Examining the dynamics of return and volatility spillover effect facilitates investment decisions. In this paper, we examine the volatility spillover effect of gold, oil and stock markets among G7 countries. This paper is structured as follows. Section 2 highlights the literature review. Section 3 shows the objectives and section 4 explains the methodology. Section 5 deals with analysis and results, and finally, the conclusion in section 6.

2. Literature Review

Qin et al. (2018) used returns of the Chinese RMB exchange rates and the stock markets in China and Japan from 1998 to 2018, empirically examined the volatility spillover effects between the RMB foreign exchange markets and the stock markets. There are co-volatility impacts between the financial markets in China and Japan, according to evidence, and the volatility of RMB exchange rates contributes to co-volatility spillovers across the financial markets. "Return shock from the stock markets, on the other hand, can cause co-volatility spillover to the foreign exchange markets. The estimations also suggest that the Japanese stock market's spillover effects are stronger than those from foreign exchange markets and Chinese stock markets, implying that the market with the strongest spillover effects is Japan's stock market. The estimates also reveal that the Japanese stock market has more spillover effects than the foreign exchange markets and Chinese stock markets, implying that markets with greater accessibility have greater spillover effects on other markets. The average co-volatility spillover effects between the RMB exchange markets and the stock markets in Japan and China are generally negative, according to our findings. The ramifications of these findings for risk management and hedging methods are significant."

While looking at the volatility spillover effects and examining time-varying correlations across four stock indices: CAC, DAX, FTSE100, and S&P 500 from January 5, 2004, to October 1, 2009. They're also known for displaying numerous elements of volatility and correlation in a time-varying variance-covariance matrix. We first discover that volatility spillover effects between European and US stock markets are pervasive using the BEKK model. The UK stock market is the leading transmitter of volatility in the European stock market, whereas the US stock market is the primary exporter. Second, we use the DCC model to see if there is a time-varying link between global equities markets. Correlations are not only conditional, but also considerably time-varying, according to the author. Furthermore, the results show that in the DCC model, the time-varying conditional correlation follows a mean-reverting process; however, according to this research, this is only true for European stock markets (Xiao & Dhesi, 2010).

Diebold et al. (2009) compared the crises of 2009 to East Asian stock market contagion and dependency outbreaks in the early 1990s. Using the forecast error variance decomposition from a vector autoregression, they produced return and volatility spillover indices over rolling sub-sample windows. They discovered that the East Asian return and volatility spillover indexes function differently over time. While the return spillover index demonstrates that East Asian equity markets are becoming more interconnected, the volatility spillover index demonstrates massive bursts during major market crises such as the East Asian crisis. The severity of the present global financial crisis is evidenced by the fact that both return and volatility spillover indexes hit their respective maximum during the current global financial crisis.

There is an examination of the impact of stock market volatility on the foreign exchange market in Pakistan, India, Sri Lanka, China, Hong Kong, and Japan. From January 4, 1999, through January 1, 2014, data for this study was collected on a daily basis. The EGARCH (Exponential Generalized Auto-Regressive Conditional Heteroskedasticity) model was used to study asymmetric volatility spillover effects between the stock and foreign exchange

markets. There is a bidirectional asymmetric volatility spillover between Pakistan's stock market and Hong Kong and Sri Lanka's foreign exchange markets, according to the EGARCH study. Stock market volatility in India is conveyed uni-directionally to the country's foreign exchange markets, according to the statistics. The data show that stock market volatility in India is unidirectionally transferred to the country's foreign currency market. There is no evidence of volatility transmission between the two markets in Japan, according to the research (Jebran & Iqbal, 2016).

To estimate time-varying correlations, multivariate Garch models, which are linear in squares and cross products of the data, are widely utilised. DCC models (dynamic conditional correlation) are a new type of multivariate model. In these correlation models, the flexibility of univariate GARCH models is paired with the simplicity of parametric models. Despite the fact that they aren't linear, they can usually be approximated fast using univariate or two-step processes based on the probability function. They've been shown to work in a variety of scenarios and to produce useful empirical data (Engle, 2002).

X. Diebold et al. (2012) proposed measures of total and directional volatility spillovers using a generalised vector autoregressive framework in which forecast-error variance decompositions are invariant to variable ordering. From January 1999 to January 2010, the researchers used our methodologies to describe daily volatility spillovers across US stock, bond, foreign exchange, and commodities markets. Despite large variations in volatility in each of the four markets across the sample period, cross-market volatility spillovers remained quite minimal until the global financial crisis of 2007. The volatility spillovers grew as the crisis progressed, with the failure of Lehman Brothers in September 2008 triggering particularly large spillovers from the stock market to other markets.

An empirical analysis of volatility spillover from oil prices to stock markets using an asymmetric BEKK model is proposed by Agren & Martin (2006). The study continued with the exception of the Swedish stock market, strong evidence of volatility spillover is found using weekly data on the aggregate stock markets of Japan, Norway, Sweden, the United Kingdom, and the United States. According to news impact surfaces, volatility spillovers are statistically significant but quantitatively insignificant. Oil shocks are less prominent than stock market shocks, which are due to other sources of uncertainty than the price of oil.

Chulia et al. (2008) had two main goals, i.e., to begin, volatility transmission between stocks and bonds in European markets is investigated using the DJ Euro Stoxx 50 index futures contract and the Euro Bund futures contract, two of the most famous financial assets in their respective domains. Second, a trading rule is developed for the major European futures contracts. The economic impact of observed volatility spillovers on a variety of markets and assets can be calculated using this method. Volatility spillovers occur in both directions, according to the statistics, and the stock-bond trading rule provides particularly favourable after-transaction returns. These findings have far-reaching consequences for asset allocation and portfolio management.

Despite the fact that there is now good evidence that sovereign risk premia are driven by a shared mechanism, little is understood about the intricate links between sovereign bond markets. Using daily data on sovereign bond yield spreads and a common component, we use Diebold and Yilmaz's VAR approach to examine the strength and direction of bilateral

links between EU sovereign bond markets. The forecast-error variance decomposition of this FAVAR shows that the bilateral spillover communicated and received between bond markets is highly heterogeneous. For all eurozone countries, spillover is more important than internal issues. The CE countries primarily influence one another. Only Denmark, Sweden, and the United Kingdom are relatively free of spillover. Despite starting from a high point, the spillover has expanded significantly since 2007. We use this methodology to analyse the dynamic links between spreads and the ratings of the major credit rating agencies, as well as to quantify the impact of sovereign rating news. Rating news and sovereign risk premia have a two-sided relationship, according to our findings. Rating news has a wide range of effects, with downgrades at lower grades having a far bigger impact. Domestically, the impact is frequently lower than on bond spreads of other sovereigns (Claeys & Vasicek, 2012).

Santis et al. (1998) applied a parsimonious multivariate GARCH process is used to estimate and verify the conditional form of an International Capital Asset Pricing Model. We can extract any quantity that is a function of the first two conditional moments because the approach is fully parametric. The findings back up a model that accounts for both market and foreign exchange risk. These sources of risk, on the other hand, are only discovered when their prices are permitted to fluctuate over time. The analysis also shows that, with the exception of the US equity market, the currency risk premium often accounts for a large portion of the overall premium.

Using a new panel data set for European countries, the relationship between foreign direct ownership of enterprises and firm- and region-level output volatility is studied. At the corporate level, there is a substantial, positive correlation between foreign ownership and value-added volatility. This link holds in cross-sections as well as in panels with fixed effects from companies, capturing change within firms over time. When it comes to domestic enterprises with holdings in other countries, the favourable link is explained by international variety rather than the owner's nationality. The findings are also observable at the aggregate level, where regional volatility is shown to be positively related to foreign investment in the region. The positive association between aggregate volatility and foreign investment can be explained by the granularity of the company size distribution and the fact that foreign ownership is concentrated among the largest firms (Kalemli-Ozcan, Sorensen, & Volosovych, 2014).

Foreign stock markets move in lockstep over time, according to a significant body of research. As a result of this co-movement, returns and volatility spillover effects can be seen in a variety of goods, from equities and bonds to soft commodities. During the recent financial crisis, it was once again demonstrated that no market is immune to the effects of other global markets. Returns and volatility spillover effects from the Hang Seng, London, Paris, Frankfurt, and New York stock markets to the JSE are validated using an aggregate-shock (AS) model. The data also show that the JSE All Share index is influenced directly by the economic sector, where the crisis began as a result of contagion (Heymans & Camara, 2013).

3. Objectives

1. To examine the volatility spillover between Oil, Gold and Stock markets of G7 countries;
2. To examine the cointegration and causal relationship between Gold, Oil and stock markets of G7 countries;
3. To construct a volatility spillover index between commodities and G7 stock.

4. Research Methodology

4.1. Data input

We obtain the major stock market index data for G7 countries from Bloomberg. The following are the indices of the stock market, commodities and oil, used to examine the cointegration and estimate volatility Spillover index.

Index	Country
DAX Index	Germany
CAC 40 Index	France
S&P/TSX Composite Index	Canada
FTSE MIB Index	Italy
TPX Index	Japan
UKX FTSE	United Kingdom
SPX	USA
GOLD	XAU
Crude Oil	WTI

The sample data for the study covers the period between January 2002 and June 2018. The authors have not used the data for the years following 2018 due to the pandemic and disruption in the global supply chain network. In addition, the crude oil prices during 2019 traded within a relatively narrow price range between $55/b and $75/b, the lowest range since 2003. The frequency of data includes weekly high, low, open and closing indexes. The weekly prices indicate the prices from Monday to Friday for all the benchmark indices. The weekly returns are the log returns calculated based on the closing index value on every Friday. The oil price is calculated based on the West Texas Intermediate (WTI), which is a grade of crude ***oil*** used as a benchmark in oil pricing. The nominal values of the oil price are adjusted for inflation using the headline consumer price index for the respective months. Similarly, the historical gold price has also been adjusted for inflation using the consumer price index. Monthly data of Oil, gold and market returns are used for data analysis and interpretation.

Return=ln($COt|COt-1$), where COt is the closing price for the current period and COt-1 is the previous period's closing price.

4.2 Augmented Dickey-Fuller Test (ADF)

The Augmented Dickey-Fuller test is a test of stationarity in time series data. The data is said to be non-stationary if it carries unit root. A non-stationary process is one in which statistical properties vary with the change in time. A stationary process carries constant variance irrespective of time and means reverting to zero. ADF test examines whether the unit root is present in the series for three levels, i.e., only constant, trend & constant, no trend and constant. ADF test equation:

$$\Delta Y_t = \lambda + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (1)$$

Where:

λ is the random walk drift

γ constant for linear trend

P maximum lag length

β constant for time trend

We check for stationarity, applying the ADF test for the time series data of Gold, oil and stock market of G7 countries. Johansen cointegration is applied to examine the nature of cointegration between the stock market and commodities. VAR autoregression and Vector Error Decomposition models are used to model spillover index.

4.3. Granger Causality Test

The Granger Causality test is applied to determine the causal relationship between two variables. The causality may be unidirectional and/or bidirectional. The test was proposed by Granger (1969) and popularised by Sims (1972).

Steps involved in Granger Causality Test

The test begins by converting the time series data to its first order I(1) and runs a regression. Estimate the following unrestricted equation taking an autoregressive lag length *p*

$$x_t = c_1 + \sum_{i=1}^{p} \alpha_i x_{t-i} + \sum_{i=1}^{p} \beta_i y_{t-i} + u_t \quad (2)$$

$$H_0: \beta_1 = \beta_2 = \ldots = \beta_p = 0 \quad (3)$$

Conduct an *F*-test of the null hypothesis by estimating the following restricted equation by OLS.

$$x_t = c_t + \sum_{i=1}^{p} \gamma_i x_{t-i} + e_t \tag{4}$$

Compare their respective sum of squared residuals.

$$RSS_1 = \sum_{t=1}^{T} \hat{u}_t^2 \quad RSS_0 = \sum_{t=1}^{T} \hat{e}_t^2 \tag{5}$$

If the test statistic

$$S_1 = \frac{(RSS_0 - RSS_1)/p}{RSS_1/(T-2p-1)} \sim F_{p,\,T-2p-1} \tag{6}$$

is greater than the specified critical value, then reject the null hypothesis that *Y* does not Granger-cause *X*.

It is worth noting that with lagged dependent variables, as in Granger-causality regressions, the test is valid only asymptotically. An asymptotically equivalent test is given by

$$S_1 = \frac{T(RSS_0 - RSS_1)}{RSS_1} \sim \chi^2(p) \tag{7}$$

5. Analysis and Discussion

5.1. Augmented Dickey-Fuller test of Oil, Gold and Stock Returns

Forecasting requires the data to be stationary and homoscedastic. A stationary data has the properties of mean, variance and autocorrelation invariant of time. The augmented dickey fuller test determines whether the data is stationary or not. We examine whether the series is stationary for three different types of an equation, i.e., random walk without drift and trend, only intercept, trend and intercept. The following are the hypothesis to check for stationarity.

Ho: The time series is non-stationary

H_1: The time series is stationary

The significance of the results is tested at a 5% level. We apply the unit root test at three levels, i.e. Random walk (No drift and trend) $\boldsymbol{\Delta_y = \gamma y_{t-1} + \varepsilon_t}$, Drift without linear time trend $\boldsymbol{\Delta_y = a_0 + \gamma y_{t-1} + \varepsilon_t}$, drift and linear time trend. $\boldsymbol{\Delta_{y_t} = a_0 + \gamma y_{t-1} + a_2 t + \varepsilon_t}$. The test result indicates the times series data of the stock market, gold and oil are stationary at the first difference for all three equations. The coefficients for drift and trend for all the three variables that indicate the presence of trend, seasonal and irregular variations in the time series data of gold, oil and stock market. The irregular variations indicate the presence of shocks. Converting non-stationary series into stationary would facilitate whether there exists cointegration among the variables. Forecasting accuracy can be improved by applying stationary data in econometric forecasting models.

Table 1

ADF test for the returns of stock and commodities market

ADF stationarity test for the returns of stock and commodities market.			
Market	Intercept	Trend and Intercept	No Intercept and Trend
Crude oil	-0.822895	-0.835255	-0.822884
	(0.0000)*	(0.0000)*	(0.0000)*
Gold	-1.137444	-1.148831	-1.13361
	(0.0000)*	(0.0000)*	(0.0000)*
CAC	-1.092589	-1.092655	-1.090357
	(0.0000)*	(0.0000)*	(0.0000)*
DAX	-0.965641	-0.985646	-0.95112
	(0.0000)*	(0.0000)*	(0.0000)*
FTSE	-1.011393	-1.014319	-1.011322
	(0.0000)*	(0.0000)*	(0.0000)*
SPTX	-1.048481	-1.085481	-1.040593
	(0.0000)*	(0.0000)*	(0.0000)*
SPX	-1.077964	-1.102274	-0.997958
	(0.0000)*	(0.0000)*	(0.0000)*
TPS	-0.970924	-0.979125	-0.954652
	(0.0000)*	(0.0000)*	(0.0000)*
UKX	-1.105171	-1.14348	-1.097165
	(0.0000)*	(0.0000)*	(0.0000)*

5.2. Johansen Co-integration test

We apply the Johansen cointegration test (1988, 1995) to examine whether the stock markets of G7 countries, Gold and Oil are cointegrated. The test examines the long-run relationship between the stock market movements. The results of the ADF test indicate the series of returns of all G7 countries are integrated in the same order I(1). We run unrestricted Vector Auto Regression to estimate the number of cointegrating equations. The assumption made to run the model is no intercept and trend in the Cointegrating equation and Vector Autoregression.

Table 2 and Table 3 show the results of the cointegration test. The test results are interpreted based on two Likelihood ratio (LR) statistics. First is the trace test and second is the Maximum Eigenvalue. To determine the number of the cointegrating equation, the null hypothesis is set as no cointegrating equation against the alternative of k-1 number of equations, where k is the number of variables. The theoretical framework of the Johansen test suggests there may be zero or r number of cointegrating equations, where $0 > r < k$.

The following are the hypothesis of the cointegration test

H0: $r = ro$ (None – no cointegration)

H1: $ro < r < k$ (There exists r number of cointegrating equations)

The hypothesis is done sequentially, starting from none and proceeding to (k) in steps till the null hypothesis cannot be rejected. The results are interpreted based on the obtained values of Trace and Max Eigen statistic value. The null hypothesis is rejected if the trace or

Eigenvalue is more than the critical value or the probability is less than 5%. Both trace test and Maximum Eigenvalues are statistically significant at a 5% level for all null hypotheses. The trace test and Maximum Eigenvalue indicate 4 cointegrating equations. It is evident that the stock markets of all G7 countries and commodities markets are not cointegrated. The Maximum Eigenvalue indicates 4 cointegrating equations. It shows the price movement of gold, oil and stock market cannot deviate from equilibrium in the long term. Any shock or irregular variations in the price movement will die down with an increase in time, and finally, an equilibrium is established. Forecasting the price movement of one variable using the other is possible when the variables are cointegrated.

Table 2

Johansen cointegration test (Trace test) of stock and commodities market

Johansen cointegration Trace test				
No of cointegrated equations	EV**	F Statistic	Critical value	P – Value
None *	0.504525	315.8219	179.5098	0.0000
At most 1 *	0.399953	235.7666	143.6691	0.0000
At most 2 *	0.364338	177.5414	111.7805	0.0000
At most 3 *	0.281442	125.8894	83.93712	0.0000
At most 4 *	0.208044	88.21143	60.06141	0.0000
At most 5 *	0.197265	61.62102	40.17493	0.0001
At most 6 *	0.128449	36.57179	24.27596	0.0009
At most 7 *	0.107669	20.89898	12.32090	0.0015
At most 8 *	0.067052	7.912258	4.129906	0.0058
Trace test result: 8 cointegrating equations				

*rejection of null hypothesis at 5% significance level.
** Eigenvalue

Table 3

Johansen cointegration test (Maximum Eigenvalue) of stock and commodities market

Johansen cointegration Trace test (Maximum Eigenvalue)				
No of cointegrated equations	EV**	F Statistic	Critical value	P – Value
None *	0.504525	80.05523	54.96577	0.0000
At most 1 *	0.399953	58.22519	48.87720	0.0040
At most 2 *	0.364338	51.65205	42.77219	0.0041
At most 3 *	0.281442	37.67797	36.63019	0.0376
At most 4	0.208044	26.59040	30.43961	0.1401
At most 5 *	0.197265	25.04923	24.15921	0.0378
At most 6	0.128449	15.67281	17.79730	0.1014
At most 7 *	0.107669	12.98672	11.22480	0.0243
At most 8 *	0.067052	7.912258	4.129906	0.0058
Maximum Eigen value test result: There are 4 cointegrating equations				

*Rejection of null hypothesis at 5% significance level
**Eigenvalue

Spillover Index

Spillover is the transmission of volatility induced by one variable into another variable that is supposed to be cointegrated. The spillover effect occurs when one or more markets are interlinked. The spillover index measures the percentage of forecast error variance caused by

own and other variables. We construct a spillover index for the return and volatility series of the stock indices of G7 countries.

We follow the stepwise conceptual process to model return and volatility spillover for the G7 countries. The procedural steps involved are as follows

Step 1: Check whether the historical series of returns is stationary using the Augmented Dickey-Fuller test

Step 2: Run unrestricted Vector Auto Regression to estimate the optimum lag structure (p)

Step 3: Conduct the Johansen cointegration test at (p) lags to check the number of cointegrating equations (r)

Step 4: Apply the decision rule to choose between Vector Auto Regression (VAR) and Vector Error Correction Model (VECM). VAR model is used where there is no cointegration among the variables. VECM model is applied when there is at least one cointegrating equation among the variables.

Step 5: Estimate the parameters of the VECM model taking (p-1) lag.

Step 6: Forecast 10 weeks ahead variance decomposition for return and volatility

Step 7: Perform diagnostics test to check for model accuracy.

Step 8: Construct the spillover index separately for the series of returns and volatility of G7 countries.

Using the above-mentioned methodology, we forecasted 3 weeks ahead spillover index and presented the spillover index in Table 4, Table 5 and Table 6. A detailed analysis of the tables is presented after Table 6.

Table 4

One week ahead variance decomposition

	USA	UK	Germany	Japan	France	Canada	Italy	Oil	Gold	Contribution from others
USA	96.08	2.78	0.00	0.03	0.02	0.02	0.08	0.27	0.71	3.92
UK	52.17	46.63	0.02	0.02	0.42	0.08	0.02	0.17	0.48	53.37
Germany	46.72	21.36	30.69	0.13	0.13	0.29	0.33	0.26	0.09	69.31
Japan	22.17	4.76	1.42	70.15	0.00	0.00	0.12	0.01	1.36	29.85
France	53.08	22.92	8.76	0.30	13.66	0.22	0.71	0.27	0.09	86.34
Canada	0.21	0.08	0.21	0.40	0.49	97.97	0.19	0.00	0.45	2.03
Italy	39.53	10.36	2.66	0.00	6.41	0.07	40.81	0.09	0.05	59.19
Oil	8.18	0.46	0.19	0.07	0.02	0.51	0.75	89.68	0.14	10.32
Gold	11.38	2.76	0.24	1.05	0.25	0.04	0.20	0.36	83.70	16.30
Contribution to others	233.45	65.48	13.51	2.00	7.75	1.23	2.41	1.43	3.37	330.63
Contribution including own	329.53	112.11	44.20	72.15	21.40	99.20	43.23	91.11	87.07	900.00
									spillover index	36.74%

Table 5

Two weeks ahead variance decomposition

	USA	UK	Germany	Japan	France	Canada	Italy	Oil	Gold	Contribution from others
USA	95.293	3.086	0.002	0.044	0.178	0.225	0.161	0.354	0.657	4.710
UK	56.078	41.529	0.050	0.620	0.687	0.205	0.086	0.166	0.580	58.470
Germany	49.663	20.511	27.516	0.706	0.187	0.237	0.728	0.346	0.107	72.480
Japan	26.584	4.782	1.274	65.497	0.059	0.004	0.228	0.216	1.355	34.500
France	55.093	22.694	8.047	1.037	11.918	0.185	0.662	0.284	0.080	88.080
Canada	0.290	0.069	0.493	0.356	0.581	97.431	0.243	0.003	0.534	2.570
Italy	40.617	10.141	2.255	0.243	6.195	0.070	40.152	0.092	0.235	59.850
Oil	10.160	0.629	0.351	0.105	0.033	0.554	0.745	87.066	0.356	12.930
Gold	15.604	2.566	0.289	1.336	0.325	0.196	0.187	0.390	79.108	20.890
Contribution to others	254.088	64.477	12.761	4.447	8.246	1.677	3.041	1.851	3.903	354.490
Contribution including own	349.381	106.006	40.277	69.943	20.164	99.108	43.193	88.918	83.011	900.000
									Spillover index	39.39%

Table 6

Three weeks ahead variance decomposition

	USA	UK	Germany	Japan	France	Canada	Italy	Oil	Gold	Contribution from others
USA	93.87	3.92	0.01	0.12	0.23	0.47	0.20	0.32	0.85	6.13
UK	58.07	38.87	0.05	0.89	0.79	0.29	0.15	0.15	0.74	61.13
Germany	51.59	20.58	24.96	1.14	0.25	0.21	0.86	0.31	0.10	75.04
Japan	29.56	5.08	1.22	61.80	0.08	0.05	0.23	0.24	1.74	38.20
France	56.93	22.32	7.35	1.42	10.84	0.17	0.61	0.26	0.11	89.16
Canada	0.34	0.07	0.68	0.34	0.69	96.78	0.31	0.01	0.78	3.22
Italy	41.78	9.75	2.08	0.32	6.04	0.06	39.53	0.09	0.35	60.47
Oil	12.33	0.60	0.36	0.10	0.03	0.71	0.71	84.66	0.51	15.34
Gold	17.65	2.75	0.33	1.27	0.37	0.30	0.21	0.37	76.74	23.26
Contribution to others	268.25	65.07	12.09	5.60	8.47	2.26	3.29	1.74	5.17	371.95
Contribution including own	362.12	103.94	37.05	67.40	19.31	99.04	42.82	86.40	81.91	900.00
									Spillover index	41.33%

Tables 4, Table 5 and Table 6 show the weekly volatility Spillover index of G7 stock market and commodities. We run the Vector Error correction model and forecast the error variance for 10 weeks. The error decomposition quantifies the market variability caused by self (respective index) due to shock and the percentage of volatility coming from other indices. The rows in the table indicate the contribution from others, and the column shows the contribution to others. The spillover tables are to be read as (i x j) matrix. Every ij-th value in the matrix shows the contribution of forecast error variance from country j to i for all $j \neq i$. For every country in a row (i), we estimate the contribution of error variance due to shocks

or innovations from other countries by simply adding values of (j), for all j ≠ i. The diagonal values in the matrix for every i=j show the contribution from own to the forecast variance. The total values in every row excluding j=j show the contribution of volatility from other countries j_1, j_2 – ---- j_n. The diagonal value shows the contribution from its own. The sum of values in every row (i) excluding i=j or the diagonal element in the row shows the contribution from others. We then add all i=1…..n to get the total contribution from others. The sum of columns (j) for all j ≠ i provides the contribution of every country to the forecast error variance of other countries. In simple terms, the sum of rows for all j ≠ i highlights the contribution from others. Similarly, the sum of columns for all j ≠ i shows the contribution to others.

Spillover index = Contribution from other / Contribution including own

For example, for One week ahead variance decomposition in the above table, the total contribution from others for three weeks ahead variance decomposition is 371.95, and the total contribution, including own, is 900. Thus, the spillover index = 371.95/900 = 41.33%.

6. Conclusion

The economic and financial integration of G7 countries makes the market cointegrated. Price discovery and volatility Spillover is a common phenomenon of cointegrated markets. Gold and Oil price influence the market returns due to oil price affecting inflation. The group of G7 countries contributes nearly 50% of global GDP. The extent of integration among the G7 countries makes the return and volatility getting spillover from one country to another country. For instance, the shock in one country makes the market volatile. When the markets are integrated, the volatility spans from one country to another. We apply the Johansen cointegration test and found the existence of cointegration among gold, oil price and stock markets of G7 countries. During the normal scenario, the price of all three variables would be affected by the economic driving forces. The presence of a cointegrating relationship among the three variables induces the phenomenon of price discovery and volatility spillover effect. If any of the three variables experience shocks, the deviation is temporary and the variables move together in the long run. During economic downturn and high inflation, gold is perceived to be the safer asset and its price is inversely proportional to inflation. Furthermore, during a recession, the stock markets tank, which induces the investors to move to safer investments in gold.

Transmission of volatility is a common phenomenon in an integrated market. We apply Diebold – Yilmax methodology to calculate the spillover index for return and volatility. The spillover index is constructed through a variance decomposition process by running Vector Error Correction Model. We found out the presence of volatility transmission in return and volatility within the G7 countries. The spillover index shows evidence of inward and outward transmission of volatility among the benchmark stock indices of G7 countries and commodities. Traders, investors and speculators can predict the volatility using the spillover index and design appropriate trading strategies.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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DEFI – POTENTIAL, ADVANTAGES AND CHALLENGES[2]

Blockchain technology may decrease transaction costs, promote decentralised platforms and build distributed trust, paving the road to new business models. In the financial sector, blockchain technology approves the progress of more innovative, boundless and clear decentralised financial services. Decentralised financial services can broaden financial encompassment by promoting open access and innovation. By scraping out several restrictions, they reveal new opportunities for entrepreneurs and innovators. A year ago, the whole value locked in DeFi (Decentralised finance) systems was almost $600 million, and by May 2021, it was about $88 billion. The frantic development of the ecosystem requires newcomers to understand its basic characteristics. The purpose of this paper is to estimate the advances of decentralised finance, classify current business models, and outline potential challenges and constraints.

Keywords: decentralised finance; blockchain; cryptocurrencies; smart contracts
JEL: O31; D86; L14

1. Introduction

Blockchain technology and distributed ledger (DLT) have obtained immense acceptance since the creation of Bitcoin more than a decade ago (Nakamoto, 2008). The initiation of a distributed, open and distributed ledger allows for censorship-resistant limitless financial transactions between customers. In addition to regular financial transactions, a lot of DLTs maintain scripts for their transactions, supporting customers to set complex payment terms and conditions. Some blockchains, such as Ethereum, even authorise payments to depend on the execution of full Turing programs, so-called smart contracts (Buterin, 2020). 'Decentralised Finance' (DeFi) is neither a legal nor a technical term. In addition to this, DeFi, a new sub-field of blockchain, specialises in improving financial technologies and services on top of smart contract enabled ledgers (Schär, 2020). However, it is progressively employed in the future transformation of finance and its regulation. Typical usage includes one or more components of: (i) decentralization; (ii) distributed ledger technology and blockchain; (iii) smart contracts; (iv) disintermediation; and (v) open banking (Leonhard, 2019). The determination of all DeFi protocols and utilisation is smart contracts, a term that

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is commonly assigned to small applications gathered on a blockchain and running on a large network consisting of plenty of computers. Smart contracts to some extent, are ineffectual in comparison to common centralised calculations. On the other hand, their superiority is the high level of security, in the perception that smart contracts ensure deterministic performance and permit everyone to check the resulting changes in status. When accomplished securely, smart contracts are extremely transparent and reduce the risk of manipulation and arbitrary interference. Smart contracts have access to a full set of Turing instructions and are accordingly quite completely. Moreover, they could store cryptocurrencies and thus act as a custodian, with fully adaptive criteria for how, when and to whom these assets can be honoured. This approves a wide variety of interesting applications and thriving ecosystems.

To accept the novelty of smart contracts, we must first look at ordinary server-based web applications. When somebody interacts with such an application, he cannot follow the internal logic of the application. Furthermore, the user does not control the environment of execution. Either one (or both) can be manipulated. As a result, the customer should trust the service provider. One of the blockchain's major innovations is the transfer and trade of financial assets out of credible intermediaries (Wüst, Gervais, 2017). Smart contracts alleviate both issues and guarantee that the application works exactly as anticipated. The contract code is saved in the main blockchain and can therefore be viewed publicly. The behaviour of the contract is determined and the requirements of functions (in the form of transactions) are processed simultaneously by hundreds of participants in the network, ensuring the legitimacy of performance. When execution results in changes in the balance, such as a shift in account balances, these modifications are subject to the consensus rules of the blockchain network and will be reflected and protected by the blockchain status tree.

The initial idea of smart contracts was introduced by Szabo (1994). He uses the vending machine to evolve further the concept and argues that a lot of agreements can be "embedded in the hardware and software we work within such a way as to make a dereliction of contract costly to the infringer". Buterin (2013) proposed a blockchain-based platform for smart contracts to resolve all trust problems concerning the execution environment and provide secure global states. Furthermore, the platform enables contracts to collaborate. The idea was additionally characterised by Wood (2015) and enforced under the name Ethereum. Despite the numerous alternatives, Ethereum is the biggest platform for smart contracts in terms of market capitalisation, convenient applications and advancement activities (Wood, 2014).

Many commonly centralised financial tools are now implemented and utilised in distributed blockchain systems employing smart contracts. This market sector has become known as decentralised finance (DeFi, henceforth) and has gained popularity as projects have emerged to meet the needs of a wide variety of cryptocurrency users and enthusiasts. Decentralised finance is a movement in the space of the blockchain, which has recently attracted increasing interest. The term is usually assigned to open financial infrastructures created on public platforms for smart contracts, such as the Ethereum blockchain (Buterin, Vitalik, 2014).

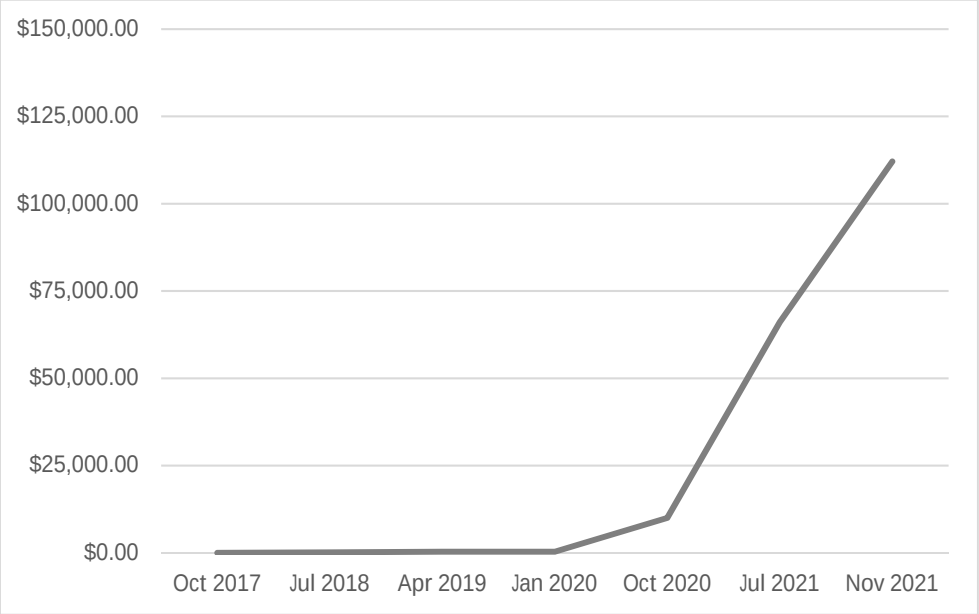
Unlike the conventional financial sector, DeFi does not depend on intermediaries and centralised institutions (Antonopoulos, 2018). Rather, it is established on open protocols and decentralised applications (DApps). The agreements are implemented by smart contracts, transactions accomplished in a safe and deterministic way, and the changes are legitimised on a public blockchain. In such a way, this architecture can create a consistent and supremely

interoperable financial system with exceptional transparency, equivalent access rights and little need for trustees, central clearinghouses or escrow services, as most of these functions can be taken over by smart contracts.

DeFi is still a market alcove with comparatively low volumes, but growing at a rapid pace. The amount of funds locked in DeFi-related transactions has recently reached $88 billion. It is important to understand that these are not values of volume or market capitalisation, but a value related to reserves that are locked in smart contracts for operation in various ways. Figure 1 shows the US dollar asset values locked in DeFi applications.

Figure 1

Total locked value in DeFi contracts (MM USD)



Source: Defipulse.com (2021).

DeFi already proposes a broad array of applications. For example, stable US dollar-backed coins can be purchased on decentralised exchanges (Moin, Sekniqi, Sirer, 2020), it is possible to move these tokens to evenly decentralised lending platforms to receive interest and then add tokenised interest-bearing instruments to a decentralised liquidity pool of blockchain-based investment fund. DeFi's main innovation is similar to a blockchain: reducing the need for trust by substituting centralised platforms with a decentralised system. The emerging system is treated as untrustworthy, which means that no party needs to be trusted to accumulate funds and send transactions. The decentralised character also decreases people's influence on fees and circumstances for employing the system, which is rather transparently governed by supply and demand. Furthermore, DeFi systems are open to everyone. In particular, this means that people can play roles as lenders that have traditionally been in the hands of big players, such as banks.

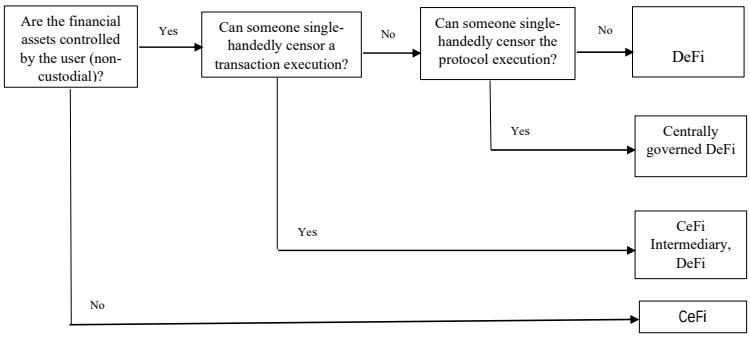
The *subject* of this study is DeFi (decentralised finance), and the *object* is the elucidation of the potential, advantages and challenges for the mass penetration of DeFi. The *purpose* of this paper is to estimate the advances of decentralised finance, classify current business models, and outline potential challenges and constraints. On the ground of a literature review and a comparative analysis between the traditional financial system (CeFi) and DeFi platforms, the following hypothesis is defended: *DeFi platforms solve some problems such as inefficiency, centralised control, limited access, opacity, and lack of interoperability inherent in CeFi.*

2. The Potential of DeFi

Decentralised finance is an entire environment of financial services implemented through smart contracts located in publicly distributed accounting registers. This new proposal intends to decentralise the common financial system by producing services and applications that are detached from reliable intermediaries, allowing unreliable peer-to-peer transactions (Ammous, 2015). Instead of relying on common financial service providers, which are followed by high costs, protracted processes and deficiency of transparency, DeFi implements decentralised financial services. So, applications such as lending, derivatives and trading are automatised and accomplished transparently, reliably and without the requirement for trust (Holotiuk, Pisani, Moormann, 2017). Through the use of publicly accessible protocols, decentralised applications (dApps) and smart contracts, DeFi allow people to play both roles in financial transactions by consuming and providing services, thus "challenging finance, what the Internet did to the media by decomposing the invention of new financial instruments" (Medium.com, 2019).

Figure 2

The boundary between CeFi and DeFi



Source: Qin et al., (2021).

Qin et al. have created a methodology that emphasises borderlines between CeFi and DeFi (Qin et al., 2021). They ask three questions. The first one is whether the financial assets are held by the user, i.e. whether the customer holds control over its assets. If the customer is not in control, i.e. does not hold custody nor can transact the assets without a financial intermediary, that is an example of CeFi. The second one is whether someone can unilaterally

censor a transaction execution. Such a dominant intermediary points to the existence of a CeFi intermediary, as long as the asset settlement can still take place in a decentralised, DeFi-compliant manner. At last, Qin et al. ask the question of whether an entity can single-handedly break, or forbid the protocol's execution. Supposing that this is the case, they should assert that the DeFi protocol is centrally managed. If the answer is negative, then the protocol in question could be qualified as a pure DeFi protocol. Figure 2 illustrates the methodology of Qin et al.

2.1. DeFi vs. CeFi

This chapter provides specific DeFi solutions to the five drawbacks of CeFi: inefficiency, centralised control, limited access, opacity, and lack of interoperability inherent in traditional financial systems.

2.1.1. Inefficiency

DeFi may realise financial transactions with high volumes of assets and low friction, which is generally an enormous administrative burden for CeFi. DeFi builds reusable smart contracts in the shape of dApps projected to execute a particular financial operation. These dApps are accessible to any customer who looks for a specific kind of service, no matter what the size of the transaction is, for instance, a put option execution. To a great extent, a customer may self-serve inside the range of existing smart contracts and blockchain within the application. In the case of Ethereum-established DeFi, the contracts may be utilised by anybody who pays the flat gas fee, commonly around $0.15 for a transfer and $2.00 for a dApp characteristic such as leveraging opposite to collateral. Once redistributed, these contracts constantly support their service with near-zero administrative overhead.

One of the formations in DeFi that advances efficiency is Keepers. They are extrinsic members directly motivated to supply a service to DeFi protocols, such as auditing positions to safeguard that they are fully collateralised or triggering state updates for differing functions. To assure that a dApps' advantages and services are optimally priced, keepers' rewards are frequently structured as an auction. Pure, clear competition adds value to DeFi platforms by assuring customers pay the market price for the services they demand.

A different conception that likewise encourages efficiency is a fork. A fork, in the framework of open-source code, is a copy and reuse of the code with upgrades or improvements layered on top. A typical fork of blockchain protocols is to link them into two parallel currencies and chains. Doing so builds competition at the protocol level and constructs the best conceivable smart contract platform. Not only the code of the whole Ethereum blockchain is public and forkable, but each DeFi dApp developed on top of Ethereum as well. If inefficient or suboptimal DeFi applications occur, the code may be effortlessly copied, advanced, and redeployed through forking. Forking and its advantages rise from the open character of DeFi and blockchains.

2.1.2. Centralised Control

The second drawback of CeFi is the powerful control exercised by governments and big institutions, allowing for a monopoly over parameters such as the money supply, rate of inflation, and admission to the best investment opportunities. In contrast, the society of stakeholders or even a prearranged algorithm may control an element, such as the inflation rate, of a DeFi dApp. If a dApp includes distinctive rights for an administrator, all customers are knowledgeable of the rights, and any customer may effortlessly discover a less-centralised counterpart. DeFi reverses this centralised control by transferring control to open protocols with transparent and unchangeable settings (Schilling, Uhlig, 2019). As no central authority governs or coordinates access to the decentralised environment, customers control their data and store their financial resources themselves. Because customers can save their entry tokens, i.e., signing keys and allowing their transactions, they are completely self-contained. While this, on the one hand, prevents theft or confiscation of funds by a centralised party, individual users, on the other hand, are not protected against the loss of their access tokens, as only they can recover them.

While distributed ledgers do not depend on a specific operator as a trusted agent, they instead distribute trust in a network of nodes (Anjum, Sporny, Sill, 2017). System security is based on the assumption that sufficient nodes in the network are kept fair so that they can reach a consensus on the validity of transactions (Chen, Bellavitis, no date). Consensus ensures that the system is fixed (meaning that transactions cannot be modified, added or deleted retroactively) and resistant to censorship (sometimes called vitality), which ensures that new valid transactions will eventually be included.

Public blockchains are composed to be open, which means that they do not set entry rules and everyone can collaborate with them. DeFi applications assembled on public blockchains derive these attributes by default. Approvals can exclusively be included if DeFi platforms are established on a private blockchain with supplementary entry restrictions or by determining further permissions in the code (Grech, Camilleri, 2017). This also allows anybody to participate in speculation or margin trading, which is not accessible to anybody when utilising centralised platforms, as specific restrictions request (Xu et al., 2017).

The open-source origin of blockchain and the public character of all smart contracts ensures that drawbacks and inefficiencies in a DeFi project may be easily recognised and "forked away" by customers who copy and advance the impaired project. Therefore, DeFi endeavours to invent protocols that instinctively and delicately motivate stakeholders and keep up a robust equilibrium through cautious mechanism design. Naturally, trade-offs exist between having a centralised party and not having one. Centralised control permits for radically definite action in a crisis, sometimes the imminent approach but likewise perhaps an overreaction. The course to decentralising finance will assuredly confront increasing problems because of the challenges in pre-planning for every eventuality and economic nuance. Conclusively, nonetheless, the transparency and security acquired through a decentralised approach will conduce to powerful, robust protocols that may turn into trusted financial infrastructure for a universal customer base.

2.1.3. Limited Access

As smart contract platforms lead to more-scalable applications, customer friction descends, allowing a broad range of customers and thus diminishing the third drawback of CeFi: limited access. Not limited to the DeFi space, but widespread in it, is the aspect of transforming smart contracts within decentralised autonomous organisations (DAO). By allowing the community to propose legislation and vote based on their share of the proposal, management is distributed. The three central aspects of management – joint incentives, accountability and transparency are realised through the creation of consumers and investors accountable for the success of the ecosystem.

It is rare for CeFi markets to operate without downtime. For example, the New York Stock Exchange and the Nasdaq Stock Exchange are the two major trading venues in the United States, and their business hours are Monday to Friday from 9:30 a.m. to 4 p.m. Eastern Time. Due to the non-stop nature of blockchains, most if not all DeFi markets are open 24/7. As a result, DeFi does not have pre-or post-market trading compared to CeFi whereby liquidity on a range of products is typically thin during these periods. Furthermore, system outages at CeFi stock exchanges and CeFi cryptocurrency exchanges have been known to occur due to numbers of users attempting to access the exchanges during times of volatility, such as the GameStop short squeeze event, not to mention the intervention by brokerage firms to restrict their respective customer's purchase and sale of certain equity products due to liquidity and solvency concerns (Robinhood.com, 2021).

DeFi contributes broad underserved groups, such as the worldwide community of the unbanked also small businesses that use large shares of the labour force (for instance, almost 50% in the United States) direct access to financial services. The subsequent effect on the whole global economy shall be strongly positive. Even users who have admission to financial services in CeFi, such as bank accounts, mortgages, and credit cards, do not have admission to the financial services with the best competitive pricing and best agreeable terms; these services and structures are limited to big institutions. DeFi permits any customer access to the wholeness of its financial infrastructure, despite his wealth or geographical region.

A case of resolving the limited access issue is yield farming. This practice affords access to many who demand financial services but whom CeFi drops behind. To sum up, yield farming produces inflationary or contract-funded prizes to customers for staking capital or using a protocol. These prizes are payable in the identical basic asset the customer owns or in a different asset such as a governance token. Any customer can engage in yield farming. A customer may stake an amount of any size, despite how modest, and receive a proportional prize. This ability is specifically strong in the example of governance tokens. A customer of a protocol that distributes a governance token via yield farming turns into a partial owner of the platform through the issued token. A rare situation in CeFi, this mechanism is an ordinary and celebrated manner to provide ownership of the platform to the people who utilise and benefit from it.

2.1.4. Opacity

The fourth flaw of CeFi is opacity. Most publicly distributed accounting records provide transparency by default, as all transactions saved in the blockchain are publicly seeable. Transaction senders and recipients are identified by aliases, while transaction values and submitted data are sent clearly and specifically. Unless additional confidentiality measures are taken, it has been demonstrated that transactions can be related and customers can be recognised (Meiklejohn et al., 2013). For DeFi applications, basic transparency means that all use and stored funds are public at all times. DeFi delicately resolves the problem of opacity through the open and contractual character of agreements. It is worth investigating how smart contracts and tokenisation promote transparency inside of DeFi.

Smart contracts bring an instantaneous advantage in terms of transparency. All parties are enlightened of the capitalisation of their counterparties and, to the degree necessary, may see how funds will be redistributed. The parties may observe the contracts themselves to determine if the terms are acceptable and to remove any uncertainty that may occur when they collaborate under the contract terms. This transparency alleviates the risk of legal burdens to a large extent and brings peace of mind to minor players. In the current environment of CeFi, they could be exploited by dominant counterparties through postponement or even completely inhibiting their end of a financial agreement. In practice, the average user does not comprehend the contract code, rather, he or she depends on the open-source character of the platform and the knowledge of the crowd to sense security. In general, DeFi diminishes counterparty risk and hence establishes a host of efficiencies not demonstrated under CeFi.

DeFi participants are responsible for performing under the terms of the contracts they utilise. One procedure for guaranteeing the proper behaviour is staking. Staking is escrowing a crypto-asset into a contract so that the contract discharges the crypto-asset to the suitable counterpart only after the contract terms are met; alternatively, the asset returns to the initial owner. Counterparties may be requested to stake on any claims or cooperations they execute. Staking carries out agreements by charging a tangible penalty for the offending side and a tangible prize for the cooperation. The tangible prize shall be at least as good as the result of the initial terms of the contract. These transparent incentive systems produce more reliable and clearer assurances than CeFi agreements.

2.1.5. Lack of Interoperability

The fifth flaw of CeFi is the lack of interoperability. CeFi services are complicated to combine, usually requiring a wire transfer, and in many instances cannot be reintegrated. The capabilities for DeFi are considerable and innovations continue to expand at a non-linear rate. This expansion is sustained by the facility of composability of DeFi services. Some blockchain ecosystems, such as Ethereum, maintain vigorous programming instruments that are used for DeFi services. Sophisticated applications, containing auctions, voting and trading can be created with smart contracts. Their functions can be called by customers and smart contracts, which allows for easy connection, arrangement or mixture of extant applications without supplementary programming exertion.

Once a fundamental framework has been established, it is possible to be created synthetic assets and implement new protocols allowing for borrowing and lending. A higher layer would permit for the accomplishment of leverage on top of borrowed assets. Such compatibility may continue in a growing number of directions as new platforms occur. Bringing together contracts to build new kinds of services is often seen as a "Lego" feature of DeFi protocols. This feature stems from the run of smart contracts as creating blocks and linking them to build more useful structures. The benefits of composability, particularly tokenisation and networked liquidity are explained below.

Tokenisation is a critical form in which DeFi platforms coordinate with each other. A good example is a percentage holding stake in a private commercial real estate venture. It would be a challenge for CeFi to collateralise this asset either for a loan or a derivative position backing. As DeFi depends on joint interfaces, applications may straightly plug into each other's assets, repackage, and subdivide positions as required. DeFi can unlock liquidity in traditionally illiquid assets through tokenisation. A typical example would be the creation of fractional shares from an indivisible asset such as a stock. We may expand this conception to provide fractional ownership to scarce resources such as unique art. The tokens may be utilised as collateral for any other DeFi service, such as leverage or derivatives. We are capable to invert this archetype to build token bundles of groups of real-world or digital assets and trade them similar to an ETF. Let's imagine a dApp comparable to a real estate investment trust (REIT), but with the extra proficiency of permitting the owner to divide the REIT into separate real estate components to choose a favoured geographical location and distribution within the REIT. Ownership of the token gives direct ownership of the allocation of the properties. The owner may trade the token on a decentralised exchange to close the position.

Tokenising hard assets, such as real estate or precious metals, is more difficult than tokenising digital assets because the practicable considerations associated with the hard assets, such as maintenance and storage, cannot be executed by code. Legal constraints according to jurisdictions are likewise a challenge for tokenisation; however, the adequacy of secure, contractual tokenisation for nearly all use cases ought not to be undervalued.

The conception of interoperability broadens effortlessly to liquidity in the exchange use case. CeFi exchanges, particularly those that individual investors ordinarily utilise, cannot easily share liquidity with other exchanges without specialised access to a prime broker, which is usually restricted to hedge funds. In DeFi, as a subcomponent of the contract, any exchange application may use the liquidity and rates of any other exchange on the same blockchain. This feature allows for networked liquidity and brings about very competing rates for customers within the same application.

2.2. Overview of the services provided through DeFi

This subsection illustrates the capability of DeFi applications by displaying typical applications. Conditionally, this application can be summarised in the following five sections: lending platforms, asset platforms, decentralised exchanges (DEX), derivative

services and payment networks. While more sections are emerging, the focus of this study will be on these five sections.

- **Lending platforms:**

Decentralised lending services are the biggest class of DeFi outputs, with $28.48 billion in locked funds (Defipulse.com, (2021). They offer loans to companies or individuals utilising smart contracts as intermediaries and mediators. In this way, the "common" intermediaries obligated for centralised lending are eliminated. In connection with the analysis in the previous paragraph, Table 1 illustrates a comparison between CeFi and DeFi lending platforms. These smart contracts automatise the lending agreement, including interest rate rules. Pooled loans utilise float interest rates that object to supply and demand. The funds of all borrowers are gathered in a single, smart contract-based lending pool, and lenders begin to gain interest just when they deposit their money in the pool. Nevertheless, the interest rates are a function of the pool's utilisation rate. When liquidity is easily accessible, loans will be inexpensive. However, during times of high demand, loans will become dearer. Lending pools have the supplementary benefits that they may accomplish maturity and size conversion while maintaining comparably high liquidity for the individual lender.

Table 1

Comparison between CeFi and DeFi – Lending platforms

	CeFi	DeFi
Inefficiency	- Acquiring a loan includes expenses of time and money. - Non-optimal rates for borrowing and lending because of inflated costs.	- Instant liquidity at the press of a button with minimal transaction costs. - Algorithmically pooled and optimised interest rates.
Centralised Control	- Interest rates are affected by the US Federal Reserve and admission to loan services controlled by regulation and institutional policies. - Borrowing and lending rates are controlled by institutions.	- MakerDAO platform is publicly controlled by the MKR holders. - Compound rates are settled algorithmically and provide control of market parameters to COMP stakeholders motivated to transfer value to users. - Aave interest rates are controlled algorithmically.
Limited Access	- Acquiring loans is arduous for a vast majority of the population. - Complication in infiltrating high-yield USD investment opportunities or competitive borrowing. - Exclusively selected groups have access to substantial quantities of money for arbitrage or refinancing.	- Open capability to draw DAI liquidity against an overcollateralised position in any supported ERC-20 token. Admission to a competitive USD-denominated return in the DSR. - Open capability to borrow or lend any supported assets at competing for algorithmically established rates (provisionally subsidised by COMP distribution). - Flash loans democratise admission to liquidity for instantly profitable businesses.
Opacity	- Ambiguous collateralisation of lending organisations.	- Clear collateralisation ratios of vaults discernible to the whole ecosystem.
Lack of Interoperability	- Cannot trustlessly utilise USD or USD-collateralized token in smart contract agreements. - Cannot reuse supplied positions for other investment opportunities. - Cannot monetise or use surplus collateral in a lending position.	- Issuance of DAI, a permissionless USD- tracking stablecoin supported by cryptocurrency. DAI may be utilised in any smart contract or DeFi application. - Tokenised positions through cTokens may be utilised to turn static assets into yield-generating assets. - Credit delegacy enables parties to utilise deposited collateral when they do not require borrowing liquidity.

- **Asset platforms:**

Traditional assets serve mainly as capital collateral for companies. Similarly, virtual assets in the crypto area have comparable goals. Nonetheless, since they are built, saved and traded through the blockchain, they are innately public and their shifts are transparent. Using smart contracts, they may be traded automatically and without restrictions. Assets are the second most valuable class in Defi. Popular assets platforms in the DeFi space are USDT, USDC and BUSD with a locked value in US dollars ($30.97B), ($24.75B) and ($10.68B), respectively (Defipulse.com, 2021).

- **Decentralised exchanges (DEX):**

Services that concentrate on decentralised cryptocurrency and token exchange are frequently classified as DEX and represent the third biggest category of DeFi products, with about $18.92 billion in locked funds (Defipulse.com, 2021). DEX operates likewise to a stock exchange, but rather than being managed by a central provider, the exchange is managed by a smart contract located on a blockchain such as Ethereum. The absence of a centralised authority indicates that the principles and supervisions for trading are prearranged in the code of the smart contract and consumers must interact with it to trade assets. Typically, a smart contract further processes consumer funds during the trading process to assure a proper payout. Concerning the analysis in the previous paragraph, Table 2 presents a comparison between CeFi and DeFi exchanges.

Table 2

Comparison between CeFi and DeFi – Exchanges

	CeFi	DeFi
Inefficiency	- Trades usually demand two parties to settle.	- An AMM (automated market makers) that enables steady access for trading against the contract.
Centralised Control	- Exchanges that control which trading pairs are supported.	- Enables anybody to construct a new trading pair if it does not already exist and automatically transmit trades through the most effective pathway if no direct pair exists.
Limited Access	- The most excellent investment opportunities and returns from liquidity providing are limited to big institutions.	- Anybody may become a liquidity provider and gain fees for doing so. Any project may issue its token on Uniswap to give anybody access to it.
Opacity	- Unidentified if the exchange controls all users' entire balance.	- Transparent liquidity levels in the platform and algorithmic pricing.
Lack of Interoperability	- Capability to trade assets on one exchange is not readily executed within the different financial applications.	- Any token swap required for a DeFi application may use Uniswap as an installed feature.

To discover the swap rate, smart contract-based liquidity pools utilise a variety of fixed product models, where the relative price is a function of the smart contract's token reserve ratio. In its rudimentary form, the fixed product model may be represented as $xy = k$, where x and y coincide with the smart contract's token reserves and k is a constant. Bearing in mind that this equation should uphold when anyone performs a trade, we obtain $(x + \Delta x).(y + \Delta y) = k$. It may then be simply displayed that $\Delta y = (k/(x + \Delta x)) – y$. Therefore, Δy will accept negative values for any $\Delta x > 0$ (Schär, 2020). Any swap is located on a convex token reserve curve. A liquidity pool utilising this model cannot be drained, as tokens will become pricier with lower reserves. When the token supply of either one of two tokens comes nearer zero,

its relative price increases infinitely as an outcome. It is necessary to mention that smart contract-based liquidity pools are not dependent on extrinsic price feeds (so-called oracles). Whenever the market price of an asset changes, anybody may take benefit of the arbitrage opportunity and exchange tokens with the smart contract while the liquidity pool price converges to the present market price.

A different method is to attract liquidity reserves through a smart contract that enables big liquidity providers to link and promote prices for particular trade pairs. A customer who chooses to swap token x for token y can send a trade request to the smart contract. The smart contract will collate prices from all liquidity providers, adopt the best proposal on behalf of the customer, and perform the trade. It operates as an entrance between customers and liquidity providers, guaranteeing the best fulfilment and atomic settlement. In opposition to smart contract-based liquidity pools, with smart contract-based reserve gathering, prices are not set inside of the smart contract. Rather than, prices are determined by the liquidity providers. This method functions excellent if there is a comparably large base of liquidity providers. Nevertheless, if there is restricted or no competition for a certain trade pair, the method can lead to collusion risks or even monopolise price setting. Such corrective, reserve aggregation protocols commonly have some (centralised) control means, such as maximum prices or a minimum number of liquidity providers.

A substitute to classic exchange or liquidity pool models is peer-to-peer (P2P) protocols, ditto called over-the-counter (OTC) protocols. They mainly depend on a two-step method, where participators may request the network for counterparts who would like to trade a given pair of crypto-assets and then bargain the exchange rate bilaterally. Once the two parties agree upon a price, the trade is performed on-chain through a smart contract. Unlike other protocols, suggestions may be approved completely by the parties who have been included in the bargaining. Particularly it is not attainable for a third party to front-run somebody accepting a suggestion by examining the pool of unconfirmed transactions (mempool). For efficient performance, the procedure is mainly automated. Also, one may utilise off-chain indexers for peer finding out. These indexers presume the task of a directory in which individuals may announce their intention to make a particular trade.

Curve Finance (Curve. fi, 2021), whose users have locked in more than $8.16 billion, is the largest example in this category, aiming attention primarily on trading and lending to stablecoins. Another famous DEX service is Uniswap, with over $5.47 billion in the capital (Uniswap.org, 2021). The Uniswap smart contract is publicly applicable on the blockchain, and any customer can interact directly with it. The major mechanic behind Uniswap is the pooling of liquidity, which eliminates the need to process order logs. Consumers pay 0.3% transaction fees, which are added to the liquidity pool used and raise income for liquidity providers.

- **Derivative services:**

Decentralised derivatives are tokens that obtain their value from a basic asset's performance, the result of an event, or the establishment of any other noticeable variable. They commonly need an oracle to trace these variables and consequently present some dependencies and centralised elements. The dependencies may be lessened when the derivative contract utilises numerous independent data sources. Table 3 illustrates a comparison between CeFi and DeFi

derivatives. Tokenised derivatives may be designed without the presence of third parties and in a form that forbids malicious impact. Famous instances of DeFi derivatives are Synthetix ($796.1M) (Synthetix.io, 2021), Nexus Mutual ($359M) (Nexusmutual.io, 2021) and BarnBridge ($294.5M) (Barnbridge.com, 2021).

Table 3

Comparison between CeFi and DeFi – Derivatives

	CeFi	DeFi
Inefficiency	- Fixed income rates are lesser because of layers of fat in CeFi. - Suboptimal rates for borrowing and lending because of excessive costs. - Sizable asset buys suffer from slippage as traders consume into the liquidity pool.	- Lean infrastructure operating on Ethereum permits more vying rates and diversified liquidity pools. - Algorithmically pooled and optimised interest rates. Complimentary flash loans (no collateral) provided for instant use cases. - Synths exchange rates are supported by a price feed, which removes slippage.
Centralised Control	- Fixed income instruments are mainly limited to governments and big companies. - Borrowing and lending rates are controlled by organisations. - Assets may principally only be bought and sold on registered exchanges.	- Yield protocol is open to participants of any size. - dYdX rates are defined algorithmically. - Provide synthetic assets in one spot that may trace any real-world asset.
Limited Access	- Numerous investors have restricted entry to buy or sell complex fixed-income investments. - Hardship in acquiring high yield USD investment opportunities or competitive borrowing as well as futures and derivative products. Admission to capital for instantly gainful initiatives is restricted. - Admission to particular assets is geographically restricted.	- Yield enables any market participator to buy or sell a fixed income asset that settles in a target asset of their preferring. - Open capability to borrow or lend any provided assets at competitive algorithmically defined rates. Involves a continuous futures contract that could synthetically support any asset. Complimentary flash loans produce anybody admission to large amounts of capital to capitalise on arbitrage or different profitable opportunities. - Anybody may access Synthetix to buy and sell Synths.
Opacity	- Risk and unpredictability of counterparty in traditional agreements. - Vague collateralisation of lending institutions.	- Comprehensible collateralisation publicly known on Ethereum blockchain supporting the investment. - Obvious collateralisation ratios of borrowers are visible to the entire ecosystem.
Lack of Interoperability	- Fixed income instruments usually settle in cash which the investor ought to decide how to distribute. - Hard to repurpose funds inside of a financial instrument. - Real-world assets such as stocks can't be readily presented directly on a blockchain.	- yTokens may settle in any Ethereum target asset and even settle synthetically into a floating-rate lending protocol to reserve returns. - Flash loans may instantly use the wholeness of the assets under management for external opportunities without risk or loss to investors. - Synth representations of real assets are completely consistent with Ethereum and other DeFi protocols.

- **Payment networks:**

Even elementary financial instruments such as payments are decentralised to decrease the impact of central payment providers to create an open financial environment. As a result of the essence of blockchain technology, customers can exchange cryptocurrency safely and straight without the commitment of intermediaries. Nonetheless, huge fees and unavoidable

lags require specific services that improve decentralised payments. The core technology for services like Flexa ($1.35B) depends on payment channel technology (Flexa.network, 2021), xDAi ($74.2M) builds side chains (Xdaichain.com, 2021). The above categories are not absolute and represent guidelines for classification, as plenty of features of DeFi are still issue to adjust. In addition, many DeFi services can be identified with more than one or even supplementary groups. Gnosis, for example, can be classified as DEX (decentralised exchange) due to its protocol and as an asset over conditional tokens (event-based assets).

3. Risks and challenges before the implementation of DeFi

3.1. Security

This study determines three features of DeFi products that necessitate distinguished consideration in terms of security: the vulnerability of smart contracts, infrastructure risk and weaknesses in interdependence. The past has proved that insufficient security has led to huge financial losses, with some of the most notorious incidents being cited for clarity.

DeFi products are based on smart contracts that operate directly or indirectly with consumer funds. When more funds are associated with a particular smart contract, it turns more appealing to potential attackers. In this way, smart contracts can be seen as similar to public error programs, as any user who finds an error in the contract may employ the vulnerability and conceivably steal money. The case that the contract code and all past collaborations with it are stored transparently in the blockchain makes it even simpler to detect errors. Accordingly, smart contract developers have to put a lot of work into programming contracts without susceptibilities. Utilising familiar layout templates and best procedures is a good starting point. Further external security audits can also increase confidence in the correctness of the contract. Developers may still construct a contract so that possible security adjustments are enforceable while the contract is running on the blockchain. Nevertheless, such an updated device claims some form of management that efficiently reduces the degree of decentralisation. The past has shown a huge impact of programming errors in smart contracts, for example, on DAO and its respective portfolios (Cryptoslate.com, 2020; Coingeek.com, 2020; Theblockcrypto.com, 2020).

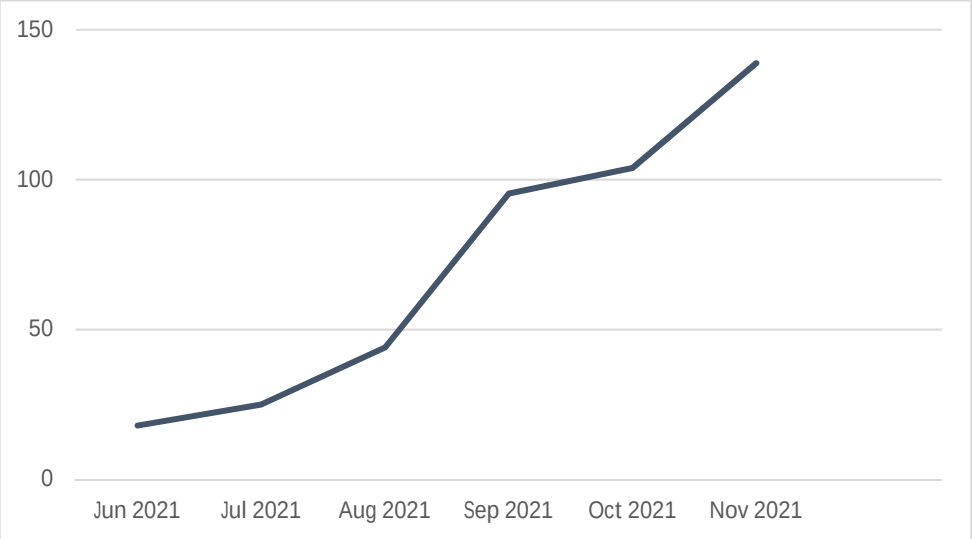
Although the deterministic and decentralised enforcement of smart contracts has its benefits, there is a risk that something will be confused. If there are coding errors, these errors can potentially create vulnerabilities that could enable an attacker to drain a smart contract, induce chaos, or do the protocol unusable. Consumers should be attentive that the protocol is as safe as the smart contracts that underlie it. Unfortunately, the average consumer will not be capable to read the contract code, even less of assessing its security. Although audits, insurance services and official inspections are partial solutions to this problem, some ambiguity remains. Analogous risks remain in the performance of the contract. Most users do not understand the payload of the data they are requested to sign as part of the transactions and can be misguided by a compromised interface.

Next, the core infrastructure may have additional impacts on the DeFi product, which must be taken into account when designing application – distinguishing security means. For

example, the limited bandwidth of the Ethereum blockchain led to network congestion in 2020 (Figure 3). The contract uses expectations to assure timely interplay between the members. In this case, a crowded network can lead to missed user queues, as valid transactions by honest customers may not be recorded on time (Winzer, Herd, Faust, 2019). Therefore, the properties of the basic consensus mechanism affect the application-specific protection properties.

Figure 3

Average weekly price for gas in the Ethereum blockchain denominated in Gwei



Source: Duneanalytics.com, (2021).

Designing new protocols for the DeFi area demands distinctive attention. In particular, due to the ability to constitute distinct DeFi products and build new protocols based on existent ones. The protection of a given protocol cannot be analysed in a stand-alone model: the influences of other protocols ought to also be taken into account. This aspect is emphasised by the presentation of two specific attacks. The first is frontrunning, so-called by Daian et al. (Daian et al., 2020). The term ex-ante control covers all scenarios in which one party attempts to record its transaction before the competing transaction. Any attempt at initial implementation could lead to a so-called "priority gas auction", in which customers substitute as the price of gas increases for their transactions. The idea is for the miners to be stimulated by including their transactions in the block as a priority.

Finally, due to the great interest in DeFi, the system is becoming increasingly attractive for attacks and fraud. In September 2020, it was revealed that several tokens had been used in a "pump and dump" scheme (News.bitcoin.com, 2020). Influencers disseminated information about this token to encourage other users to invest in it. Once the price of the token was high enough, the major investors sold their shares to get a great return on investment.

3.2. Limited scalability

Blockchain technology and its functions deteriorate from restricted transaction throughput, which is frequently seen as a major obstacle to the widespread adoption of this technology (Abra.com, 2019). The main reason is that the blocks in the registry have only a restricted space shared by transactions, implementation of smart contracts and requirements of the contract functions. Therefore, when plenty of applications and their customers contend for restricted block space, miners choose the transactions that suggest the largest fees. Thus, consumers have to adopt either very large fees or lengthy delays to confirm new transactions.

Ethereum is the main choice for DeFi applications due to its programmability, wide community and wide array of developer instruments. Nevertheless, due to its restricted scalability, Ethereum cannot cope with the increasing number of customers and arising DeFi applications. An analysis by the German digital business association Bitkom says it is extremely controversial whether Ethereum is a viable platform for DeFi, exceptionally when even more customers log into the system (Bitkom.org, 2020). When demand for DeFi applications raised in the late summer of 2020, Ethereum's transaction fees raised dramatically and built plenty of other applications on the blockchain platform impossible.

3.3. Oracles

While the collaboration among two chains, such as smart contracts, is easy, the transmission of data from extrinsic sources and websites to a smart contract builds new challenges. Plenty DeFi products depend on extrinsic information such as exchange rates provided by so-called oracles. As the data obtained from these oracles influence the behaviour of smart contracts and consumers, the challenges posed by the transfer of external data along the chain are considerable anxiety. More precisely, the security of these DeFi products is established on the dependability, accuracy and correctitude of the information provided by the oracles. Oracles introduce dependencies and, in some cases, can lead to a highly centralised performance of the contract. To diminish this risk, plenty of projects depend on large oracle networks with M-of-N data schemes. Oracles are therefore evaluated based on their accountability for transparency and the required level of confidence. Popular products based on DeFi oracles are Maker (Makerdao.com, 2021), Compound (Compound.finance, 2021), AmpleForth (Ampleforth.org, 2021) and Synthetix (Synthetix.io, 2021). ChainLink even offers a network of oracles that do information approachable through its API (Chain.link, 2021). Its growing importance is likely to be associated with important partnerships, such as Google, Oracle or Salesforce.

The Maker project mitigates some of the defiances listed above by linking data from numerous sources rather than depending on data from an individual source. For each kind of extrinsic data, a set of oracle whitelists is defined, which often supply examples. These examples are combined by an aggregator that generates the concluding data addressed to the platform. Therefore, the dependability of oracle data is enhanced through copy. The oracles used must be independent so that the failure of one oracle does not affect other oracles. The aggregator calculates the median of the reported samples to cancel any large deviation. In addition, Maker provides the ability to update the white list of oracles, which leads to the

swap of oracles. The update is established on the verdict of the managers governing the MKR token.

Liu et al., after examining the DeFi oracles, introduce large-scale calculations of price volatility, downfalls, and transaction activity examinations (Liu et al., 2020). In addition, the authors offer recommendations for designing oracle decisions. First, each oracle must indicate information such as data sources, frequency of updates, and description of price variations. Such common information may be easily supplied and significantly increases transparency by allowing consumers to comprehend where the fluctuations from distinct sources come from. Second, because oracles do as credible third parties, it ought to be possible to hold them accountable for misconduct such as missing reports or large price deviations. This can be achieved by including inducements in the scheme of Oracle solutions. For instance, oracle operators win rewards when the frequency and accuracy of their emissions are adequate. On the other hand, the penalty for poor performance can be realised by denying awards and probably even withdrawing crypto assets from a previously provided pool.

3.4. Regulations

The creation of unified global standards to regulate the crypto-economy may alleviate risks such as censorship or collusion, but to date, they do not exist. As the DeFi market raises in size and effect, it will require large regulatory inspections. Most existing regulatory concepts still deal mainly with the classification of tokens for tax purposes. The Liechtenstein and US governments operate as worldwide role models, and regulators, in general, have increased clarity by following suit (Consensys.net, 2019). For DeFi, it is not yet clear how the generated income is regulated. The correct status of the whole environment as such is not undoubtedly determined. Questions arise about the possibility of abuse or illegal use. However, it is often unclear whether the ecosystem may even face a shutdown. An example in this context is an algorithmic stablecoin venture identified as Basis. It was forced to cease its activities due to regulatory concerns in December, 2018. The worrying message on their homepage serves as a warning to similar future undertakings: “Unfortunately, having to apply US securities regulation to the system had a serious negative impact on our ability to launch Basis. As such, I am sad to share the news that we have decided to return capital to our investors. This also means, unfortunately, that the Basis project will be shutting down” (Basis.io, 2018).

Punishing a particular use is difficult due to the aspects of self-reading and decentralised completion of transactions. There is a critical chasm between management and external regulation that needs to be filled regarding Ethereum’s DeFi. In addition, the lack of information about your customer (KYC) processes in the DeFi environment makes it difficult for regulators to admit it as an official financial field. KYC practices are difficult to apply. As a result, regulators face the great challenge of not inhibiting innovation too much when regulating DeFi. Yeung (2009) asserts that the equilibrium between legal and technical code maintains interplays with distinct aspects (economic, political, social) without hurting the society (Yeung, 2019).

In September 2020, the European Commission has introduced a project to regulate "crypto-assets" (digital, blockchain-based assets), which is anticipated to enter into force by 2023. The Regulation "Crypto Asset Markets" (MiCA), which is straightforwardly suitable to all European countries. Member States define the broadest regulation of digital assets to date. As far as DeFi is concerned, it is not yet clear what the consequences of this project are. Although the project contains most kinds of crypto assets and classifies them variously, DeFi tokens are not expressly addressed. The DAI stablecoin may be categorised as a so-called asset-referenced Token according to the project (European Commission, 2020). The classification is justified by the soft attachment to the lucky dollar. Yet many tokens and contracts may be reflected as "issuer-free". This is a key issue in this context. Probably smart contracts in the DeFi area can be categorised at some point as crypto asset service producers. However, convincing legal research needs to be done to further explain the connection with DeFi.

A great number of large market-cap cryptocurrencies have been decreed as commodities by the CFTC, which exempts them from monetary circulation laws. Some states, though, such as New York, have a regulation that targets brokerages with a focus on the transfer and swap of cryptocurrencies. As DeFi keeps on to spread and the total number of released assets continues to rise, it is anticipated to foresee enhancing special and nuanced regulations directed at DeFi protocols and their customers. Cryptocurrency taxation has yet to be completely established from a regulatory point of view, and accounting software/on-chain supervising is just starting to approach mainstream retail audiences. As long as the DeFi are subjected to new regulations (virtually daily), such as permitting banks to be cryptocurrency custodians, the market outlook for these institutions is murky.

3.5. On- and Offramping

Usefulness and user experience can ascertain the destiny of projects. Since DeFi was originally designed by experienced crypto users, they were created primarily for their needs. So far, the design of several decentralised applications (dApps) has been essentially ameliorated. Nevertheless, the terms of application are often clarified at a high technical level or are completely ingrained in financial jargon. In the long run, this poses a threat to the mass acceptance of some DeFi projects. An attainable resolution may be to guide inexperienced customers through the workflow in a tutorial way, showing consequences in progress (whilst providing a link to a clarification).

On- and off-ramping attribute to the approaches of swapping conventional assets for crypto-assets and vice versa. Centralised exchanges are established on confidence in an intermediary, request authentication through KYC practices, have restricted scalability, suffer from security problems, process off-chain transactions and impose significant fees (Medium.com, 2018). Many of these shortcomings are equivalent to the constraints faced by traditional banks. The superior centralised exchanges are Coinbase, Binance and Kraken. To ensure seamless on- and off-ramping, these companies need to grow significantly to meet the requirements of all customers.

3.6. Confidentiality

The fact that all information is public to the blockchain suggests various challenges - varying from "transaction connectivity, crypto-key management, crypto-privacy resilience issues to quantum computing, chain data privacy, usage, interoperability or compliance of the provisions on confidentiality, such as the GDPR "(Bernal Bernabe et al., 2019). By default, all transactions that occur in Ethereum are visible to the public. Although system addresses are pseudonyms (Sas and Khairuddin, 2017), they may be decoded utilising centralised exchange information to identify customers and metadata (Neudecker and Hartenstein, 2017) (Victor, 2020). Because financial information is very sensitive to many people, privacy is a hot topic. In particular, consumers seek private transactions so that no unauthorised party can get data about consumers' financial activities. In addition, decentralisation, openness and protection of the integrity of blockchain technologies suggest challenges to compliance with confidentiality provisions (i.e. the right to be forgotten).

Nevertheless, various projects discuss these problems. Private transfers, according to Williamson, can be accomplished utilising various techniques (Aztec.network, 2021). For example, disconnection between the sender and the recipient of the tokens is possible when a contact party based on a smart contract is used (Tornado-cash.medium.com, 2019). Rollups enable customers to hide smart contracts, and Ernst & Young shares an open-source warehouse named Nightfall that utilises zk-snarks to do Ethereum transactions private (Medium.com, 2019). However, the overall confidentiality offering of public blockchains has serious remaining challenges to address. Bernabe et al. claim that consumers have the authority to execute anonymously in particular cases and that only by complying with this right can a blockchain support a truly confident model of identity (Bernal Bernabe et al., 2019).

Conclusion

In contrast to CeFi, DeFi offers inspiring possibilities, such as the power to build an open, transparent and unchanging financial infrastructure. Consisting of multiple extremely interoperable protocols and applications, all transactions may be checked by any individual and the data is easily accessible for analysis by users and researchers. On the other hand, the blockchain limits DeFi's transaction throughput, transaction confirmation latency, and privacy. Ultimately, DeFi and CeFi share the same goal: to provide customers with high-quality financial products and services and to boost the entire economy. To summarise, DeFi and CeFi each have their own set of advantages and disadvantages, and we cannot find a trivial way to combine the best of both systems. Therefore, we believe that these two distinct but intertwined financial systems will co-exist and improve each other. It is expected that CeFi and DeFi to co-exist, complement, strengthen and learn from each other's experiences, mistakes and innovations. CeFi and DeFi are already tightly intertwined (e.g., through centrally controllable stablecoins) and have jointly allowed the onboarding of a wider (e.g. technical) user demographic.

DeFi generally will be an attractive phenomenon that has huge and ever-growing potential. While the initial services posed issues such as payments and trading resolutions, progress has

been made to more modern products providing more sophisticated financial services. The Lego aspect reinforces this evolution even more. On the one hand, developers utilise smart contracts and decentralised decisions to create reliable forms of conventional financial tools. On the other hand, they build entirely new financial instruments that could not be executed without the main public blockchain. Atomic swaps, autonomous liquidity pools, decentralised stablecoins and flash loans are a few of the numerous illustrations that reveal the huge resources of this ecosystem. Based on the growing complexity, the management of these processes is becoming increasingly complex.

Although this system has big power, there are some dangers. The main challenges the system faces are scalability and safety. In particular, the existing scaling problems raise the question of whether Ethereum, as a modern DeFi platform, can cope with the growing demands. In addition, the term "decentralised" is misleading in some instances. Numerous protocols and applications utilise extrinsic information sources and distinguished administrator keys to manage the system, perform smart contract updates, or even accomplish urgent shutdowns. Despite this is not necessarily a problem, consumers should be aware that in many cases there is a great deal of trust. In addition, regulatory uncertainties need to be taken into account. In this regard, a solution for KYC is not available and, as a result, DeFi suffers from a lack of appropriate recognition as a valuable ecosystem of financial services in the eyes of the public. However, if these problems can be resolved, DeFi can bring a pattern change in the financial sector and conceivably promote a more stable and transparent financial infrastructure.

In general, it can be expected that the growth of DeFi can determine the growth of the blockchain sector in the forthcoming years, as it motivates decisions and enables people to access services when they are not offered by banks or other financial institutions.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE BEHAVIOUR OF TAX REVENUE AMID CORRUPTION IN NIGERIA: EVIDENCE FROM THE NON-LINEAR ARDL APPROACH[7]

One of Nigeria's greatest challenges is the generation of adequate tax revenue to meet her rising expenditure, and the country has continued to contend with corruption, particularly in its public sector. We employ the non-linear autoregressive distributed lag (NARDL) technique to examine tax revenue behaviour amid corruption using Nigeria's quarterly data over the 1999-2019 period. The result of the NARDL bounds test to cointegration demonstrates the presence of a long-run relationship between tax revenue and corruption along with income level, agriculture, inflation rate, foreign aid and female labour force participation. The results of estimation indicate the existence of asymmetry in tax revenue behaviour. We find evidence of a significant positive impact of negative changes in the control of corruption and a significant negative effect of positive changes in the control of corruption on tax revenue in the long run. Other long-run significant determinants of tax revenue in Nigeria include income level, foreign aid and female labour force participation. Based on these empirical outcomes, this study offers some recommendations.
Keywords: Tax revenue; Corruption; NARDL technique; Nigeria
JEL: D73; E62; F13; H26; H32

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Introduction

There is no doubt that one of Nigeria's greatest challenges is generating adequate revenue to meet her expenditure occasioned by rising demand for socio-economic infrastructures such as portable water, electricity, roads, healthcare, education, and security, among others. A major source of government finance is the tax revenue. Interestingly, taxation has long been recognised as an important instrument used by government to regulate the national economy, intervene in resources allocation and distribution of income, and an effective tool for achieving economic development in a country (Tanchev, 2016). However, successive governments in Nigeria have not been able to mobilise adequate tax revenue to drive sustainable economic development. In an attempt to strengthen the economy's capacity to collect tax, the government enacted an act that established the Federal Inland Revenue Service (FIRS) in the year 2007. Consequently, the FIRS, which had been a Department under the Ministry of Finance, was granted autonomy. Some of the reasons why tax bodies like the FIRS are created in each country include integration of tax operations and effective collection of tax compared to the ones obtainable under the civil service (Fjeldstad, 2006). Thus, it was expected that the tax body would become more efficient and effective in the delivery of its services as well as insulating it from unnecessary political interferences. Although the amount of tax collected increased in the early years of the establishment of the FIRS, the body was unable to sustain the growth in tax revenue in the years that follow.

Whereas the desire of every government is to sustain the generation of high tax revenue, public sector corruption can be an impediment to the successful mobilisation of revenue via tax collection. It has been suggested that the common features of tax systems in poor countries (Nigeria inclusive) are corruption and tax evasion (Fjeldstad, 2003). In carrying out its daily activities, the government delegates certain responsibilities to its officials, including the collection of taxes. But these officials might exploit their position for private gain or benefit (Aidt, 2003). Therefore, high corruption among tax officials/administrators can reduce a country's capacity in the collection of tax (Ajaz, Ahmad, 2010; Friedman et al., 2000; Johnson et al., 1999; Tanzi, Davoodi, 1997), and a substantial part of funds which ought to have gone to government's treasury are never realised due to corruption (Fjeldstad, 2003; Ghura, 1998; Kiser, Baker, 1994; Ul-Hague, Sahay, 1996).

On the other hand, subscribing to the view of Leff (1964) and Huntington (1968) that corruption can be beneficial in an economy characterised by weak institutions and inefficient bureaucracy by increasing its efficiency and raising the level of economic activity, a few scholars argued that some level of corruption could be tolerated to facilitate the collection of taxes in countries where wages of tax officials are very low and there are constraints on efforts required to know taxpayers' actual liabilities (Flatters, MacLeod, 1995). It has also been suggested that at very high levels of corruption, revenue collected from taxes can rise (Akdede, 2006; Alm et al., 2014). These authors opined that if the cost of evasion (the amount of bribes required to evade tax) is higher than the tax obligations, individuals will pay their taxes rather than engaging in evasion, leading to higher tax collection.

Some of the major obstacles to tax collection in Nigeria (and other African countries) are perceived corruption among tax officials and the lack of understanding of tax systems

operated in many economies on the African continent (Aiko, Logan, 2014). In addition, many individuals often ask what the taxes they pay are used for because there is not much on the ground in terms of tangible infrastructure or public utilities. This lack of trust reduces people's commitment to pay taxes and it also raises the likelihood that they will not comply by paying taxes. Therefore, high corruption (with an unfair tax administration) is likely to promote a culture of non-compliance among taxpayers, leading to less tax collection and revenue.

Nigeria is one of the countries where corruption remains a serious problem and scholars have suggested that it has spread to almost every part and/or sector of the economy (Abu et al., 2015; Abu, Staniewski, 2019). Also, authors have emphasised that corruption is a major factor militating against the proper functioning of Nigeria's FIRS and the growth of tax revenue (Micha et al., 2012; Momoh, 2018; Salami, 2011). A substantial amount of revenue is lost due to tax avoidance and evasion (acts of corruption) by a considerable number of firms (Momoh, 2018). Moreover, despite measures put in place to check fraudulent practices including the establishment of anti-corruption agencies such as the Economic and Financial crimes Commission (EFCC) and the Independent Corrupt Practices Commission (ICPC), some tax officials still engage in corrupt acts (Salami, 2011).

Despite the existence of low tax revenue and the relatively high corruption in Nigeria, researchers have paid less attention to examining the empirical relationship between these two variables, probably due to the lack of adequate data on tax revenue and corruption. In fact, Micah et al. (2012) blamed the lack of proper record (data) keeping for the poor performance of the FIRS. The few studies conducted on the corruption-tax revenue relationship in Nigeria are Onogwu (2018) and Omodero (2019). Whereas these authors' efforts deserve some commendations, the approach they employed is not without shortcomings. For instance, the number of observations used by Omodero (i.e. 23 years) and Onogwu (i.e. 22 years) falls short of 30, which is the minimum requirement for time series analysis. Second, the authors did not conduct unit root tests to ascertain the stationarity status of the variables used in their studies. Third, the results of the OLS estimation the authors reported might be meaningless if the variables considered in their studies were non-stationary. Fourth, the authors did not conduct diagnostic tests such as serial correlation, heteroscedasticity and misspecification tests making one to doubt the validity of their results.

Thus, the present study contributes to the literature in a number of ways. First, the study uses quarterly data spanning over the 1999-2019 period, making a substantial number of observations readily available for analysis. Second, this study conducts unit root tests to ascertain the stationarity status of the variables used in the analysis. Third, our study is the first to employ the non-linear autoregressive distributed lag ARDL (NARDL) technique to examine the relationship between tax revenue and corruption. Using the NARDL method makes it possible to investigate the asymmetric (positive and negative changes) impacts of corruption on tax revenue. Lastly, the NARDL approach solves problems such as endogeneity bias and consequently the generation of reliable and/or valid results.

Following the introduction the second section highlights the trends or movements in tax revenue and corruption in Nigeria. Section three consists of a review of related studies on tax revenue and corruption, while the fourth section is for theoretical framework and model

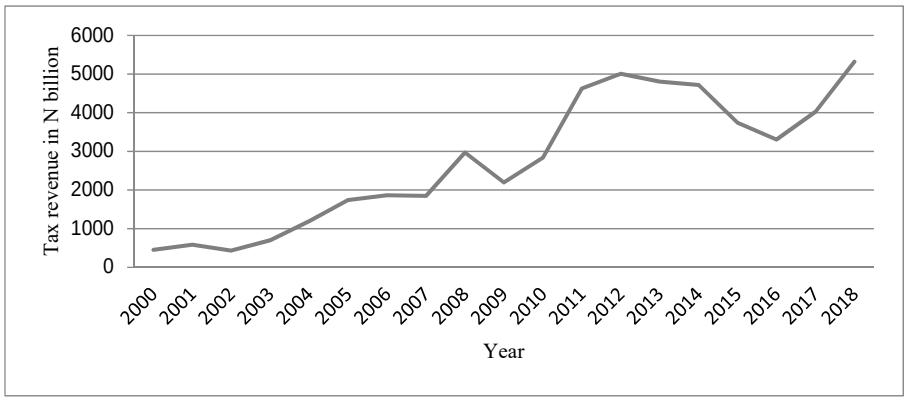
specification. The fifth section contains data and econometric techniques, while section six is the discussion of results. The last section concludes the study.

Trends in Tax Revenue and Corruption in Nigeria

As stated in the introduction, the primary goal of creating the FIRS was to raise (and sustain) the amount of revenue collected via tax. However, it appears that the establishment of the tax body has not led to a significant improvement in revenue generation and/or sustained growth in tax collection. Available statistics from Nigeria's FIRS illustrate that tax revenue (in billion Naira) fluctuated over the 2000-2018 period. For example, from N455.3 billion in 2000, tax revenue decreased to N433.9 billion in 2002 before jumping to N1,866.2 billion in 2006. Thereafter, tax revenue declined to N1,846.9 billion in 2007, but it later increased to N2,972.2 billion in 2008. The fluctuation in tax revenue continued as it decreased to 2,197.8 billion in 2009. Even though tax revenue increased to N5,007.7 billion in 2012, it soon fell to N4,716.6 billion in 2014 and further to N3,307.5 billion in 2016. The value of tax revenue was N5,320.5 billion in 2018 (Figure 1).

Figure 1

Plots of tax revenue (in N billion) in Nigeria calculated based on the data collected from FIRS



Similarly, the share of tax revenue in GDP fluctuated during the same period. In addition, tax revenue share in real and nominal GDP was less than 10 percent from 2000 to 2018 (Figure 2). The low share of tax revenue in GDP in Nigeria is consistent with the view of Besley and Persson (2014) that tax collection in low-income countries has remained low and it ranges between 10 to 20 percent of GDP compared to the 40 percent average for their high-income counterparts.

Besides unimpressive tax revenue performance, Nigeria's other challenge is public sector corruption. The Transparency International (TI) in the year 2020 ranked Nigeria as one of the leading corrupt nations in the world and the fourth most corrupt in the West African sub-region. A cursory look at the TI's corruption perception index indicates that Nigeria has not

fared well in tackling corruption. The index ranges from 0 (most corrupt) to 100 (most clean). Nigeria's corruption index, which stood at 12 in 2000, rose to 16 in 2002 before dropping to 14 in 2003. Although the index increased to 19 in 2005 and 27 in 2008, it declined to 24 in 2010-2011. The index assumed a rising trend to 27 in 2012, but it fell to 26 in 2015. The corruption index rose to 28 in 2016 and later declined to 27 in 2017-2018 (Figure 3). The low corruption index suggests that Nigeria's corruption level has remained high over the years.

Figure 2

Plots of tax revenue share in real and nominal GDP in Nigeria calculated based on the data collected from FIRS and World Bank's WDI

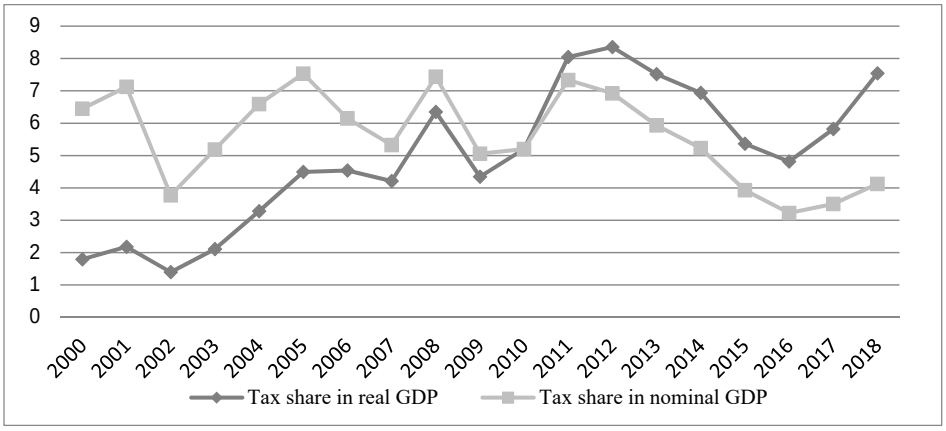
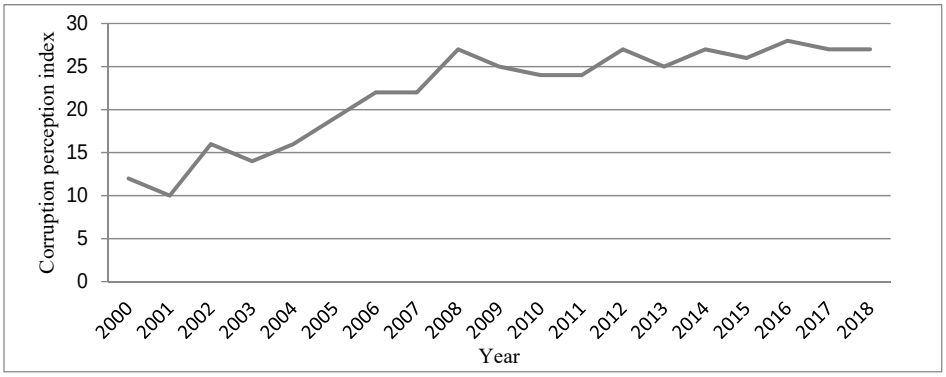


Figure 3

Plots of corruption perception index in Nigeria based on the data collected from Transparency International



Thus, the movements in tax revenue and corruption index suggest that Nigeria has been less successful in tax collection and it remains a country where corruption continues to rear its ugly head.

Review of Related Studies on Corruption and Tax Revenue

Authors have examined the empirical relationship between tax revenue and corruption. Most of these studies focused on a group of countries, employing cross-section or panel data. For example, Arif and Rawat (2019) investigated the influence of governance and corruption on the tax revenue in 10 emerging and growth-leading nations from 2001 to 2015 using the pooled mean group (PMG) estimator. The results demonstrate that improvement in governance and the fight against corruption exert a significant and positive effect on tax revenue mobilisation.

Also, Epaphra and Massawe (2017) analysed the impacts of governance and corruption on different types of taxes in selected African economies using the random effects and fixed effects estimators. Other variables, including income per capita, inflation, agriculture, trade openness, tariff rate and tax rate, were considered in the study. The authors found that good governance raises tax revenues, while corruption has a negative impact on tax revenues. Besley and Persson (2014) attempted to answer the question "why developing countries tax so low". The results of the regression analysis indicate that an improvement in the corruption index (less corruption) has a positive impact on tax revenue. In addition, tax revenue increases at a high-income level and decreases at a low level of income. Other significant drivers of tax revenue are property rights protection, average years in war, ethnic fractionalisation and executive constraints. Rodríguez (2018) employed both system system-generalised method of moments (system-GMM) and panel corrected standard error (PCSE) estimators to examine the drivers of tax revenue and/or its compositions in 138 economies from 1976 to 2015. The author discovered that the quality of governance, female labour force participation, education, international trade and democracy promote tax revenue mobilisation. On the other hand, agriculture, inflation, foreign aid, natural resource rents and population tend to reduce the amount of tax collected.

In addition, Imam and Jacobs (2014) regressed 11 types of taxes on corruption, including real income per capita, openness, share of agriculture in GDP, and inflation in 12 Middle East countries from 1990 to 2003 using the system-GMM technique. The results illustrate that reducing corruption has a negative impact on taxes collected on goods and services, while it raises other forms of tax revenue. Other important determinants of tax revenue include income per capita, agricultural share in GDP, openness and inflation. Furthermore, Ajaz and Ahmad (2010) investigated the effect of institutional variables (corruption and governance) and structural factors on tax revenue in 25 developing economies during the 1990-2005 period using the GMM estimator. The results illustrate that corruption has a negative effect on tax collection, and better governance has a positive impact on tax revenue. Also, factors such as inflation (proxied by the log of consumer price index) and industrial output share in GDP are important in explaining tax revenue.

Similarly, Mahdavi (2008) employed the GMM estimation method to assess the effect of corruption on tax revenue in 43 countries from 1973 to 2002. The results suggest that less corruption has a positive impact on tax revenue. Furthermore, Bird et al. (2008) examined the effect of governance (corruption, voice and accountability) on tax effort (proxied by tax revenue share in GDP) in a cross country study over the 1990-1999 period using the ordinary

least squares (OLS) and the two-stage least squares (TSLS) estimation methods. Other potential determinants considered in the study included GDP per capita, population growth rate, openness (exports plus imports to GDP ratio), and non-agricultural share in GDP. The results show that reducing corruption has a positive effect on tax revenue. In addition, population growth and income per capita have a negative effect on tax revenue, but the non-agriculture sector has a positive impact on tax revenue.

In the same vein, Thornton (2008) employed the OLS and TSLS estimators to evaluate the impact of corruption on the composition of tax revenue in a sample, consisted of 53 the Middle East and African countries. The results illustrate that corruption has a strong negative and significant impact on tax revenue collected on international trade transactions, domestic goods and services and social security. Also, Hwang (2002) investigated the effect of corruption (proxied by different indexes of corruption) on government revenue in 41 to 66 countries using the OLS, TSLS and seemingly unrelated regression (SUR) estimation techniques. The empirical evidence demonstrates that corruption is positively related to taxes on international trade, but negatively associated with domestic tax revenue and government revenue share in GDP.

Moreover, Alm et al. (2014) employed different estimation methods to examine the corruption and tax evasion relationship using firm-level information. The authors found that corruption raises the level of tax evasion, which consequently results in low tax revenue. In addition, Ketkar et al. (2005) evaluated the effects of corruption on tax revenue and foreign direct investment (FDI) in 54 developed and developing economies since 1996 using multiple regression analyses. The results reveal that a reduction in corruption raises revenue directly via higher tax collection and indirectly through higher FDI inflow and taxable income. Ghura (1998) assessed the effects of corruption and economic policies on tax revenue in 39 Sub-Saharan African (SSA) economies over the 1985-1996 period. The regression results indicate that tax revenue rises with a reduction in the level of corruption. In addition, agriculture, inflation, openness, human capital development, external factors, and structural reforms are equally significant in explaining tax revenue. Tanzi and Davoodi (1997) investigated the relationship between corruption, economic growth and public finances across countries from 1980 to 1995 using regression analysis. The results reveal that high corruption has a negative impact on tax revenue, including total revenue and non-tax revenue. The empirical results also indicate that income per capita is significant in explaining government revenue.

Some studies have evaluated the impact of corruption on tax compliance, tax effort, and tax morale with its consequences on tax revenue. For instance, Pessino and Fenochietto (2010) examined the determinants of tax effort (measured by tax revenue as a share of GDP) in a sample of 96 economies during the 1991-2006 period by employing the stochastic frontier method of analysis. The results demonstrate that countries with a low level of corruption have a high level of tax revenue. Gupta (2007) used various estimation approaches such as the fixed effects, random effects, PCSE, system-GMM and difference-GMM estimators to investigate factors that influence tax revenue effort in 105 developing countries for a period of 25 years. The results illustrate that less corruption has a positive effect on tax revenue, mainly in low and middle-income countries. Also, variables such as income per capita, share of agriculture in GDP, openness to trade, foreign aid, and political stability are important determinants of tax revenue. Moreover, Picur and Riahi-Belkaoui (2006) examined the

relationship between corruption, bureaucracy and tax compliance in 30 developing and developed economies using OLS with the White correction method. The empirical results show that control of corruption has a positive effect on tax compliance, and bureaucracy has a negative impact on tax compliance. These findings suggest that less corruption promotes tax compliance, which results in high tax revenue, while bloated bureaucracy encourages non-compliance, which leads to less tax revenue. On his part, Torgler (2004) used the weighted ordered probit analysis to examine corruption and tax morale relationship in transition countries during the 1995-1998 period. The author found that the higher the perceived size of corruption, the lower the tax morale and as a result, the less tax revenue.

In Nigeria, Omodero (2019) employed the OLS technique to analyse the effects of shadow economy and corruption on tax revenue performance during the 1996-2018 period. The author concluded that both corruption and the shadow economy have adverse impacts on tax revenue in Nigeria. Also, Onogwu (2018) analysed the impact of corruption on public sector revenue and investment in Nigeria from 1997 to 2017 using the OLS method. The author found that corruption raises public investment, while there was no evidence that corruption exerts an influence on government revenue.

A review of empirical literature indicates that little attention has been given to the corruption and tax revenue relationship in Nigeria. Also, existing studies on the corruption-tax revenue relationship employed inadequate sample size, did not conduct unit root tests, employed inappropriate estimation techniques, and failed to perform important tests, including serial-correlation and heteroscedasticity tests. This study contributes to the literature by employing the NARDL method to investigate the behaviour of tax revenue amid corruption in Nigeria using quarterly data over the 1999-2019 period. In addition, conventional diagnostic tests like serial-correlation and heteroscedasticity, as well as tests were conducted to ascertain the validity of the results.

Theoretical Framework and Model Specification

In building the tax model, this study relies on the theory of tax compliance of Graetz et al. (1986). The authors explained how the interaction between taxpayers and tax officials could influence the amount of tax collected via enforcement and bribery (an act of corruption). Contributing to the discourse, Flatters and MacLeod (1995) presented a model which shows that some level of corruption can be tolerated to make the tax system efficient, particularly if the wages of tax officials are very low and there are huge constraints on efforts required to know precisely taxpayers' liabilities. Supporting this argument, Akdede (2006) and Alm et al. (2014) suggested that corruption can provide a conducive environment for tax compliance. The authors opined that if the costs of evasion (i.e. the amount of bribes taxpayers are required to pay to officials to evade tax) are higher than the costs of paying tax, then, individuals (or firms) will comply and pay their tax rather than giving the huge bribes to tax officials. This will raise the level of tax revenue.

On the contrary, some scholars argue that corruption reduces the effectiveness of the government's policy instruments, leading to a reduction in the government's ability to

enforce tax laws and raise tax revenue (Chander, Wilde, 1992; Virmani, 1987). Authors have also emphasised that collusion between taxpayers and tax collectors can result in an understatement of tax liabilities and, consequently, a reduction in the amount of tax that is remitted to the treasury (Aidt, 2003; Flatters, MacLeod, 1995). To a greater extent, raising income tax will lead to a reduction rather than an increase in tax revenue in countries where tax administrators are very corrupt (Bowles, 1999; Sanyal, 2002; Sanyal et al., 2000; Tanzi, Davoodi, 1997).

The foregoing discussion illustrates that the level of corruption (COR) tends to affect tax revenue (TAX). Thus, a model in which TAX is dependent on COR is specified as:

$$LTAX_t = \beta_0 + \beta_1 COR_t + \varepsilon_t \quad (1)$$

Other than corruption (the variable of interest), certain variables which also influence tax revenue in the literature are considered in this study. They include income level, agriculture, inflation, foreign aid and female labour force participation. For example, authors argue that income level measured by GDP per capita (GDPC) goes a long way in affecting tax revenue mobilisation (Bird et al., 2008; Gupta, 2007; Imam, Jacobs, 2014; Tanzi, Zee, 2000; Teera, 2003). Thus, at a higher income level, countries have a higher capacity to collect and pay taxes (Chelliah, 1991), leading to higher tax revenue (Imam, Jacobs, 2014).

In addition, agriculture (AGR) tends to influence the revenue that can be collected via tax (Gupta, 2007; Tanzi, Zee, 2000; Teera, 2003). In developing countries where agriculture constitutes a substantial amount of economic activity and is dominated by subsistence production and farming, it may be difficult to tax those who engage in agricultural production and farming due to their low earnings. Therefore, in a country like Nigeria with subsistence agricultural production and poor farmers, agriculture is expected to have a negative effect on tax revenue.

Furthermore, inflation proxied by the consumer price index (CPI) and a measure of macroeconomic uncertainty or instability (An et al., 2016) can also affect the level of tax revenue. The higher the inflation rate (or higher uncertainty/worsening macroeconomic condition), the lesser the revenue generated from different taxes (Imam, Jacobs, 2014). In line with this view, authors, including Tanzi (1977), suggested that real tax revenue declines with high inflation. Thus, the high inflation rate in Nigeria is expected to have a dampening impact on tax revenue.

Moreover, foreign aid (AID) can influence the amount of tax collected (Gupta, 2007; Rodriguez, 2018). The effect of AID depends on whether it is used to finance consumption or expand production (Gupta, 2007). It has also been suggested that the behaviour of revenue can be influenced by the composition of AID (Gupta et al., 2003; Rodriguez, 2018). Whereas Gupta et al. (2003) and Rodriguez (2018) found that concessional loans raise tax revenue, authors such as Mahdavi (2008) and Benedek et al. (2014) confirmed a negative effect of grant on tax revenue.

Also, female labour force participation (FELP) can dictate the movement in tax revenue (Mahdavi, 2008; Rodriguez, 2018). The higher the participation of females in the labour force, the higher the labour income that is taxable. The reason behind this argument is that

housewives carry out some duties at home (considered as work) for which they receive no payment (Rodriguez, 2018). Thus, participating in the labour force, enable females to earn income that can be taxed. Authors also believe that women are more likely to comply with tax obligations compared to men as they pay greater attention to ethical issues (Rodriguez, 2018; Torgler, Schaltegger, 2005).

Taking these variables into consideration, the new tax revenue model is re-specified as follows:

$$LTAX_t = \beta_0 + \beta_1 COR_t + \beta_2 LGDPC_t + \beta_3 LAGR_t + \beta_4 LCPI_t + \beta_5 AID_t + \beta_6 FELP_t + \varepsilon_t \quad (2)$$

where L denotes the logarithm of the variables.

Data and Econometric Techniques

The major constraint of this study is the lack of data for a substantial number of observations/years (i.e. n>30 or above) required for a time series analysis. In particular, the data on control of corruption is available from the year 1996 and the data on tax revenue from 1999. It is noteworthy that previous studies on tax revenue determinants in Nigeria used federally collected revenue as a proxy for tax revenue. In our case, we use tax revenue data which are published by the FIRS and available for only a few years. Proper record (data) keeping of tax revenue has been a major problem in tax administration in Nigeria (Micah et al., 2012). On the other hand, data on other (control) variables are available for a considerable number of years. To address this issue, annual data on all variables for the 1999-2019 period were converted into quarterly data using the Gandolfo's (1981) interpolation method. This leaves us with a higher number of observations, that is, quarterly data for 1999:1-2019:4 (i.e. n=76) because the first and last years of the series were eliminated during interpolation. The Gandolfo's procedure has been used in past empirical studies (Abu, Karim, 2021; Abu et al., 2019; Baharumshah et al., 2006; Baharumshah, Rashid, 1999). In addition, it has been stated that interpolated series do not cause bias in estimates of cointegrating vectors even in finite samples (Smith, 1998).

The data were collected from various sources as follows. The data on GDP per capita, consumer price index, agriculture, foreign aid and female labour force participation were obtained from the World Bank's World Development Indicators (WDI); the control of corruption from the World Bank's World Governance Indicators (WGI); and TAX from the Federal Inland Revenue Service.

Unit root tests

Prior to the estimation of the relationship between tax revenue and corruption, the Augmented Dicker-Fuller (ADF) and Phillips-Perron (PP) tests were used to ascertain the unit root property/status of the data/series. This test (unit root test) is required to guide against the generation of misleading results. The ADF equation (Dickey, Fuller, 1979) is specified as:

$$\Delta y_t = \mathrm{a} + \rho y_{t-1} + \theta_1 \Delta y_{t-1} + \cdots + \theta_k \Delta y_{t-k} + \varepsilon_t$$

where y_t is the series, and ε_t the error term. The equation is used to test the null hypothesis:

$H_0 : \rho = 0$ (unit root)

Against the alternative hypothesis:

$H_1 : \rho < 0$ (series is stationary)

In addition, the PP test (Phillips and Perron 1988) was used as a complement to the ADF test. If the ADF/PP statistic is smaller than the critical value at 1%, 5% or 10%, the H_0 is not rejected. On the other hand, if the ADF/PP statistic is higher than the critical value, the H_1 is accepted.

Non-linear ARDL technique

In examining the relationship between tax revenue and corruption, this study employs the NARDL approach of Shin et al. (2014). The NARDL method is an asymmetric extension to the popular ARDL model (Pesaran, Shin, 1999; Pesaran et al., 2001). The rationale for using the NARDL technique is based on the opinion of scholars that the relationship that exists between variables is not always linear. This technique can be used whether the series are of order one [i.e. I(1)] or a combination of variables of [I(1)] and order zero [I(0)], but it cannot accommodate I(2) variables (Ibrahim, 2015; Jalil et al., 2014; Shin et al., 2014). Also, the method is more appropriate in estimating the relationship between variables using finite or small samples.

The NARDL model $(p, k_1, k_2, k_3, k_4, k_5)$ to be estimated is specified as follows:

$$\begin{aligned} \Delta LTAX_t = \delta_0 &+ \sum_{i=1}^{p} \delta_1 \Delta LTAX_{t-i} + \sum_{i=0}^{k_1} \delta_2^* \Delta\, COR_{t-i}^* + \sum_{i=0}^{k_2} \delta_3 \Delta LGDPC_{t-i} \\ &+ \sum_{i=0}^{k_3} \delta_4 \Delta LAGR_{t-i} + \sum_{i=0}^{k_4} \delta_5 \Delta LCPI_{t-i} + \sum_{i=0}^{k_5} \delta_6 \Delta AID_{t-i} \\ &+ \sum_{i=0}^{k_6} \delta_7 \Delta FELP_{t-i} + \beta_1 LTAX_{t-1} + \beta_2^* COR_{t-1}^* + \beta_3 LGDPC_{t-1} \\ &+ \beta_4 LAGR_{t-1} + \beta_5 LCPI_{t-1} + \beta_6 AID_{t-1} + \beta_7 FELP_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

where δ_0 is the constant, δ_1 - δ_7, and β_1 - β_7 are coefficients to be estimated. The short-run and long-run models' asymmetric parameters are decomposed into negative partial and positive partial sums in equations which are specified as (4) and (5), respectively. This enables us to determine the asymmetric impacts of COR on LTAX.

$$\sum_{i=0}^{k_1} \delta_2^* \Delta\, COR_{t-i}^* = \sum_{i=0}^{k_1} (\delta_2^+ \Delta\, COR_{t-i}^+ + \delta_2^- \Delta\, COR_{t-i}^-) \quad (4)$$

$$\beta_2^* COR_{t-1}^* = (\beta_2^+ COR_{t-1}^+ + \beta_2^- COR_{t-1}^-) \quad (5)$$

The decomposed parameters COR^+ and COR^- represent positive and negative changes in the control of corruption, respectively. A positive change implies greater control of corruption, while a negative change indicates lesser control of corruption. Thus, a positive/negative sign of the coefficient of control of corruption (COR) implies that reducing corruption has a positive/negative impact on tax revenue.

The NARDL procedure begins with the bounds test for a null hypothesis of no cointegration (H_0) against the alternative hypothesis of cointegration (H_1). The equations required to test each hypothesis are stated as follows:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$, and H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$

In testing these hypotheses, the Wald test is carried out on the joint significance of the coefficients by computing the F-statistic. The statistic is then compared with the upper and lower critical bounds. Where the computed F-statistic is larger than the upper bound [I(1)], the null hypothesis of no cointegration between/among the variables is rejected. On the other hand, if the computed F-statistic is smaller than the lower bound [I(0)], then the null hypothesis is not rejected. In the event that the F-statistic lies between I(0) and I(1), the inference would be inconclusive.

The asymmetry test is conducted to ascertain whether a non-linear relationship exists between or among variables. The test accounts for asymmetric effects via the computation of decomposed negative and positive partial sums of the concerned explanatory variable or regressor. Next is to conduct the Wald test to check the joint significance of the partial sums and to test the null hypothesis of no asymmetry. If the short-run coefficient of the negative partial sum of COR is different from the positive partial sum of COR, that is,

$\sum_{i=0}^{k_1} \delta_2^+ \neq \sum_{i=0}^{k_1} \delta_2^-$. It is confirmed that asymmetric impact is present.

In the same vein, if the long-run coefficient of the negative partial sum of COR varies from the positive partial sum of COR, that is:

$\beta_2^+ \neq \beta_2^-$. Then the asymmetric effect is established.

Once the variables are found to have a cointegrating relationship, the long-run coefficients would be estimated using the model, which is specified as follows:

$$LTAX_t = \theta_0 + \theta_1^+ COR_t^+ + \theta_1^- COR_t^- + \theta_2 LGDPC_t + \theta_3 LAGR_t + \theta_4 LCPI_t + \theta_5 AID_t + \theta_6 FELP_t + \varepsilon_t \quad (6)$$

In addition, the short-run coefficients can be estimated using the model that is specified as follows:

$$\Delta LTAX_t = \Upsilon_0 + \sum_{i=0}^{p} \Upsilon_1 \Delta LTAX_{t-i} + \sum_{i=0}^{k_1} (\Upsilon_2^+ \Delta COR_{t-i}^+ + \Upsilon_2^- \Delta COR_{t-i}^-) + \sum_{i=0}^{k_2} \Upsilon_3 \Delta LGDPC_{t-i} + \sum_{i=0}^{k_3} \Upsilon_4 \Delta LAGR_{t-i} + \sum_{i=0}^{k_4} \Upsilon_5 \Delta LCPI_{t-i} + \sum_{i=0}^{k_5} \Upsilon_6 \Delta AID_{t-i} + \sum_{i=0}^{k_6} \Upsilon_7 \Delta FELP_{t-i} + \psi_1 ECT_{t-1} + \varepsilon_t \quad (7)$$

ECT_{t-1} is the error correction term lagged by one period, and its coefficient, ψ_1, is the represents the speed of adjustment required to restore the long-run equilibrium following any shock. In estimating the NARDL model, the Akaike Information Criterion (AIC) was used to select the optimal lags for the variables. The justification for using the AIC is based on its superior performance compared to other lag selection criteria, even in finite samples (Liew, 2004).

Diagnostic tests

Diagnostic tests were performed to ascertain/check the reliability of the results. These tests show whether the estimated model has problems of serial-correlation and hetero-scedasticity. The Breusch-Godfrey serial-correlation Lagrange multiplier test was used to check whether the residuals are serially correlated, and the Breusch-Pagan-Godfrey heteroscedasticity test to ascertain if the error terms in the model are homoscedastic. In addition, the Ramsey RESET test was carried out to ascertain whether the model is well specified.

Stability tests

In an attempt to evaluate the stability status of the estimated model and its parameters, the stability tests were carried out. The objective was achieved using the cumulative Sum of recursive residuals (CUSUM) and the cumulative Sum of squares of recursive residuals (CUSUMQ). If the plots of the CUSUMQ break outside the lower and/or upper bounds, it will be concluded that the parameters are not stable over the long run (Greene, 2003).

Results and Discussion

Results of unit root tests

The unit root test results in Table 1 indicate that some variables are stationary or do not have a unit root. They include LGDPC and LAGR. On the other hand, series such as LTAX, COR, LCPI, AID and FELP exhibited a unit root, but they became stationary after their first difference.

Table 1

Results of unit root tests

	ADF				PP			
Variable	Level	ρ-value	1st diff.	ρ-value	Level	ρ-value	1st diff.	ρ-value
LTAX	-1.661	0.446	-4.558***	0.000	-2.173	0.217	-4.689***	0.000
COR	-1.859	0.349	-5.218***	0.000	-2.150	0.226	-5.119***	0.000
LGDPC	-4.230***	0.001	-	-	-4.945***	0.000	-	-
LAGR	-3.072**	0.033	-	-	-4.655***	0.000	-	-
LCPI	-1.044	0.733	-3.196**	0.024	-2.646	0.088	-4.472***	0.000
AID	-2.331	0.165	-4.225***	0.001	-2.407	0.143	-4.320***	0.000
FELP	-2.441	0.134	-8.745***	0.000	-3.482**	0.011	-	-

** and *** indicate a rejection of the null hypothesis of no unit root at 5% and 1% levels, respectively.
Source: Authors' calculation.

These findings demonstrate that the series/variables are a mixture/combination of I(0) and I(1), thus, providing justification for the bounds test to cointegration.

Results of NARDL bounds test to cointegration

The result of the NARDL bounds test to cointegration in Table 2 illustrates that the calculated F-statistic (i.e. 8.42) is higher than the upper critical bound value (i.e. 3.90) at the 1% level.

Table 2

Results of bounds test to cointegration

Function = f$(TAX/COR, LGDPC, LAGR, LCPI, AID, FELP)$			
	Critical values bounds		
F-stat. = 8.4214***		I(0)	I(1)
	10%	1.92	2.89
	5%	2.17	3.21
	1%	2.73	3.90

******* denotes statistical significance at a 1% level and a rejection of the null hypothesis of no cointegration.
Source: Authors' calculation.

This finding reveals the existence of cointegration among LTAX, COR, LGDPC, LAGR, LCPI, AID and FELP. Thus, the variables have a long-run equilibrium relationship.

Results of asymmetry test

The result of the asymmetry test (for long-run relationship) in Table 3 demonstrates that the calculated F-statistic is 5.6866 with a corresponding probability of 0.0067. This finding suggests that there is an asymmetric relationship between tax revenue and corruption in the lond run.

Table 3

Result of asymmetry test

Wald Test	Results
F-stat.	5.6866(0.0067)

Note: Values in parenthesis are probability values.
Source: Authors' calculation.

Results of NARDL model estimation

The results of the estimation of NARDL model are presented in Table 4. The optimum lag length of the estimated model selected by the AIC is 4,4,1,3,3,0,4,4. The long-run results indicate that control of corruption (COR) is significantly related to tax revenue (LTAX). A positive change (or an increase) in COR by 1 unit reduces LTAX by a 2.71% at a 1% level, while a negative change (or decrease) in COR by 1 unit raises LTAX by a 2.75% at a 1% level in the long-run. In addition, income level (LGDPC) has a positive and significant impact on tax revenue. A 1% increase in LGDPC leads to a 2.73% increase in LTAX at a 1% level in the long run.

Table 4

Results of selected short-run and long-run non-linear ARDL models

Short-run coefficients (D.V is ΔLTAX)			Long-run coefficients (D.V is LTAX)		
Regressor	Coeff./Se	ρ-value	Regressor	Coeff./Se	ρ-value
$\Delta LTAX_{-1}$	0.4664*** (0.0758)	0.0000	Constant	-2.5420 (5.6597)	0.6557
$\Delta LTAX_{-2}$	0.4132*** (0.0822)	0.0000	COR^{+}	-2.7142*** (0.7101)	0.0005
$\Delta LTAX_{-3}$	0.3190*** (0.0646)	0.0060	COR^{-}	2.7500*** (0.6424)	0.0001
ΔCOR^{+}	0.3782 (0.3562)	0.2947	LGDPC	2.7277*** (0.2960)	0.0000
ΔCOR_{-1}^{+}	1.7030*** (0.4536)	0.0006	LAGR	-0.6130 (0.5525)	0.2739
ΔCOR_{-2}^{+}	1.2995*** (0.4388)	0.0051	LCPI	-0.0327 (0.2564)	0.8990
ΔCOR_{-3}^{+}	1.3194*** (0.3996)	0.0020	AID	-0.0709* (0.0379)	0.0678
ΔCOR^{-}	-1.1877*** (0.3115)	0.0005	FELP	0.0611*** (0.0172)	0.0010
ΔLGDPC	1.7620*** (0.2768)	0.0000			
$\Delta LGDPC_{-1}$	-1.2327*** (0.3793)	0.0023			
$\Delta LGDPC_{-2}$	-1.0398*** (0.3475)	0.0047			
ΔLAGR	-1.3461*** (0.2745)	0.0000			
$\Delta LAGR_{-1}$	0.9088** (0.3529)	0.0138			
$\Delta LAGR_{-2}$	0.7361** (0.3126)	0.0236			
ΔLAID	0.1140*** (0.0240)	0.0000			
$\Delta LAID_{-1}$	0.0720** (0.0293)	0.0187			
$\Delta LAID_{-2}$	0.0502* (0.0278)	0.0787			
$\Delta LAID_{-3}$	0.0252* (0.0137)	0.0573			
ΔFELP	0.0886*** (0.0322)	0.0090			
$\Delta FELP_{-1}$	-0.1317*** (0.0162)	0.0000			
$\Delta FELP_{-2}$	-0.0823*** (0.0118)	0.0000			
$\Delta FELP_{-3}$	-0.0531*** (0.0082)	0.0000			
ECT_{-1}	-0.5844*** (0.0612)	0.0000			

Δ is the first difference operator. Values in parenthesis are standard errors. *, ** and *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. A positive/negative sign of COR indicates greater control of corruption/lesser control of corruption.

Source: Authors' calculation.

Furthermore, foreign aid (AID) has a negative and significant effect on LTAX. A 1% increase in AID causes LTAX to decline by a 0.07% at a 10% level in the long run. Moreover, female labour force participation (FELP) is significantly related to LTAX. An increase in FELP by 1% leads to a 0.06% increase in LTAX at a 1% level in the long run. However, agriculture (LAGR) and inflation rate (LCPI) have a negative and insignificant effect on LTAX in the long run.

The short-run results show that COR has a significant impact on tax revenue. A positive change in COR lagged by one period by 1 unit raises LTAX by 1.70%, while a negative change in COR by 1 unit reduces LTAX by 1.19% at a 1% level in the short-run. In addition, a 1% increase in LGDPC raises LTAX by a 1.76% at a 1% level in the short run. Moreover, an increase in LAGR by 1% reduces LTAX by 1.35% at a 1% level in the short run. Furthermore, AID and FELP have a positive and significant impact on LTAX. A 1% increase AID and FELP lead to an increase in LTAX by 0.11% and a 0.09%, respectively, at a 1% level, in the short-run.

The coefficient of the error correction term lagged by one period (ECT_{-1}) is negative and statistically significant at a 1% level. This implies that approximately 0.58% of the deviation from equilibrium will be corrected in the fourth quarter of the year.

Results of diagnostic tests

The results of diagnostic tests in Table 5 indicate that the Breusch-Godfrey serial-correlation Lagrange multiplier test statistic is 4.19, with its probability value of 0.12. This finding illustrates that there is an absence of serial-correlation in the estimated results.

Table 5

Results of diagnostic tests

Test Statistic	Results
Serial Correlation: χ^2	4.1992[0.1225]
Heteroscedasticity: χ^2	19.4846[0.9293]
Mis-specification Test: F-statistic	0.5651(0.4567)

Values in parenthesis are probability values.
Source: Authors' calculation.

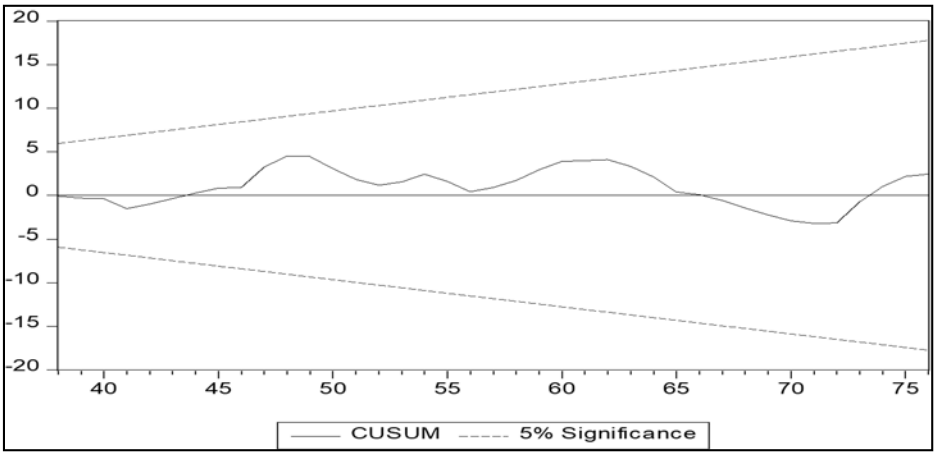
Similarly, the Breusch-Pagan heteroscedasticity test statistic (19.48) with its probability value (0.92) demonstrates that the errors are homoscedastic. Lastly, the Ramsey misspecification test statistic and probability are 0.5651 and 0.4567, respectively. This implies that the estimated model is well specified.

Results of stability tests

The results of the CUSUM and CUSUMQ tests in Figure 4 and Figure 5 reveal that the plots are within the boundaries, implying that the model and its parameters are stable in the long run.

Figure 4

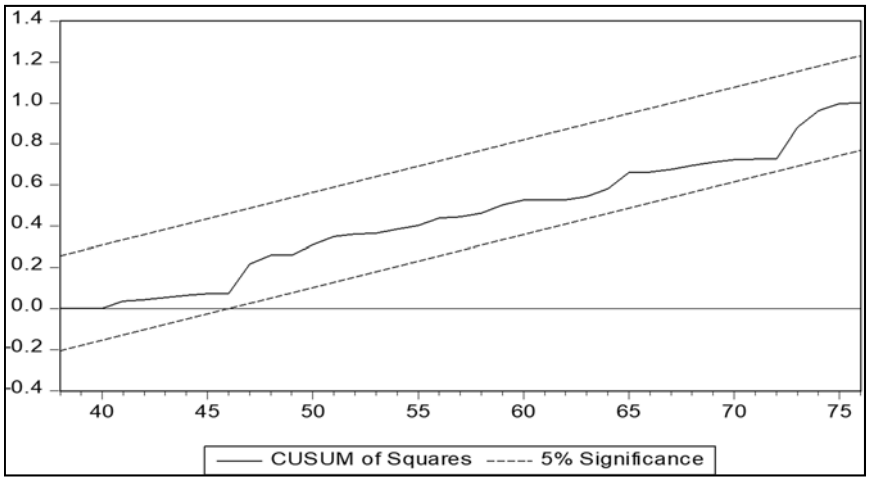
Cumulative sum of recursive residuals plots



Source: Authors' calculation.

Figure 5

Cumulative sum of squares of recursive residuals plots



Source: Authors' calculation.

Overall, the bounds test result reveals that there is a long-run relationship among tax revenue and corruption (along with GDP per capita, inflation, agriculture, foreign aid and female labour force participation). The results of estimation of the NARDL model show that corruption has asymmetric (i.e. negative and positive) effects on tax revenue in Nigeria in the short run and the long run. The negative sign of control of corruption is consistent with studies carried out earlier (Alm et al., 2014; Hwang, 2002; Imam, Jacobs, 2014). For example, Imam and Jacobs (2014) discovered that an improvement in the corruption index is associated with fewer taxes collected on goods and services, corporation and other enterprise

taxes. Similarly, the study by Hwang (2002) suggested that high corruption is positively related to taxes on international trade. Also, the results of the work of Alm et al. (2014) indicated that at higher levels of corruption (costs of bribery), firms reported their incomes or sales rather than paying huge bribes to tax officials to evade taxes. Consequently, tax revenue increased. On the other hand, the positive sign of the coefficient of control of corruption (reducing corruption) lends support to prior studies (Besley, Persson, 2014; Bird et al., 2008; Gupta, 2007; Ketkar et al., 2005; Mahdavi, 2008). These studies confirmed that less corruption raises tax revenue collection.

The negative association between an improvement in control of corruption (reducing corruption) and tax revenue supports the claim that at a higher corruption level (when tax officials demand huge bribes from taxpayers to evade taxes) payers will pay their taxes rather than incur the huge bribes officials ask them (to engage in tax evasion), leading to higher tax collection. This negative relationship portrays the situation in Nigeria, where the existence of weak institutions and inefficient bureaucracy create a conducive atmosphere for corruption to thrive within the economy, including the tax system. As stated earlier, corruption remains a serious issue in the Nigerian tax system (Micha et al., 2012; Momoh, 2018; Salami, 2011), and it might have aided tax revenue. Contrariwise, the positive linkage between control of corruption and tax revenue suggests that tackling or lowering the level of corruption leads to higher tax revenue collection.

The positive effect of income level on tax revenue lends support to past studies (Castro, Camarillo, 2014; Dioda, 2012; Ghura, 1998; Gupta, 2007; Muibi, Sinbo, 2013; Imam, Jacobs, 2014; Nwosa et al., 2012; Tanzi, Davoodi, 1997). For example, Ghura (1998) found that tax revenue increases with income level in SSA countries, while Nwosa et al. (2012), as well as Muibi and Sinbo (2013), discovered that rising level of income raises revenue in Nigeria. Thus, as income level increases the capacity to collect and pay taxes increases (Chelliah, 1971; Gupta, 2007).

The negative sign of the coefficient of agriculture in the short-run is in line with the findings of previous studies (Bird et al., 2008; Castro, Camarillo, 2014; Dioda, 2012; Ghura, 1998; Gobachew et al., 2017; Gupta, 2007; Imam, Jacobs, 2014; Zarra-Nezhad et al., 2016). This finding is a reflection of Nigeria's situation where the agriculture sector, which plays a significant role in the economy, provides employment opportunities for many who engage mainly in subsistence agriculture/farming and earn very low incomes. This makes it difficult to tax them, leading to lower tax collection.

The positive association between aid and tax revenue in the short run is consistent with the works of Gupta et al. (2003) and Rodriguez (2018), while the negative relationship between them in the long run lends support to the ones reported by Mahdavi (2008) and Benedek et al. (2014). The negative influence of aid on tax revenue portrays the Nigeria's situation where foreign aid (and other foreign capital) encourages domestic consumption rather than boosting the production of goods and services, leading to a decline in income-generating opportunities. The low levels of income have an adverse effect on tax revenue.

Conclusion

Despite its abundant natural and human resources, Nigeria has not been able to generate adequate tax revenue to meet its rising expenditure. Coupled with the low tax revenue is the corruption problem that Nigeria is contending with. We employ the NARDL estimation method to investigate tax revenue behaviour amid corruption in Nigeria using quarterly data from 1999 to 2019. We find the presence of asymmetry between corruption and tax revenue in Nigeria both in the long run and short run. Positive changes in control of corruption reduce tax revenue, while negative changes in control of corruption raise tax revenue in the long run. Other variables, including income level, foreign aid and female labour force participation, are significant determinants of tax revenue in Nigeria in the long run. Based on these findings, this study offers some recommendations.

First, although reducing corruption appears to be positively and negatively related to tax revenue in the long-run, persistent corruption can leave a devastating impact on an economy, and make a country and its citizens perpetually underdeveloped. Therefore, it is important that government take steps to further strengthen existing institutions to reduce corruption to the barest level so as to encourage tax revenue generation in the long run. To this end, the Nigerian government is advised to increase the funding of anti-corruption agencies such as the EFCC and ICPC to enhance their capacity to tackle corruption head-on. Also, special courts can be established to speed up the dispensation of justice and ensure that those found to be corrupt (both tax officials and taxpayers) are sanctioned or punished appropriately. In addition, there is a need for increased monitoring and evaluation of the operations of the FIRS to ensure that officials do not engage in any acts which are inimical to the success of the revenue agency.

Second, since income level has a positive impact on tax revenue in the long run, government and policymakers are encouraged to take steps to boost people's income. The increased level of income will raise individuals' capacity to pay taxes, leading to higher tax revenue. Third, given that aid discourages tax collection in the long run, the government should devise means to be less reliant on foreign aid in order to promote tax mobilisation. Finally, the government should encourage more female participation in the labour force. Higher female participation does not only raise overall labour income, but also increases the amount of tax collected.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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COVID-19 AND LABOUR MARKET IN KOSOVO[4]

The purpose of this paper is to understand the impact of the pandemic on the labour market in Kosovo, as well as the response of institutions to address the challenges produced by the pandemic. The research model was based on the quantitative approach and comparative study. Furthermore, this study focused on the official data about the impact of Covid-19 on the labour market in Kosovo and Government reactions, as well as comparing it with the best practices of European countries. The pandemic has had a significant impact on the labour market in Kosovo; Kosovo institutions have adopted an emergency package as well as the economic recovery package as a response to the challenges produced by the pandemic. The pandemic has had a significant impact on the labour market in Kosovo. The Government of Kosovo has drafted and approved two packages in order to support employment. However, the number of people who have benefited from these measures is small compared to the needs.
Keywords: Kosovo; Covid-19; labour market; measures; institutions
JEL: J45; JEL: E24; JEL: J01

1. Introduction

Measures taken by Kosovo institutions have only partially addressed the challenges of the pandemic in the labour market. The main importance of studying this topic lies in the fact that the pandemic has a significant impact on the labour market in Kosovo; Kosovo institutions have adopted the emergency package, as well as the economic recovery package in response to the challenges posed by the pandemic; as well as the results of empirical research we understand that employers, workers and the unemployed consider that institutions have not done enough to support them in the time of the pandemic.

The pandemic has had a significant impact on the labour market in Kosovo. The data of the Employment Agency from the Labour Market Information System show a significant

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increase in the number of jobseekers registered in the Employment Offices (Employment Agency [EA], 2020). Thus, the number of jobseekers registered in the Employment Offices by the end of June 2020 is 75,939, of which 35,246 are female, while 40,693 are male. While, mediations in regular employment due to the pandemic have been very low, in which case, in the period January – June mediated in regular employment through the Employment Offices are 897 people, of which 366 women, while 531 men (2020). The sector most affected by the pandemic in terms of employment is the wholesale and retail trade sector in this case the number of employees in this sector from 80 thousand at the beginning of the pandemic has dropped to 43 thousand. However, the extent of the impact of the pandemic on the labour market will be seen after the pandemic ends because many employers are now keeping workers on hold.

According to the quarterly assessment of the Central Bank of Kosovo, Kosovo's economy during 2020 is facing the economic and social crisis caused by the Covid-19 pandemic (Central Bank of Kosovo [CBK], 2020, p. 6). Restrictive measures on the movement of citizens and closure of certain economic activities have caused economic shock, broadcast by external channels as well as domestic demand. In particular, the structure of Kosovo's economy, which is highly dependent on foreign income (exports of services and remittances, which together account for close to one-third of GDP), make it very sensitive to this global shock.

Especially for Kosovo World Bank Group finds that:

- Kosovo was projected to grow by about 4 percent by 2020; however, due to the Covid-19 explosion, the economy is expected to shrink by 4.5 percent while services exports, public and private investment fall;
- If the outbreak is prolonged and control measures are maintained during the third quarter of 2020, the recession may be longer and the revenue shortage greater, limiting further policy response;
- The government has announced an incentive package of 2.8 percent of GDP to support affected citizens, businesses and professions. Proper targeting of this package remains essential in mitigating the economic, poverty and social impact of the crisis (World Bank Group [WBG], 2020, p. 19-24).

The main objectives of this paper are:

- Understanding and presenting the experiences by others countries in related with measures undertaken by the governments to addressing the effects of pandemic in labour market;
- Analyzes the challenges of the impact of pandemic in labour market in Kosovo;
- Researches the measures undertaken by the Government of Kosovo to addressing the effects of pandemic in labour market;
- Researches the number of jobseekers and unemployed people which have benefit from these measures.

The hypothesis of the paper is that:

- Number on jobseekers and unemployed people which have benefited by the two packages of Government to addressing the challenges of pandemic in labour market, is very low.

The subject of the paper is limited because the pandemic is going on and Government has undertaken other measures to help the people who have lost the job because the pandemic, as well as to help the jobseekers who have been unemployed even before the pandemic. Other measures adopted by the Government in 2021 and measures which are planning to approved until end of the year (2021) are not included in this paper.

2. Literature Review

One of the main measures taken by almost all the world's governments to avoid spreading the virus and protect workers is to promote works from home. Organization for Economic Co-operation and Development and International Labour Organization find that "In order to promote a rapid shift towards work from home, governments took many measures to simplify its use, including financial and non-financial support for companies" (Organization for Economic Co-operation and Development [OECD] and International Labour Organization [ILO], 2020, p. 21). Another measure taken by Governments was to allow work within companies by restricting business activities to essential services by enforcing anti-virus standards (p. 22). Also, "Providing sickness benefits and paid leave for all workers is another measure taken by governments" (p. 23). However paid leave is an effective tool only in cases of limitation periods. Increasing the demand of many workers to provide family care, extending the duration of paid leave (parental leave) or providing financial means to pay for care services, as well as special measures to address the care needs of employee's essential service, many of whom are women (p. 24). Other measures taken by Governments were a combination of different measures, as well: job support subsidies (p. 25), liquidity support for businesses (p. 27), income support for workers who have lost their jobs through the self-employment scheme (p. 29), employment services and training for jobseekers and workers (p. 32), promoting social dialogue (p. 33).

The Organization for Economic Co-operation and Development has found that the pandemic has affected almost all countries of the world and more than 50 million people worldwide. According to the OECD (2020) "In socio-economic terms governments are providing massive fiscal support to protect businesses, families and the population in need. Governments have spent more than $ 12 trillion globally since March 2020" (p. 2). According to this study, "Many countries, including European Union countries, have reallocated public funds to crisis priorities by supporting health care, small and medium-sized enterprises, the population in need and crisis-stricken regions" (p. 2).

The institutions with the greatest responsibility for managing the consequences of the pandemic in the labour market are the public employment services. The International labour Organization (2020) has listed the main points of response of the Public Employment Services to the pandemic. The main points of this reaction are: "Active labour market policies and programs have been very important in helping workers and employers during the

pandemic; use of technology to adapt and facilitate the capacity of Public Services in providing employment services even during a pandemic; active labour market support is much more important when offered as an integrated package with other economic measures in business support, especially in countries with a high degree of informality in the labour market" (p. 1-2).

Kniffin et al. (2020) say that "The impacts of Covid-19 on workers and jobs across the globe have been dramatic" (p. 1). Blocking businesses and industries in order to stop the spread of the virus has produced unique and fundamental challenges for employers and workers. Thus, "At the level of individual workers affected by the closure overnight turned into: (a) workers from home; (b) essential workers as: medical staff and shop workers; (c) unemployed who are looking for 'equivalent' work or seeking unemployment benefit" (p. 4). Also Kaushik. M. and Guleria. N. (2020) says that closure during the pandemic "Has affected different sectors to varying degrees" (p. 1). For instance, "Airlines, hotels, manufacturing industry are completely banned and it will take a long time to get out of this situation, if it can ever come out" (p. 1). Consequently, millions of people in such sectors are likely to lose their jobs forever.

Seen as a whole, the pandemic has caused a massive rise in unemployment in western countries. According to Eichhrost, W., Marx, P., Rinne, U (2020) "Looking at the growth of unemployment during 2020, there has been a massive increase in countries like Spain and Sweden. This increase has been even greater in the US, while other countries saw a fairly moderate reaction to unemployment, e.g. France, Great Britain or Italy" (p. 2). Also, "Some countries have seen a massive decline in working hours in general, and in particular a massive increase in announcements for and short-term employment (although there is a lack of accurate data)" (p. 3). The United States is the most prominent case of a large increase in unemployment.

The United Kingdom has faced major difficulties in the labour market due to the pandemic. Dias, M., J, Robert., V, Fabien., X. Xiaowei (2020) have found that "The public health response to Covid-19 has led to a significant decline in job demand in many sectors of economic activity in the UK" (p. 32). The immediate policy response to the pandemic imposed the closure of entire sectors of the economy, including non-core retail businesses, hospitality and leisure, while air travel was halted mainly due to travel restrictions. "The initial policy response has focused on softening the blow to the finances of families and allowing the majority of workers and firms to resume their original activities once the crisis is mitigated" (p. 32).

France has mobilized various measures to address the challenges posed by the pandemic in the labour market. The French government has approved measures for active workers, the unemployed and those suffering from the pandemic. The wage subsidy is one of the main measures. Tatiana (2020) finds that "Under this type of scheme, the suspension of employment contracts is combined with the maintenance of a part of the remuneration (70% of the gross remuneration, 84% of the net remuneration) paid by the state. Employers must advance the payment of wages, with the state paying its assistance later" (p. 28). The next measure is unemployment support. The government has adopted new rules on unemployment benefits. The purpose of these new rules is to enable those who were in the scheme before the start of the pandemic to continue to benefit, and to strengthen the rules for new

beneficiaries. Another measure is the payment to persons affected by the pandemic. "Persons affected by the Covid-19 virus are entitled to receive replacement income from social security and more specifically from health insurance" (p. 28).

The Federal Government of Germany has adopted a number of different measures to support the labour market. Occupational health and safety measures. Adam, Christian (2020) find that "1. Workplace adjustment. 2. Toilets, food and rest facilities. 3. Ventilation. 4. Infection control measures for construction sites, farms, field service personnel, etc. 5. Infection control measures for collective workplaces. 6. Work from home. 7. Business trips and meetings. 8. Distance. 9. Equipment and tools. 10. Organization of schedules and working hours. 11. Storage and cleaning of work clothes, etc." (p. 293). The extension of working hours in the health sector, reduction of working hours in other sectors, part-time work (750,000 companies have stated that they worked part-time during 2020), Continuous payment in case of illness of workers (person suffering from covid is released from work while maintaining the right to compensation), child care (if the child is infected or if the children are attending school from home and the parent needs to take care of them), quarantine and prohibition of professional activities (in which caseworkers are paid if there are official decisions to terminate work), etc.

Austria has taken measures to mitigate the negative effects of the pandemic on the labour market. Rene, Thomas (2020) find that "The main components can be summarized as follows: (i) a €15 billion 'Corona support fund', targeted at all firms, (ii) a €2 billion 'difficulty fund', aimed at the self-employed, independent professionals and small enterprises, (iii) guarantees and postponement of tax liabilities for businesses, and (iv) 'Covid-19 short-term work scheme with an initial budget of around €12 billion. Measures (i)-(iii) addressed to businesses that have little or no income due to crisis. All measures were announced as methods to keep the business functioning and capable of securing employment" (p. 15).

The pandemic has hit the labour market in Italy very hard. The Italian government has taken a number of measures to mitigate the impact of the pandemic on the labour market. Marco (2020) found that some of the measures taken by the Italian government are: "Parental leave – as a result of the temporary closure of schools, public and private sector employees and self-employed workers caring for children under the age of 12 or with disabilities were entitled to up to 15 days paid leave for both parents; Temporary ban on dismissal – employers banned from taking collective redundancies; work from home; measures to protect health and safety at work; development of social dialogue during the emergency phase" (pp. 309-311).

Wage subsidies and various tax incentives for employers are the main measures taken by the Government of Croatia to address the challenges in the labour market after the pandemic (Ivana, 2020, p. 1). Slovenia has adopted a series of measures to meet the challenges of the pandemic in the labour market, such as: work from home, partial re-securing of workers' salaries for workers temporarily fired due to closure, deferral of payment of taxes and tax contributions, basic income for self-employed persons, etc. (Barbara, 2020, p. 1). The Government of Montenegro also took measures to manage the difficulties caused by the pandemic in the labour market, but these measures were not consulted with the social partners (ILO, 2020, p. 8).

Canada is one of the countries where there has been a drastic reduction in employment due to the pandemic. According to Lemieux, Th., Milligan, K., Schirle, T., Skuterud, M., (2020) "Covid-19 has caused a decrease of 32% of the total weekly hours worked between February and April 2020 and a decrease of 15% of employment" (p. 2). Almost half of the job losses can be attributed to low-income workers. The biggest losses can be attributed to the industries and professions most affected by closures (accommodation and food services) and workers who are younger, paid every hour and who are not union members.

The Australian labour market has also been severely affected by the pandemic. Borland and Charlton (2020) find that "After a sharp one-month drop in working hours from March to April during closing, this was followed by May-June by the largest increase of one month in working hours after opening" (p. 316). We have argued that what happened in the Australian labour market from March to June is best understood by looking at key executives – first, the impact of the pandemic on household spending through government business constraints and consumers voluntarily withdrawing from activities in which they perceive themselves at risk of contracting the virus; and second, the government response, and especially the job retention program.

India is one of the countries that have faced great difficulties in the labour market due to the pandemic. Walter (2020) said that "As an immediate measure of support during the blockade, the Indian Government had secured a package of US $ 25 billion, about 0.8% of GDP. Reserve Bank of India has taken steps to release about $ 18 billion in liquidity to the banking system" (2020). In addition, an economic stimulus package was announced as part of the 'Self-Support Mission' project, amounting to INR 20 trillion (about 10% of GDP).

Psychologically, the pandemic has affected the labour market in several dimensions. According to Trougakos, Chawla, McCarthy (2020), "The Covid-19 pandemic has disrupted the lives of workers across the globe, yet it makes little sense how Covid-19 health anxiety (CovH anxiety) – that is, feelings of fear and intimidation about having or contracting Covid-19 – affects in critical work, home and health outcomes" (2020).

The Covid pandemic will radically transform the job market globally. Fana, Perez, Enrique (2020) find that "The Covid crisis is so deep that it will not only radically affect the labour markets in the short and medium term, but can also profoundly change the way of organizing the work" (p. 402). Telework will transform the labour market and replace the classic form of work with the physical presence of workers in the workplace, but this will not be the only transformation. This is because "Early evidence from Italy suggests that industries that employ more robots per worker in production tend to exhibit a lower risk of infection due to Covid-19" (p. 402). Automation can be accelerated after the crisis as it can be used as a strategy to minimize health risks while maintaining production and economic activity.

3. Methodology

The data presented in the paper are taken by institutions and are administrative data. Administrative data is the data by Government and Ministries collect about their operations. It includes data for routine operations regarding the impact of the pandemic on the labour

market. This administrative data source is a data holding that contains information collected primarily for administrative purposes, but in this paper we based our research on these data. The data presented here are taken from Government public sources. The authors have systematized and cross-referenced such data for the needs of analysis.

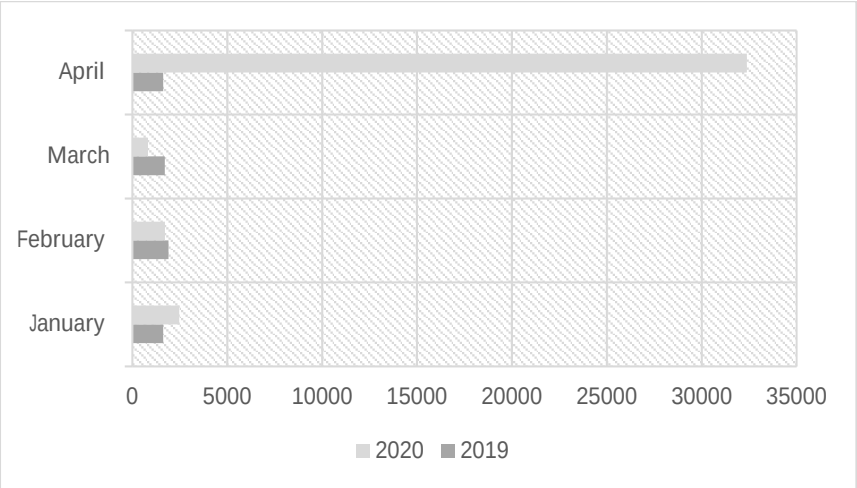
4. Result and discussion

4.1. The effects of the pandemic on the labour market – statistical and administrative data

The administrative data of the Employment Agency and the statistical data of the Kosovo Agency of Statistics show an enormous increase in the number of job seekers in the Employment Offices in the first months of the pandemic in 2020. According to these data, the number of jobseekers registered as unemployed in the Employment Offices in the period January – June 2020 was 37392, in contrast to the same period of 2019 when the number of registered jobseekers was 6882.

Table 1

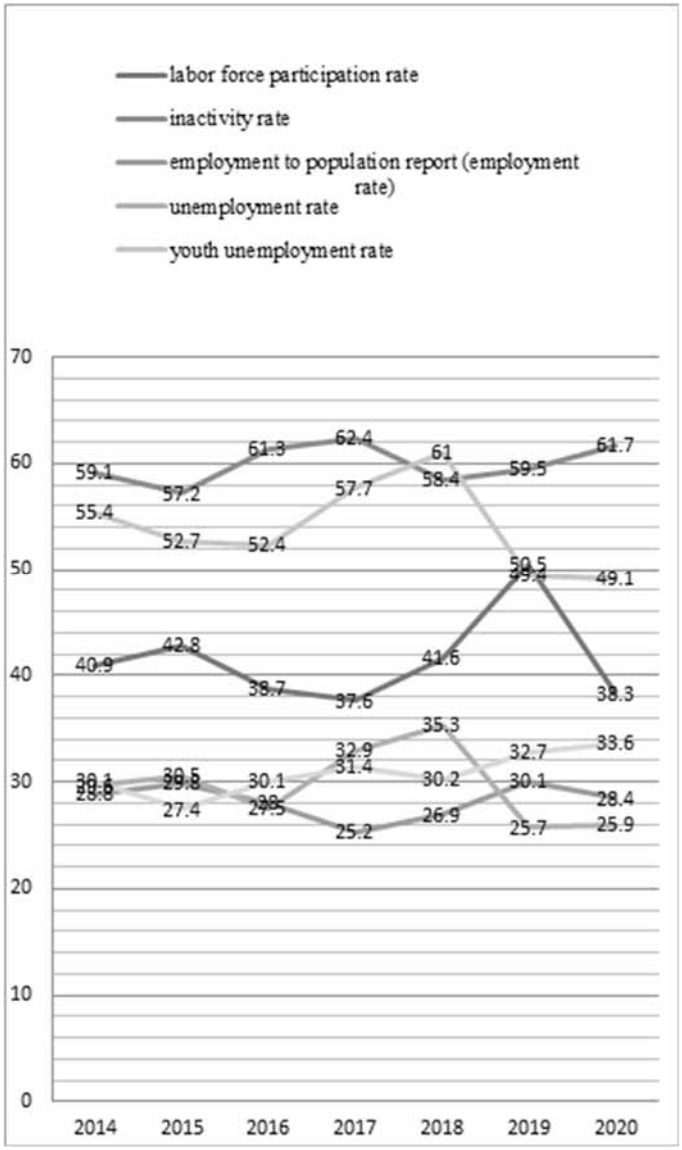
Administrative data by Employment Agency



Sources: Employment Agency. (2019) Performance report for 2019. Pristine: EA; Employment Agency. (2020) Performance report for 2020. Pristine: EA.

Figure 1

Comparison of key labour market indicators in the last five



Sources: Kosovo Agency of Statistics. (2018). Labour Force Surveys for 2018. Pristine: KAS; Kosovo Agency of Statistics. (2017). Labour Force Surveys for 2017. Pristine: KAS; Kosovo Agency of Statistics. (2016). Labour Force Surveys for 2016. Pristine: KAS; Kosovo Agency of Statistics. (2015). Labour Force Surveys for 2015. Pristine: KAS; Kosovo Agency of Statistics. (2014). Labour Force Surveys for 2014. Pristine: KAS; Kosovo Agency of Statistics. (2018). Statistical Yearbook of the Republic of Kosovo, 2018. Pristine: KAS. Kosovo Agency of Statistics. (2019). Statistical Yearbook of the Republic of Kosovo, 2019. Pristine: KAS. Kosovo Agency of Statistics. (2020). Statistical Yearbook of the Republic of Kosovo, 2020. Pristine: KAS.

The unemployment rate has risen from 25.7% in 2019 to 25.9% in 2020. The increase in the unemployment rate is estimated to have come as a result of the impact of the Covid 19 pandemic on the labour market, in which a considerable number of workers have lost their jobs. The employment rate in 2020 was 28.4%, compared to the year 2019, the employment rate was 30.1%, in which case, it is considered that there was a decrease in employment of 1.7%, which is considered to have come as a result of the pandemic and its impact on the labour market. Large gender differences lie in the labour market. 20.8% of working-age women were active in the labour market in 2020 (21.1% in 2019), compared to 56.0% of men (59.7% in 2019). Unemployment is higher for women than for men (33.2% for women, 23.5% for men in 2020). In 2020, 53% of women were employed in the education, trade and healthcare sectors, while 46.3% of men were employed in the construction, manufacturing and trade sectors. The unemployment rate among young people aged 15-24 has decreased from 49.4% in 2019 to 49.1% in 2020. About 37.4% of young people aged 15-19 were long-term unemployed (12 months). Based on the 2020 labour Force Survey, there are gender differences among young people in terms of unemployment. Among young men, the unemployment is 45.2%, while among women, the unemployment is 57.2%, i.e. with a difference of 12%. According to VET, about 67% of the registered unemployed are considered long-term unemployed, while the percentage of young people in the NEET category has increased from 32.7% in 2019 to 33.6% in 2020 (33.2% among young women and 34.0% among men).

4.2. The reaction of Kosovo institutions to the impact of the pandemic on the labour market

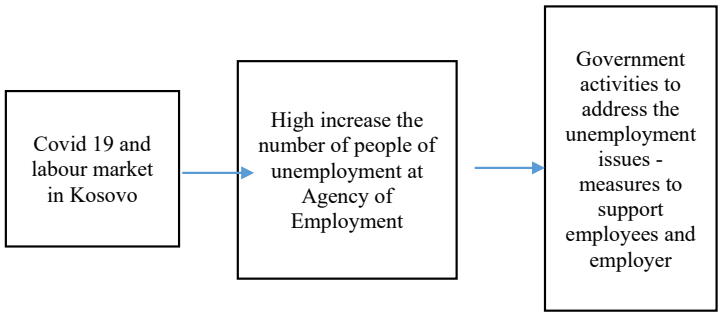
At the end of March 2020 the Government of the Republic of Kosovo approved the Fiscal Emergency Package to address the consequences of the pandemic (Decision of the Government of the Republic of Kosovo, No 01/2019, dated: 30.03.2020). If we look at the measures contained in the package, we see that, out of 13 measures contained in the package in total, 6 of them are directly for the labour market, as they are:

- Double payment of the value of the social scheme for all beneficiaries of social schemes for April and May;
- Additional payment in the amount of thirty (30 €) euros per month for all beneficiaries of social and pension schemes which receive a monthly payment in the amount of less than one hundred (100 €) euros for the months of April, May and June;
- Providing a salary supplement in the amount of three hundred (300 €) for field workers who are directly exposed to the risk of infection in their work: medical staff, police, Correctional Service officials, Emergency Management Agency officials, KSF staff, workers working in Quarantine;
- Additional payment in the amount of one hundred (100 €) euros for workers of grocery stores, bakeries and pharmacies for April and May;
- Additional payment in the amount of one hundred (100 €) euros for workers of grocery stores, bakeries and pharmacies for April and May;

- Payment of monthly assistance in the amount of one hundred and thirty euros (130 €) to citizens, who lose their job due to the public health emergency situation for the months of April, May and June.

Figure 2

The process of drafting and approving new packages



In addition to the Fiscal Emergency Package, the Government of the Republic of Kosovo in 2020 approved the measures for the implementation of the Economic Recovery Package (Decision of the Government of the Republic of Kosovo, No 06/58, dated: 14. 01. 2021). The approved plan for the implementation of the Economic Recovery Program amounts to three hundred and sixty-five million euros (365,000,000.00 €). If we look closely at the measures contained in the economic recovery package, out of a total of 15 measures, only 5 of them are for direct employment support, as they are:

- Increase of employment, in particular of specific groups of workers with a lower probability of employment;
- Increase local agricultural production, increase employment in rural areas, reduce the import of agricultural products, overcome the challenges of lack of sales caused by Covid-19 and increase food security;
- Stimulating aggregate demand, which promotes production and employment with multiplier effects in the economy;
- Financial support for youth employment, support of civil society organizations, other informal groups, stimulation of cultural, artistic, sports activities and their revitalization;
- Financial support for projects and initiatives aimed at improving the position of women in society and the economy.

Table 3

Fiscal Emergency Package to address the consequences of the pandemic

Fiscal Emergency Package to address the consequences of the pandemic		
Number	Measures	Amount, €
1	Double payment of the value of the social scheme for all beneficiaries of social schemes for April and May	7,650,000.00
2	Additional payment in the amount of thirty (30 €) euros per month for all beneficiaries of social and pension schemes who receive a monthly payment in the amount of less than one hundred (100 €) euros, for the months of April, May and June	---------
3	Financial support for companies that are in financial difficulties due to the decline of their activity due to the public health emergency situation	----------
4	Providing interest-free lending to public enterprises that have financial difficulties due to the public health emergency situation, in order to ensure their temporary liquidity, with a return until 31.12.2020	20,000,000.00
5	Providing additional financial support to the Municipalities of the Republic of Kosovo that have been affected in dealing with the pandemic, in case of need due to the eventual extension of the public health emergency situation	10,000,000.00
6	Providing a salary supplement in the amount of three hundred (300 €) for field workers who are directly exposed to the risk of infection in their work: medical staff, police, Correctional Service officials, Emergency Management Agency officials, KSF staff, workers working in Quarantine	15,000,000.00
7	Additional payment in the amount of one hundred (100 €) euros for workers of grocery stores, bakeries and pharmacies for April and May	3,000,000.00
8	Payment of monthly assistance in the amount of one hundred and thirty (130 €) euros to citizens who lose their job due to the public health emergency situation, for the months of April, May and June	4,000,000.00
9	Supporting initiatives and projects aimed at improving the lives of non-majority communities in the Republic of Kosovo, which have been hit hardest by the public health emergency situation, in the amount of up to two million	2,000,000.00
10	Increase the budget for grants and subsidies for the Ministry of Agriculture, Forestry and Rural Development to increase agricultural production	5,000,000.00
	Increase the budget for grants and subsidies to the Ministry of Culture, Youth and Sports to avoid the situation created by the emergency situation of public health in sports and cultural activities	5,000,000.00
11	Support for exporters in the Republic of Kosovo after the end of the public health emergency situation	10,000,000.00
12	Financial support for companies that register employees with an employment contract of at least one (1) year during the period of public health emergency situation, from one hundred and thirty (130 €) euros for the next two months after registration	6,000,000.00
13	Payment of monthly assistance in the amount of one hundred and thirty (130 €) euros for citizens with severe social conditions, registered as unemployed in the competent institution, who are not beneficiaries of any monthly income from the Kosovo budget, for the month of April , May and June	3,000,000.00

Source: Decision of the Government of the Republic of Kosovo, No. 01/2019, dated: 30.03.2020.

Table 4

Economic Recovery Package

Economic Recovery Package		
Number	Measures	Amount, €
1	Facilitate access to credit for private enterprises, to finance investment projects and the continuation of the operation	100,000,000.00
2	Relief of the tax burden of businesses, to improve their short-term liquidity	15,000,000.00
3	Increase of employment, in particular of specific groups of workers with lower probability for employment	67,300,000.00
4	Increase local agricultural production, to increase employment in rural areas, to reduce the import of agricultural products, to overcome the challenges of lack of sales caused by Covid-19 and to increase food security	26,000,000.00
5	Stimulating aggregate demand, which promotes production and employment with multiplier effects in the economy	15,000,000.00
6	Support the operation and capital investments of public enterprises, in particular, those investments that are of a strategic nature, to afford the reduction of collection revenues and the necessary capital investments to be undertaken	17,000,000.00
7	Financial support for youth employment, support of civil society organizations, other informal groups, stimulation of cultural, artistic, sports activities and their revitalization	5,000,000.00
8	Support for existing and new programs related to regional development through the Ministry of Regional Development, which affect balanced regional development	2,000,000.00
9	Support to non-majority communities in the Republic of Kosovo, for projects and initiatives aimed at improving their lives and their economic revival	2,000,000.00
10	Financial support for projects and initiatives aimed at improving the position of women in society and the economy	2,000,000.00
11	Support of the education sector to enable the successful start and progress of learning during the school year 2020/2021	10,000,000.00
12	Support to Kosovo municipalities to manage the situation created by the Covid-19 pandemic	10,000,000.00
13	Financial support for compatriots covering the cost of the insurance policy premium	3,000,000.00
14	Financing (reimbursement of budget lines) for the implementation of the measures of decision no. 01/19 of the Government of the Republic of Kosovo	71,700,000.00
15	Contingency for emergencies – Contingency is maintained for emergencies for better coping with the pandemic Covid-19	19,000,000.00

Source: Decision of the Government of the Republic of Kosovo, No. 06/58, dated: 14.01.2021.

4.2. Administrative data and discussion

The data on the results consist of administrative data obtained from government agencies regarding the number of beneficiaries of various measures. It should be noted that the execution of the measures has not been completed yet, which means that it is a process, which is still ongoing and consequently, we do not yet have collected data on the number of citizens who have benefited from the measures; some of the institutions have not yet systematized and published the data until the moment of writing this paper. It should also be noted that we have focused only on measures that are directly related to the labour market, while other measures we have not traced.

Regarding the measure for the payment of monthly assistance in the amount of one hundred and thirty euros (130 €) for citizens with severe social conditions, registered as unemployed

in the competent institution, who are not beneficiaries of any monthly income from the Kosovo budget, for April, May and June, in the amount of up to three million (3,000,000.00 €) euros, as can be understood from the data presented in chart 1, the number of families that have benefited from this measure is a total of 87,277 with 261,523 members.

Table 5

Beneficiaries of the fifteenth measure of the emergency package

Beneficiaries of the fifteenth measure of the emergency package		
Month	Number of families	Number of a family members
April	25,376	75,184
May	31,381	94,713
June	30,520	91,626
Total	87, 277	261, 523

Source: Government of Kosovo.

Table 5 summarizes the number of beneficiaries by measures to support the labour market from the emergency package. Regarding the measure for supporting employers to support the salaries of active workers with 170 euros each in order to maintain the current level of employment, the number of active workers who have benefited from the measure is 148,188. The purpose of the measure is to support employers in order to keep workers at work, as well as to maintain the current level of employment. The measure for the support of inactive workers was aimed at supporting inactive workers with 130 euros per month. The number of citizens who have benefited from this measure is 834 beneficiaries. Measures to support new workers have also been part of the package. The purpose of the measure was the financial support of new workers with 130 euros per month. The number of citizens who have benefited from this measure is 14,988 beneficiaries. The number of beneficiaries from the measure of support of endangered workers with 100 euros per month is 14,925 beneficiaries.

Table 6

Measures to support the labour market, as well as the number of beneficiaries by measure

Measures to support the labour market		
Measures	The number of the beneficiaries	Indicators of the labour market by measures by persons (2020)
Support for active workers	148,188	507,826 (total active persons)
The number of inactive workers who have benefited from the measures	834	720,392 (total inactive persons)
Support for new workers	14,988	n/d
Support for vulnerable workers	14,925	n/d
Total	178,935	

Source: Government of Kosovo and Kosovo Agency of Statistics. (2020). Labour Force Surveys for 2020. Pristine: KAS.

4.3. Comparing the measures undertaken by Government of Kosovo with measures undertaken by other countries for the labour market

In Table 7, we compare the measures undertaken by Government of Kosovo with measures undertaken by other countries regarding the labour market. The aim of this part is to crosscut

and compare the measures undertaken by other countries with measures undertaken by Kosovo institutions regarding to support for employers and employees. The table identifies the main measures to support the employers and measures to support the employees undertaken by the other countries, in another hand, for each measure, we compare with measures undertaken by Kosovo. As we can see from the table, only some of the measures undertaken by other countries are also adapted for Kosovo. We had wage subsidies in Kosovo. While Kosovo does not have a scheme for unemployment benefits, only for three months (March, April and May) of 2020, the unemployed persons had a benefit from an emergency package in the name of unemployment. Also, Kosovo has paid leave for maternity, but this is only for women on the job, while unemployed women don't benefit any paid leave. Some of the measures were for all citizens, not only for employers and employees, like psychological support to face the pandemic.

Table 7

Measures undertaken by the governments of other countries to support the labour market / compare with Kosovo

Measures undertaken by the governments of other countries to support the labour market / compare with Kosovo			
Measures to support the employers	Kosovo	Measures to support the employees and unemployed	Kosovo
Active market labour measures (Wage subsidy)	Yes	New rules on unemployment benefits	Partly
Creation of specific new financial funds	No	Replacement income - paid leave	Partly
Extension of working hours in the health sector	Yes	Extension of working hours in the health sector	Yes
Occupational health and safety measures	Yes	Sickness benefits in case of Covid-19 contamination/isolation	No
Work from home (telework)	Yes	Work from home	Yes
Restricting business activities to essential services	Yes	Active market labour measures (Start-up)	No
Development of social dialogue with employers	Partly	Development of social dialogue with employees	Partly
Various tax incentives	Partly	Partial re-securing of workers' salaries	No
Psychological support for employers	Partly	Psychological support for workers	Partly

5. Some Policy Recommendations

Based on the data presented in the paper, we have articulated some policy recommendations:

- Increase the general number of people who benefit from measures through increasing the budget for these measures.
- Government must target to maintain current jobs. Current jobs can maintain by support for the employee through different kinds of subsidies (wage subsidies, subsidies for the training of employees, subsidies for pensions or tax of employees, etc.).
- To target integration of the people who are inactive in the labour market through active market labour measures.

- Promotion of employment of the people from vulnerable workers in the labour market (communities, women, etc.) through business start-up programs.
- To invest in vocational training programs based on the needs of the labour market (for example, training for online sales).
- Government of Kosovo must expand the measures to support the employers and employees based on the good experiences of other countries (creation of specific new financial funds, a start-up for job seekers, etc.).

6. Conclusions

Based on the results of the research, the authors of the paper concluded that the pandemic has had a significant impact on the labour market in Kosovo due to the fact that we have closures of many businesses, which has led to the termination of employment contracts and increasing the number of unemployed and jobseekers registered in the Employment Offices. Then, although Kosovo institutions have adopted the emergency package, as well as the economic recovery package in response to the challenges posed by the pandemic, according to participants in the study, it appears that the institutions have not done enough to support them during the pandemic and that most of them did not benefit from the emergency package measures as well as the economic recovery package. Therefore, based on these data, it can be concluded that the Government of Kosovo has not had a proper strategy to help the citizens affected by the pandemic.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE IMPACT OF INNOVATION ON THE STRUCTURE OF THE ASSETS OF THE ENTERPRISES[6]

The article evaluates the impact of the intensity of innovation of the enterprise on the structure of its assets. The importance of optimising the structure of assets to ensure the efficient operation of the enterprise is substantiated and the optimal structure of the company's assets is determined in terms of minimising the duration of the operating cycle. It has been established that the process of optimising the structure of enterprise assets in order to ensure the efficiency of its operation should be considered through the prism of comprehensive optimisation of all components. The study of enterprises by the method of alternative valuations gave grounds to determine the ratio between non-current and current assets of 80:20, which may be optimally provided that automated and high-tech production. The sequence of stages of the asset structure optimisation model has been proposed and described, the mechanism of determining the optimal structure at each of the stages is outlined, the expediency of practical application of the model is proved.
Keywords: innovative activity; assets; optimal structure; operating cycle
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Introduction

In modern conditions, the development of the world economy is closely linked with the pace of scientific and technological progress. Therefore, innovation is one of the key sources and prerequisites for enterprise development and economic growth in general.

Innovation is considered as an implementation process that extends to a new or significantly improved product (good or service) or process, a new marketing method or a new organisational method in business practice, organisation jobs and external relations (OECD, 2015). Innovative activity characterises the harmonised interaction in accordance with the needs, available assets of the enterprise and scientific and technical potential, which leads to the improvement of quantitative growth indicators, encourages the revival of economic activity and business activity of the enterprise.

In today's market conditions, only those companies that can quickly adapt to new requirements, offer consumers quality products, use innovative technologies and develop effective development strategies function effectively. In addition, the priority component of the enterprise should be to increase the competitiveness of goods and services, reduce production costs, improve its quality. The growth of innovation activity will allow to outpace the pace of development of other enterprises and sectors of the economy.

The implementation of innovative activities affects the structure of assets of the enterprise, which necessitates the study of the ratio of different components of property during the implementation of innovations and analyse the impact of such a structure on individual indicators of financial condition.

In the process of optimising the asset structure of enterprises, the criteria that best meet modern economic requirements, environmental challenges and internal targets are used.

The Literature Review

Research by Ukrainian and foreign authors (Vasylenko, 2015; Tkach, 2012; Fatkhutdinov, 2016; Ramos et al., 2016) is devoted to the study of problems related to innovative development and management of innovative processes at the enterprise.

The strategic goals of managing innovative activities of the enterprise aimed at resource conservation are to reduce the cost of production resources and increase its efficiency (Bagrova, Yudina, 2013). Effective management of innovation is a necessary prerequisite for determining the directions of further development of the enterprise and strengthening its competitive position in the market environment (Sakhatskyi, Kazandzhi, 2017). E. Lousã (2013) developed and applied a number of indicators to compare enterprises of different technological industries and different scales of activity, as well as to better characterise and analyse the organisation in terms of its own activities focused on innovation.

The ability of the enterprise to carry out innovative activities is defined by researchers as innovative potential. Accordingly, the innovation potential is characterised by a system of resources required for basic and applied research, design and technological work focused on

solving scientific, scientific and technical, social and economic and environmental problems of the enterprise (Dudar & Melnichenko, 2008). Researchers identify four levels (high, medium, low and zero innovation opportunities) of innovation potential of the enterprise, which can be used to determine the ability of the enterprise to implement new technologies in economic turnover and, at the same time, provide financial needs of current production and economic activities. Levels of innovation potential are differentiated depending on the availability of own financial resources (Garbar, 2020).

A group of scientists has developed a model of adaptive management of innovation processes in conditions of uncertainty, taking into account the risk factor in enterprises. The results of the practical application of the model allow to make management decisions and adapt to changes in the external environment in the operational management of innovation in the enterprise and can be used to solve other problems of optimising management processes (Babenko et al., 2017). At the same time, other researchers have identified five models (collaboration, outsourcing, licensing, trade, and incorporation), the combination of which determines the openness of the company's innovation strategy (Lamberti et al., 2016).

Theoretical and practical substantiation of issues related to asset structure management in order to ensure the effective operation of enterprises, devoted to the scientific works of economists (Blank, 2008; Mizina, 2010). Asset structure is the share of assets in different categories of enterprises. It is constantly adjusted along with changes in industrial structure and market competition and is the result of the coordination of goals and management strategies at different stages of enterprise activity. The structure of assets mainly affects the value of the enterprise, as well as profit, liquidity and risk control of the enterprise (Liu et al., 2019). Optimisation of the structure and composition of the company's assets should be aimed, on the one hand, to ensure the useful use of certain species in the future and on the other – to increase the total potential ability to generate operating profit (Nosach, Lebedeva, 2019).

Today there are no strict rules for choosing the optimal organisational structure of the enterprise and its assets for innovation. Scientists have proposed an approach to optimise the structure of investment resources of the enterprise and the choice of funding based on the criterion of optimising economic security (Zlotenko et al., 2019). Differences in the formation of the asset structure of large and small enterprises, in particular under the influence of innovation, were studied by Wagenvoort, R. (2003).

Problems of optimising the structure of non-current and current assets in terms of their components were also studied by economists (Bashnyanin, 2012; Gura, 2012; Vlasova, 2013; Koshelyok, 2015; Fedorova, 2016). M. Humeniuk (2016) argued for the need to upgrade fixed assets through the use of innovative technologies in the production process.

Without underestimating the importance of these studies, we note that there are a number of issues that need attention and solutions, such as: the application of a comprehensive approach to optimising the asset structure of the enterprise in terms of innovative development to ensure the efficiency of its activities.

Thus, the above arguments indicate that in a competitive environment, the question of the innovation component in optimising the structure of enterprise assets is relevant.

Research Methodology

The purpose of the study is to assess the impact of the intensity of innovation of the enterprise on the structure of its assets and justification of the optimal structure of assets of the enterprise by optimising the production process by reducing the duration of the operating cycle.

In the process of research, the method of expert assessments was used, which from a professional point of view allows to more accurately identify problems in functioning enterprises. Each enterprise is a unique economic system, so the universal standardised methods and models, which are based on certain mathematical laws, do not allow for the application of an individual approach in the implementation of management decisions. The method of expert assessments is one of the main methods of scientific and technical forecasting, which is based on the assumption that based on the opinions of experts, it is possible to build an adequate model for the future development of the forecasting object.

The object of the study were two highly efficient Ukrainian enterprises (ALS "Trembita" and LLC "Hals-2000") and a leader among beverage producers in the Polish market Grupa Krynica Vitamin. The obtained indicators of financial statements of enterprises were evaluated by experts (employees of the Department of Economic Development, Industry and Infrastructure of Ivano-Frankivsk Regional State Administration and the Department of Regional Development of Chernivtsi Regional State Administration, representatives of innovative enterprises – a total of 10 people) and analysed by us. Based on the processing and analysis of the collected data, alternative variations of the composition and structure of assets of the studied enterprises have been identified. According to the results of the assessment of the enterprise, the optimal ratio between non-current and current assets has been found. The reliability of the results has been confirmed: the structure of assets of one of the studied enterprises, which is innovative and active, is proportional to the obtained optimal ratio. The results of the study are recognised as practically significant and will be implemented in other enterprises.

It has been proved that the use of the method of expert assessments in the process of optimising the structure of assets, taking into account the innovation component, contributes to the adoption of informed, rational and sound decisions.

The study also used such a method of economic analysis as a comparison – to compare over time the indicators of innovation activity of industrial enterprises in Ukraine and Poland. To achieve this goal, data from the State Statistics Service of Ukraine and the Central Statistical Office of Poland were used.

Results of Analysis

In the current economic environment, most companies in Ukraine rely on a conservative business model, where business is seen as an activity focused on performing certain functions and resource management. As a result of such activities, the production and sale of goods or services in exchange for cash or other goods and services are carried out. Often companies use a "strategy of transfer and borrowing", which is to use the world's scientific and

technological potential and transfer innovations created abroad in their own economy or start producing products that are already manufactured in developed countries. However, applying the experience of economically developed countries in Ukraine by simple transfer is not always appropriate, as it is necessary to take into account the specifics of the country and the state of its economy.

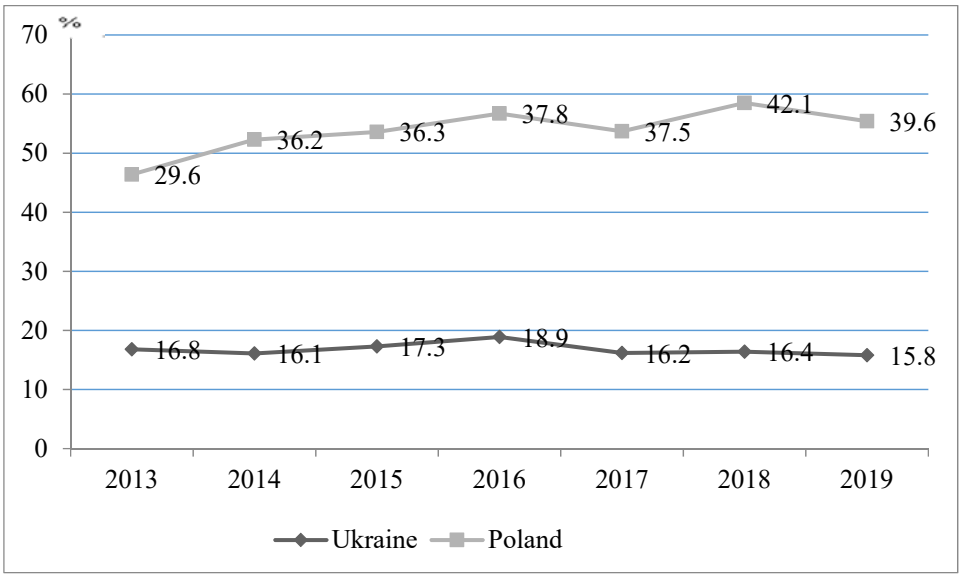
The result of European integration should be a change from a conservative business model to an innovative one – as a result of increased competition between Ukrainian and foreign manufacturers. That is why the implementation of innovative activities is a key task of Ukrainian enterprises, which has certain features of asset and capital management.

Considering the dynamics of the number of enterprises engaged in innovation activities in Ukraine, we note: in 2015, innovation activities in the industry were carried out by 824 enterprises, or 17.3% of those surveyed; in 2017 – 759 enterprises, or 16.2% of the surveyed; in 2019 – 782 enterprises or 15.8% of the surveyed. Thus, we observe a decrease in the intensity of innovation and its quality (Scientific and Innovation of Ukraine, 2020, p. 71).

The development of innovation infrastructure in one of the EU countries, Poland, is more intensive. There is a significant gap between Ukraine and Poland in terms of the share of enterprises engaged in innovation (Figure 1). Thus, the share of innovation-active enterprises in the total number of industrial enterprises in Poland in 2019 was 2.5 times higher and amounted to 39.6% (Scientific and Innovative Activity of Ukraine, 2020, p. 71; Statistical Yearbook of the Regions, 2020, p. 102). If in Poland, during the study period, the share of enterprises engaged in innovation in the total number of industrial enterprises increased, in Ukraine, there was a tendency to decrease in 2019.

Figure 1

The share of enterprises engaged in innovation



Source: Authors.

At the same time, it should be noted that, compared to other EU countries, Poland ranks low in this indicator. For example, on average, more than half of all enterprises in the EU were engaged in innovation (52.9%), and in Germany – about 80% (Tkach, 2016, p. 93).

The low share of innovation-active enterprises in Ukraine and the reduction of their number in 2019 is a negative fact due to a number of factors. Among them, in our opinion, the greatest influence is political and economic:

- divergence of centres of influence in the process of distribution of budget funds;
- unfavorable economic climate for innovation and the inability to compensate for significant risks arising from innovative investments;
- politicisation of society and distrust of business in public authorities;
- absence of legislative and tax support for innovation-active enterprises (Sas, 2019);
- insufficiency of systematisation in the measures taken by the state to intensify innovation. More than 90% of industrial enterprises are privatised, which virtually eliminates state regulation;
- lack of financial resources to provide research and implementation of innovative developments;
- inflation risks, inefficient ways to stabilise the hryvnia exchange rate, high NBU discount rate and excessive business lending rates (Kalinichenko, 2016);
- high dependence of the country's economy on loans from international financial organisations and funds;
- high level of monopolisation of industries;
- high costs of enterprises for innovation with low effective demand for new products;
- increased risk due to high uncertainty of the result and long payback period of innovative technologies;
- weak investment attractiveness of domestic enterprises for both foreign and domestic investors.

In order to predict the development of the innovative activity of enterprises and the effectiveness of management decisions in this area, it is necessary to eliminate the negative impact of the above factors.

Innovation potential is characterised by resources, which are a set of means by which the ability of the enterprise to achieve the goal of innovation. The main economic resources, in this case, are funds, which are represented by tangible and intangible assets of the enterprise. The material component of the innovative potential of the enterprise includes mostly fixed assets, in particular the part that is directly involved in the production process. The intangible component of innovation potential, which can still be described as an intellectual component, includes intangible assets, marketing resources, management and infrastructure resources,

and labour resources. Each component has specific purposes of use, is influenced by various factors, and its presence can be both a strong and a weak sign of the enterprise to carry out innovative activities.

Scientists traditionally believe that material resources are the basis for the formation of the innovative potential of the enterprise (Bagrova, Yudina, 2013; Nosach, Lebedeva, 2019). This opinion is confirmed by the results of the analysis of the distribution of innovation costs. Thus, in Ukraine in 2015, innovation costs were distributed in the following ratio: 14.8% – internal and external research and development, 0.6% – the acquisition of other external knowledge, 80.6% – the purchase of machinery, equipment and software (in including 44.3% – purchase of machinery, equipment, vehicles) (Scientific and Innovative Activity of Ukraine, 2020, p. 77). Given the fact that in the process of production, the Ukrainian enterprises use morally and physically outdated technical and technological base, the share of investments directed to the active part of fixed capital is insignificant. At the same time, in Poland in 2015, 16.7% of innovation expenditures were directed to internal and external research and development, 0.8% – to the acquisition of other external knowledge, 1.2% – to the purchase of software, 51.4% – to the purchase of machines, machinery, equipment, vehicles (Statistical Yearbook of the Regions, 2016, p. 472). That is, in contrast to Ukraine, in Poland, a much larger share of investment was accounted for by fixed assets.

In 2019, there were negative changes in the distribution of innovation costs in terms of investing assets of Ukrainian enterprises. In particular, in Ukraine, 20.5% of expenditures were directed to internal and external research and development (5.7% less than in 2015), 0.3% – the acquisition of other external knowledge (0.3% less than in 2015) year), 71.6% – purchase of machinery, equipment and software (9.0% less than in 2015) (Scientific and innovative activities of Ukraine, 2020). In Poland in 2018, 36.7% of innovation expenditures were directed to internal and external research and development, 53.5% – to the purchase of software, machinery, machinery, equipment, vehicles, buildings and land (Statistical Yearbook of the Regions, 2019, p. 392).

In times of rapid scientific and technological development and informatisation of society, special attention should be paid to intangible assets in enterprises. Intellectual capital is the foundation for building the potential of the enterprise; it allows to carry out innovative activities and provides competitive advantages in the market. In our opinion, the development of non-traditional tangible assets for the formation of the innovative potential of the enterprise is interesting. It's about business culture and brand. It is worth noting that in Poland in 2018, 2% of innovation costs were the cost of independent work of staff on innovation (Statistical Yearbook of the Regions, 2018). In Ukraine, such statistics are not calculated and costs are not incurred.

The results of the study confirm that the innovative activity of Polish industrial enterprises is much higher and, accordingly, higher competitiveness compared to our manufacturers. Therefore, Ukrainian companies need to intensively implement innovative technologies in the production process. This will affect the structure of their assets, in particular increase the share of non-current assets. The structure of assets in terms of mobile and immobile parts, i.e. current and non-current assets, has a significant impact on the results of the enterprise and business efficiency. Therefore, Ukrainian companies that will increase innovation

activity and borrow the experience of Poland, need to pay attention to both the advantages and disadvantages of the accumulation of non-current assets, and focus on the optimal ratio between non-current and current assets. Our study aims to find the most optimal asset structure. To do this, we have chosen companies that operate effectively and are innovative.

Given the turnover of current assets and a greater degree of their liquidity, compared to non-current assets, we believe that increasing the share of current assets in total assets is associated with increased efficiency. The formation of the property structure depends largely on the industry in which the company operates, so it makes it impossible to form a mobile structure in each of the companies. According to the management practice of Ukrainian enterprises, intangible assets occupy a small share in the property structure, while fixed assets, which are a component of tangible assets, are obsolete. We believe that the main reason for this situation is usually the lack of financial resources, due to which companies are not able to invest in fixed assets that are directly involved in the production process and do not accumulate intangible assets. Physical and moral depreciation of fixed assets sometimes reaches 80% of the property structure of industrial organisations (Gura, 2012).

Thus, we see a clear link between the process of innovation in the enterprise and the structure of assets innovation steadily leads to an increase in non-current assets of the enterprise (due to an increase in intangible assets and fixed assets), i.e. the formation of less mobile assets.

Successful asset management can increase the efficiency of operational and financial activities in the relationship. On the one hand, the optimisation of the company's assets is aimed at ensuring the full useful use of certain types, and on the other – to increase the total potential ability to generate an operating profit. In order to ensure the effective operation of the enterprise and optimise non-current and current assets, it is necessary to take into account not only the sectoral characteristics of operating activities but also the average operating cycle for the enterprise, positive and negative assessments of all types of assets.

When studying the structure of assets, it is necessary to sort mobile assets according to the degree of liquidity. Traditionally, they are divided into absolutely liquid assets, which include money and their equivalents (A1); average liquid assets, i.e. receivables of the enterprise (A2); illiquid assets, the main component of which are inventories (A3). Non-current assets are illiquid assets (A4).

The structure of assets affects the efficiency of management, the key to which, in our opinion, is the length of the operating cycle. The duration of the operating cycle is the period of time between the purchase of materials, use in production, sale of finished products and receipt of cash. Reducing the value of the indicator can be achieved by optimising the production process and increasing production efficiency.

Consider how different options for the structure of assets affect the change in the duration of the operating cycle, in particular, provide a positive change: reduction.

The assessment of the impact of the structure of assets on the duration of the operating cycle was carried out on the materials of financial and economic activities of ALS "Trembita" and LLC "Hals-2000". These are industrial enterprises (ALS "Trembita" belongs to light industry enterprises, and LLC "Hals-2000" belongs to food industry enterprises), where innovations that affect the structure of their assets have been actively implemented recently. These

enterprises were chosen because they differ in the mobility of the asset structure. Thus, ALS "Trembita" is dominated by non-current assets, and the property of LLC "Hals-2000" is formed mainly at the expense of current assets.

ALS "Trembita" is one of the undisputed leaders in the garment industry of Ukraine, in particular in the market of men's clothing in our country, as well as abroad. Due to the high level of business culture, the products of this company are successfully sold in Ukraine, Germany, Italy, France and the United States. Electronic and automatic equipment of equipment helped to improve the quality of products and increase production. Trembita is one of the leaders in Europe and the world in terms of output. The products have a high level of competitiveness and meet international standards. The technical condition and technological level of the enterprise meet the requirements of European standards. This is a modern enterprise, which uses the latest advances in science and technology of the garment industry (Catalog of leading enterprises of Ukraine, 2021).

The company is actively engaged in innovative activities. The share of spending on innovation during 2013-2019 fluctuated significantly. It was the highest in 2016 and accounted for 34% of the company's costs. The average annual value of the company's property in 2019 was 3454 thousand dollars and revenue from sales of products – 4067 thousand dollars. Due to the increase of intangible assets and active renewal of fixed assets, the following asset structure was formed at the enterprise: 80% are non-current assets (A4), 20% –are current assets (A1, A2, A3). The share of absolutely liquid assets is 4% and the share of medium liquid assets – 5%, illiquid assets are 11% of total assets.

To assess the optimal structure of assets, it is necessary to consider various variations in the structure of assets of ALS "Trembita". Each of the proposed options provides for different ratios of current and non-current assets, as well as variations within current assets, depending on the degree of liquidity. The impact of such changes on the results of the enterprise as:

1. Structure of assets of this enterprise in the absence of innovation and in the period of active implementation: the first of them is characterised by the ratio of non-current and current assets of 60% : 40% (Option I), the latter – 80% : 20% (Option III);
2. Different options for the ratio of asset groups A1, A2, A3, namely:

   - variations 1.2, 2.2, 3.2 characterise the volume of absolutely liquid assets (A1) at the level of 5%, i.e. within the limits that will ensure the appropriate level of liquidity and solvency at the current level of current liabilities of the enterprise;
   - variations 1.1, 2.1, 3.1 characterise the decrease in absolutely liquid assets (A1) by 1% and illiquid assets (A3) by 1%, as well as a corresponding increase in average liquid assets (A2) by 2%, which leads to a slight increase in the operating cycle, provided that the ratio of non-current and current assets remains unchanged;
   - variations 1.3, 2.3, 3.3 characterise the increase in absolutely liquid assets (A1) by 1% and medium liquid assets by 1% (A2), as well as a corresponding decrease in illiquid assets by 2% (A3), which leads to a slight decrease in the operating cycle, provided the ratio of non-current and current assets.

As a result, variation 3.3. characterises the optimal structure of assets in terms of the optimal size of both non-current and current assets. The structure of ALS "Trembita" assets is close to option 3.1 (Table 1).

Table 1

The duration of the operating cycle of ALS "Trembita" with different options for the structure of assets

Indicator	Option I (60% : 40%) Lack of innovatio			Option II (70% : 30%) Insignificant implementation of innovative activities			Option III (80% : 20%) Active implementation of innovative activities		
	1.1	1.2	1.3	2.1	2.2	2.3	3.1 (available)	3.2	3.3 (optimal)
Structure (%)									
A1	4	5	6	4	5	6	4(4)	5	6
A2	17	15	16	12	10	11	6(5)	4	5
A3	19	20	18	14	15	13	10(11)	11	9
A4	60	60	60	70	70	70	80(80)	80	80
Total	100	100	100	100	100	100	100	100	100
Sum (thousand dollars*)									
A1	138	173	207	138	173	207	138 (128)	173	207
A2	587	518	553	415	345	380	207 (188)	138	173
A3	656	691	622	484	518	449	345 (388)	380	311
A4	2073	2073	2073	2418	2418	2418	2763 (2750)	2763	2763
Total	3454	3454	3454	3454	3454	3454	3454	3454	3454
The duration of the operating cycle (days)									
Duration of inventory turnover, days	58	61	55	43	46	40	31 (34)	34	28
Duration of turnover of receivables, days	52	46	49	37	31	34	18 (17)	12	15
The duration of the operating cycle, days	110	107	104	79	76	73	49 (51)	46	43

** at the rate of the NBU on January 1, 2019.*

Source: Authors.

Taking into account the existing value of ALS "Trembita" assets, which is reflected as a sub-item of variation 3.1, in the second stage, the probable value of asset groups is calculated in accordance with the proposed changes in the structure. In the third stage, the probable duration of the operating cycle (the sum of the duration of inventory turnover and receivables) is determined, provided that the value of assets of groups A2 (receivables) and A3 (inventories) changes. The study found that with an increase in the value (share) of non-current assets and a corresponding decrease in the value (share) of current assets, including receivables and inventories, the duration of the operating cycle decreases.

When assessing and justifying the optimal amount of cash, it should be noted that their increase is usually positive, as it indicates an increase in liquidity and acceleration of sales of the enterprise. However, cash is characterised by inflationary depreciation, so companies should try to make more rational use of free cash. In the management process, it is advisable to keep in the accounts the minimum amount of cash required to ensure current operations.

According to the results of the analysis, the structure of assets at ALS "Trembita" in terms of the ratio of current and non-current assets is optimal. The structure of current assets is imperfect. Therefore, to reduce the operating cycle, you should use a variant of structure 3.3. This will increase the share of cash and reduce the share of inventories.

The next object of study is LLC "Hals-2000". This is a well-known fish processing enterprise of the Dobra Ryba brand in Western Ukraine. The share of expenditures on innovative technologies is average, and during 2013-2019 it did not exceed 15%. Determining the impact of innovative activities of LLC "Hals-2000" on the duration of its operating cycle, we note that this company was established in 2000. The volume of sold products of the enterprise amounted to 3539 thousand dollars, and the total amount of assets – 4369 thousand dollars. The company is actively implementing innovations, so over the past two years, the structure of its assets has changed significantly. Currently, the ratio of non-current and current assets is almost 50% : 50%, i.e. the company is characterised by an asset structure that is close to option 3.2 (Table 2). Accordingly, the structure of assets in terms of the ratio of non-current and current assets is not optimal.

Table 2

The duration of the operating cycle of LLC "Hals-2000" with different options for the structure of assets

Indicator	Option I (30% : 70%) Lack of innovatio			Option II (40% : 60%) Insignificant implementation of innovative activities			Option III (50% : 50%) Activation of innovation activity			Optimal 80% : 20%
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2 (available)	3.3	
Structure (%)										
A1	4	5	6	4	5	6	4	5 (5)	6	6
A2	32	30	31	27	25	26	21	19 (21)	20	5
A3	34	35	33	29	30	28	25	26 (26)	24	9
A4	30	30	30	40	40	40	50	50 (48)	50	80
Total	100	100	100	100	100	100	100	100	100	100
Sum (thousand dollars*)										
A1	175	218	262	175	218	262	175	218 (218)	262	262
A2	1398	1311	1354	1180	1092	1136	917	830 (917)	874	218
A3	1485	1529	1442	1267	1310	1223	1092	1136(1136)	1048	393
A4	1311	1311	1311	1747	1747	1747	2184	2184 (2097)	2184	3494
Total	4369	4369	4369	4369	4369	4369	4369	4369	4369	4369
The duration of the operating cycle (days)										
Duration of inventory turnover, days	151	156	147	129	133	124	111	116 (115)	107	40
Duration of turnover of receivables, days	142	133	138	120	111	116	93	84 (93)	89	22
The duration of the operating cycle, days	293	289	284	249	244	240	204	200 (208)	196	62

** at the rate of the NBU on January 1, 2019.*

Source: Authors.

Reducing the level of innovation and depreciation of fixed assets can increase the share of current assets to 70-60%. This usually results in an increase in current assets such as

receivables and inventories. Accordingly, the duration of the operating cycle increases. In order to form the most objective conclusion about the optimal structure of assets and determine whether to increase or decrease the share of non-current assets, we offer a study of different options for the structure of assets. The following changes are considered:

- change in the ratio between non-current and current assets: increase the latter to confirm the feasibility or inexpediency of increasing the share of non-current assets (Option I – current assets are 30%, a Option III – 50%);

- optimisation of the structure of current assets by liquidity (variation of groups of assets A1, A2, A3 is carried out in accordance with the above approach. The overall increase in the share of current assets causes an increase in the share of groups A2 and A3, but the variation within 1-2% remains the same as in the study ALS "Trembita");

- application of the probable optimal asset ratio of 80% : 20%, which provides for an increase in intangible assets and fixed assets as a result of the high intensification of innovation (as a result, the optimum ratio of 80% : 20% was confirmed, which is justified by a significant reduction in the duration of the operating cycle).

Thus, among the three options considered, the current ratio between non-current and current assets of LLC "Hals-2000" 50% : 50% is more appropriate. However, from the point of view of minimising the duration of the operating cycle, it is optimal to achieve a ratio of 80% : 20%, which will involve the active implementation of innovation.

In order to confirm the results of the study, the reliability of the optimal ratio between non-current and current assets of 80% : 20% on the example of one of the innovative enterprises in Poland.

Grupa Krynica Vitamin specialises in the production of beverages and provides bottling services in aluminum bottles and PET packaging. At the end of 2019, the company launched a production line for filling glass containers. In addition, the company's sales structure for exports changed. Revenues from the sale of beverages outside Poland amounted to 47%. The company supplies products to almost 40 countries. In 2019, 51% of production was energy drinks classified as special foods. The second category by share in the company's portfolio (43%) were carbonated beverages. The volume of sold products of the enterprise amounted to 76915 thousand dollars, and the total assets – 41637 thousand dollars.

As of now, the structure of assets corresponds to option 2.2. (Table 3). Variation in the structure of assets was carried out similarly to the method used in the study of ALS "Trembita". Sub-item of variation 2.2. called "existing", characterises the existing structure of assets at the enterprise, which formed the basis for further calculations. The evaluation results confirm the feasibility of optimising the asset structure of the company "Grupa Krynica Vitamin" to achieve the optimal ratio of 80% : 20%. As a result, the duration of the operating cycle will be reduced.

Table 3

The duration of the operating cycle at the company "Grupa Krynica Vitamin" with different options for the structure of assets

Indicator	Option I (60% : 40%) Lack of innovatio			Option II (70% : 30%) Insignificant implementation of innovative activities			Option III (80% : 20%) Active implementation of innovative activities		
	1.1	1.2	1.3	2.1	2.2 (available)	2.3	3.1	3.2	3.3 (optimal)
Structure, %									
A1	4	5	6	4	5 (1)	6	4	5	6
A2	17	15	16	12	10 (15)	11	6	4	5
A3	19	20	18	14	15 (15)	13	10	11	9
A4	60	60	60	70	70 (69)	70	80	80	80
Total	100	100	100	100	100	100	100	100	100
Sum, thousand dollars*									
A1	1666	2082	2491	1666	2082 (331)	2498	1666	2082	2498
A2	7078	6246	6661	4997	4164 (6074)	4580	2498	1666	2082
A3	7911	8327	7495	5829	6246 (6436)	5413	4164	4580	3747
A4	24986	24986	24986	29146	29146	29146	33309	33309	33309
Total	41637	41637	41637	41637	41637	41637	41637	41637	41637
The duration of the operating cycle, days									
Duration of inventory turnover, days	37	40	35	27	29 (30)	25	20	21	18
Duration of turnover of receivables, days	33	29	31	23	19 (28)	21	12	8	10
The duration of the operating cycle, days	70	69	66	50	48 (58)	46	32	29	28

** at the rate of the NBU on January 1, 2019.*

Source: Authors.

Thus, considering the impact of different options for the structure of assets on the change in the duration of the operating cycle of industrial enterprises engaged in innovation and characterised by different levels of property mobility, industries and sales, we can draw the following conclusions:

- increase in innovation activity of the enterprise affects the increase in the property structure of non-current assets and provides a positive change – reducing the duration of the operating cycle;

- the formation of a more mobile structure of assets in the enterprise has a negative impact on the duration of the operating cycle, as it slows down the turnover of current assets, including inventories and receivables, due to the growth of the absolute amount with constant sales revenue;

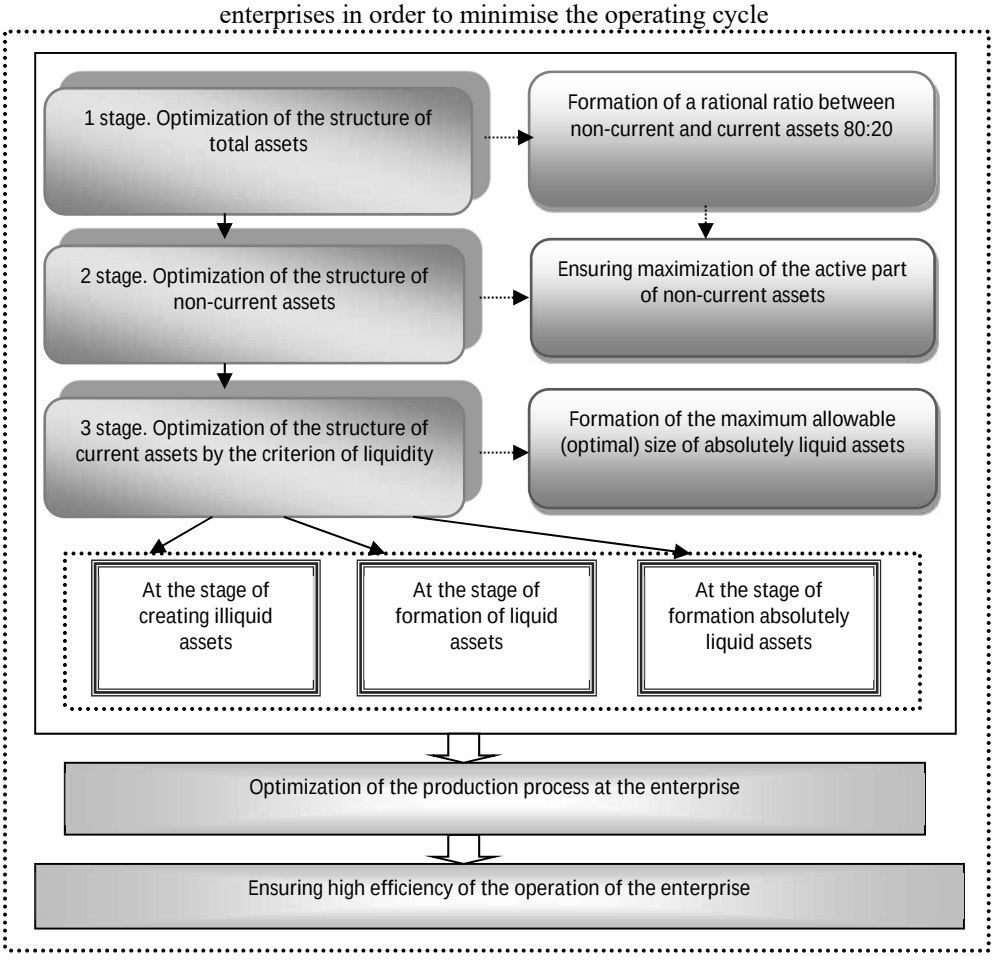
- an increase in the share of A1 (absolutely liquid assets) leads to a reduction in the duration of the operating cycle, as evidenced by all three options for capital structure;

- shorter operating cycle duration, among the proposed, provide options for the structure of assets, which provide for the average (among the three proposed) share of medium liquid assets and less (among the three proposed) share of illiquid assets.

In our opinion, the optimisation of the structure of assets in order to ensure the efficiency of the enterprise, namely the criterion of minimising the duration of the operating cycle, should be carried out in three stages, which are shown in Figure 2.

Figure 2

The mechanism of optimisation of the asset structure of innovatively active industrial enterprises in order to minimise the operating cycle



Source: Authors.

At the first stage, it is advisable to optimise the ratio of the value of non-current and current assets of the enterprise, which will ensure better performance. If the share of non-current assets is more than 40%, the asset structure is considered "heavy", less – "light". "Heavy" structure indicates significant overhead costs and high sensitivity to changes in revenue, "light" – the mobility of the enterprise (Bashnyanin, 2012). For industrial enterprises, it is the increase in the share of non-current assets in the total amount that minimises the operating cycle, which is due to the peculiarities of the technological process.

In the second stage, given the above, the main task of optimising the structure of non-current assets is to increase the share of the active part of fixed assets. This is due to the fact that the active part is directly involved in the production process and thus determines a certain volume and proper quality of products (working machines and equipment, measuring and regulating devices, production tools, as well as some technical facilities). The passive part creates the conditions for the production process (buildings, structures, vehicles, power machines and equipment, transmitting devices and other fixed assets). The task of the second stage of optimisation of the property structure of the enterprise is to ensure the maximisation of the share of fixed assets in the structure of non-current assets.

Based on the analysis, we can say that the structure of current assets by the criterion of liquidity has a significant impact on the duration of the operating cycle. With this in mind, the third stage optimises the ratio by the criterion of liquidity of the three main types of current assets: absolute (cash), medium (receivables) and illiquid assets (inventories). According to this stage, you can identify ways to optimise at each stage of production. At the stage of formation of illiquid assets –minimisation of inventories and work in progress through the introduction of innovative technologies, rational use and storage, the optimal choice of suppliers and others. At the stages of formation of absolutely and medium-liquid assets – rational organisation of the sales process, compliance with settlement and payment discipline, the use of marketing levers to increase sales (advertising) and others.

The consequence of such optimisation is a reduction in the duration of the operating cycle, which improves the efficiency of management as a whole.

Modern production requires significant costs for scientific and technical development, and implementation of results, and in many cases, this burden is unbearable for individual businesses in conditions of fierce competition (Tubolets, 2016). The lack of own financial resources, low profitability and insignificant market share do not allow Ukrainian companies to withdraw money from circulation for the introduction of innovative technologies. It is the innovation component that is the main source of social progress not only in world-leading countries, but also in such small countries as Iceland, Ireland or Thailand, which are sometimes even ahead of the leading countries in implementing scientific achievements. The importance of scientific and technological progress is evidenced by the special attention of the state to the scientific sphere in all countries. It manifests itself in significant and diverse types of government support. Unfortunately, today private enterprises have insufficient financial opportunities and can ensure the development of only certain projects related to specific business activities.

Discussion

Changes in the institutional environment and the development of European integration processes lead to new requirements for Ukrainian enterprises: to intensify innovative activities that involve efficient and rational use of tangible and intangible assets, use a resource and material-saving technologies, automate production processes, update fixed assets, use innovative approaches. However, a survey conducted by H. Pozo (Pozo et al., 2019) shows that the main motivating factor for innovation in small businesses in Brazil is the search for sources of increasing profits. For these companies, innovation is equated with the purchase and use of new machinery and equipment. We believe that the size of net profit is not the most important problem for Ukrainian enterprises. The priority for them is to increase competitiveness and market share.

In the process of research, we considered the optimisation of the asset structure of the enterprise in order to ensure the efficiency of its operation by reducing the duration of the operating cycle. Of course, the process of optimising the structure of assets can be based on other criteria that have been studied by various authors. Thus, N. Kovalchuk et al. (2019), among the many criteria that can be used in Ukrainian enterprises to improve the structure of assets, offer two, such as: increasing the market value of shares and net income. It should be noted that the criteria for maximising the company's net profit and market value do not fully meet modern economic requirements and are not a priority. This opinion is confirmed in the research of the authors (Sosnovska, Zhytar, 2018), who note that the choice of principles and methods of building a financial architecture depends on such financial interests of the entity as the formation of flexible financial potential, optimising capital structure, increasing investment attractiveness, maximising profit and increase the market value of the enterprise.

As we see from the results of our research, it is advisable to identify a set of political and economic factors that negatively affect the innovative activity of enterprises. At the same time, L. Kalinichenko (2016), along with political and economic, identifies social and technological factors that affect the level of innovation activity of enterprises. The analysis of current social factors makes it possible to conclude that it is necessary to form a cult of engineering and technical worker and thus create conditions to provide industrial enterprises with highly qualified personnel (Kalinichenko, 2016). The importance of corporate social responsibility and the environmental basis of sustainable development has also been emphasised (Pylypiv et al., 2018).

It has been established that the development of innovative activity in industrial enterprises is important and will help optimise the structure of assets. This statement is supported by I. Balaniuk and other (Balaniuk et al., 2019) researchers, who note that the use of innovative technologies in agricultural enterprises can provide such important for Ukraine expansion of production, increasing the resource base of enterprises and social development of rural areas.

The practical results of the operation of both Ukrainian and foreign companies, in particular Polish enterprises, allowed us to determine the directions of intensification of innovation processes during the formation of assets of industrial enterprises. At the same time, a group of scientists has identified the benefits of management success in information and

telecommunications companies and companies specialising in professional, scientific and technical activities in Ukraine and Poland (Mamatova et al., 2020).

The forecasted trends of changes in the analysed indicators, obtained using the method of alternative estimates, show that for industrial enterprises, the ratio between non-current and current assets is 80:20, which allows to optimise the duration of the operating cycle and the volume of innovation. According to Kirdina, O. (2013), the optimisation of the ratio of current and non-current assets should be based on the following principles: taking into account the immediate prospects of operating activities and forms of diversification (the volume of current and non-current assets of the enterprise, formed at the initial stage certain reserve potential that will provide opportunities for product growth and diversification of operating activities); ensuring the appropriate ratio for the formed current and non-current assets of the volume, for the structure of production and sales; ensuring the optimal ratio of current and non-current assets to the efficiency of economic activity; providing opportunities for high turnover of assets in the process of their use. We believe that compliance with the above principles in innovative enterprises will contribute to competitiveness and efficiency.

In the business system, business culture is an effective intangible asset. The development of business culture is an important means of improving social and economic relations, which has a significant impact on improving the economic efficiency of the enterprise and improving the economic situation of the country as a whole. An important type of intangible assets is the brand. We support the opinion of Gorovy, D. (2016) that intangible assets should be grouped into three categories, which are most often defined in the financial statements:

- brand (this also includes a design that stands out in the US, Japan, UK, Sweden and other EU countries), marketing research (Russia);
- information: software, patents and research (EU countries, Russia and Ukraine), mineral exploration (Sweden, Japan and the Netherlands), preparation for production (Russia);
- human capital, as well as organisational capital (Japan, EU countries), vocational training (Sweden, Russia).

Conclusions

Thus, during the study, the main goal was realised – to assess the impact of the intensity of innovation of the enterprise on the structure of assets of the enterprise by optimising the production process, which will reduce the duration of the operating cycle.

The following strategic tools were used for this: innovation and investment policy of the enterprise, new knowledge and technologies, new fixed assets, capital of the enterprise and financial resources that invest in tangible and intangible assets, production resources.

This allowed us to obtain the following scientific results: first, to justify the feasibility of increasing the innovative activity of Ukrainian enterprises; secondly, to determine the

optimal ratio of non-current and current assets for these enterprises; thirdly, to indicate the areas of optimisation of current assets.

It has been proved that in the process of improving the efficiency of the enterprise, an important place is occupied by the optimisation of the asset structure. The share of non-current assets should be sufficient to ensure their productive use, as well as quality renewal based on the introduction of new technologies.

At the same time, the share of current assets must provide sufficient liquidity and manoeuvrability. The optimisation is associated with the largest reserves of inventory reduction in enterprises, especially in terms of material-intensive production.

At the enterprises it is expedient to form stocks of necessary values within the possible minimum for constant maintenance of continuity of production process that will reduce the expenses of the enterprise connected with storage and damage of stocks. It is necessary to accelerate the sale of products, payments for products sold and services provided to prevent the creation and reduction of receivables.

Given all the advantages and disadvantages that will provide the company with working capital and non-working capital, the optimal ratio between non-current and current assets is 80 : 20. With such an asset structure, companies will be able to implement innovative technologies, improve the production process, increase competitiveness and increase market share.

The practical significance of the obtained results has been confirmed by the presence of such a ratio in the structure of assets of one of the investigated enterprises of ALS “Trembita”, which is innovation-active and export-oriented.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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INNOVATION AS A SUCCESS KEY FOR MANUFACTURING SMEs: EMPIRICAL INSIGHTS FROM KOSOVO[4]

The purpose of this research is to analyse the impact of innovation types on the sales growth of manufacturing SMEs in Kosovo. The production base of the Western Balkan countries is very low, so innovations should be developed which are perceived as catalysts for increasing the production capacity of SMEs in these countries. In terms of methodology, the research sample consists of 200 SMEs from the manufacturing sector. The manufacturing sector is not very developed in Kosovo, so this number constitutes 90% of manufacturing SMEs. The achieved results were analysed through logic regression, processing them in the statistical program SPSS. The findings confirm the hypotheses that Marketing innovations and product innovations have a positive impact on increasing sales of these SMEs. Meanwhile, organisational innovations do not have an impact on increasing sales of manufacturing SMEs. This study was conducted with manufacturing SMEs in Kosovo, so the main limitation of this research is the non-inclusion of SMEs in other sectors. This research is of particular importance because there is no research that aims to study the impact of innovation types on increasing sales of manufacturing SMEs in Kosovo. Therefore, the results of this research can serve government bodies in drafting policies and strategies for the development of innovative activities of manufacturing SMEs.
Keywords: Innovation; Sales growth; Manufacturing SMEs; Kosovo; logic model
JEL: L25; L26; M20

1. Introduction

Like other countries in the Western Balkans region, Kosovo has undergone radical changes during the political and economic transition. As a result of special political characteristics, the country has been subjected to extreme conditions in the business environment that affect the development of SMEs during various stages. As an Autonomous entity in the former Yugoslavia, Kosovo was subject to national discrimination and the labour market, occupation

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and finally, the war in 1999. This made Kosovo a unique case of transition on its path to economic and political transformation. The development of entrepreneurship and business activities are seen as the main sources of income and job creation that can help Kosovo in the process of economic recovery (Business Support Centre Kosovo BSC, 2011).

Entrepreneurs in post-conflict countries face economic and institutional barriers. Limited access to working capital, limited managerial and technical expertise are among the most pronounced limitations. In many transition economies, especially in the Western Balkans, the small enterprise sector has not grown fast enough to prevent rising unemployment, nor has it met its potential as a growth engine (Qorraj, Jusufi, 2019). Also, the number of businesses that conduct their activity electronically has not increased numerically. Firms need to be innovative to succeed in business activities (Rrustemi, Jusufi, 2021). Therefore, most firms in transition countries do not have sufficient potential for the development of innovations, especially new product development, so very few focus on business activities. In general, the concept of innovation is still a new term for firms in the Western Balkans region. The following table presents the innovations made by the enterprises of the Western Balkan countries.

Table 1

Innovation in Western Balkan enterprises

WB countries	% enterprises that introduced a new product/service	% enterprises that introduced a process innovation
Kosovo	56	45
North Macedonia	28	25
Serbia	40	20
Albania	9	4
Montenegro	25	15
Bosnia & Herzegovina	45	33

Source: Jusufi, et al., 2020.

All types of innovations are of particular importance to manufacturing firms. The conceptualisation of innovation and the level of development of countries moderate the link between innovative activities and success in increasing the level of production (Bıçakcıoğlu-Peynirci et al., 2019). Therefore, the impact of innovations on business performance or the growth of firms has found great interest in many studies in the field of marketing and enterprise management. Most of the findings of these papers and researches emphasise that innovative firms experience more growth than non-innovative ones (Colombelli et al. 2013; Jusufi et al. 2020).

However, in addition to innovations, other elements of the firm also affect their growth, such as the level of education of employees, the characteristics of entrepreneurs, the age of the firm, etc. Therefore, in this research, in addition to the variables related to innovation, some variables related to the characteristics of SMEs analysed are included, such as the level of education of employees, the size of SMEs. So, in addition to the type of innovation, in our research are also included variables that are thought to affect the success of exporting SMEs. In our judgment and the results achieved, it can be stated that these factors are among the most important that determine the success of manufacturing SMEs. The objectives of this paper are:

1. *Review of literature related to innovations and types of innovations;*
2. *Research on the impact of types of innovations on increasing sales of manufacturing SMEs;*
3. *Drawing conclusions regarding this issue.*

The novelty of this paper is that it is one of the few papers that has addressed the issue of innovations and their importance for Kosovar manufacturing SMEs. The significance of the research lies in the fact that it has provided empirical evidence that, in particular, product/ process innovations greatly influence the success of Kosovo's manufacturing SMEs. This paper has a special contribution both in applied aspects and in terms of research. From applied aspects, this paper provides information to manufacturing SMEs on which types of innovations are most accessible and most useful for their business. In terms of research, this research is one of the few researches that deal with the relationship between innovation and increasing the production of SMEs.

Initially, the literature will be reviewed, which deals with the types of innovations, the characteristics of marketing innovations, products and organisational ones, their impact on the growth of SMEs and their business and organisational performance, etc. The literature review section will present the hypotheses of this paper which derive from the literature review. After that, the research methodology will be presented, the research model as well as the results achieved from this research with 200 manufacturing SMEs in Kosovo. In the end, will be presented the conclusions reached from this scientific research.

2. Kosovo Economic Contex

Kosovo reached the highest rate of economic growth and development between 1965-1975. Qualitative changes in the production structure took place at this time. In the early 1980s, due to the political and economic crisis in the former Yugoslavia, the political and economic situation in Kosovo changed dramatically. Kosovo, like most of the countries of Yugoslavia, became embroiled in ethnic conflicts. GDP growth fell to an annual average of 1.8% at the beginning of those years, dropping further to 1.1% over the years 1986-1988. The early 1990s are characterised by the mass exclusion of Albanians from the public sector and a decline in domestic production to 10-30% of its capacity. This has also influenced the boom in SME creation during the years 1990-1993 (Krasniqi, Mustafa, 2016).

According to World Bank reports, Kosovo is a low-income country which has experienced solid economic growth with an average of 3.4% and has grown every year since the 2008 global financial crisis. Kosovo has higher economic growth than neighbouring countries, however, this economic growth remains insufficient to reduce unemployment, especially female and youth unemployment. Also, this increase is not enough to reduce migration abroad. With a population of about 1.8 million, with a GDP per capita of 3,480 euros, Kosovo continues to be the third poorest country in Europe. Due to Kosovo's low export base, export growth will primarily rely on external demand for metals, despite signs of increased service exports and export diversification (European Commission, 2020; Qorraj, Jusufi, 2021).

The specific historical and institutional context in Kosovo best reflects the opportunities and threats to SME-dominated private sector development. The development path of entrepreneurship in Kosovo begins with the so-called "small economy" during the 1970s and 1980s. Not aligned with the Soviet Union, Tito led Yugoslavia as a specific state model, the so-called self-governing socialism, which consisted of a mixture of elements of planned economy and market economy. These changes allowed the establishment of small private enterprises, which were limited in the number of employees they could employ, averaging 10 employees. Meanwhile, in agriculture, they were limited to the land area that could be owned by private farmers up to 10 ha (Dana, 2010).

But in Yugoslavia, the development of the small enterprise sector had marked regional differences. While it was very well developed in the northern province of Vojvodina, more or less comparable to Slovenia and Croatia, it was very underdeveloped in Montenegro, Macedonia and Kosovo. However, the existence of the private property, although limited, has played a vital role in private sector construction during the post-1989 reform period (Bateman, 2000). During the nineties, Kosovo had a very weak economy. This led to the dominance of shuttle-trade businesses, while the number of businesses of the more stable type, typical of more developed economies, was limited (Kastrati, 2012).

With the end of the war, Kosovo had to start everything from scratch. During this period, remittances (about 14% of GDP) and donor contributions, especially during the reconstruction phase, have stimulated the development of SMEs through the generation of high aggregate demand (Krasniqi, 2012). Although they make up almost the entire private sector, the number of SMEs in Kosovo is small compared to the countries of the Western Balkans region. Kosovo ranks last in the region with 25.5 SMEs per 1000 inhabitants (Riinvest, 2017).

Most of the active private enterprises in Kosovo are engaged in trade, about half of them fall into the wholesale and retail trade sectors. The same sector also employs the largest number of employees. Experts have consistently emphasised the manufacturing sector as crucial to the country's economic development. Although it remains small, the number of manufacturing enterprises seems to be increasing every year. According to a report by ABC Accelerator (2017), from 2012 to 2017, about 130 startups were created in Kosovo, but the survival of startups in Kosovo is generally very small and a large number of them fail, end the activity of after going through an incubator or grant program.

It should be noted that according to the source of funding donations committed by states, the value of donations committed to Kosovo was about € 1,117 million or 49.5% of the total. From international multilateral institutions, about € 1,067 million or 45% of the total, and from non-governmental organisations, about € 177 million or 7.3% of the total. The main donors are the United States with about € 296 million or 12.53%, followed by Japan with € 137 million or 5.82% and Germany with € 129 million or 5.48%, Denmark with € 94 million, Canada with € 75 million, Switzerland with € 71 million or 3.02%, the Netherlands, Bulgaria, Turkey, etc. So, international donations are one of the most important instruments that have contributed to creating the development base of the Kosovo economy.

3. Literature Review

There are different definitions of innovations in the literature. The process of creating new ideas in SMEs in order to increase business performance is an innovation. According to European Commission-Oslo Manual (2005), innovation is the implementation of a new or significantly improved good or service, or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. Innovations involve numerous activities which vary from firm to firm (Rogers, 1998; Pejic Bach et al., 2015; Bezdrob, Šunje, 2014). Authors like Oke et al. (2007); Chetty & Stange (2010) classify innovations as product, process, marketing, and organisational innovations. There is various research on the impact of innovation on the business performance of SMEs. Damanpour & Evan (1984); Deshpande et al. (1993); McGrath et al. (1996); Han et al. (1998); Hult & Ketchen (2001); Calantone et al. (2002); Garg et al. (2003); Stojčić et al. (2018); Milfelneret et al. (2019) in their studies claim that innovations have a positive impact on the business performance of firms. According to them, those SMEs that manage to develop innovations will have good business performance.

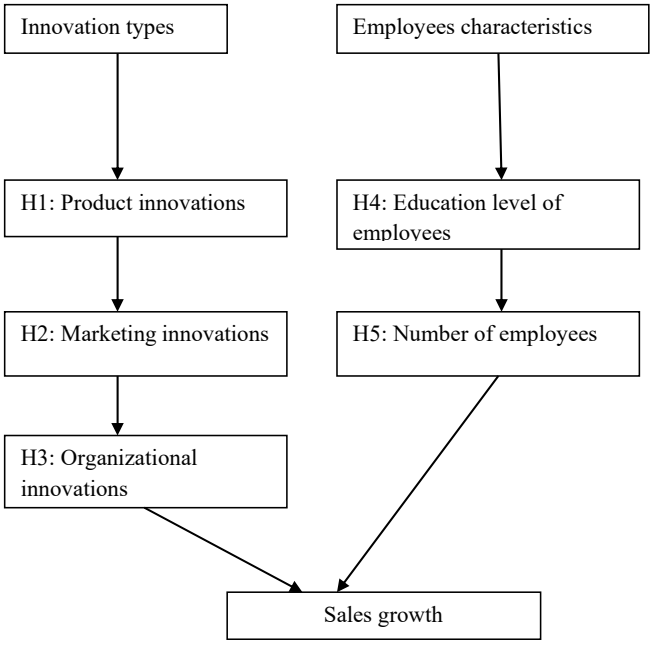
Karlsson & Olsson (1998); Lee et al. (2010), in their studies, concluded that product and process innovations are very important for SME growth. Also, Langley et al. (2005); Balakrisha Kanagal (2015) claim that product innovations are positively related to SME growth and performance. The best business performance depends on the product innovations that the firm develops. This is the result that has been achieved by Boziz (2011). However, according to Hoffman et al. (1998), innovations do not have an immediate impact on increasing the business activities of SMEs. A period must pass to see the impact of innovation on the growth of business activities. Love & Roper (2015) argues that not all SMEs can carry out innovative activities. Only those SMEs that are productive have a greater tendency for innovation.

Aralica et al. (2008) claim that the level of innovative activities of SMEs in different sectors stems from the characteristics of the markets where these SMEs operate. So market characteristics are more dominant in defining innovations than the technologies and processes of these SMEs. Lachenmaier & Woessmann (2004) conclude that innovations are of great importance in increasing the exports of manufacturing firms. So innovations are an important factor in increasing the level of exports of many manufacturing firms.

Atuahere-Gima (1996); Subramanian & Nilakanta (1996); Han et al. (1998); Li & Atuagene-Gima (2001) have come to the conclusion that product innovations are important in enhancing firm performance. Also, Hernandez-Espallardo & Delgado-Ballester (2009); Ar & Baki (2011) have achieved similar results in terms of the relationship between firm performance and product innovation have achieved similar results in terms of the relationship between firm performance and product innovation. The performance of the firm, in particular, the performance of the organisation increases as a result of product innovations. In this line are also the results of Rosli & Sidek (2013); Bayus et al. (2003); Morone & Testa (2008); Krasniqi & Desai (2016); Reçica et al. (2019).

Figure 1

Research model



Source: Self estimation.

Geroski et al. (1993) conclude that product innovation has positive effects on profit margins. Meanwhile, Tankosic and Vapa (2017) claim that product innovation depends on firms' intangible sources. Karbowski and Prokop (2020) consumers are an important source of product innovations. Customer demands, needs and tastes are the starting point of product innovations in an SME. Whereas Lukas and Ferrell (2000) claim that consumer orientation in the market is a source of development of innovations that have been discontinued before. Bozic (2007) emphasise that the higher the intensity of customer orientation, the higher will be the intensity of product innovation development.

Another point of view on product innovations has been given by this author, who emphasises that the capacity to develop product innovations depends on the market share of the firm. The higher this portion is, the greater the opportunities for product innovation are. Prasnikar et al. (2008) claim that in order to be successful in product innovations, firms need to develop technological, marketing and complementary competencies. Whereas Vega-Jurado et al. (2008) emphasise that technological competencies are the main determinants of product innovation development. These determinants are dependent on the industrial sector and the level of innovation of the new product.

According to Schubert (2009) the success of product innovations can be defined as the increase in sales of these products in the market. Meanwhile, Kleinschmidt and Cooper (1988) claim that the success of product innovation depends on its ability to be sold in the

international market. These authors, through their work, affirmed that there is a positive relationship between product innovation and firm performance and its growth. Moreira and Silva (2013) claim that market orientation impacts product innovations.

However, there are studies that have found evidence that product innovations do not have a positive impact on SME growth. The study of Rexhepi-Mahmutaj & Krasniqi (2020) provides empirical evidence that product innovations have a negative relationship with the firm's sales growth and this relationship is not significant. Whereas, the study of Halpern & Murakozy (2012) proves that product innovations negatively affect the productivity of the firm. The discussions so far guide us in defining the first hypothesis of this study:

H1: Product innovations positively affect the growth of manufacturing SME sales

Levitt (1960) has studied the impact of innovation types on the profit and sales of SMEs. According to this author, marketing methods are very important in securing profit from innovations of products, organisational, marketing etc. Schmidt & Rammer (2007) conclude that product innovations influence SME decisions to undertake marketing innovations, etc. According to Radas (2003), there are significant differences between manufacturing and service firms in terms of innovation development. In service firms, product innovations are more important than other types of innovation, while in manufacturing firms, all types of innovations are equally important.

Krasniqi & Dula (2016) claim that firm size is not important for all types of innovations. Firm size is very important for product innovations, while it is not important for marketing and organisational innovations. Different types of innovations have a different impact on the growth of sales or even the growth of SME exports. Therefore according to Cieslik & Michalek (2017), of all the types of innovations, product innovations have the greatest impact on increasing exports and sales than marketing and organisational innovations. Similar results have been achieved by Cassiman & Ros (2007).

In their research, Slogar & Bezic (2019) have concluded that product and process innovations enable increased sales, while other types of innovation do not enable increased sales. Meanwhile, Krasniqi & Kutllovci (2008) conclude that market pressure and consumer identity are the main elements that impact all types of innovations in firms. Based on these elements, firms are determined in the development of various innovations, which then affect the increase of business capacity.

Muller et al. (2018) also emphasise that every new or modified product and every innovation in SME marketing affects the growth of sales or even exports of firms. While Liao & Rice (2010); Rhee et al. (2010); Naidoo (2010); Ajayi & Morton (2015), in their research, emphasised the importance of marketing innovations in increasing SME sales and firm performance. Without new and innovative marketing strategies, methods and techniques, there can be no increase in sales and improvement in business performance. Based on these discussions, the following hypothesis can be formulated:

H2: Marketing innovations have a positive impact on increasing sales of manufacturing SMEs

Innovative changes in SMEs are important for business and employee orientation. Therefore these innovations represent importance and value in the literature in the field of innovation. It should be noted that organisational innovations have not been adequately addressed so far. Researchers have been more curious about other types of innovation than organisational innovations. Among the authors who have contributed to the better recognition of organisational innovations can be mentioned McGee et al. (1995); Sanidas (2005); Rosenbusch et al. (2011); Evangelista & Vezzani (2012); Zaied Ben et al. (2015). These authors emphasised that organisational innovations have an impact on the business performance of the firm.

Therefore, based on these evidences, the following hypotheses can be formulated.

H3: Organisational innovations have a positive impact on increasing sales of manufacturing SMEs

H4: The level of education of employees has a positive impact on increasing sales of manufacturing SMEs;

H5: The number of employees or the size of the firm affects the growth of sales of manufacturing SMEs

4. Research Methodology

Primary data were collected through a research questionnaire. 100 manufacturing SMEs were interviewed in 7 regions of Kosovo: Prishtina, Prizren, Peja, Gjilan, Mitrovica, Gjakova and Ferizaj. The interview lasted about 50 minutes and general managers or sales and marketing managers were interviewed by the authors of this paper. Kosovo has a limited number of manufacturing SMEs, so the sample is about 80% of manufacturing SMEs. These SMEs sell their products inside and outside Kosovo. So they export to EU countries, regional countries and Turkey. The logistic regression model was used to achieve the intended results. The data obtained were processed through the SPSS Program.

Table 2

Variables and their categories

Dependent variable	*Variables categories*
Sales growth	1 – Yes; 0 – No
Independent variables	*Variables categories*
Product/Process innovation	1 – During the last three years SME has created new products/processes, or made a substantial one modification in products/processes; 0 – Otherwise
Marketing innovation	1 – During the last three years SME has introduced a new marketing method for its products; 0 – Otherwise
Organisational innovation	1 – Over the last three years, the organisation has changed its organisational structure; 0 – Otherwise
Control variables	*Variables categories*
Education level	1 – Employee has university degree; 0 – otherwise
Size of SME	Number of employees

Source: Self estimation.

The dependent variable has two categories. The SMEs, and specifically their managers, were asked if their sales have increased over a period of 3 years. This period is 2017-2020. Data were collected during the period January 2021 – March 2021. Whereas the independent variables consist of Marketing innovation, Product/Process Innovation and Organisational innovation. In addition to the dependent variable and the independent variables, there are also control variables. The level of employee education and the number of employees of these SMEs will serve as control variables to analyse their impact on sales growth, in addition to the variables related to the types of innovations.

The following table presents the descriptive statistics of the variables. As can be understood from the table, the number of analysed SME employees varies from 5 employees to 100 employees. The level of education of employees consists of 2 categories. Also, other variables consist of 2 categories: 0 and 1.

Table 3

Descriptive statistics

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Product/Process innovation	200	0	1	0.10	0.30
Marketing innovation	200	0	1	0.20	0.34
Organizational innovation	200	0	1	0.12	0.41
Education level	200	0	1	0.41	0.49
Size of SME	200	5	100	10.45	8.04

Source: own calculations.

The table below presents the logical estimation for SME sales growth. Independent variables show how much the types of innovations influence the sales growth of manufacturing SMEs.

Table 4

Logic model estimation

Variables	B	SE.	Wald	df	Sig.	Exp(B)
Product/Process innovation	0.952	0.621	1.452	1	0.056**	1.042
Marketing innovation	1.235	0.709	5.238	1	0.008***	1.756
Organizational innovation	0.756	0.721	1.527	1	0.743	0.852
Education level	0.826	0.285	3.511	1	0.006***	2.021
Size of SME	-0.059	0.357	4.257	1	0.179	1.127
Constant	6.486	2.154	8.541	1	0.009	0.003

*** Significant at 1% level, ** significant at 5%, * significant at 10% level
Source: own calculations.

The first variable or product innovations are significant and are positively related to the increase in sales of manufacturing SMEs. So the first hypothesis can be proved to be correct. Similar results have been achieved by Jusufi et al. (2020). According to them, product innovations have a positive impact on increasing sales of manufacturing SMEs, especially those that are exporters. Bozic (2011), Ar & Baki (2011), Reçica et al. (2019); have achieved similar results. Meanwhile, opposite results have been achieved by Rexhepi-Mahmutaj & Krasniqi (2020). The results of these authors show that product innovations have a negative impact on increasing sales of manufacturing SMEs. Also, these results do not represent significance in their econometric model.

In terms of marketing innovation, this type of innovation is significant in our model and has a positive relationship with the dependent variable, which represents the increase in SME sales. So the more productive SMEs realise marketing innovations, the greater the likelihood of increased sales of these SMEs. So even the second hypothesis of our paper can be proved to be correct. Liao & Rice (2010); Rhee et al. (2010); Naidoo (2010); Moses Ajayi and Morton (2015) have achieved similar results. Marketing innovations are very important for the survival of SMEs, especially the productive ones. Although the literature so far has not paid special attention to this type of innovation, they are of particular importance for the survival, growth and orientation of all SMEs.

Organisational innovation does not represent a significance and does not have a positive relationship with the increase of sales of manufacturing SMEs. Sanidas (2005) has achieved other results where according to him, this type of innovation has an essential contribution to economic growth and to the growth of firms in particular. Also, Evangelista & Vezzani (2012); Zaied Ben et al. (2015), in their research, has achieved results that this type of innovation has an impact on the growth of the firm. McGee et al. (1995); Rosenbusch et al. (2011) have achieved results similar to the results of our research, where according to them, organisational innovations have no impact on increasing sales and performance of firms.

The number of employees or size of SME is not significant in our model, while it has a positive relationship with the dependent variable. Lee (2009) has achieved similar results. According to him, the number of employees or the size of the firm positively affects the business performance or even the profitability of the firm. Similar results have been achieved in the research of Ibhagui & Olokoyo (2018). The level of education of employees is a variable that has a positive relationship with the dependent variable and is also significant. Such results have also been achieved by Marimuthu et al. (2009); Akinboade (2015); Jusufi & Ramaj (2020). Based on this evidence, the fourth hypothesis can be proved to be correct. The following table shows two models. The first model includes independent variables which relate to the types of innovations. In this model, product innovations and marketing innovations are significant.

Table 5

Various specifications of the Logit Model

Logit estimations	Model (1)		Model (2)	
	B	Sig	B	Sig
Product/Process innovation	0.416	0.090*	0.830	0.023**
Marketing innovation	0.645	0.004***	0.580	0.090*
Organizational innovation	0.402	0.729	-0.092	0.673
Education level	-	-	0.381	0.002**
Size of SME	-	-	0.246	0.145
Model fit				
n	200	-	200	-
−2 log-likelihood	344.27	-	286.53	-
$\chi 2$	1.194	-	16.153	-
Nagelkerke R2	0.029	-	0.038	-
Overall percentage of predictions				
correct	58.2	-	51.9	-

*** Significant at 1% level; ** significant at 5%; * significant at 10% level.
Source: own calculations.

The likelihood of increasing sales is 41.6% and 64.5%. So these figures represent the likelihood of increased sales of manufacturing SMEs from Product innovations and Marketing innovations. In the second model, in addition to the independent variables, the control variables are also included. In the second model, the same variables are significant, i.e. product innovations and marketing innovations. Of the control variables, only the employee education level variable is significant. The likelihood of increasing the sales of manufacturing SMEs from product innovations is 83%, while from marketing innovations, is 58%. The likelihood of increasing sales of manufacturing SMEs is 38.1% as a result of the level of education of employees.

Conclusion

This research presents the impact of innovations types on increasing sales of manufacturing SMEs. The hypothesis validation is done through data processing in the logic model. The results obtained have helped to validate as hypotheses the hypotheses set out in the literature review section. The first type of innovation, product/process innovations represents a significance in our model. It is also in a positive relationship with the dependent variable that represents the increase in sales of productive SMEs. Despite the fact that the manufacturing sector is not very developed in Kosovo, manufacturing SMEs have developed new products which have placed them in the local and international markets. The development of new products has a great impact on increasing the sales of manufacturing SMEs.

In terms of marketing innovations, this type of innovation is also vital for increasing the sales of manufacturing SMEs. New marketing techniques and methods, effective marketing strategies have a tremendous impact on the business performance of manufacturing SMEs. The cost of innovation is quite high, even the preliminary plan for innovation development requires detailed market research, detailed analysis of competing SMEs, high-quality human resources, etc. Therefore SMEs, especially those from the manufacturing sector, must do their utmost to develop both product and marketing innovations. The results of empirical research and most of the literature sources suggest that business performance is greatly influenced by the innovations that SMEs develop.

Kosovo institutions can use the findings and evidence of this research, drafting their policies for the development and support of manufacturing SMEs in accordance with the evidence of this paper. Promoting the innovation activities of Kosovar entrepreneurs is vital to Kosovo institutions. Therefore, government agencies and other relevant institutions should constantly work with Kosovar entrepreneurs in promoting innovative activities, especially those of product and marketing. The third type of innovation, or organisational innovation, does not represent significance in our model. Most of Kosovo's manufacturing SMEs are firms that have a simple organisational structure, have a small number of employees and small managerial staff. Therefore any innovation of organisational nature will not greatly affect the business performance of these SMEs. Thus, for Kosovo's manufacturing SMEs, marketing and product innovations are more important than organisational innovations.

In addition to the types of innovations, the increase in sales of productive SMEs is also influenced by the level of education of employees and the number of employees. These

variables, in our model we have treated as control variables. The level of education of employees is significant and is in a positive relationship with the dependent variable. In addition to product and marketing innovations, the level of employee education also has a positive impact on business performance or on increasing sales of Kosovo's manufacturing SMEs. Despite the fact that the education system in Kosovo does not offer graduates in accordance with the demands and needs of the labour market, still, the educated employee influences the business performance of these SMEs. These SMEs mostly need qualified staff from vocational schools which provide technical skills. Such schools in Kosovo are few, so the relevant institutions should open more vocational technical schools which train and train employees for manufacturing firms.

In terms of SME size or number of employees, 90% of Kosovo's productive SMEs do not have more than 100 employees. Therefore this variable does not represent significance in our model. It can therefore be concluded that the number of employees of manufacturing SMEs is not important for the business performance of these SMEs.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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SMALL FIRMS' CAPITAL STRUCTURE AND PERFORMANCE[4]

The article examines the existence and strength of capital structure determinants on SMEs' financial performance. We tested predictions using a panel of 230 SMEs during 2015-2019 in Kazakhstan.
The study is one of the few studies investigating the capital structure of small business companies' profitability in developing countries.
The empirical analysis's main conclusions show the negative impact of all debt levels on the return on assets and the direct interaction between the debt burden and equity. The findings show that industry effects are significant in explaining SMEs' capital structure decisions. The results generally suggest that following the pecking order theory, owners of small firms maximize their retained earnings and raise debt only when additional funding is needed.
Keywords: capital structure; firm performance; profitability; small companies; ROA; ROE; emerging markets
JEL: C23; G32; L26

1. Introduction

SMEs play a vital role in generating employment and ensuring sustained economic growth in all countries. For example, in Kazakhstan, small companies' share on GDP increased between 2015 and 2019 from 20% to 25.5% (Statistic committee, 2019). According to IEG (2018), the SMEs' share in emerging markets on GDP is 50-60%. In Germany it is 53%, in the UK it is 51%, in Finland – 60%, in the Netherlands – 63%. The World Bank (2019) estimates that formal SMEs' share reaches 40% of GDP in emerging markets.

However, financial resources are a crucial obstacle to their growth in those economies. According to the IFC (2020), 40% of official micro SMEs in emerging economies have an

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unfulfilled need for $5.2 trillion per year. In this regard, one of the major factors influencing a firm's productivity is capital structure and related decisions.

On the one hand, the leverage allows the company to earn more in the future, but on the other hand, there is always a financial risk associated. There is a possible loss as the investment may become worthless while the loan needs to be repaid following contract terms. The degree of such a financial risk is related to the company's financial structure.

It is essential to understand whether firm performance is affected by the capital structure or other reasons. A lot of capital structure research papers use data from relatively large publicly listed firms. The theoretical framework usually uses illustrations and causal empirical data concerning large companies. In many countries, it is challenging to obtain publicly available small businesses' financial data. In this regard, few studies have been done on SMEs' capital structures that are not publicly traded on a stock market, especially in emerging markets.

The purpose of this study is to examine the existence and strength of capital structure determinants on small firms' financial performance in order to determine what capital structure theory they follow in their financing decision.

Kazakhstan is a unique country for conducting scientific research on SMEs. If investments were attracted mainly for oil extraction and construction at the beginning of independence, the current development goal targets SMEs. The government has a variety of lending programs to support small businesses. Simultaneously, SMEs are income taxed at the lowest rates (e.g., according to Tax Codex (2017), micro firms, with an annual income of less than 10.3 million tenges (about $24,000) a year, pay taxes of 2% of the income. Small firms with annual revenue of less than 875.1 million tenges (about 2 million US dollars) a year pay 3% corporate income tax, and medium-sized firms with annual revenue of less than 8.75 billion tenges (about $20 million) a year, income tax rate is 10%). However, many firms in developing countries have problems with financing their activities, which may lead them to bankruptcy. According to the (MFRK, 2020), 3146 enterprises went bankrupt in 2018, 50% more than in 2017, in 2019 – 3626. Moreover, as of March 1, 2020, the total number of businesses in bankruptcy proceedings was 3269.

This study applies the capital structure theory in small businesses (companies with less than 100 employees and with an annual income that does not exceed 875.1 million tenges (about 2 million US dollars) a year) and will try to test some control variables on the example of small enterprises.

In every empirical analysis, the problem with this attitude is that the capital structure's significant determinants must be evaluated in a somewhat arbitrary way, or worse, they must be omitted altogether. However, this may lead to a distortion of the results.

The paper will expand the empirical work on the capital structure by using small firms' extensive panel data over five years (2015-2019) from all the economic sectors. To reduce or avoid the bias of omitted variables, we use the panel data. Two coefficients are used to assess profitability: return on assets (ROA) and return on equity (ROE). According to Newman (2011), studying the relationship between the choice of debt level and a firm's performance is significant for many reasons. They attribute this to the growth in the average debt level of companies worldwide, the need for the influence of debt on firm performance,

and learning the connection between the debt level and shareholder wealth. The maximization of the wealth of shareholders is the main task of company managers.

2. The Literature Review

The theory of Modigliani and Miller (1958) had a significant influence on the financial management practice, compared to previous studies, which concluded that solely its future earnings determine any firm's value. According to their theory, based on stringent set conditions, including ideal capital markets (which implies zero-taxation), the capital structure does not influence the firm's performance. If the Modigliani-Miller theory were correct, managers would not have to worry about making decisions about firms' capital structure because such decisions do not affect stock prices. However, the Modigliani-Miller theory only works in an ideal market. Although the authors revised their original theory in 1963, adding a factor such as corporate taxes to the model, the theory also did not find universal acceptance. For example, the statement of Jensen and Meckling (1976) differs from the statement of Modigliani and Miller (1963) that corporate taxes affect the cost of capital and, therefore, the value of the firm. The authors argue that borrowed capital, even in the absence of taxes, can affect the results of the corporation's activities.

Since the fundamental work of Modigliani & Miller (1958), much of the empirical research has focused on testing the implications of two competing capital structure theories, namely the trade-off theory and the pecking order theory. Empirically, the theories have experienced both successes and difficulties. Each point of view successfully explains several general patterns in the observed debt ratios, such as the relationship between the firm characteristics and the cumulative use of various sources of capital.

According to the Trade-off theory, profitable firms have more opportunities to use debt and protect income from taxes. Therefore, profitable firms prefer to finance their activities with debt to save on taxes. The theory was confirmed in studies of Chakraborty (2010), Chittenden et al. (1996), and Karadeniz (2008).

Pecking order theory does not imply a target amount of leverage or optimal capital structure. Each firm chooses its debt ratio based on financing needs (Myers, Majluf, 1984). Pecking-order theory assumes that debt-issuing firms mean that they have a positive development perspective: the company has investment opportunities and growth. Managers will not put the firm at bankruptcy risk because they are unsure of future profitability. In this regard, only companies that are sure of their ability to repay their obligations will take on debt. Thus, according to the theory, capital is issued to distribute risk among shareholders, and debt is issued to avoid wealth sharing. It is consistent with maximizing shareholder wealth and is therefore widely supported by other researchers. The preferred sources of funding are internal funds because the firm's managers know more about the firm's problems than the various third-party partners. Therefore, there is a distortion of data between managers and multiple partners, including market participants. According to Titman et al. (1988), the firms that generate high profits usually retain an acceptably low share of liabilities since profitable firms can acquire the necessary assets from their sources. The higher the company's profitability,

the lower its debt level and the higher its retained earnings. Consequently, high-profit companies use their funds for investment, not for debt financing.

Empirical findings on the relationship between performance and leverage are controversial. The Trade-off theory suggests that the relationship between capital structure and profitability is positive. According to Jensen and Meckling (1976), the firms try to limit the organization's costs because of the differences that may arise between investors and bondholders when choosing the method of financing. Thus, reducing the value of companies leads to increased efficiency. An increase in debt has a positive effect on the value and efficiency of the firm (Ross, 1977). This statement is also supported by Hadlock and James (2002), Vijayakumaran and Vijayakumaran (2019) and Vo (2017), who conclude that firms expecting high returns prefer debt financing. The results found by the authors obtained are corresponding with the trade-off and agency cost theory. Therefore, we put forward the following hypothesis:

H1: The debt ratio has a positive correlation with the profitability of small firms.

The pecking order theory is supported by most empirical studies, such as studies of Abor (2007), Degryse et al. (2012), Di Pietro et al. (2018), Heyman et al. (2008), Mukherjee and Mahakud (2010), Nicos Michaelas et al. (1999). These authors' empirical studies have shown that firms prefer to finance new investment projects mainly at the expense of retained earnings. Therefore, they concluded that companies with high profits are less likely to need borrowed funds. Empirical studies provide evidence ensuring an adverse relationship between debt levels and profitability (Booth et al., 2001; Ebaid, 2009; Friend, Lang, 1988; Kester, 1986; Khatoon, Hossain, 2017; Rajan, Zingales, 1995; Wald, 1999). Following these studies, we put forward the following hypothesis:

H2: Debt ratio has a negative relationship with the profitability of small firms.

ROE allows comparing the ROI in shares of a given company with the return on alternative investments. The company's investment opportunities depend on this. The financial leverage level characterizes the influence of the capital structure on the ROE. However, the financial leverage impact works both ways. If it occurs due to a definite difference between the economic ROA and the price of borrowed funds, it increases the ROE.

Nevertheless, if the borrowing cost exceeds the ROA, the financial leverage impact acts to the enterprise's detriment, reducing the net ROE. Therefore, it is not easy to evaluate each capital source. Abor (2005) finds a significant and positive relationship between ROE and the short-term debt ratio. It means that short-term debt becomes less expensive, resulting in high returns. We, therefore, hypothesize:

H3: Debt ratio has a positive relationship with return on equity.

The negative correlation between capital structure and ROE is found in studies of Zeitun and Tian (2014), who studied the capital structure of Jordanian firms, and Abor (2007), who examined capital structure on the example of small and medium enterprises in Ghana, South Africa. We, therefore, hypothesize:

H4: There is a negative correlation between debt ratio and return on equity in small businesses.

Size can be an important factor in profitability. Large companies can save on scale and can use their market power. Therefore, they can favourably influence profitability (Shepherd, 1986). According to Chakraborty (2015), a larger firm may have more capacity, and size may affect the firm's performance. The evidence suggests that small companies are less efficient than large ones. Ayyagari (2011), Dabla-Norris (2017) studies result positively influence the firm's size on its productivity.

One of the significant determinants of profitability is asset efficiency. For a small private firm, tangible assets' present value largely determines its market value (Hutchinson, 1995). According to Chakraborty (2015), by accepting tangible assets as collateral, creditors are taking self-defence measures. Following the agency cost theory, there is a risk that shareholders may make suboptimal investments. Thus, in the event of a default on their debt obligations, firms with sufficient tangible assets can avoid bankruptcy. These statements are also supported by Harris (1991), which argues that a large volume of tangible assets should correspond to a more substantial firm's liquidation value. According to Coleman et al. (2016), firms with high total assets will allow firms to get high liquidation value in the event of bankruptcy, and it will allow lenders to reimburse most of their borrowings.

At the same time, the Trade-off theory assumes that firms with a significant amount of intangible assets should rely on equity financing. In contrast, firms with tangible assets should rely more on debt financing (Harris, 1991). However, the benefits and disadvantages of offering excessive debt are significant.

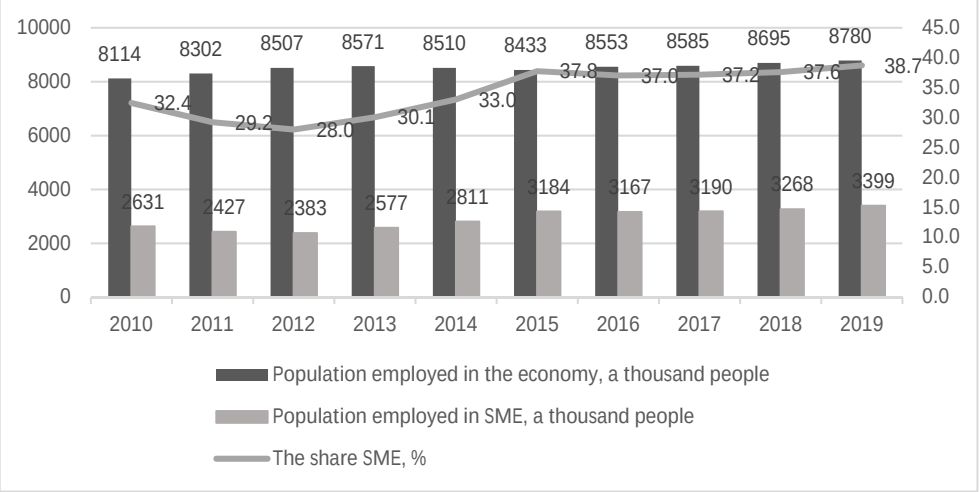
The effective income tax rate helps determine the quality of tax management and the financial position (Gaspar et al., 2016). A company with a high tax rate should use more debt because it should have more leverage due to the higher income it protects from taxes. Several empirical studies, such as MacKie-Mason (1990), studied the tax impact on a firm's financial policy, mainly in developed countries where the focus is on tax policy. Graham et al. (2017) argue that taxation does influence corporate financial decisions, but the value of this effect is generally small.

3. Overview of Small Companies in Kazakhstan

SMEs represent the central sphere of employment of the population. It has become a kind of indicator of the General State of Affairs in the economy. They form new market niches and points of economic growth. Besides, it contributes to maintaining competition at the proper level and flexible restructuring of production. They also provide acceleration of innovation processes, forming social orientation of market relations and employment growth. By the data (UNDP, 2019), the number of small enterprises in the world economy exceeds 95% of all enterprises' total number. SMEs account for more than 60% of the employed and their share in GDP reaches 50%. Today in Kazakhstan, one in five of the working-age active population is engaged in SM businesses. Almost half of them are individual entrepreneurs. If we compare the share of SMEs on GDP, as of 01.01.2020, they account for 38.7% of the overall number of enterprises in Kazakhstan (Figure 1). The share of the country's GDP of 29.5% (Damu, 2019). By comparison, in developed countries, the share of SMEs is higher than 50%. This indicates the insufficient development of SMEs in Kazakhstan.

Figure 1

Dynamics of the number of employed people in the Republic of Kazakhstan



Source: Damu, 2020.

One of the most challenging problems hindering SME development is the absence of sufficient financial resources for most subjects to meet their investment and working capital needs. SMEs have a relatively lower ability to provide collateral for a loan they need. In such cases, the banks need to increase credit risk premium making the loans more expensive for these companies. Simultaneously, low labour productivity does not promote improving the economic efficiency of the small business and constrains lending to small businesses secured by fixed assets.

It is no coincidence that developed countries' assistance to small businesses occupies a special place. All developed countries with market economies use different methods of administrative, legal, and economic support. The incentive mechanism includes, first, legislative acts that ensure the development and implementation of credit programs. Also, direct and guaranteed loans, preferential subsidies, tax incentives, and other financial and economic support forms.

To improve the small firms' performance, Kazakhstan has several financial support programs for small and medium-sized enterprises as Programs of "Damu" subsidiary company, "State business support" programs, and "Business Roadmap" program. One of the main programs is implemented by providing the State Fund with second-tier banks with financial resources for subsequent lending to SMEs. All financial measures of the government aim not only to directly increase the financial capabilities of business entities but also to stimulate nature and are designed to direct their development following national interests. The state supports SMEs in agriculture, innovation, exports, regional production placement and relies on a diverse financial lever (Damu, 2019).

4. Research Methodology

The data for this study were taken from the database of the Agency for Statistics of Kazakhstan. Information was extracted regarding balance sheets and income statements of the 230 non-financial small enterprises for the period 2015 to 2019. The period was chosen because the average life of small companies in Kazakhstan is 3-4 years. Approximately 50% of businesses in the EU do not survive in the first 5 years, and in 15% of cases, business closure takes the form of bankruptcy (OECD et al., 2015). The sample contains 16 sectors, covers 13 regions, and 3 main cities.

4.1. Empirical Model and Variables

Financial performance indicators are defined by return on assets (ROA) and equity (ROE). They are the most commonly used performance measure proxies used by Ebaid (2009), PeiZhi and Ramzan (2020), Salim and Yadav (2012), San, Heng (2011), Zeitun and Tian (2014). ROE is calculated by dividing the net income by the average shareholders' equity. ROA is calculated as the ratio of net profit to total assets. Explanatory variables are the short-term debt ratio (STDR) and long-term debt ratio (LTDR). To determine the short-term debt ratio, we divide the short-term debt by total assets. The long-term debt ratio is determined by long-term debt to total assets. Besides the main variable, we selected control variables that impact the firm's performance, such as size, taxes (ETR), and tangible assets (TA). We determine the size as the firm's logarithm's income for one year. Tangible assets are measured by dividing net fixed assets by total assets. The ETR reflects the real share of tax payments from the taxpayer's amount of profit or income for a specified period. This indicator is determined by dividing 1the income tax amount by the total profit before tax.

4.2. Econometric model

Our dataset includes observations over four years. That is why panel data econometric techniques were employed for the study. We assume OLS, Fixed-effects model, and Random-effects model. The estimation equation is as follow:

$$Performance_{it} = \beta_0 + \beta_1 STDR_{it} + \beta_2 LTDR_{it} + \beta_3 Size_{it} + \beta_4 TAT_{it} + \beta_5 ETR_{it} + \varepsilon_{it}$$

where:

$Performance_{it}$ is ROA or ROE;
STDR – short-term debt ratio;
LTDR – long-term debt ratio;
Size – log of sales;
TAT – asset tangibility;
ETR – effective tax rate;
t = 2015-2019 years;
i = 1-230, companies;
ε_{it} – the residual term.

4.3. Descriptive Statistics

Table 1 shows descriptive statistics by industry group for all variables. ROA and ROE are the dependent variables, while independent variables are short-term debt ratio (STDR) and long-term debt ratio (LTDR). The control variables are Size, Asset tangibility, and Effective tax rate. Descriptive statistics represent average values, standard deviation, and minimum and maximum variables. The average return from assets of each firm is 1%. The mean value of ROE is 26. However, we need a more accurate analysis as the standard deviation is very high. The results show a poor performance by small companies (with less than 100 employees and with an annual income of less than $2 million a year) in Kazakhstan. Although the average value of ROA and ROE has a positive result, there are also firms with negative values of these variables. Let's look at the sectors of the economy in table 1. Agricultural enterprises (column 6) have the lowest negative profitability, although their share of long-term debt is higher than that of all other industries. Which also corresponds to the theory of hierarchy. Because the agricultural sector is a priority industry in Kazakhstan, the state helps its growth through many policies. For example, by giving them loans at the lowest rate and taxing them at the lowest rate. However, since individual entrepreneurs are mainly engaged in agriculture, there is no valuable property secured on credit. There is no way to get such a loan despite the large amounts allocated for agricultural development. Many lands are excluded from agricultural turnover due to several factors like land reclamation and water supply (Khapova, 2018).

Table 1

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Agriculture	Mining	Manufacturing	Sales	Construction	Services
Return on assets	1076	0.01	0.47	-8.24	7.52	-0.003	-0.412	0.004	0.072	0.044	0.004
Return on equity	1076	0.26	1.44	-13.54	14.22	0.319	-0.483	0.291	0.328	-0.324	0.291
Short-term debt ratio	1076	0.13	0.24	0	2.12	0.060	0.174	0.085	0.255	0.138	0.085
Long-term debt ratio	1076	0.26	0.50	0	5.75	0.398	0.284	0.286	0.174	0.102	0.286
Size	1076	5.54	0.80	0	7.82	5.356	5.225	5.339	6.135	5.457	5.339
Asset tangibility	1076	0.39	0.29	0	1.00	0.478	0.323	0.483	0.166	0.355	0.483
Effective tax rate	1076	0.09	0.13	-0.54	0.70	0.048	0.034	0.089	0.125	0.148	0.089

Source: Authors.

From Table 1, the short-term debt ratio is around 13% on average, and the average long-term debt ratio is around 26%. The data indicate a stable firm's condition. Long-term debts are preferable in agro-industrial companies (40%) (Table 1, column 7). Short-term debt is preferred by trading companies (25.5%) (Table 1, column 9). Trading companies are more profitable than others and they prefer short-term debt. Most retail businesses do not have fixed assets on their balance sheet. Therefore, they cannot provide collateral for long-term

loans, as shown in Asset tangibility shown in Table 1. Consequently, they have to finance their activities with short-term loans. Using large amounts of debt in an economy at an early stage of development, such as Kazakhstan, is risky. Based on this rule, it can be assumed that the majority of small firms in Kazakhstan adhere to the correct policy since they have only 40% of the debt share in the total capital. Agro-industrial companies pay the lowest taxes – about 2-3% of the income. The highest taxes are paid by companies engaged in trade and construction (from 3 to 10%).

5. Results and Discussions

Pearson correlation analysis of variables is presented in Table 2. Correlation analysis provides an early sign that all independent variables are significantly related to ROA. We can see only the short-term debt ratio is significantly related to ROE. Correlation analysis also indicates a possible multicollinearity problem. Therefore, we conducted a variance inflation factor (VIF) test to check the multicollinearity problem among independent variables. The VIF indicator is used in regression analysis to identify multicollinearity and then exclude from the model those predictors whose VIF is too high. In our case, the highest VIF is 1.10. It shows a low level of multicollinearity. According to Allison (1999) and Chechet et al. (2014), if the VIF is less than ten, then multicollinearity does not exist.

Table 2

Pearson Correlation Matrix

Variables	VIF	ROA	ROE	SDR	LDR	SIZE	TAT	ETR
Return on assets		1.000						
Return on equity		0.018*	1.000					
Short-term debt ratio	1.04	-0.226*	0.061*	1.000				
Long-term debt ratio	1.06	-0.175*	-0.017	-0.121*	1.000			
Size	1.12	0.160*	0.019	0.097*	-0.100*	1.000		
Asset tangibility	1.10	-0.096*	-0.038	-0.139*	0.171*	-0.235*	1.000	
Effective tax rate	1.05	0.115*	0.021	-0.011	-0.142*	0.168*	-0.080*	1.000

* shows significance at the 0.5 level. Calculated from the data taken from Statistic Agency database of KR

Source: Authors calculation.

The analysis uses regression models such as pooled OLS, random effect, and fixed-effect models. The regression results are shown in Table 3 and Table 4.

If there are no significant differences between object samples, it is possible to build a regression using pooled OLS. However, we should be careful when using it. The models built using it may not meet the quality requirements for their parameters, and it is not enough to display well the regularities of the process development. Panel data models with fixed effects, allow to get rid of the influence of an unobservable variable and get unbiased parameter estimates. We need to determine which model is most suitable for our research. The Hausman test and Breusch-Pagan test are used to select one of the three models. To determine the dependence between the fixed and random effect, we use the correlation between the individual components of the firm's errors and control and explanatory variables. If a correlation is found between the factors, then a fixed effect model is used. Otherwise, the random effect model is used. The result of the Hausman specification test in the study

indicates that there is no correlation between explanatory variables and personal effects. To define the correspondence between the OLS regression and the random effect, we use the Breusch-Pagan test.

Table 3

Regression analysis results with ROA

Return on assets	Pooled OLS	t-value	Fixed effect	t-value	Random effect	t-value
Short-term debt ratio	-0.369***	-8.88	-0.339***	-6.05	-0.369***	-5.25
	(0.041)		(0.056)		(0.070)	
Long-term debt ratio	-0.155***	-5.27	-0.038	-0.89	-0.155**	-2.42
	(0.029)		(0.043)		(0.064)	
Size	0.082***	4.64	0.096***	3.28	0.082***	3.58
	(0.018)		(0.029)		(0.023)	
Asset tangibility	-0.104*	-1.96	-0.004	-0.02	-0.104**	-2.00
	(0.053)		(0.182)		(0.052)	
Effective tax rate	0.183*	1.95	0.132**	2.09	0.183**	2.56
	(0.094)		(0.063)		(0.071)	
Constant	-0.329***	-3.15	-0.475**	-2.58	-0.329**	-2.27
	(0.105)		(0.185)		(0.145)	
Mean dependent var.	0.007		0.007		0.007	
R-squared	0.127		0.059		0.084	
F-statistic/Wald Chi^2	16.64		10.29		56.356	
Number of obs.	1076.000		1076.000		920.000	
Prob (F-statistics)	0.000		0.000		0.000	
Hausman test	Chi-square = 9.417				p-value = 0.094	
Breusch-Pagan test	chi2(5) = 422.48, p-value = prob(chi-square) = 0.000					

Notes: Figures in parentheses are robust standard errors. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are shown in parentheses.
Source: Authors calculation.

The regression analysis results for the three models are shown in Table 3 for ROA and Table 4 for ROE. Tests between pooled OLS and random effect, between random and fixed effect have shown that random effect is a more appropriate model.

ROA and capital structure

The analysis performed to interpret the firm's performance showed that all three models are significant, as can be seen from the F-test in Table 3. However, the R-square value varies only from 5.9% to 12.7%, indicating the model's low explanatory power. The short-term and long-term debt ratios have a negative sign under the three estimation techniques. After reviewing the results and the relationships between the factors, we found that as a firm's profitability increases, its debt ratios decrease, in line with our hypothesis H2. It is consistent with the pecking-order theory of Myers and Majluf (1984).

This result corresponds to the result obtained (Abor, 2007; Adjei, 2012; Borgia, Newman, 2012; Ebaid, 2009; Kamau et al., 2018; Khan, 2012; Mateev et al., 2013; Rodrigues et al., 2017; Rossi et al., 2015; Saif-Alyousfi et al., 2020; Škuláňová, 2020; Verma et al., 2020). Given this result, we infer that a higher share of debt in the structure of financial resources has a significant negative impact on companies' profitability.

We also find that the return on assets also depends on the firm size and the tax rate. Table 3 indicates that there is a statistically significant and positive correlation between size and firm performance. This result corresponds to empirical studies such as Ahmad and Shashazrina (2012), Dabla-Norris (2017).

Tangible assets have a negative relation with the performance of the firm. It means that for small businesses, the availability of fixed assets does not matter. Another reason for the negative correlation between profitability and tangible assets may be that agricultural companies and manufacturing companies have much equipment. Still, it is more difficult for them to profit than trading companies or companies providing services.

The results show a significant and positive relationship between the effective tax rate and ROA. According to Pettit and Singer (1985) small companies are not as profitable as big firms, so the probability of using loans to obtain tax benefits decreases to zero. Since small companies do not need additional tax benefits, this statement does not correspond to the trade-off theory. The company prefers debt financing because of tax deductions for interest payments.

ROE and capital structure

The study's next goal is to determine the relationship between debt and ROE of small firms in Kazakhstan. However, unlike ROA, the result showed a nonsignificant relationship between the debt and ROE. Table 5 shows that capital structure variables measured by a short-term debt ratio are positively related to ROE. It corresponds to the Verma et al. (2020) results. The negative correlation between long-term debt ratio and ROE corresponds to the empirical studies results of Abata and Migiro (2016), Yinusa et al. (2016). It means that leverage impacts shareholder returns and is consistent with Myers and Majluf (1984) pecking-order theory. The results also contradict the theory of Agency costs, which States that equity financing worsens firms' performance. It suggests that Kazakhstan's profitable small firms prefer to use loans for a short period first rather than loans for an extended period. A negative result indicates that as a firm records an improvement in performance over time in terms of ROE, the less debt it uses in its capital structure. They may prefer to use more equity financing than debt financing to prevent the value they have created from being absorbed. This means that in addition to the direct prediction proposed in agency cost theory between the firm's performance and the capital structure, this finding suggests that the firm's financial leverage choice depends on its past performance. However, we cannot accept hypotheses 3 and 4 for prediction since there is no significant relationship between ROE and debt ratio. Authors from Egypt and Jordan also did not find a significant relationship between these factors (Saeedi, Mahmoodi, 2011; Zeitun, Tian, 2014).

Nevertheless, the results do not correspond to the findings of (Phillips and Sipahioglu, 2004), who studied quoted UK organizations with hotel interests. They argue that the high debt levels in the capital structure result from the firm from its high productivity. Also, do not correspond to the results of Margaritis and Psillaki (2010), who studied French firms, Berger and Bonaccorsi di Patti (2006), who analyzed banks in the United States, and Yeh (2010),

who analyzed Taiwanese firms. These authors argue that high debt ratios contribute to better performance.

However, in studies of the capital structure of companies in emerging markets, authors like Ebaid (2009), who studied Egyptian firms' capital structure, Khan (2012), who studied Pakistani companies, and Zeitun and Tian (2014), who studied companies capital structure located in Jordan, have not confirmed any significant relation between STDR and ROE. Ebaid (2009) argues that debt negatively affects the firm's performance, measured as ROA, and has no significant influence on ROE. Salim and Yadar (2012), who study this issue as an example of Malaysian companies, argue that debt negatively affects the companies' financial performance. Abor (2007), investigating the dependence between the capital structure of SMEs and their performance indicators in Ghana, find an inverse relationship between these factors. From these studies, we sign that capital structure choice has a weak influence on the companies' performance in emerging markets. It may also imply that the firm capital structure in developed and developing markets may differ and impact the firm's performance differently. According to studies, the distinction between total balance sheet debt and LTDR is much more pronounced in emerging countries than in developed economies (Booth, et al., 2001). The differentiation in long-term and short-term debts lies in developed countries' well-developed legal systems. That cannot be said about developing countries.

One of the reasons for the difference in the results of developing countries like Kazakhstan from developed countries may be the banking system. In 2020, there were 27 banks in Kazakhstan, including the national bank. Price controls in the securities markets, along with government credit programs for privileged sectors, can significantly impact the structure of corporate finance.

Capital structure's and firm performance's relationship can also be affected by the ease of doing business. According to the World Bank (2020b) "Doing Business" report, Kazakhstan belongs to countries with above-average returns and ranks 25th in terms of ease of doing business. Along with countries like Russia, Malaysia, Georgia, Venezuela, Argentina, Bulgaria, China, Thailand, and others. For example, Egypt is ranked 114th, while the United States and the United Kingdom are ranked 6th and 8th. What makes a significant difference is that an entrepreneur in an economy with a low income usually spends about 50% of their per capita income on starting a company, compared to just 4.2% for an entrepreneur in a high-income economy.

As for the impact of capital structure on ROE, the results are presented in Table 4.

The firm Size represents a positive but statistically insignificant relationship with ROE. This result is consistent with Rovolis and Feidakis (2014), whose study was based on firms' financial statements from 20 countries, Ebaid (2009), who analyzed Egyptian firms, and with research by Indian companies, Tripathy and Shaik (2019), who found the size is positively related to a firm's performance. Larger firms are expected to use better technology (Tripathy, Shaik, 2019). According to Chakraborty (2010), a company's size may impact its performance, as a larger firm may have more capacity. Large companies are more stable and have the ability to easily expand their assets and increase their ability to qualify for debt while minimizing their risks. Large economies benefit from firms of various sizes: small firms, to

gain access to long-term debt, while fast-growing economies only increase the access of large and medium-sized firms to long-term debt.

Table 4

Regression analysis results with dependent variable ROE

Return on equity	Pooled OLS	t-stat	Fixed effect	t-stat	Random effect	t-stat
Short-term debt ratio	1.122*	1.82	2.132	0.89	1.122	1.01
	(0.2617)		(2.403)		(1.110)	
Long-term debt ratio	-0.034	-0.08	0.093	0.56	-0.034	-0.56
	(0.425)		(0.166)		(0.061)	
Size	0.035	0.13	0.235	1.31	0.035	0.36
	(0.257)		(0.179)		(0.097)	
Asset tangibility	-0.013	-0.84	-0.521	-1.50	-0.638	-0.90
	(0.758)		(0.348)		(0.712)	
Effective tax rate	0.832	0.59	-0.009	-0.03	0.832	1.03
	(0.415)		(0.311)		(0.808)	
Constant	0.292	0.19	-0.964	-0.79	0.292	0.70
	(1.522)		(1.214)		(0.415)	
R-squared	0.005		0.007		0.005	
F-statistic/Wald Chi^2	5.329		0.708		1.650	
SD dependent var	7.016		7.016		7.016	
Number of obs	1076		1076		1076	
Prob > F/ chi2	0.377		0.588		0.895	
Hausman test			Chi-square = 3.39		p-value = 0.6397	
Breusch-Pagan test			chi2(5) = 2355.76 with p-value = prob(chi-square) = 0.0000			

Notes: Figures in parentheses are robust standard errors. *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are shown in parentheses.

If we consider the relationship between return on capital and tax shields, we see a positive, however statistically insignificant, relationship between them. The "secured debt" hypothesis states that all other things being equal, if tangible assets secure a company's debts, they can borrow at lower interest rates (Scott, 1977). A positive result between the tax rate and profitability is possible due to government policy. In Kazakhstan, small businesses with minimal profits pay only 3% tax on income. Nevertheless, if the profit increases to a certain amount, they will have to pay 10% tax on the income. According to Michael Engelschalk Jan Loeprick (2015), small businesses operating under the simplified tax regime are taxed based on their turnover, not net profit. In Kazakhstan, according to Tax Codex (2017), small businesses are also taxed based on their turnover. The research has shown that many of the existing theses are simplified and do not consider equity, and do not promote business growth. Based on our data, firms subject to turnover tax are also not efficient. Since the ROA of the trading company is only 7% at an effective tax rate of 12% (Table 1, column 10), and the ROA of the construction business is only 4.4% at an effective tax rate of 14.8% (Table 1, column 11). Therefore more attention should be paid to improving the design and control of simplified modes. Besides, the low tax rate means that debt cannot provide tax benefits in Kazakhstan. Therefore, the use of high-level debt cannot be a reasonable strategy.

Using data from Pakistan for 2006-2011 concludes that after-tax increases, firms respond by understating profits, switching to the informal economy, or changing their legal form (Waseem, 2018). In addition, even though tax revenues were higher immediately after the tax increase, they were below the original level three years later.

Concerning capital structure and taxes, Belitski et al. (2016) note that corruption compensates for the negative influence of high taxes on starting a business. They examine the relationship between corruption and income tax rates in a group of 72 countries between 2005-2011 and consider that higher tax rates prevent business start-ups. Based on Rocha et al. (2018) found that tax cuts after eliminating registration costs reduce the informality of firms in Brazil; however, this effect is mainly due to the registration of existing firms rather than to the creation of new formal enterprises.

Finally, Asset tangibility and ROE have a negative but also insignificant correlation. The firms expecting high growth rates in the future should use more equity financing. Our study result means that small companies' activities in Kazakhstan do not correspond to the Agency theory. With the help of various benefits, the tax system of Kazakhstan encourages growing companies, allowing them to retain profits and encourage investment. However, it is necessary to review the requirements for bank lending to small businesses since long-term loans require collateral in fixed assets, which are not available to all small businesses. This makes it possible only to obtain short-term loans.

According to the study by Calomiris et al. (2017), the relationship between creditor rights and bank loans using micro-level data for 12 developing countries. The authors argue that legal systems for movable collateral are generally weak. They limit the number of movable assets used as collateral while not having centralized registries and requiring court orders to enforce defaults. However, when the creditors' rights protection to movable property improves, banks lend a third more using the same collateral level. The authors checked which of the three components (creation, monitoring, or enforcement) is more important and found that the monitoring and enforcement components are the most relevant, implying that the results are due to the availability of collateral registers and the probability of extrajudicial enforcement.

In summary, in Kazakhstan, the relationship between firm performance and capital structure confirms the presence of the Pecking Order Theory in the financial strategy of Kazakhstan's small companies. Since small companies do not need additional tax benefits, the results confirm that the effects of taxes on capital structure choices are not consistent with the Trade-off theory.

6. Conclusion

The presented research shows that the capital structure impact is still controversial, especially in developing countries such as Kazakhstan. This country has specific characteristics and rules, such as a favourable investment environment and a low-income tax rate for small businesses.

We used panel data from small enterprises in Kazakhstan to conduct an empirical study of the impact of capital structure theory in the small business sector. The results obtained indicate that the presented theories of capital structure are relevant to small enterprises in Kazakhstan. The empirical analysis's main conclusions show the negative impact of all debt

levels on the return on assets and the direct interaction between the debt burden and equity, which is consistent with the pecking-order theory.

We have not found a significant relationship between the capital structure and return on capital in the case of small Kazakh enterprises. Firm size, tangible assets, and tax shields were irrelevant when explaining ROE for small firms. These factors do not significantly impact the firm's return on equity but may significantly impact the company's profitability.

Smaller firms with lower tangible asset ratios, which financial institutions consider risky because they are responsive to temporary economic downturns, are forced to base on lower external debt-financing levels. The tax effects do not appear to affect the ROE at any significant level. However, taxes may be an important element in increasing the ROA of an enterprise.

In the light of the findings of this study, we may conclude that employing a high proportion of debt in a firm's capital structure will invariably result in the low financial performance of a firm. The results generally suggest that following the pecking order theory, owners of small firms maximize their retained earnings and raise debt only when additional funding is needed.

Further research is needed to examine the small firms' capital structure over a more extended period and possibly over several economic cycles. This will allow obtaining a complete picture of the debt performance over a long period and its influence on its overall performance. The risk or macroeconomic indicators may provide a better explanation for the firm's performance.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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LAND USE IN BULGARIAN AGRICULTURAL HOLDINGS AND THE COMMON AGRICULTURAL POLICY[4]

The research on the utilisation of agricultural land in agricultural holdings has the aim to present the problems and opportunities European CAP policy brings in Bulgarian agriculture. We have used statistical methods as well as academically approved approaches to systematically assess how changes in CAP policy, have changed the landscape of agriculture and what positive and negative changes are the result of the implementation of EU norms. For competitiveness, we have presented data from the pre-EU accession and, using the graphic method, showed the changes during the research period. We try to highlight some processes in public relations regarding land use as an indispensable factor for production, as well as to define certain reasons for the registered changes.
Keywords: agriculture holdings; land use; CAP policy
JEL: Q1; Q18; C82

1. Introduction

Land use is a key element in the study of the economic activity of agricultural holdings. In the common European economic area, the CAP is the main tool for implementing common policies, respectively the collection of representative information to assess the impact of common rules and regulations on actors in agriculture. In this regard, the baseline analyses by the FADN play an important role in the whole process of EU CAP reform, i.e. the evaluation of CAP measures and the impact assessment of policy proposals. The Agricultural

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Accounting Information System (FADN) is a reliable tool for assessing farm activity and the impact of the CAP (Galluzzo, 2018, p. 928). The concept of the FADN was developed in 1965, when Council Regulation 79/65 established the legal basis for the organisation of the network of holdings. It consists of annual monitoring carried out by the Member States of the European Union. Since 1966, the European Farm Structure Survey (FSS) program has been implemented in order to study and analyse the economic activity of agricultural units. With Regulation (EU) 2018/1091 of the European Parliament and of the Council of 18 July 2018 on integrated farm statistics and repealing Regulations (EC) No 1166/2008 and (EU) No 1337/2011 (Text with EEA relevance.) EU and FAO create chrono topical surveys on the agricultural holdings. In this research, the preliminary data from the last survey is used for comparative purposes. Representative empirical information is collected to track trends in the development and structure of agricultural holdings. This is an essential indicator for an objective analysis of the ongoing processes in the primary industry. In this way, a platform of empirical data is built, which is the basis of statistical knowledge needed in the development, implementation, monitoring, evaluation, and review of sectoral policies. The research focus is on the Common Agricultural Policy (CAP), including rural development measures and our main objective is to find how it reflects on land use and regional differences. From the listed goals set, one can make a motivated assumption that the ongoing processes in land use are a significant factor, the influence of which on the condition of the agricultural structures in the primary branch is unavoidable. This fact is confirmed by the close correlations on the axis of land use-agricultural holdings-goals of sustainable development. Regardless of their development and the changes that have taken place over the years, a significant part of the UN's Sustainable Development Goals (SDGs) is directly correlated with land use and the economic activity of agricultural producers. In this regard, the authors accept that land use, as part of land relations, is of leading importance for the economic activity of agricultural holdings. The present study examines land use at a regional level and examines agricultural land use and the structural changes that have taken place since the CAP, taking into account the previous period as a basis for comparison.

1.1. State of the art

Land use is a widely used term that has acquired citizenship in/for the identification of activities of individuals and economic entities, in the implementation of which there is a combination of economic activity with the use of land as a natural body. Agricultural land is the basic resource for agricultural production. Its rational use is essential for the competitive development of the sector (Szabolcs et al., 2014). For the purpose of this study, we clarify that we use the term "land use" in its substantive nature, arising from the fact that the state and processes in land use are an emanation and an integral part of land relations. Various authors have written on the problems of land use and the impact of CAP. The study of land relations (LR) is part of the process of studying the nature and state of economic relations and changes in the economic environment in which agriculture operates. The nature of LR is determined by their direct symbiosis with the production and economic relations in the industry. The processes in land relations and the topic of land have been considered since the beginning of economic theories. This is due to the fact that land is the main factor of production in the land-labour-capital system. In the period of the planned economy and the

transition to a market economy, scientists from the Institute of Agrarian Economics have made a significant contribution to the construction and development of theoretical and methodological formulations, whose contribution is relevant today (Diana Savova, Georgi Kyosev, Milka Koleva, etc.) (Yovchevska, 2016, p. 41). The effects of the application of the CAP in Bulgaria are considered (Ruscheva, 2010). The New Institutional Economy (Dirimanova, 2005) is also used to highlight the specifics of Bulgarian land relations. The influence of the costs of transferring agricultural land on the consolidation of agricultural property is analysed (Georgiev, Penov 2006). An analysis of land reform and institutional change in Bulgaria is developed at the Agricultural University in Plovdiv (Stoeva et al., 2020). In this regard, following the changes in land use in Bulgaria at the level of NUTS-2, we try to highlight some processes in public relations regarding land use as an indispensable factor for production, as well as to define certain reasons for the registered changes (Boliari, 2013; Boliari, 2017; Rangelova, Vladimirova, 2017).

2. Material and Methods

In the spirit of objective analysis, it should be noted that the processes of land use in different regions of Bulgaria have their historical, natural-climatic, socio-cultural, and economic specifics, established in the long-term economic practice of the country, which has all the hallmarks of an agrarian state. Despite the lag in time and the sustainability of certain agricultural practices and regional peculiarities, the establishment and establishment of agricultural holdings as a leading entity in the new economic environment caused by the change in public relations is accompanied by changes in land use in different regions of Bulgaria NUTS-2. The NUTS-2 regions are defined by the EU (EC, 2011).

The study/observation period is 2003-2016 and includes two significant institutional influences. At the beginning of this time period is the period of completion of the land reform and the emergence/activation of the free market of agricultural land in our country and the establishment of a new type of land relations. This is the stage in which the agricultural holding is established as the main economic unit in the primary branch of the country. During this period, the public relations in agriculture Bulgaria are under the influence of the pre-accession program SAPARD. Bulgaria is the first country of the former countries with a planned economy to receive funding, training programs and direct assistance in preparation for the future application of Union rules. Agriculture is a branch of the Bulgarian economy, which, although significantly supported during the pre-accession period, continued to restructure after EU membership. This process is influenced by the Common Agricultural Policy of the Union (Popov, 2019). The second part of the study period covers the process of Bulgaria's accession to the common European economic area and the implementation of the common agricultural policy after Bulgaria's full membership in the EU-28 in 2007. The chosen method is tested for the Bulgarian condition/environment and the regressions help us graphically present processes and show the change in land use. By using correlational analysis, we aim to discover what this process is like in different regions of the country.

In the present study, these changes/differences are illustrated/reflected with the help of the graphical method, with the application of the chain index, the logical method, partly with the

method of the office study, etc. The methods were selected and tested taking into account the highlighting of changes in time and territory. In the period 2003-2007, the difference in land use in the different regions of the country stands out. The institutional change after the full membership of Bulgaria in the common European economic space "accelerates" the processes in land use.

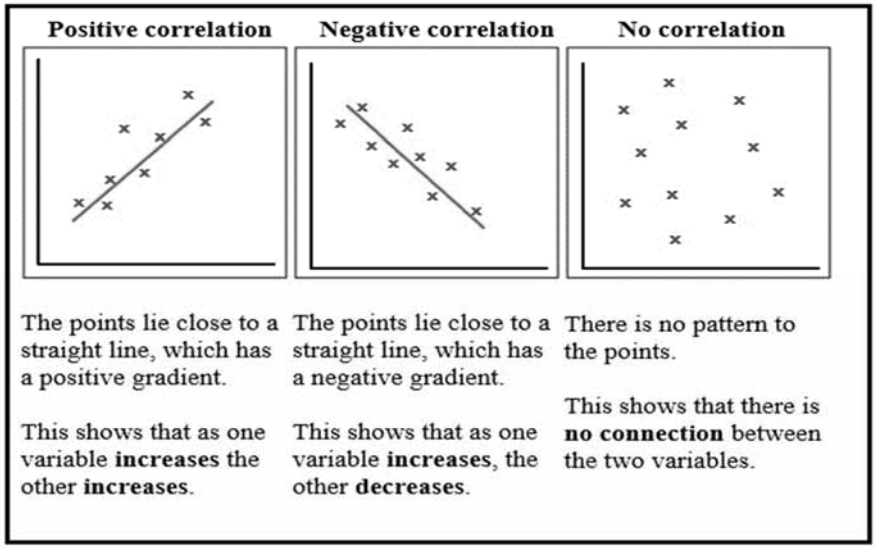
% increase = Increase ÷ Original Number × 100 (1)

If the answer is a negative number, then this is a percentage decrease.

The correlation between the utilised agricultural area, the size of the agricultural holding and the Standard output is calculated by R^2 values, which is the square of the correlation. Correlation shows the strength of a relationship between two variables and is expressed numerically by the correlation coefficient. The correlation coefficient's values range between -1.0 and 1.0. Positive and negative correlation:

Figure 1

Correlation (Positive, negative and no correlation) visualisation.



Source: Made by using Croxton et al. (1968). Applied General Statistics, Pitman.

In a narrower sense, the term correlation is understood as synonymous with a correlation coefficient ρ, which is a measure of the linear relationship between two random variables x, y, defined as the normalised covariance of the two variables:

$$\boldsymbol{p} = \frac{\boldsymbol{cov(x,y)}}{\sqrt{\boldsymbol{Var(x).var(y)}}} \quad (2)$$

The correlation coefficient (r) indicates the extent to which the pairs of numbers for these two variables lie on a straight line. Values over zero indicate a positive correlation, while values under zero indicate a negative correlation. A correlation of -1 indicates a perfect negative correlation, meaning that as one variable goes up, the other goes down. A correlation

of +1 indicates a perfect positive correlation, meaning that as one variable goes up, the other goes up (Dowdy et al. 1983).

There is no rule for determining what size of correlation is considered strong, moderate or weak. The interpretation of the coefficient depends on the topic of study. In the social sciences, it is assumed that the correlation has values of r <-0.6 or 0.6 <r, and R^2 has a value above 0.35 <R^2. Regression analysis models the relationships between a response variable and one or more predictor variables. Use a regression model to understand how changes in the predictor values are associated with changes in the response mean. Regression can be used to make predictions based on the values of the predictors (Frost 2019). R-squared is the percentage of the dependent variable variation that a linear model explains.

$$\mathbf{R^2} = \frac{\boldsymbol{Variance\ explained\ by\ the\ model}}{\boldsymbol{Total\ variance}} \quad (3)$$

$\mathbf{R^2}$ ***- squared is always between 0 and 100%:*** (4)

0% represents a model that does not explain any of the variations in the response variable around its mean. The mean of the dependent variable predicts the dependent variable as well as the regression model.

100% represents a model that explains all of the variations in the response variable around its mean. Usually, the larger the R^2, the better the regression model fits your observations.

3. Analysis of Land Use of Agricultural Holdings

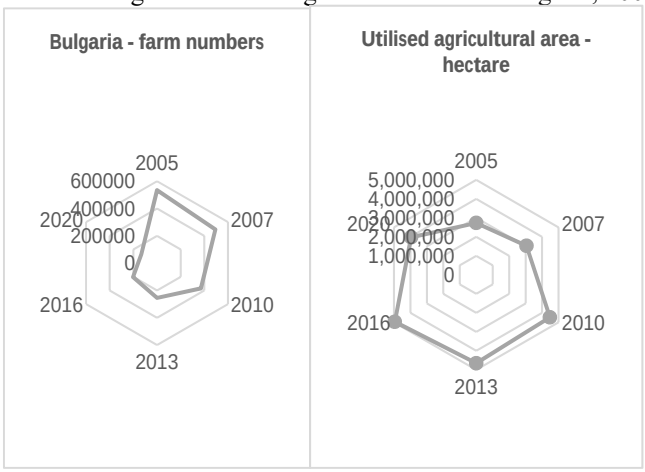
3.1. Dynamics of the used agricultural area and number of agricultural holdings in Bulgaria

After Bulgaria's accession to the EU, the economic units in the agricultural sector are in a state of dynamic development and change. Under the influence of/the pressure of direct payments and the desire to receive subsidies, some farms fail to maintain sustainable economic activity. As a result of the stressful institutional change for them, they cease to function. The process is presented graphically in Figure 2. These are primarily small and medium-sized farms. The large economic units, using all the levers provided by the CAP, continue to consolidate, and the small ones cannot continue their development in the economic situation created after 2007. In the time period from 2005 to 2016, the number of agricultural holdings decreased by almost half. This means that every second farm cannot survive in the midst of an open economy and a dominant free-market economy. In the conditions of the applied rules of the Community agricultural policy (CAP), after 2007, there is a permanent tendency to decrease in the number of agricultural holdings. The data for 2020 is preliminary data from the farm survey and shows that the process that started before the EU accession has continued and more and more farms have a case to exist or have been assimilated by the bigger ones. The processes among the organisational and economic structures are in the direction of reducing the economic units. Steady trends in this direction are registered mainly among small farms. This is just an author's remark. This process makes the landscape of Bulgarian agriculture highly diss balanced and in favour of big industrial farming, which is part of the problems related to climate change, erosion of soils, lost of

biodiversity, intensification of farming and change of crop diversity by transitioning to monocultural one. CAP provided a platform for better competitiveness for the bigger agricultural holdings but, on the other hand, had a very negative effect on smaller farms that couldn't find a place in the new market. Bulgarian laws and institutional norms were also at fault, because higher regulation and certification were required for the small farms than in any other EU country, which made the sale from farmer to the consumer almost impossible. The lack of farmer's markets and dissemination chain further discouraged the small producers. The combination of all the factors we have talked about above resulted in the current state of Bulgarian agriculture.

Figure 2

Agricultural holdings and utilised agricultural area in Bulgaria, 2005-2016

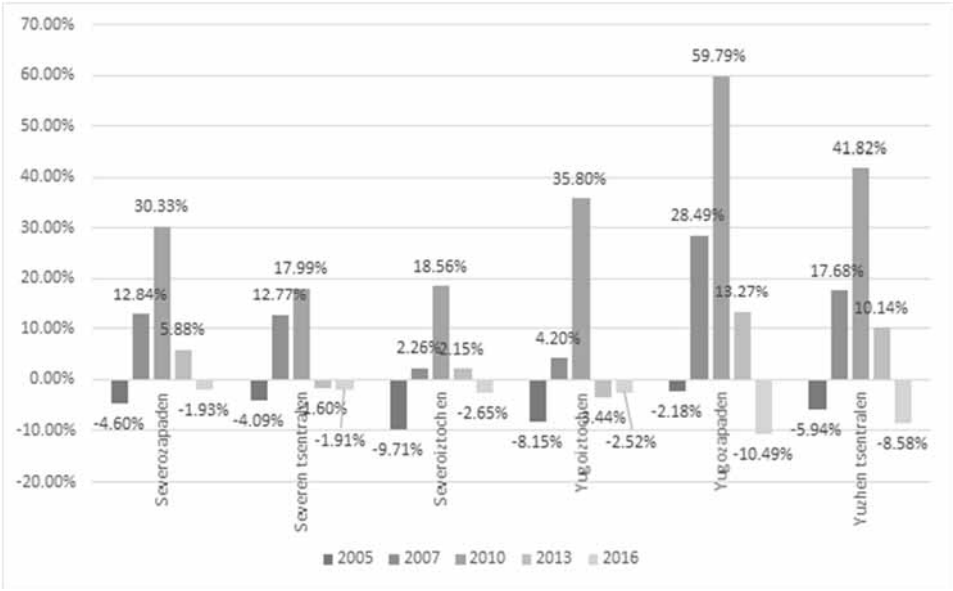


Source: Eurostat.

In the same period, there is a significant change in utilised land in Bulgaria, that doesn't mean that more land is allocated to small and medium farms, the process is exactly the opposite, only the big farms are using the new utilised land. The yearly trend is the same for every region. The biggest change in land use is 2010 when in Yugozapaden region the change is equal to 60% and the least change is 18% in Severen Tsentralen. Land relationships have been unstable because of the fast-paced changes happening in the institutional environment and how the CAP is applied to the Bulgarian environment that still suffers from the changes after the planned agriculture and collective forms before the change of the social model. The process of structural changes in economic units in agriculture is largely a test of the state of the social model of society. It is also directly related to the sustainability of economic structures in agriculture. Given the connection of all these changes and problems with the topic of this research project: "Socio-economic effects of the CAP on the development of agricultural holdings and rural households", a detailed and comprehensive analysis of the links between land use, agricultural holdings, socio-economic conditions and its impact on the status of rural households (Koteva, Chopeva, Yovchevska et al., 2020). In this project, the land use of agricultural holdings has been developed by the research team and based on previous expertise, this article's thesis and research aim was formed.

Figure 3

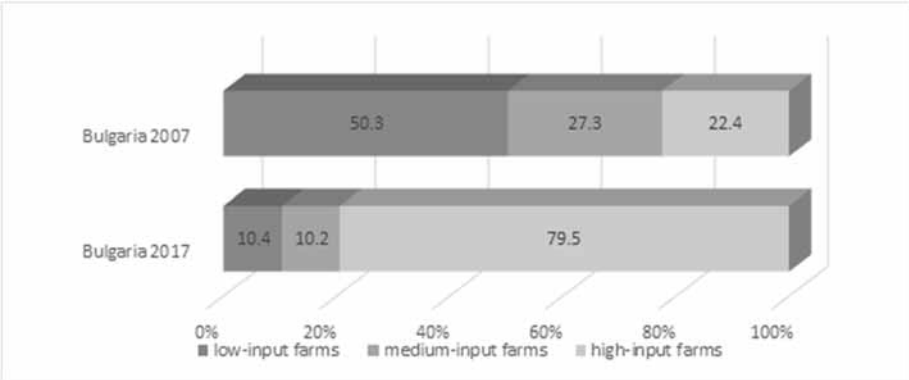
Change in utilised land in regions NUTS2



Source: Eurostat and author's calculation.

Figure 4

Intensification of low, medium and high-input farms in a utilised agricultural area (%)



Source: EU Bioeconomy Monitoring System dashboard.

The change in the intensification of farms has been drastic in the period since 2007. From low-input, the Bulgarian farm turns to a high-input one with no middle ground. The combined percentage of low and medium input farms is only 20%. The changes are dissonance between CAP policy goals, green deal and SDGs goals, and reality. The reality is that CAP, instead of completing its goals, have created and furthered the problems in Bulgarian agriculture.

Table 1

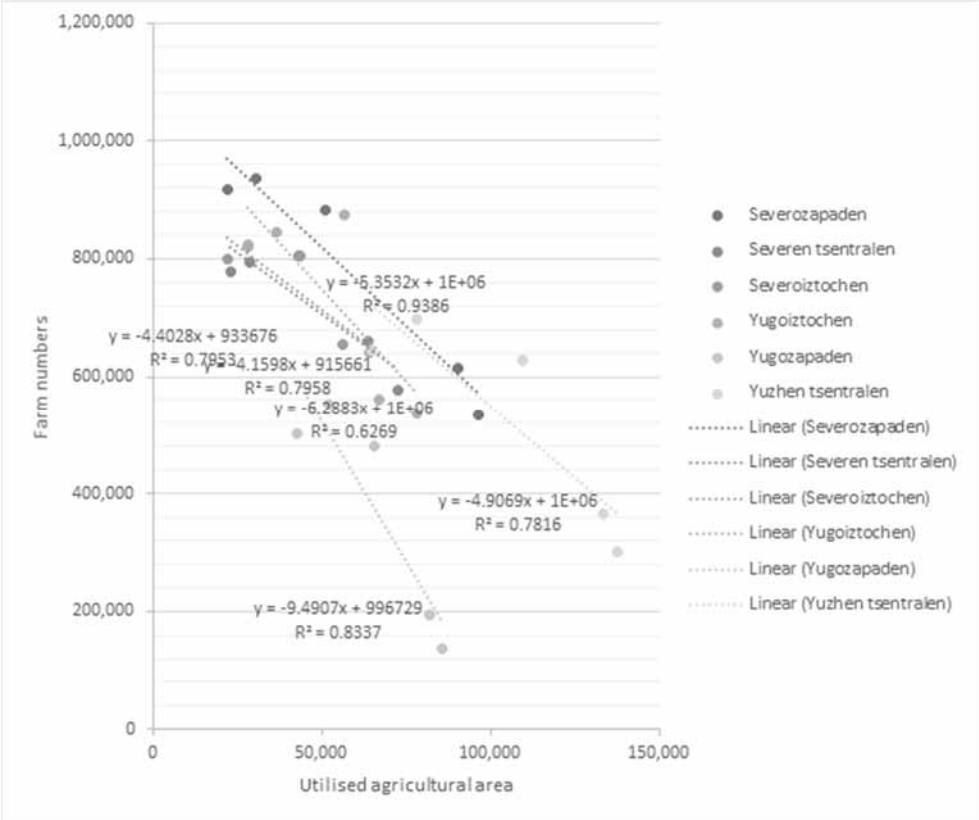
Correlation between Farm number and Utilised agricultural area

Correlation between Farm number and Utilised agricultural area	Correlation
Bulgaria	-0.9105684
Severozapaden	-0.9688181
Severen tsentralen	-0.8920947
Severoiztochen	-0.8918061
Yugoiztochen	-0.7917391
Yugozapaden	-0.9130807
Yuzhen tsentralen	-0.8840905

Source: calculations based on Eurostat data.

Figure 5

Correlation between Farm number and Utilised agricultural area



Source: Agrostatistics and author's calculations.

We find that the correlation between farm numbers and the utilised agricultural area is negative. A negative correlation means that an increase in one variable is associated with a decrease in the other. That shows us that if the farm numbers increase, the utilised agricultural area will decrease and vice versa. The strongest negative correlation is found in the

Severozapaden region, where the correlation is almost 1(-0.968). Here the two processes have a greater impact on one another, on the other hand, the least amount of impact can be found in Yugoizotchen (-0.791) but still with a value that shows a great correlation between the two variables. In Bulgaria, the trend is of transforming the agriculture holding into bigger ones that utilise more land and have a higher standard output. Still, the percentage of small farms with an average size of up to 2.0 ha and an average production volume of up to 2000 EUR remains high in comparison to other member states. That is in line with the land fragmentation after the end of the planed agriculture in Bulgaria.

There is a high positive correlation between Utilised land and Standard output that shows that the sustainability, growth potential and viability in agricultural holdings are dependable on the utilised land (how big is the agricultural holding). As it is shown in Figure 5, the lines represent the linear trend and trajectory of the land use and farm structure. The trend shows us the tendency for bigger farms that utilise more land to have a bigger standard output. This trend is especially true for the Severozapaden and Severen tsentralen region, where the agricultural holdings have steadily turned bigger and utilised more and more land. This is mostly because of the type of culture that is produced in these two regions (wheat). CAP pillar one has turned the region towards monocultures and presents a greater challenge for sustainable agriculture.

Table 2

Correlation between Utilised land and Standard output

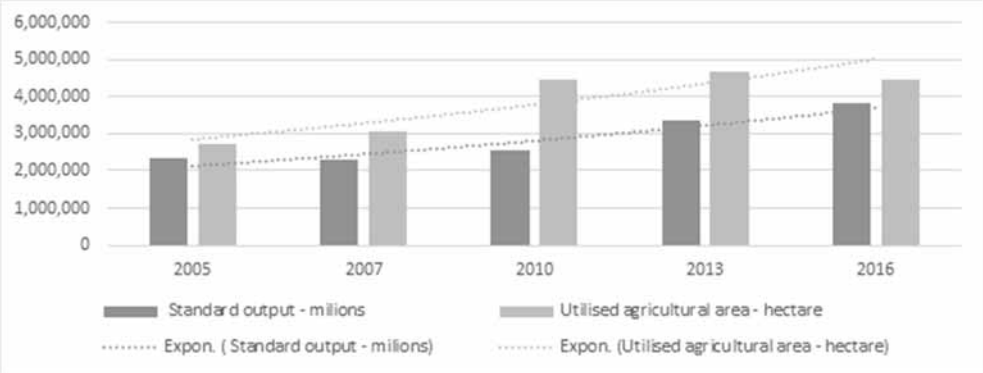
Correlation between Utilised land and Standard output	Correlation
Bulgaria	0.731174447
Severozapaden	0.804325929
Severen tsentralen	0.61883714
Severoiztochen	0.724862453
Yugoiztochen	0.736503002
Yugozapaden	0.51615331
Yuzhen tsentralen	0.700055241

Source: Eurostat and calculation.

The standard output has gradually gotten higher with CAP, having bigger agriculture holdings with free access to the world market and higher productivity from better technology. With Bulgaria's joining the EU in 2007, the national market has become part of the internal market of the Union and Bulgarian producers and traders faced a number of challenges related to the size and structure of farms and agricultural exports. The 2007-2016 period is characterised by dynamic structural changes in farms. Restructuring of agricultural holdings leads to a change in the structure of UAA by groups of farms, depending on their size. There is a positive trend towards increasing the level of specialisation and concentration of production, improving the market orientation of the farms (Sabeva 2020). After its accession to the EU, Bulgaria has established a highly dualistic agricultural structure – 75% of the holdings are very small and generated less than 9% of the standard output. By contrast, only 3% of the farms (the biggest grain producers in the country) accumulated nearly 75% of the standard output. The polarisation and overconcentration in Bulgarian farm structure, which began during the accession period, is increasing significantly after 2007 (Uzunova, 2018).

Figure 6

Standard output and utilised agricultural area

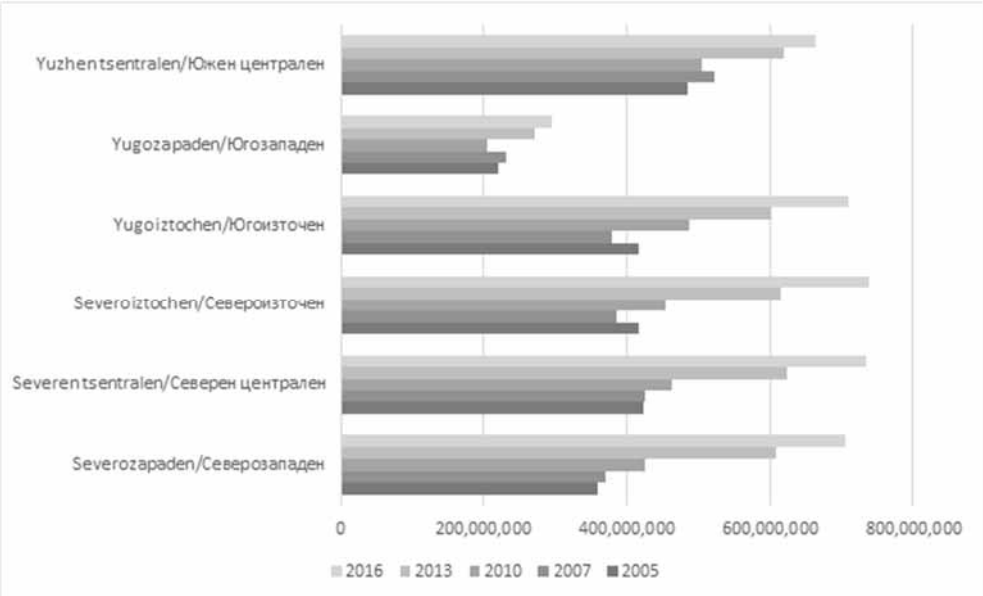


Source: Eurostat.

In different regions of Bulgaria, the standard output is getting higher in the period. The smallest change is in Yugozapaden region and the biggest is in Severen tsentralen and Severozapaden. This is mostly based on the effect of the CAP policy and moving towards grain production in these regions. In the long run, we as researchers think that will have a negative effect on soil quality, bio-diversity and will lead to the extension of small farms in Bulgaria.

Figure 7

Standart output by NUTS 2 regions

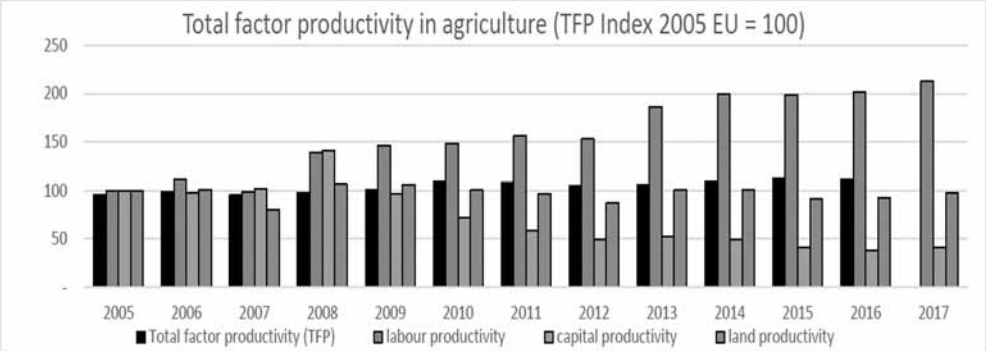


Source: MAF, department of Agrostatistics.

The total factor productivity (TFP) is increasing in Bulgaria, mainly due to an increase in labour productivity which is mainly linked to the outflow of labour (-62% between 2005 and 2017). The capital productivity presents the returns on investments. Land productivity reflects the developments in yields and rents and remains stable over the time period. The peak in 2008 is linked to crop output (Figure 8). The opinion of the authors of this research is that there should be a change in CAP in Bulgaria. CAP should be linked to soil types and the production of suitable crops for the soil. This will optimise yields and create harmonious with nature agriculture that can keep a multi-crop production. This will also help with intensification and balance the negative effects on nature.

Figure 8

Total factor productivity in agriculture

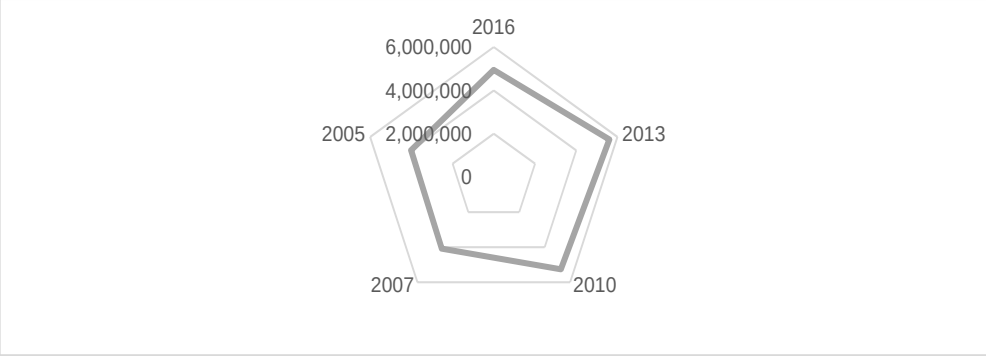


Source: Nine objectives for a future Common Agricultural Policy.

The EU policy integration reflects and new monetary flow in the country (Hubenova, 2019), making the change in the national agricultural environment move faster than the normal trend. This is shown in Figure 8, where the period since EU accession has a greater change and land productivity is the only constant that doesn't change from the new monetary flow that is to support the sector in Bulgaria.

Figure 9

Utilised agricultural area without special areas for agricultural production

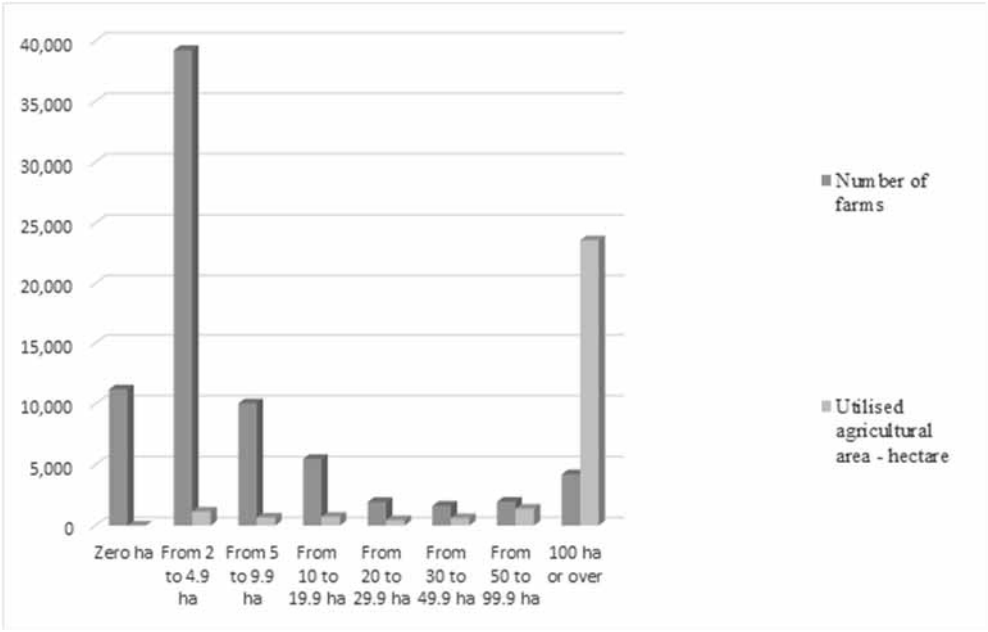


Source: Eurostat.

In the period after 2007, the used agricultural area without special areas for agricultural production registered a tendency to increase (Figure 9), despite a decrease in the number of agricultural holdings. This process of consolidation of agricultural holdings, expansion of the possibilities of the large/large economic structures in the branch and lasting tendencies of the loss of market share on the part of the small and medium economic units in the Bulgarian agriculture is confirmed by the empirical data of Figure 11 and Figure 12. The graphical presentation of the processes in land use reveals a kind of dichotomy between the number of agricultural holdings and the used agricultural area in Bulgarian agriculture.

Figure 10

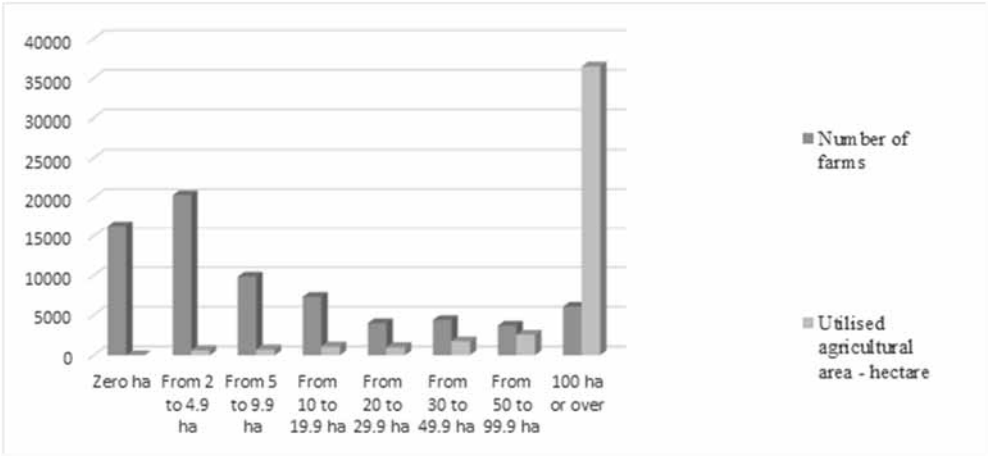
Agricultural holdings and utilised agricultural area in Bulgaria, 2007 (100 ha)



Source: Eurostat.

Many farms have a modest share in land use in our country. These are vulnerable economic units whose existence is caused by social rather than market motives. In the free environment of a market economy, they cannot survive. After a ten-year period, their number halves (Figure 10). Along with the decrease in the number of farms, this means that the average farm size increases, which is an indicator of progress in the process of land consolidation (Sabeva, 2020). Family farms are of great economic and social importance. In sync with the agricultural cooperatives, they maintain the traditions, customs, history, authentic folklore and are a symbol of the Bulgarian language in the rural areas. They ensure the employment and cohesion of rural households (Tsvyatkova, 2020).

Figure 11
Agricultural holdings and utilised agricultural area in Bulgaria, 2016 (100 ha)



Source: Eurostat.

In the period 2007-2016, farms cultivating from 2 to 4.9 hectares halved. The number of farms with more than 100 hectares almost doubled in number (Figure 10 and Figure 11). The utilised agricultural area of 2,358,23 hectares in 2007 increased to 3,648,460 ha, in 2016, which constitutes ¾ of the total utilised agricultural area of agricultural holdings (4,468,500 ha). The large agricultural production units, which in 2016 were only 6,060 out of a total of 202,720 agricultural holdings, have a dominant monopoly on the utilised agricultural land. Small and medium-sized farms are declining in number, a trend we have already commented on. The ongoing consolidation of farms has a positive tendency to reduce the number of farms up to 1 hectare, which are not eligible for SAPS payments (Koteva, 2019). CAP policy greatly contributes to the consolidation of Bulgarian agricultural holdings. The process of consolidation of large economic structures potentially exacerbates the problems facing medium and small farms.

The trend in our country is not in dissonance with the processes in a number of other member states of the Union, incl., and in some countries of the former planned economies. The number of agricultural holdings in the EU is declining rapidly. The area of agricultural land used for production remains stable. In Bulgaria, these processes are much more intense. The consolidation and enlargement of large agricultural holdings are accelerating as a result of support from Community agricultural funds. The low share of supported small farms by all potential beneficiaries, as well as the relatively low share of support, significantly affects the processes of restructuring production structures in agriculture and leads to a drastic reduction in the number of small and medium farms in Bulgaria.

Conclusion:

For the period researched, we find that number of small farms has decreased and the number of big ones has increased. The utilised land has also increased, which means that big farms

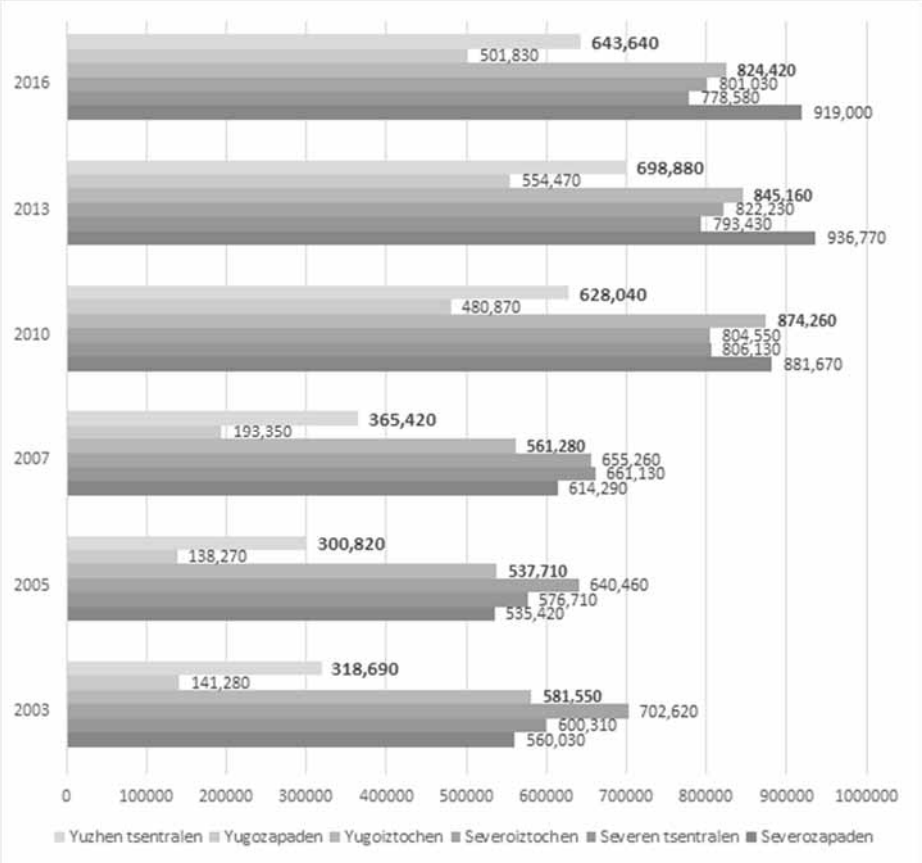
are turning bigger, and the process makes the viability of small and medium-sized farms lower. The small and medium farms need a policy shift in CAP to interfere with the current processes in land use and structure of agriculture holdings.

3.2. Land use in the different regions of Bulgaria NUTS 2

The processes of land use in the different regions of Bulgaria have their historical, natural-climatic, socio-cultural and economic specifics. These differences are reflected in Figure 12 using the graphical method. In the period 2003-2007, the difference in land use in the different regions of the country stands out. The institutional change after the full membership of Bulgaria in the common European economic space "accelerates" land use. In regions with small-scale production, such as the Southwest, the utilised agricultural area increased three times in the period 2010-2016 compared to the period 2003-2016 (Figure 12). In Bulgaria, the trend has different tendencies in different regions of the country.

Figure 12

Used agricultural area by agricultural holdings in the region of Bulgaria, 2003-2016



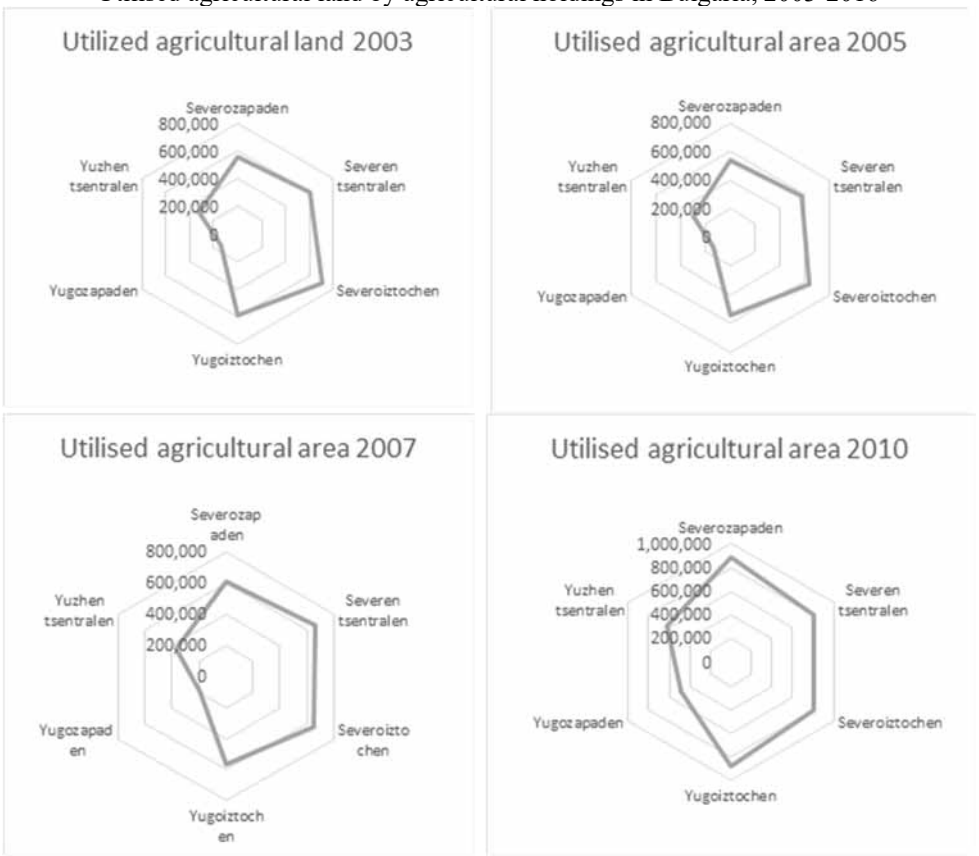
Source: Eurostat.

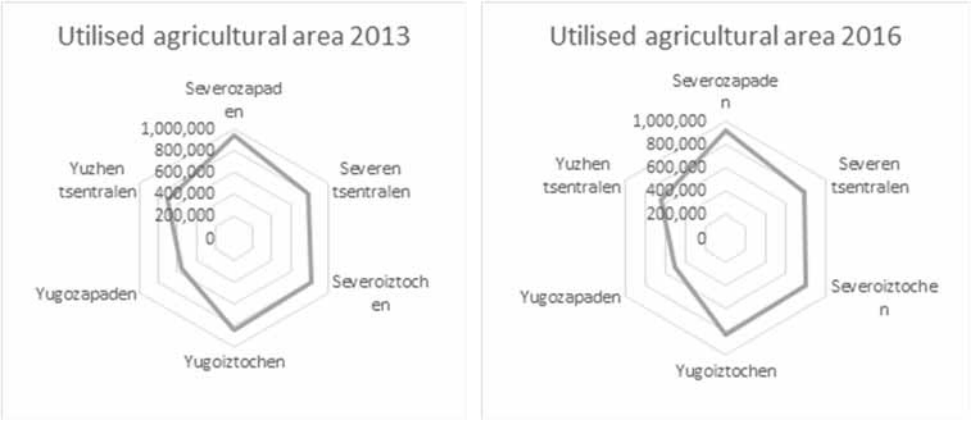
In the period after 2007, the utilised agricultural area of agricultural holdings increased. The increases are proportional to all NUTS2 regions in the country. In the South-West region, where in 2003 and 2007 the used agricultural land was the least in comparison with the other regions, the largest increase was registered. Most UAAs from agricultural holdings were reported in the North-West region. In the period 2005-2016, the utilised agricultural area of small agricultural holdings decreased by about a quarter (25%). The increase in the utilised agricultural area in all areas is a consequence of the consolidation process. The connection with the establishment of larger agricultural holdings is directly proportional to the registered process of consolidation of land resources in our country.

In the period 2003-2007, the difference in land use in the different regions of the country stands out. The institutional change after the full membership of Bulgaria in the common European economic space "accelerates" land use. In regions with small-scale production, such as the Southwest, the utilised agricultural area increased three times in the period 2010-2016 compared to the period 2003-2007 (Figure 13).

Figure 13

Utilised agricultural land by agricultural holdings in Bulgaria, 2003-2016





Source: Eurostat.

In the period after 2007, the agricultural land used by agricultural holdings increased under the influence of the combined impact of the new institutional change after full European membership and the improved economic situation, as a result of financial support for farmers' incomes from pan-European budgets. The increases are proportional to all NUTS2 regions in the country. In the South-West region, where in 2003-2007 the utilised agricultural area was the lowest compared to other regions, the largest increase was registered. Most UAAs from agricultural holdings were reported in the North-West region. In the period 2005-2016, the utilised agricultural area of small agricultural holdings decreased by about a quarter (25%). The increase in the utilised agricultural area in all regions is a consequence of the process of consolidation of the agricultural parcels cultivated by the agricultural holdings (Figure 13). The connection with the creation of larger economic units is directly proportional to the registered process of consolidation of the land resource, processed by agricultural holdings in Bulgarian agriculture (Figure 13).

A process of increasing the size of UAA is registered in all regions of the country, with an accelerated growth rate after the country's accession to the EU-28. This is due both to the opportunities for the realisation of the production in the European market of 500 million inhabitants and to the incentives to receive subsidies from the funds for the implementation of the CAP and the maintenance of rural areas in the individual Member States. This is a complex process of implementing changes in European policy, transposing pan-European legislation, and implementing it in EU countries. The dependence on the cyclical nature of the process, inevitable in the introduction of each subsequent budget and programming period, introduces a certain lag in the implementation of the changed policies and results in a certain "delay/delay" of the ongoing changes and processes in land use. This is more clearly reflected in all regions of NUTS-2 level in our country and is a kind of litmus test for the development of land relations in Bulgarian agriculture (Figure 14). Given the high degree of maturity of public relations in Bulgarian agriculture, changes in land use as a result of the implementation of the new budget and programming periods would be insignificant, even within the stochastic error.

Figure 14

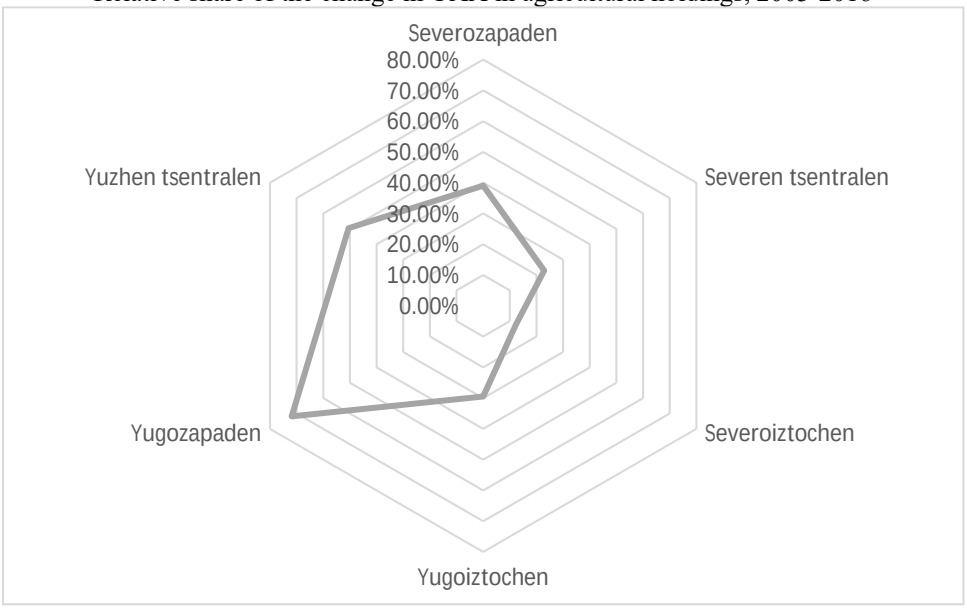
Changes in UAA in AH in the regions of Bulgaria during the period 2003-2016

Source: Eurostat.

Changes in land use in our country frame a positive change in UAA in all NUTS-2 in our country. We owe special attention to the processes taking place in the Southwest region. In the area characterised by small-scale production, in the period 2003-2016, the growth of land use in the land increased by 70% and is a sign of favourable development of agriculture and rural areas in this part of the country. Indirectly, the process is indicative of the opportunities for diversification of agricultural production, for preservation and conservation of valuable biotopes and breeding of indigenous varieties of plants and breeds of animals.

Figure 15

Relative share of the change in UAA in agricultural holdings, 2003-2016



Source: Eurostat.

The registered changes are a favourable indicator for the successful implementation of elements of the EU Green Deal and the Bioeconomy Strategy as part of the transition to a circular economy and a gentle attitude towards the soil, water, flora and fauna given the reduction of the negative impact of the human footprint on the natural environment.

The chain index, taking into account the change in UAA of agricultural holdings in Bulgaria in the period 2003-2016 highlights the positive impact of the Community agricultural policy on UAA in agricultural holdings in all regions of the country. The most "favoured" is the Southwest region. The data on the percentage change on a chain basis also register a problem that we have already commented on. During the transition to the next budget and programming period, there are signs of holding back the process of increasing UAA in the agricultural holdings.

Table 3

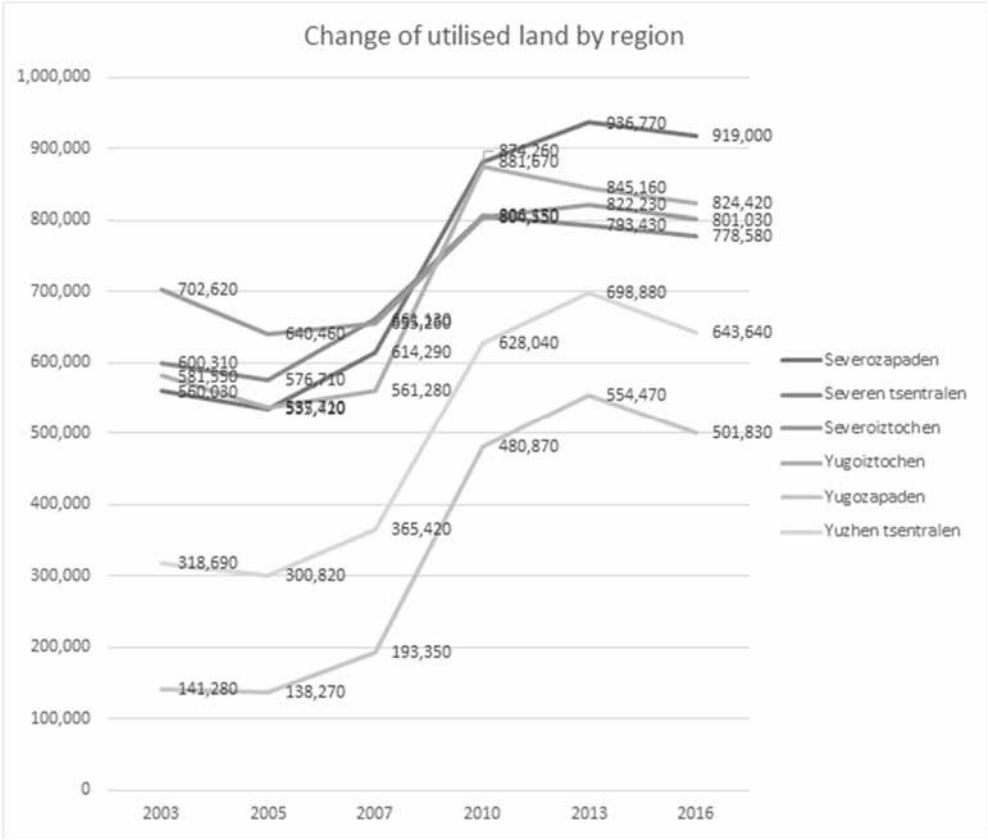
Chain index of the change in UAA by agricultural holdings in Bulgaria in the period 2003-2016

Change on chain base (%)	2005	2007	2010	2013	2016
Severozapaden	-4.60%	12.84%	30.33%	5.88%	-1.93%
Severen tsentralen	-4.09%	12.77%	17.99%	-1.60%	-1.91%
Severoiztochen	-9.71%	2.26%	18.56%	2.15%	-2.65%
Yugoiztochen	-8.15%	4.20%	35.80%	-3.44%	-2.52%
Yugozapaden	-2.18%	28.49%	59.79%	13.27%	-10.49%
Yuzhen tsentralen	-5.94%	17.68%	41.82%	10.14%	-8.58%

Source: National Statistic Institute.

Figure 16

Amendment to the UAA by the agricultural holdings in the regions of Bulgaria 2003-2016



Source: Eurostat.

This process is also registered with the help of the graphic method and is visualised in Figure 16. Evidence of the process of transition between programming periods in the implementation of the CAP is the reduction of UAA by the PA in the period after 2013. The

change is a kind of uncertainty and economic entities shrink agricultural land, awaiting new financial incentives. This is accompanied by a kind of "pulsation" in land use, which is registered in all regions of the country (Figure 16). The reasons for these changes are inherited from the way of agrarian and land reform in Bulgaria and testify to complex social processes with strong reverse influence. The immaturity of land relations and land use, as an essential part of them, also affects the agricultural structures in our agriculture. European family farms and farms are competitive and sustainable, but they are the product of a different type of social relationship established over the centuries of reconciling economic conditions and policy decisions taken and changed as a result of and after sound economic assessments.

Conclusion:

In different regions in Bulgaria, there are different problems involving land use. The specifics of the regions and the production that is cultivated is the main reason for land use change in the regions. In the regions, where the main crop is heavily subsidised by CAP, the utilised land increase. The process is true for all the regions, but the increase is disproportional.

4. Conclusions and Recommendation

Bulgarian land relationships are still in the midst of dynamic changes. In the future, with no intervention regarding policy and laws, the structural changes will continue and the trend of intensification and consolidation toward bigger agricultural holdings will be kept. As we have mentioned, these changes, when not made with sustainability and a better future that protect both farmers' interest and land, will have a long-lasting negative impact.

Recommendations for change in the practices of CAP policy in Bulgaria are made so that any negative impact can be negated in the future. There should be more national support that can help the small and medium agricultural holdings and negate the intensification and unsustainable model that the CAP resulted in. A more harmonious with nature approach should be found before bad practices settle in. Small and medium farms should be presented with better markets and better opportunities so that they do not face extinction.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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STRATEGIC DIRECTIONS FOR ENSURING FOOD SECURITY OF UKRAINE IN THE CONTEXT OF ECONOMIC INTEGRATION[4]

A methodological approach to assessing the stability of the agri-food sector based on a system of production stability indicators, food shortages, effective demand and balanced diet has been justified in order to identify threats to food security related to the instability of agro-industry and market imbalance. The methodology for assessing the sustainability of the country's agri-food market makes it possible to quantify the threats to food security associated with the instability of agricultural production and market balance and to substantiate the directions of stabilising the functioning of the agri-food markets in Ukraine.

It has been defined that the key measures include an adaptation of the regulatory framework in accordance with the requirements of the WTO and the EU in the field of product quality and safety, consumer protection, mandatory audit of food industry enterprises for the compliance with safety and quality requirements, mandatory control of imported food products and import restrictions in accordance with sanitary and phytosanitary measures. It is supposed to use the mechanism of tariff quotas within the framework of bilateral trade agreements and also bans and restrictions on imports on the basis of sanitary and phytosanitary measures.

The directions of strengthening the role of Ukraine in ensuring international food security are to increase quotas for food imports to the EU on the basis of amendments to existing trade agreements, expand foreign sales markets for Ukrainian exporters, stimulate exports and attract small and medium-sized agricultural enterprises to participate in exports.

Keywords: food security strategy, strategic priorities, food security, economic integration, food import and export, a system for monitoring the quality and safety of agricultural products and food

JEL: Q10; Q18; Q17; O13; O21

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1. Introduction

Recent years have seen the processes of globalisation to increasingly affect the food security of the state. The dependence of Ukraine's food security on the development of integration processes is due to both the geopolitical position and the significant potential of the agricultural sector of the economy. Therefore, the food security strategy should be implemented through effective government policy and the establishment of priorities for mutually beneficial cooperation with developed countries and the introduction of interstate standards. Integration of Ukraine with the countries of the European Union is especially important to ensure food security. European standards in the food sector serve as an example of the modernisation of public administration mechanisms and the development of the agricultural sector in Ukraine (Mostova, 2019). However, in recent years, despite significant shifts in the direction of European integration, the state management of the domestic agricultural sector is still characterised by insufficient coordination with European states and a lack of consistency in addressing strategic food security issues. The consequences of the issues identified include isolation of the European market from the products of the domestic agricultural sector, the lack of a comprehensive increase in the quality standards of Ukrainian production, increased import dependence on certain food products, which poses threats to the food security of Ukraine.

Therefore, the key strategic direction to ensure food security in the context of European integration of the agricultural sector should be the interstate coordination in the management of the industry within the framework of common European standards. It is the experience of the EU that is indicative of reforming the domestic agricultural sector and solving strategic issues of ensuring food security at the level of the member states and at the supranational level. When concluding the Association Agreement with the EU and the further acquisition by Ukraine of the full membership in the EU, the emphasis of ensuring food security should be set precisely on guaranteeing food independence, self-sufficiency and food quality and safety.

2. Background Paper

The scientific category "food security" in world practice reflects the state of the world food market, the food supply of the state or the union of states. The initial principles and approaches to define food security have been related to the food problem and global eradication of hunger. The Universal Declaration of Human Rights, adopted by the Resolution 217 A (III) of the UN General Assembly on 10 December 1948, testifies that everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services (Universal Declaration of Human Rights, 1948).

The right to adequate nutrition was enshrined in the Universal Declaration of Human Rights, adopted by the UN in 1948, which became the basis for further UN international legal instruments in the field of human rights.

The International Covenant on Economic, Social and Cultural Rights, adopted by UN General Assembly Resolution 2200 A (XXI) of 16 December 1966, defines food security as the right of everyone to an adequate standard of living for himself and his family, including adequate nutrition, clothing and housing, and the steady improvement of living conditions, and characterises the fundamental right of everyone to be free from hunger (International Covenant on Economic, 1966).

The introduction of the "food security" concept into international practice has been caused by the problem of food supply associated with the grain crisis in the World of 1972-1973. In 1974, the UN General Assembly officially declared the term "World Food Security", which meant ensuring stability in food markets and the availability of basic food products for all countries of the World (Universal Declaration on the Eradication of Hunger and Malnutrition, 1974, pp. 175-176). Later, in the 80s of the XX century, food security was not only about ensuring the availability and stable availability of food in the World, but also the sufficiency of food to enable people to lead an active and healthy life.

The "Food Security" concept was introduced into international scientific and political circulation in 1974, after the grain crisis of 1972-1973, by the UN General Assembly in the Universal Declaration on the Eradication of Hunger and Malnutrition (Universal Declaration on the Eradication of Hunger and Malnutrition, 1974) and the Resolution "International Commitments to Food Security in the World".

The Rome Declarations on World Food Security (1996, 2009) have established an international legal framework to ensure the right of everyone to have physical and economic access to safe and nutritious food sufficient to maintain and restore health, to lead an active and healthy life (Declaration of the world summit, 2009).

FAO enshrines a modern approach to defining national food security, which means state policy aimed at achieving the maximum level of food self-sufficiency by increasing its production, improving food supply, ensuring balanced consumption, protecting consumer rights, eradicating malnutrition and hunger (FAO, 1996; Voluntary guidelines to support, 2004).

The studies of Western economists often consider the problem of food security only at the international level, not counting the national or regional aspects (Policy and development, 2001, p. 23). Food security is defined as the state of the economy, which ensures the achievement by all residents at any time of the guaranteed access to food in the amount necessary for an active healthy lifestyle (Conway, Barber, 1990, p. 52). Scientists consider food security in the context of the dependence of a person, family, social group on what they can acquire to meet their nutritional needs (Sen, 1981, p. 131). Other scientists have studied food security from the point of view of public administration and the relationship between the influence of the country's natural and climatic conditions on the physical and economic availability of food (Peacock, 2012; Roberts, 2021; Rosegrant, 2015). It is worth to separately concern a number of scientific studies devoted to the formation of the strategy and policy of food security of the EU countries. The Common Agricultural Policy provides balanced regulation and support of the food market at the national and supranational levels, aimed at maintaining an adequate level of food security through an effective system of methods and mechanisms to protect against cheap imports and support agricultural production and food

exports (Candel, et al., 2014). The strategic directions of state regulation to ensure food security in the EU, cover the creation of a single food market (Keane, 2016; Quiroga, et al., 2017; Candel, Daugbjerg, 2020).

Researchers Aiyar A., Pingali P., Béné C. and others (Aiyar, Pingali, 2020; Béné, 2020) have studied modern challenges and threats to food security in the context of globalisation of economic processes and a pandemic. The issues of population food supply in the context of strengthening innovative development have been considered in the scientific works by Stephens, E. C., Jones, A. D., Parsons, D., Candel, J., Daugbjerg, C. (Stephens et al., 2018; Candel, Daugbjerg, 2020).

Foreign experts have not fully disclosed the issues related to the essence of food security as an object of strategic planning, as well as the ways to solve the problem of its unsatisfactory state, which is explained by the approach to the study of this phenomenon at the world level and the failure to take into account the specifics of the formation of economic development strategies and national agricultural production in individual countries.

Thus, foreign scientists mainly study the issues of food security and food availability on a global scale, focusing mainly on its state and not on dynamics and factors of influence; and they leave open the issue of national food security and its strategic security.

However, scientific literature and international legislative documents do not indicate the possibility of strategic provision of food security of the state in the long term, taking into account external economic factors and integration processes. The formation of a food security strategy in Ukraine shall be linked to the corresponding development strategy of the agrarian economy sector and integration processes; it shall organically fit into the process of forming a model of socio-economic development in Ukraine and be implemented within the framework of its economic development strategy (Mostova, 2019).

3. Methodology

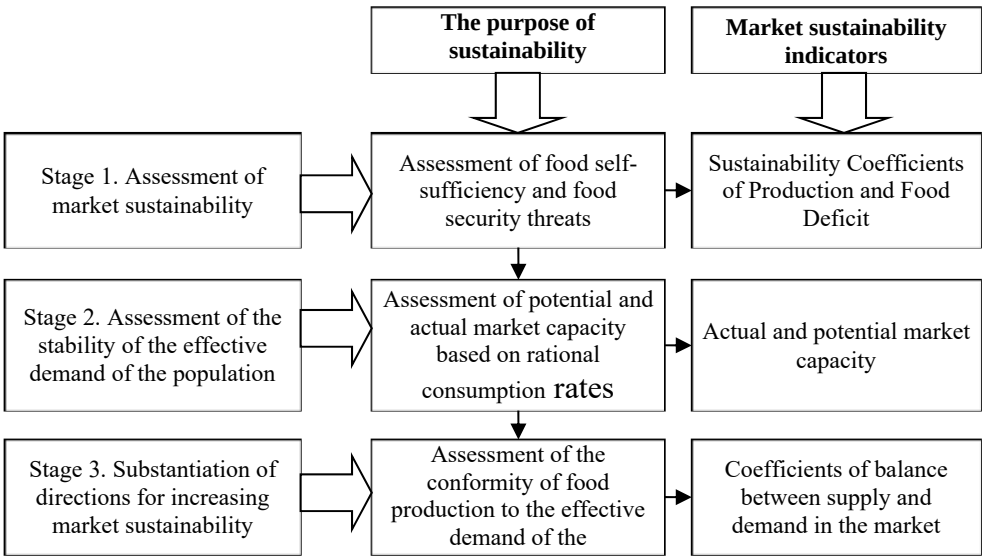
The priority areas for ensuring food security include the achievement of an agri-food market balance in terms of supply and demand, which will ensure an adequate level of food consumption by the population. An important condition for a balanced market as a factor in ensuring food security is sustainability, which should be understood as the ability of market subjects to maintain the strategic level of production compliance and the infrastructural availability with the needs of the population for food in the context of changing environmental factors.

To identify threats to food security, associated with the instability of agricultural production and market imbalance, it has been proposed to use a methodology for assessing the agri-food market sustainability based on a system of indicators of the production sustainability, the magnitude of the threat (food shortage), the level of effective demand and balance, which makes it possible to carry out a comparative analysis of the sustainability of the market in terms of food products, regions, and identify the factors of stabilisation of the country's agri-food market.

The developed methodology for assessing the sustainability of the agri-food market is carried out in 3 stages and is based on determining the conditions for its formation and functioning and the actual level of sustainability according to the system of indicators (Figure 1).

Figure 1

A methodological framework for assessing the sustainability of the agri-food market in the food security system



Source: developed by the author on the basis of Rosegrant, 2015; Aiyar and Pingali, 2020.

Threats to food security associated with the instability of the dynamics of agricultural production shall be identified at the first stage. The coefficient of sustainability of agricultural and food production shall be determined:

$$K_i = P_{\min i} \Big/ \overline{P_i} \cdot 100\%, \quad (1)$$

where:

K_i is the stability coefficient of the *i*-type food production, %;

$P_{\min i}$ – the minimum volume of the *i*-type food production for the period;

$\overline{P_i}$ – the average volume of food production for the researched period.

There is no normative value for this coefficient, however, if the stability of the food market is assessed on a 100 percent scale, and the greater the value of the stability coefficient in percentage, the higher the stability of the *i*-type food market will be.

The size of threats to food security due to the unstable dynamics of each type of food production shall be determined by the formula:

$$P_i = (P_{\min i} - \overline{N_i}) \Big/ \overline{N_i} \cdot 100\%, \quad (2)$$

where:

P_i is the level of food shortages of the *i*-type, %;

$\overline{N_i}$ – the average volume of demand for the *i*-type food on the market in accordance with the rational level of consumption (potential market capacity) for the period.

We shall consider the level of food shortage threatening in terms of value $P_i \leq 1$.

Further, the assessment of effective demand shall be carried out in accordance with the volume of food production and consumer demand. The potential level of effective demand shall be estimated as the average potential food market capacity for the period under research, i.e., the product of population size and rational consumption of the *i*-type food. The actual level of demand shall be defined as the actual market capacity on average over the period researched.

Strategic directions for the development of the agri-food market shall be substantiated on the basis of the actual and potential capacity of the agri-food market and the ability of producers to maintain the supply and demand balance at the market in the long term. The next step is to assess the balance of the market based on the coefficients:

of potential demand and supply balance according to the formula:

$$K3_i = (N_i) \Big/ \overline{P_i}, \quad (3)$$

where N_i is potential market capacity,

and of actual supply and demand balance according to the formula:

$$K3_i^* = (N_i^*) \Big/ \overline{P_i}, \quad (4)$$

where N_i^* is the actual market capacity.

The food market of the *i*- type shall be considered unbalanced at $K3_i \geq 1$ and at $K3_i^* \geq 1$, because the demand for food exceeds the volume of production in the period researched.

4. Results

The main strategic directions for ensuring food security in Ukraine should be ensuring food independence and self-sufficiency. Food independence for certain types of food is equal to the ratio of the volume of imports and the capacity of the domestic market in physical terms and has a limiting maximum criterion at the level of 30% (Lozynska, 2007, p. 154). Food self-sufficiency is the ratio of production volumes to the domestic use of food in the territory of Ukraine. Food independence and food self-sufficiency are separate indicators of food security, showing how sensitive domestic demand is to imports and domestic production, respectively.

Analysis of food independence for all agri-food products based on the balances of food resources (Table 1) has shown that two trends can be identified in recent years:

1) decreased food independence and increased import expansion (2010-2015);

2) increased food independence and reduced level of import dependence (2016-2019).

Table 1

Food independence by main types of food in Ukraine, %

Types of food	Years									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Meat and meat products	15.88	10.45	17.11	13.04	8.21	7.26	8.31	10.63	11.42	10.18
Milk and dairy products	2.89	2.75	4.20	5.47	3.54	0.87	1.18	1.56	1.86	3.53
Eggs	0.91	0.37	0.50	0.62	0.86	1.59	0.76	1.05	0.72	0.73
Sugar	5.30	2.73	0.59	0.65	0.43	0.26	0.35	0.54	0.22	0.31
Oil and other vegetable fats	47.08	39.86	39.09	49.05	37.62	30.42	43.95	48.19	34.13	35.51
Potatoes	0.51	0.65	0.36	0.37	0.63	0.29	0.45	0.39	0.88	8.78
Vegetables, melons and gourds	4.73	3.84	2.87	3.20	3.05	1.38	1.95	1.91	4.18	7.07
Fruits, berries and grapes	51.42	48.49	48.34	45.88	36.17	27.02	34.59	36.60	45.68	52.30
Bread and bread products	3.43	5.42	4.59	4.92	5.36	4.31	5.58	5.97	6.67	7.14
Food independence	7.66	6.98	7.30	7.67	5.88	3.87	4.94	5.60	7.14	9.54

Source: calculated by the author according to the information provided by the State Statistics Service of Ukraine.

Analysis of the table allows to conclude that food independence exceeds 30% for such food products as oil and other vegetable fats and fruits, berries and grapes. In general, it can be argued that food independence in Ukraine has been ensured for almost all types of food at a high level in recent years. The satisfaction of the needs of the population in vital food products is carried out at the expense of domestic production.

When analysing external economic aspects of the formation of food security of the state, it should be noted that one of the important factors to ensure and maintain it at the strategic level is Ukraine's participation in international trade. The development of foreign trade of the state requires its liberalisation. At the same time, the solution of the strategic task of

ensuring food security in the context of globalisation and reducing trade barriers has led to the fact that Ukraine has become a major importer of food. For certain types of food products, the level of food security has become a threshold. Food imports constitute currently 25-35%, while the share of imports in large cities of the country is about 50-60% (Zalizniuk, 2019, p. 33).

The balance of foreign trade in food using trade balance indicators, defined as the difference in the value of exports and imports of food, and the ratio of imports coverage by exports (balance state index), determined by the ratio of exports of food to imports, shall also be analysed (Lozynska, 2007, p. 120).

The results of the dynamics analysis and the structure of foreign trade in basic food products indicate that the coverage ratio of imports by exports of sugar in 2019 amounted to 62, eggs - 39.6, bread and bread products – 199.1, butter and other vegetable fats – 26.6, milk and dairy products – 1.8 (Table 2).

Table 2

Food foreign trade balance in Ukraine

Types of food	Trade balance, thousand tons						Import-export coverage ratio					
	2014	2015	2016	2017	2018	2019	2014	2015	2016	2017	2018	2019
Meat and meat products	17	87	121	118	116	226	1.1	1.6	1.7	1.5	1.4	1.9
Milk and dairy products	170	386	329	703	627	256	1.5	5.9	4.1	6.3	4.5	1.8
Eggs	140	115	107	148	182	193	21.0	11.5	22.4	22.1	46.5	39.6
Sugar	33	149	500	610	591	244	5.7	38.3	101.0	88.1	198.0	62.0
Oil and other vegetable fats	4355	4093	4885	5749	5727	6394	20.5	26.6	23.3	25.1	23.1	26.6
Potatoes	-23	-2	-22	-6	-6	-272	0.4	0.9	0.2	0.8	0.8	0.0
Vegetables, melons and gourds	69	117	88	315	246	-29	1.3	2.2	1.6	3.4	2.3	0.9
Fruits, berries and grapes	-506	-264	-449	-528	-547	-619	0.4	0.6	0.4	0.4	0.4	0.4
Bread and bread products	33160	38148	41211	42244	42660	57634	127.1	201.8	172.7	166.7	153.4	199.1

Source: calculated by the author according to the information provided by the (State Statistics Service of Ukraine).

The analysis of the independence of the food market is key in Ukraine's foreign trade in food, since, based on the results of calculations of its criteria, legal restrictions on the export and import of food or other restrictions on ensuring food security have been introduced without violating the international legal obligations of the state, in particular the WTO rules (Zalizniuk, 2019, p. 34).

Approbation of the developed methodology for assessing the stability of the food market for 2010-2019 has shown that there is a low level of stability in the production of sugar (67.8%), butter and other vegetable fats (64%), bread and bread products (65.2%) during the researched period.

The level of threat to food security due to the shortage turned out to be the most threatening for meat and meat products (-41.4%), milk and dairy products (-42.1%), sugar (-24.3%), fruits, berries and grapes (-45.5%) (Table 3). This means that, for the specified types of food, on average, there was a shortage of domestic production volumes compared to consumption volumes over the period.

Table 3

Stability of the agri-food market of Ukraine for the main types of food and the level of food security threat in 2010-2019

Types of food	Sustainability ratio of food production, %	Level of threat to food security due to deficit, %
Meat and meat products	89.6	-41.4
Milk and dairy products	90.0	-42.1
Eggs	86.6	18.5
Sugar	67.8	-24.3
Oil and other vegetable fats	64.0	443.1
Potatoes	85.1	243.4
Vegetables, melons and gourds	87.9	25.5
Fruits, berries and grapes	85.3	-45.5
Bread and bread products	65.2	785.2

Source: calculated by the author according to the information provided by the State Statistics Service of Ukraine.

Table 4 shows the results of assessing the effective demand of the population and the balance of supply and demand in accordance with the actual and potential values of the indicators.

Table 4

Actual and potential level of effective demand and balance of the agri-food market of Ukraine in 2010-2019

Types of food	The actual level of effective demand	Potential level of effective demand	The ratio of potential supply and demand	The ratio of actual supply and demand
Meat and meat products	2311	3 514	1,53	1,02
Milk and dairy products	9138	16 691	1,55	0,84
Eggs	736	736	0,73	0,73
Sugar	1512	1 669	0,34	0,33
Oil and other vegetable fats	558	571	0,03	0,03
Potatoes	6038	5 447	0,54	0,60
Vegetables, melons and gourds	7036	7 072	2,80	2,78
Fruits, berries and grapes	2327	3 953	0,07	0,04
Bread and bread products	4738	4 436	0,04	0,04

Source: calculated by the author according to the information provided by the State Statistics Service of Ukraine.

The analysis has revealed that the potential demand for meat and meat products, milk and dairy products, vegetables and melons and gourds is not balanced in Ukraine, as well as the

actual demand for meat and meat products, vegetables and melons and gourds, since the balance coefficients exceed 1. This means that it is necessary to increase the volume of production of these types of food, or compensation through imports in order to meet the consumer demand of the population.

5. Discussion

The economic integration provides that it is important to assess and strengthen food self-sufficiency. One of the means for increasing food independence is to increase the volume of domestic production. Analysis of food independence and self-sufficiency in previous years has shown that the potential of the agricultural sector of Ukraine can meet the domestic needs of the state for food. Even the actual share of agri-food imports can be replaced by domestic production. Import-substituting should be primarily food products for final consumption, sold directly to the population through a network of retail trade enterprises. At the same time, it is necessary to replace imported raw materials with Ukrainian counterparts at equal price and of the same quality. Imports of commodities, without which domestic food production is unprofitable or impossible, should be carried out with a minimum processing degree in order to create maximum value-added within the state. It is necessary to establish priority sectors in terms of import substitution, as well as constant monitoring of imports and sales of imported food products in the domestic market.

The analysis conducted has revealed that meat products, fish products, fruits, berries, grapes and the like have the greatest potential for domestic production. State support is carried out through the application of tariff and non-tariff protection mechanisms at the maximum level permitted by agreements with the WTO and the attraction of investments for the modernisation and development of strategically important sectors of the agricultural sector (beet growing, vegetable growing, livestock, fish farming, sugar production and others).

An important strategic task in the context of integration into the international economy is to improve the commodity structure of Ukrainian exports. It is predominantly of raw material nature with a large share of crop production. Significant volumes of agricultural raw materials are exported to the EU countries, then processed at foreign enterprises and imported into Ukraine in the form of finished products. Ensuring food security requires an increase in the volume of products processing by domestic food industry enterprises and in the export of products with higher added value. Now the investment climate within Ukraine does not facilitate international capital import. The main strategic directions for its improvement should be the trade policy mechanisms, stimulation of the joint ventures creation and joint investment projects development with the EU in the trade and economic sphere (Ostashko, 2016).

The strategic direction to ensure food security in the context of Ukraine's integration into the world economy should be the improvement and development of the food quality and safety control system.

The EU-Ukraine Association Agreement prescribes that the state has pledged to create conditions for the development of trade and economic relations with the aim of stage-by-

stage integration of Ukraine to the EU market through a free trade zone, accelerate economic reform based on market principles and adapt legislation in the food sector to EU legal norms. The State Service of Ukraine for Food Safety and Consumer Protection has been established in response to the requirements established.

Sanitary and phytosanitary measures are aimed at protecting consumers, animals and plants from pathogens and pests (hazardous organisms) that may be found in goods imported. The WTO rules prescribe that a state has the right to create its own system of protection, which shall be scientifically well-founded, based on international standards and recommendations and not contain hidden obstacles to food imports (Agrarian and rural development, 2018, p. 106). Ukraine shall adapt more than 250 EU acts into national legislation in such areas as state control in the field of sanitary and phytosanitary measures, food and feed safety, animal health and welfare, plant health, etc., in accordance with the action plan for the implementation of the Association Agreement in the field of sanitary and phytosanitary measures by the end of 2021 (Ostashko, 2016).

A European model of the food safety and quality assurance system has been introduced in Ukraine in order to achieve the objectives set at the legislative level (Ostashko, 2016).

A clear and transparent system of registration of certification bodies, market operators and organic seeds has been introduced, a mechanism of state control (supervision) over the activities of subjects of the organic market has been determined and establishes their responsibility for violation of legislation in this area. The procedures for certification of organic production and circulation of organic products have been regulated, and requirements for certification bodies and their functions have been established.

The norms of the current legislation have been adapted to the requirements of the EU in the field of trade in plants, as well as plant seeds, products derived from plants, fruits and vegetables, and also in the field of animal health and welfare, private veterinary practice, the circulation of veterinary drugs (Candel et al., 2014).

A large-scale work has been carried out in the direction of Ukraine's integration into the EU economy, aimed at developing the regulatory framework and its adaptation to international standards in order to ensure food security of the state by ensuring the safety and quality of agricultural products and food.

An important strategic direction to ensure food security is strengthening the competitive position of Ukraine in the international food market and using the opportunities of the Free Trade Zone with the EU for the development of domestic exports.

Thus, ensuring food security in the context of integration into the world economy, including the EU economy, requires Ukraine to take both justified measures to reduce imports of goods, the production of which is more expedient within the country, and to make an increase in exports to EU countries in order to strengthen the role of the state in the world markets and ensure global food security. To increase exports, it is necessary to increase quotas for duty-free import into the EU of goods produced primarily or at least partially by small and medium-sized producers (honey, mushrooms, processed tomatoes, grape and apple juice, etc.). It is necessary to promote these products in the EU markets under their own brands, which will allow them to be sold at a price favourable for export outside of zero-tariff quotas.

Strengthening the role of Ukraine in solving the world food problem lies in the implementation of mechanisms for increasing the competitiveness of domestic goods in international markets and increasing food exports. Government regulatory mechanisms should be flexible enough to protect domestic producers and at the same time comply with WTO requirements, in particular when applying protective measures such as duties and import tariffs on food. It is also necessary to strengthen state control over monitoring the balance of food to prevent losses from export restrictions.

Strengthening the food security of the state based on the protection of the internal market is based on a system of mechanisms for integrating the agricultural and food sectors and the domestic market of agricultural products and food into the global economic system and adapt the means of quality control and safety of products and food to the international standards.

Ensuring Ukraine's national interests in the international agricultural market and food independence requires the creation of an optimal structure for export-import operations. For this, within the framework of the food security and implementation strategy, it is necessary to continuously monitor the dynamics and structure of imports, track and analyse important export-oriented goods and establish indicative indicators for limiting their imports, and adopt the national concept of food independence as a component of the state food security strategy.

The system of strategic priorities for ensuring food security of the state is subject to a common strategic goal – strengthening the food independence of Ukraine through the mechanisms of protecting the domestic agri-food market and strengthening the international position in solving the global food problem, maximising the potential of domestic agro-industrial production. As a result, this makes it possible to take into account external and internal threats to food security within the context of intensification and deepening of economic integration processes and substantiate the appropriate mechanisms for the formation and implementation of a food security strategy in order to most effectively use the internal potential and obtain strategic advantages from foreign trade and interstate cooperation in the food sector.

6. Conclusions

Achieving the stability and balance of the agri-food market in terms of supply and demand is a priority for ensuring food security and an adequate level of food consumption by the population. Methodological provisions have been developed to assess the stability of the agri-food market based on a system of indicators of production stability, the magnitude of food shortages, and the level of effective demand and balance. Based on the calculations, it has been found that there is a low level of sustainability in the production of sugar (67.8%), butter and other vegetable fats (64%), bread and bread products (65.2%) in 2010-2019. The level of threat to food security due to a deficit in domestic production turned out to be the most threatening for meat and meat products (41.4%), milk and dairy products (42.1%), sugar (24.3%), fruits, berries and grapes (45.5%). Therefore, in order to meet consumer demand, it is necessary to increase the production of these types of food or to compensate for them through imports, which threatens food independence in the long term and will contribute to the further degradation of agro-industrial production.

The strategic directions for ensuring the food security of the state in the context of Ukraine's integration into the world economy is the improvement and development of the system of control over the quality and safety of agricultural products and food in accordance with international standards, increasing food independence and self-sufficiency in products with a high rate of surplus-value, strengthening the role of Ukraine in ensuring international food security and increasing exports of food and organic agricultural products. To do this, it is necessary to harmonise the regulatory framework in accordance with the requirements of the WTO and the EU in the areas of product quality and safety, consumer protection, conduct a mandatory and regular audit of food industry enterprises for compliance with safety and quality standards, as well as strengthen control over the imported products.

It is reasonable to ensure food independence and self-sufficiency through mechanisms for protecting the internal market based on import restrictions, government incentives for the production of certain types of food products, the use of the mechanism of tariff quotas within the framework of bilateral trade agreements, bans and restrictions on imports based on sanitary and phytosanitary measures. In addition, the strategic directions for increasing the role of Ukraine in international food security are an increase in quotas for food imports to the EU member states, the development of external sales markets for Ukrainian exporters, government stimulation of exports and the participation of small and medium-sized businesses in it.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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IMPACT OF AGRICULTURE LAND AND POPULATION DENSITY ON ECONOMIC GROWTH: AN EMPIRICAL EVIDENCE FROM INDIA[4]

India is an agrarian economy and stands 2nd in the world population. India is in sixth place in the list of the most significant economies globally and 3rdin the purchasing power after the United States and China. However, India still has many growing concerns like a declining share of agriculture in the GDP, rapid increment in the population, unemployment, and others. The present study investigated the linkage between agricultural land, population density, and economic growth in India. The data from 1970 to 2019 was analysed using a vector error correction model (VECM) and Granger causality test. Further, the variance decomposition (VDC) and impulse response function (IRF) was employed for a detailed explanation of the variables' relationship and innovation responses of explanatory variables. The Granger causality test results suggested that agricultural land and the gross domestic product have a neutral relationship. The population density and gross domestic product support the feedback hypothesis. Additionally, population density affects agricultural land, whereas agricultural land does not affect population density. From a policy perspective, policymakers should frame strategies to decide the nation's comprehensive significance of population density. Too high populace density diminishes the natural endowment per capita. However, it facilitates infrastructure development, prompting an ideal populace density for economic development.

Keywords: Agricultural Land, Population Density, Granger Causality, Economic Growth
JEL: N55; O13; Q10; Q56; F43

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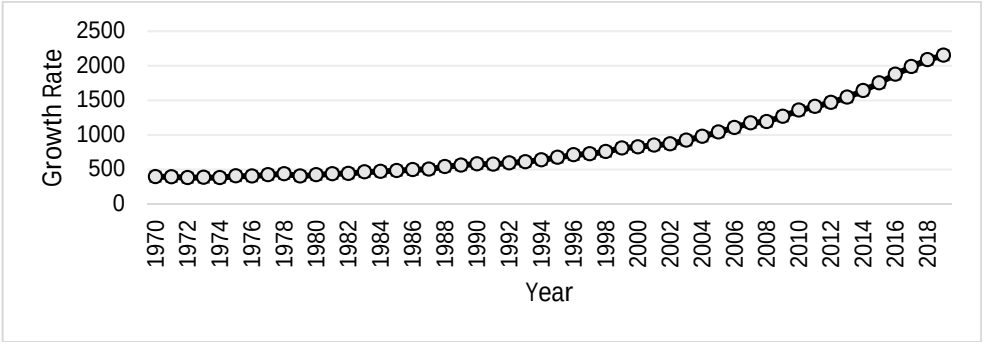
1. Introduction

Agriculture plays a strategic role in developing nations globally, especially in nations like India. Most of the population in developing nations living in rural areas, and the primary source of their livelihood in these countries is agriculture. According to the census of 2011, 69.9 percent population of India lives in rural areas and is involved in agriculture & its allied activities for their livelihood. India is in fifth place in the list of the most significant economies globally and 3rd in the purchasing power after the United States and China. However, India still has many growing concerns like a declining share of agriculture in the GDP, rapid increment in the population, unemployment, and others. Since the Indian economy has grown and diversified, the agriculture sector's contribution to Gross Domestic Product (GDP) has steadily declined from 1951 to 2011 (FAO).

At the time of the independence, agriculture was the primary sector contributing to India's GDP, followed by the industry & manufacturing, and service sectors. As the economy starts to grow, structural changes are taking place, and the share of agriculture is continuously declining. During the time of independence, agriculture contributes around 53 percent of India's GDP, and now this time service sector in India takes over agriculture and industry & manufacturing. The trend of economic growth over the years is shown in Figure 1.

Figure 1

Trend of economic growth

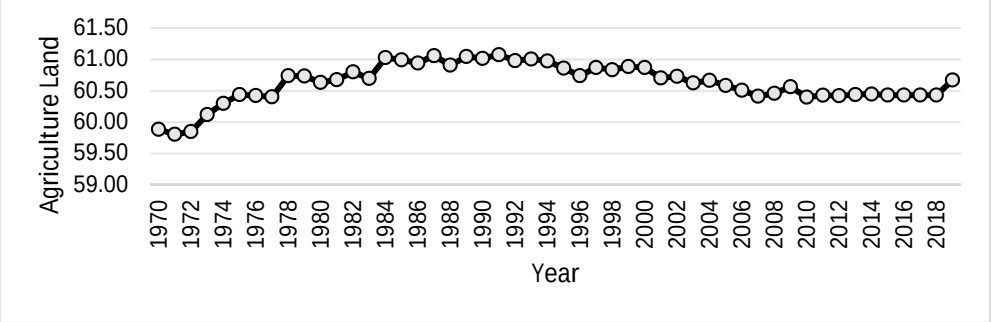


Source: www.data.world.co.in.

In 2020-2021, first time in the last 17 years agriculture sector made a record by contributing to India's GDP by approximately 20 percent (pib.gov.in). The covid-19 pandemic has destroyed most of the national economies around the globe. The Indian economy also showed a negative growth rate during the covid-19 period in 2020-2021, but agriculture is the only sector that had a positive growth rate in the Indian economy (Cariappa, 2021). Agriculture land is defined as "land currently used to produce agricultural commodities including forest products or land that have the potential for such production (Brewer, Boxley, 1981). The trend of agriculture land over the years is shown in Figure 2.

Figure 2

Trend of agriculture land

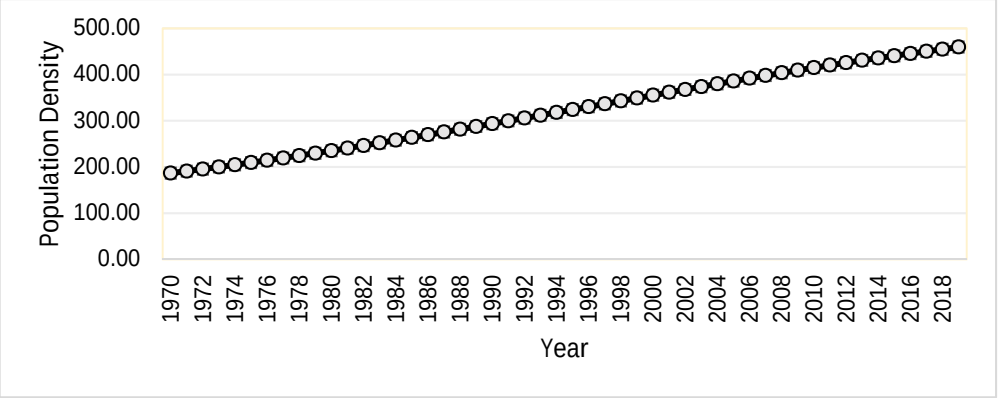


Source: www.data.world.co.in.

According to the Indian Council of Agricultural Research, India is blessed with large arable land with 20 Agri-climate, a wide range of climate conditions and soil types, and can grow different crops. Notwithstanding these realities, the average productivity of many crops in India is very low. India's arable land space of 159.7 million hectares (394.6 million sections) is the second biggest after the United States. Its gross irrigated crop area of 82.6 million hectares (215.6 million sections of land) is the biggest in the world. These lands have a favourable combination of soil quantity, growing season, moisture supply, size and accessibility". The rapidly growing population coupled with enlarged food demand entails either an extension of agricultural land or adequate production gains from current resources (Fitton et al., 2019). The trend of population density is shown in Figure 3.

Figure 3

Trend population density



Source: www.data.world.co.in

Sustainable use of agriculture is essential for economic growth (Hamidov et al., 2016). Land-use changes affect the environmental quality mainly when affected lower-quality lands are

environmentally sensitive (Lubowski, 2006). There are severe and rising concerns about the effects of fast population growth on the environment and natural resources, including forests, land, water, biodiversity, and other resources (World Commission on Environment and Development, 1987; Ehrlich, Ehrlich, 1990). The impact of population growth on agriculture and natural resource management has been debated, at least from Malthus (Malthus, 1872). In India, the increase in population size due to unplanned activities, urbanisation is increasing rapidly, which reduces the agricultural land and has a serious impact on the natural resources (Shivani, 2017). Fast populace growth appears to influence the farming area straightforwardly, which upsets the food supply in rural and urban regions. Therefore, food safety and increasing agricultural land losses have become a global concern problem (Oko et al., 2021).

Most of the studies in India are on the economic growth nexus with various variables (for example, Brewer, Boxley, 1981; Mahmood, 2012; Hamidoy et al., 2016; Purnami, Santini, 2017; Hinz et al., 2020). Scant literature was available on economic growth nexus on agricultural land and population density. India is an agrarian economy and stands 2nd in the world population. Seeking for the significant importance of these variables in economic growth, the present study examined the agricultural land and population density linkage with economic growth. The remaining parts of the study are organised as follows: Section 2 discusses the literature review. Methodology and results are discussed in Sections 3 and 4. Finally, the conclusion and policy recommendations are suggested in Section 5.

2. Literature Review

The ample literature was available on the economic growth nexus with various variables. So, in this section, an attempt was made to explore the nexus of economic growth with agricultural land and population density. Lubowski (2006) assessed the association between agriculture land-use changes, soil productivity, and pointers of environmental sensitivity. The results discovered that land moving among cultivated and less intensive agricultural uses is less valuable and more vulnerable to erosion than other cultivated land, both broadly and locally. Sali (2012) investigated the factors responsible for decreasing the amount of agricultural land available in developed countries and explored the negative correlation between GDP and agricultural change to discover the contributing factors behind this decline. Paned data was used in this analysis of the period 1995-2009. The analysis was carried out on a penal of 30 countries with appear middle or high income in the period 1995-2009 period. The study results indicated that the decrease in the cropland that is currently taking place in developed nations is caused by the expansion of forested areas, the urban expansion, and the abonnement of the least productive areas.

Mahmood and Chaudhary (2012) analysed the effect of foreign direct investment on carbon dioxide emissions in Pakistan". It takes carbon dioxide emissions and FDI as a dependent variable, the share of manufacturing value-added, and population density as independent variables. Econometrics tools like ADF, PP, Ng-Perron, Zivot-Andrews unit root test, and ARDL model were utilised in the study. The results showed that the long-run relationship in the model, but the short-run relationship does not exist. FD, manufacturing value-added, and

population density have a positive impact on carbon dioxide emissions. Salvati (2013) presented a quantitative evaluation of rural land-use changes in a region devoted to agriculture and experiencing an increasingly higher human effect from urbanisation and land abonnement. The evaluation was carried out at the municipality scale over 40 years (1970-2010) using the national agriculture census data. The results showed how reducing the area devoted to traditional crops and the spreading of high-intensity crops decrease the quality of rural landscapes, especially in areas with a "historical" attitude toward agriculture.

Maletta (2014) analysed the trends and prospects in agriculture and food production related to land & land productivity. He discussed this issue on a global level. Secondary data were used in the study that has been taken from the statistical database complied by FAO. The study found that the world agriculture output, both for food and non-food farm production, has been rising steadily ahead of the population. Also, it reveals that agricultural growth in the past half country, especially in later decades, was primarily due to higher land productivity with just a tiny contribution from additional land. Ohlan (2015) investigated the impact of populace density, energy consumption, economic growth, and trade openness on CO2 emissions in India. The review utilised the yearly data for the period 1970-2013. The autoregressive distributed lag model and vector error correction model were utilised in the study. The study discovered that populace density, energy consumption, and economic growth have a statistically significant positive effect on CO2 discharges both in the short-run and long run. The results also showed that populace density is the primary factor influencing CO2 emissions changes among these three variables.

Nzunda and Midtgaard (2017) analysed the spatial relationship between deforestation and forest protection area, accessibility, human population density, and regional gross domestic product. The period of the study was taken from 1995-2010. The study used the Multiple Linear Regression Model for the statistical analysis. The results of the study indicated that protected areas are essential in reducing deforestation. Higher population density and gross domestic product would be associated with less deforestation if they switched from dependence on wood for various uses and deforestation-based livelihoods. Purnami and Santini (2017) examined the impact of population growth on agricultural land conversion. A sample of 62 farmers was taken in the study to achieve the objective of the analysis. Data obtained from the sample were analysed through the SEM-PLS method. The study found that population growth and agricultural land conversion had a positive and significant effect on the conversion of agricultural land.

Lanz et al. (2017) examined how uncertainty and changeability in agricultural output destroy the capacity to feed a huge, rising, and growing worldwide populace. The study depended on the two-sector Schumpeterian model of growth. They utilise the secondary data for the period 1960-2010. The study discovered that advancement in agriculture innovation is a crucial determinant of sufficient food creation in a world with a rising populace and per-capita income. The results likewise showed that the populace is significantly influenced by variability in TFP (Total Factor Productivity). Reddy and Dutta (2018) investigated the effect of agricultural input use on agricultural gross domestic product. They used the secondary data for the period of 1980-1981 to 2015-2016. A simple regression method was used to assess the impact. The results demonstrated that factors like fertilisers and net irrigated areas are not statistically significant. It implies they do not have a significant effect on agricultural

GDP during the period 1980-2016. Conversely, factors like pesticides, power, precipitation, and seeds significantly affect the agricultural GDP during this period.

Fitton et al. (2019) analysed the potential trends, dangers, and vulnerabilities identified with land use and land accessibility that might arise from reducing water accessibility. The results demonstrated that around the world, 11-10 percent of crops and gross land can be vulnerable to a decrease in water accessibility and may lose some functional, productive capacity. Lessening farming regions related to dietary changes offer the most significant buffers against land loss and food instability. Apata et al. (2019) studied the connection between the agricultural land-use system and climate change. For this purpose, the farm-level cost-route survey of cross-sectional data of 800 respondents was used. The data were analysed by using statistical tools and techniques like the trilogarithms model and multivariate probit model. The study results indicated a strong relationship between efficient use of agricultural land adaptive processes to climate change. Hinz et al. (2020) assessed the pathways of agricultural productivity, land use, and land cover changes in India and their effect on earthbound biodiversity and carbon stockpiling. The results showed that it is essential that the agricultural lands will probably grow, and existing farmlands need to be strengthened to meet the future food production demands.

Considering the review above, there is a need to work on the interaction of agricultural land and population density with economic growth. Thus, this paper has made an attempt to investigate the association between agricultural land, population density, and economic growth in India.

3. Data and Methodology

3.1. Data

Gross Domestic Product (GDP), Agricultural Land, and Population Density of India are retrieved from World Data Indicators (WDI). The yearly data for the period 1970-2019 is selected for the analysis. The measurement units of data are given below in Table 1.

Table 1

Variables Description

Variable	Symbol	Measurement
Gross Domestic Product	GDP	"Constant 2010 US$, Per Capita"
Agricultural Land	AL	"Percentage of Land Area"
Population Density	POP	"People Per Square Kilo Meter of Land Area"

Source: www.data.world.co.in.

3.2. Econometric Model and Methodology

3.2.1. Unit root test

In the first phase, Augmented Dickey-Fuller (ADF) was used to determine the stationarity of the data set. A null hypothesis is set, H_0: $Series\ has\ a\ unit\ root$, i.e., series is non-stationary (Dickey, 1981). So, the subsequent equation is set:

$$\Delta Y_t = \alpha_1 \beta_0 \beta_1 + \beta_{AL} AL_t + \beta_{POP} POP_t + \mu_t \quad (1)$$

Where Y_t, AL_t, POP_t and μ_t are Gross Domestic Product, Agricultural Land, Population Density and μ_t the error term.

3.2.2. Johansen co-integration

The co-integration test assists in the confirmation of the null hypothesis [H_0: $There\ is\ no\ co-integration$] (Johansen, 1988). The Trace test and the maximum eigenvalue test are the two components of the Johansen co-integration tests.

$$LR(r_0, n) = -T \sum_{k=r_{0+1}}^{n} In\,(1 - \lambda_i) \quad (2)$$

$$LR(r_0 + r_0 + 1) = -TIn(1 - \lambda r_0 + 1) \quad (3)$$

3.2.3. Vector error correction model (VECM)

The third stage will allow for investigating both the short-run and long-run behaviours of co-integrated patterns (Engle, 1987). The standard ECM for the co-integrated sequence is:

$$\Delta GDP_t = \alpha_0 + \sum_{k=1}^{n} \beta_i\, \Delta GDP_{t-i} + \sum_{k=0}^{n} \delta_i \Delta_{t-i} + \varphi z_{t-1} + \mu_t \quad (4)$$

$$\Delta AL_t = \beta_0 + \sum_{k=1}^{n} \alpha_i\, \Delta AL_{t-i} + \sum_{k=0}^{n} \delta_i \Delta GDP_{t-i} + \varphi z_{t-1} + \mu_t \quad (5)$$

$$\Delta POP_t = \beta_1 + \sum_{k=1}^{n} \beta_i\, \Delta POP_{t-i} + \sum_{k=0}^{n} \delta_i \Delta GDP_{t-i} + \varphi z_{t-1} + \mu_t \quad (6)$$

Where, z is the ECT (Error Correction Term), and the OLS (Ordinary Least Square) residual from the subsequent long-run co-integrating regression: $GDP_t = a_0 + a_1 GDP_t + \mu_t$, $AL_t = \beta_0 + \beta_1 AL_t + \mu_t$ and $LPOP_t = \beta_1 + \beta_2 POP_t + \mu_t$ are defined as $z_{t-1} = ECT_{t-1} = GDP_{t-1} - \beta_0 - \beta_1 AL_{t-1} - \beta_1 - \beta_2 POP_{t-1}$. To confirm the VECM outcomes, a conventional Granger Causation Test is used that checks the causality flow direction from one component to another and conversely (Granger, 1969). The Granger causality test model equation:

$$\Delta GDP_t = \alpha + \sum_{i=1}^{k} \beta_i\, \Delta GDP_{t-i} + \sum_{i=1}^{k} \psi_i \Delta AL_{t-i} + \sum_{i=1}^{k} \psi_i \Delta POP_{t-i} + \mu \quad (7)$$

$$\Delta AL_t = \beta_0 + \sum_{i=1}^{k} \beta_i\, \Delta AL_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta GDP_{t-i} + \sum_{i=1}^{k} \psi_i \Delta POP_{t-i} + \mu \quad (8)$$

$$\Delta POP_t = \beta_1 + \sum_{i=1}^{k} \beta_i\, \Delta POP_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta GDP_{t-i} + \sum_{i=1}^{k} \psi_i \Delta AL_{t-i} + \mu \quad (9)$$

Whereas α, β, ψ, and γ are component to be projected and μ signify the serial error terms, $GDP_t\ AL_t, and\ POP_t$ are specified adherence for the t periods; Δ is the variance operator; k mentions to the lag numbers; α, β, ψ, and γ all are the assessment factors.

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 exhibits the summary numbers of included variables, namely economic growth, agricultural land, and population density. The mean of economic growth is the highest (860.7222) and the lowest is for the agricultural land (60.62765). The standard deviation of the agricultural land is the lowest among all studied variables. The skewness of the economic growth and population density is positive while negative for the agricultural land. It implies that agricultural land has the option of negative earnings. All variables' series are normally distributed as p-value is greater than 5 percent.

Table 2

Descriptive statistics of Variables

Statistics\Variables	GDP	AGL	POP
Mean	860.7222	60.62765	322.1097
Median	656.9442	60.66915	321.1238
Maximum	2151.726	61.07447	459.6329
Minimum	381.5396	59.80681	186.7320
Std. Dev.	509.6078	0.310281	84.78097
Skewness	1.091121	-0.707739	0.017486
Kurtosis	3.074501	3.321711	1.707492
Jarque-Bera	9.932772	4.389743	3.482915
Probability	0.126968	0.111373	0.175265
Sum	43036.11	3031.382	16105.48
Observations	50	50	50

Source: Author's Calculation.

4.2.2. Unit Root Test

There is a requirement for data series to be stationary in the analysis. The outcomes of the unit root test are shown in Table 3. For stationary analysis, an increased Dickey-Fuller (ADF) test is used. The table revealed that at first difference, all variables' p-value is less than 5 percent which indicates the decision of rejection of null hypothesis H0: series has unit root or not stationarity. The results indicate that series are integrated at I (1).

Table 3

Unit-Root Test (Augmented Dickey-Fuller)

Variables	ADF Statistics	First Difference (P-Values) *
GDP	-4.954348	0.0011
AGL	-8.086072	0.0000
POP	-3.160874	0.0291

Source: Author's Calculation.

The findings show that I (1) series are integrated. However, the appropriate lag length or number of lags in Vector Auto-regression (VAR) must first be selected before the Johansen co-integration and the VECM analysis. The various lag values showing the log L, LR, FPE, AIC, SC, and HQ are presented in Table 4. In all cases, however, lag 2 had a significant

value. Thus, 2, the appropriate lag duration, may be calculated and is utilised for subsequent studies analyses.

Table 4

Result of Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-595.0625	NA	13331744	24.91927	25.03622	24.96347
1	-125.1230	861.5559	0.060870	5.713456	6.181257	5.890239
(2)	-60.66153	110.1216*	0.006068*	3.402564*	4.221214*	3.711933*

* Indicates lag order, LR- sequential modified LR test statistics (each test at 5% level, FPE- Final prediction error, AIC- Akaike's information criterion, SIC- Schwarz information criterion, HQ-Hannan Quinn information criterion".

Source: Author's Calculation.

4.3. Johansen Cointegration Test

After knowing that all variables are stationary and integrated at I (1); further the Johansen Cointegration test is run. Johansen's test has further two tests that are Trace test statistics and Maximal eigenvalue statistics. The null hypothesis of this test is H0: There is no co-integration in series. Table 5 discloses both tests result. The values shown for the hypothesised number of co-integrated equation none, at most 1 and at most 2, both trace and eigenvalue statistics reject the null hypothesis as obtained statistics values for all is greater than its critical values at 5 percent. The results indicated that at most 2 vectors could be formulated. So, this test confirmed the presence of long-run association among variables series.

Table 5

Johansen Cointegration Test

Trace Test Statistics				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.683162	74.71081	28.87707	0.0000
At most 1*	0.264742	20.69074	15.49471	0.0075
At most 2*	0.124268	6.236674	3.831466	0.0125
Maximal Eigenvalue Statistics				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.683162	54.02007	21.13162	0.0000
At most 1*	0.264742	14.45406	14.26460	0.0467
At most 2*	0.124268	6.236674	3.831466	0.0125

Note: Trace test statistics and Max-eigenvalue test indicate 3 co-integrating eqn(s) at the 0.05 level, *denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values".

Source: Author's Calculation.

4.4. Vector Error Correction Model

As specified in the results of the Johansen co-integration test, the VECM test has to perform to study the long-run relationship and how the divergence of variables is corrected. The analysis of VECM is disclosed in Table 6, along with the coefficients, t-statistics, and p-value. In this study, economic growth is the dependent variable and agricultural land and population density are explanatory variables. Both long-run and short-run effects are enclosed by the VECM test. The ECT and adjustment speed came out to be -0.110743 with

significant t-statistics value. This negative and significant value satisfied the condition of continuation of the long-run relationship among variables.

The negative value (-0.110743) specified that prior period divergence in the variables is corrected at a speed of 11 percent in every year. It indicates when the co-integrated series experience the disequilibrium; GDP modifies itself and maintains equilibrium. Observing lagged value of studied variables, at lag one values of GDP and POP is significant, which indicates the presence of short-run causality moving towards GDP. On the other hand, at both lags, the agricultural land coefficient is insignificant, which specified the short-run causality absence from AGL towards GDP.

Table 6

Vector Error Correction Model

Dependent Variable →	D(GDP)		
	coefficient	t-statistics	p-value
Cointeq1	-0.110743	-2.575274	0.0139
D (GDP (-1))	0.324585	2.097324	0.0425
D (GDP (-2))	0.103605	0.679141	0.5011
D (AGL (-1))	-23.57923	-0.768529	0.4468
D (AGL (-2))	-5.371277	-0.191183	0.8494
D (POP (-1))	-99.29204	-1.701489	0.0968
D (POP (-2))	33.66858	0.499474	0.6203
C	391.6578	2.899656	0.0061

Source: Author's Calculation.

Further, with the help of the Wald Test existence of a short-run relationship is verified whether jointly POP (-1) and POP (-2) granger cause the GDP or not. The null hypothesis POP (-1) = POP (-2) = 0 was evaluated using the Wald Test for POP (-1) and POP (-2) coefficients. The null hypothesis is rejected because the p-value (0.0014) for this chi-square statistical is less than 5 percent, according to the data in Table 7. As a result, it is possible to conclude that there is short-run causation between POP and GDP.

Table 7

Wald Test

Test Statistic	Value	Degree of Freedom	Probability
F-statistic	6.557487	(2, 39)	0.0035
Chi-square	13.11497	2	0.0014

Source: Author's Calculation.

To check the fitness model parameters, there is a need to perform the serial correlation test. This test helps in verifying the absence the serial correlation among variables under study. The serial correlation of Breusch and Godfrey in residual diagnostic, the LM test is chosen by identifying two lags (Table 4). The null hypothesis was H0: there is no serial correlation. The results presented in Table 8 indicated that the null hypothesis could be ignored since the p-value is more significant than 5 percent based on the prob. chi-square value (0.1958). As a result, there is no indication of serial correlation across components, which is a positive indicator for the model.

Table 8

Breusch-Godfrey Serial Correlation LM Test

F-statistic	Obs* R-squared	Prob. F (2,37)	Prob. Chi-Square (2)
1.379336	3.261114	0.2644	0.1958

Source: Author's Calculation.

The CUSUM and CUSUM Square tests are used to determine the validity of the model constants. Figure 4 and Figure 5 show the plot of both tests. Both figures depict the blue line for model constants are within the limits of 5 percent significant level, which verifies that variables are stable and consistent.

Figure 4

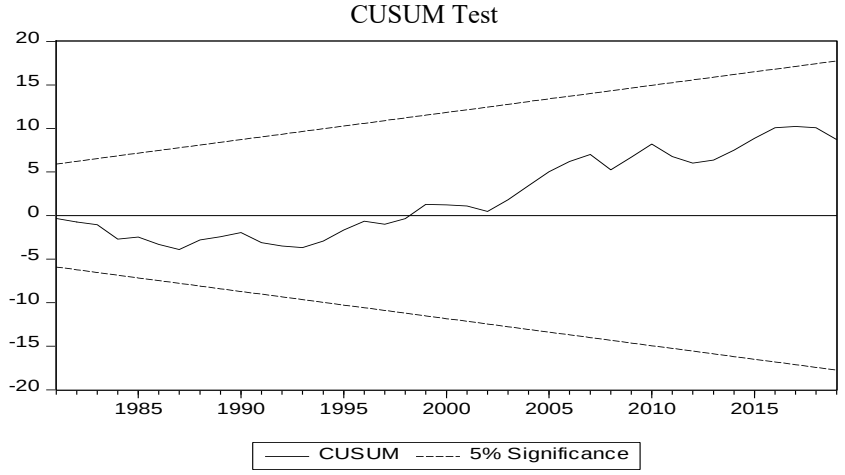
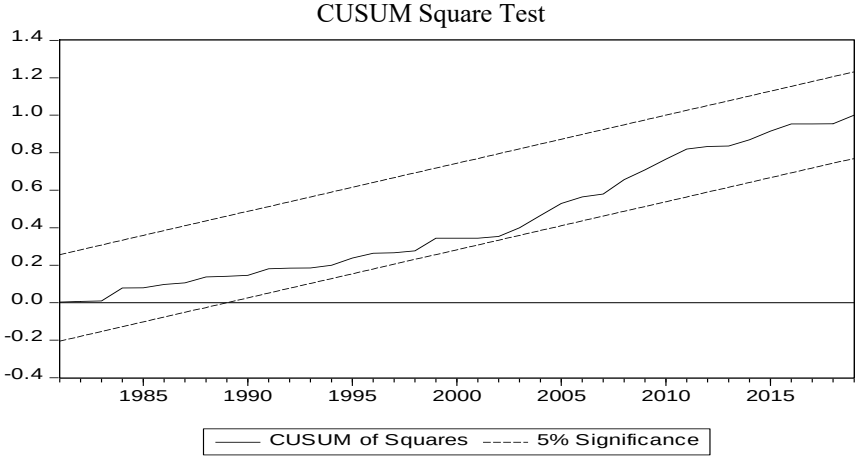


Figure 5



4.5. Pairwise Granger Causality Tests

The Pairwise Granger Causality test was used to confirm the VECM results. This test facilitates the verification of the long-run and short-run causal connections between variables. The results are presented in Table 9. Based on f-statistics table revealed that AGL and GDP does not granger cause each other as p-value is greater than 5 percent significance level. Observing the causal relationship between POP and GDP, it suggested the bi-directional causal relationship between POP and GDP. Thus, it supports the feedback hypothesis and confirms the results of VECM analysis and Wald test (Table 7 and Table 8). Further, the table shows that null hypothesis H0: POP does not granger causes AGL, is rejected as p-value is less than 5 percent. This directs to the decision that changes in POP cause changes in the AGL.

Table 9

Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.
AGL does not Granger Cause GDP	0.19532	0.8233
GDP does not Granger Cause AGL	1.66655	0.2009
POP does not Granger Cause GDP	3.30069	0.0464
GDP does not Granger Cause POP	3.83334	0.0294
POP does not Granger Cause AGL	3.26722	0.0478
AGL does not Granger Cause POP	2.27646	0.1149

Source: Author's Calculation.

4.6. Variance Decomposition Analysis

Further, the present study performed the VDC for a detailed understanding of the relationship among variables. The findings are exhibited in Table 10. The table demonstrates that in the first period, economic growth explains 100 percent variations itself. In a short period, 85 percent of variations are due to the GDP itself and 14 percent is described by the POP. In the long run, i.e., in period 20, POP explained the around 12 percent variability in GDP while AGL explained only 1.43 percent.

Considering the forecasted error variance of AGL, the table showed that an 88 percent variation in AGL is produced by the AGL itself in the short run from 1 to 5 periods. In the long run, the study found that variance error in AGL is explained by itself around 18 percent, and the most significant variance error is come out to be from economic growth that is 72.48 percent. Regarding variance decomposition of POP, 75 percent of shocks is explained by POP itself in first period. In the long-run period Agricultural land contribution is slightly 8 percent, while GDP causes the highest variation, that is 74.87 percent in POP.

Table 10

Variance Decomposition

Variable	Period	S.E.	GDP	AGL	POP
GDP	1	18.98976	100.0000	0.000000	0.000000
	5	61.72369	91.23599	3.122957	5.641050
	10	148.5493	85.08232	0.908516	14.00917
	15	254.7994	85.74372	1.323320	12.93296
	20	332.7605	86.80778	1.427798	11.76442
AGL	1	0.089797	3.953143	96.04686	0.000000
	5	0.110531	11.47477	88.45129	0.073939
	10	0.136015	23.75639	76.02557	0.218033
	15	0.184832	49.43069	46.31831	4.251008
	20	0.294007	72.48104	18.45573	9.063233
POP	1	0.015931	23.39519	0.906537	75.69827
	5	0.393381	53.98045	4.633639	41.38591
	10	1.878888	67.52774	7.238633	25.23363
	15	4.131874	72.53774	7.874409	19.58785
	20	6.500451	74.87460	8.006119	17.11928

Source: Author's Calculation.

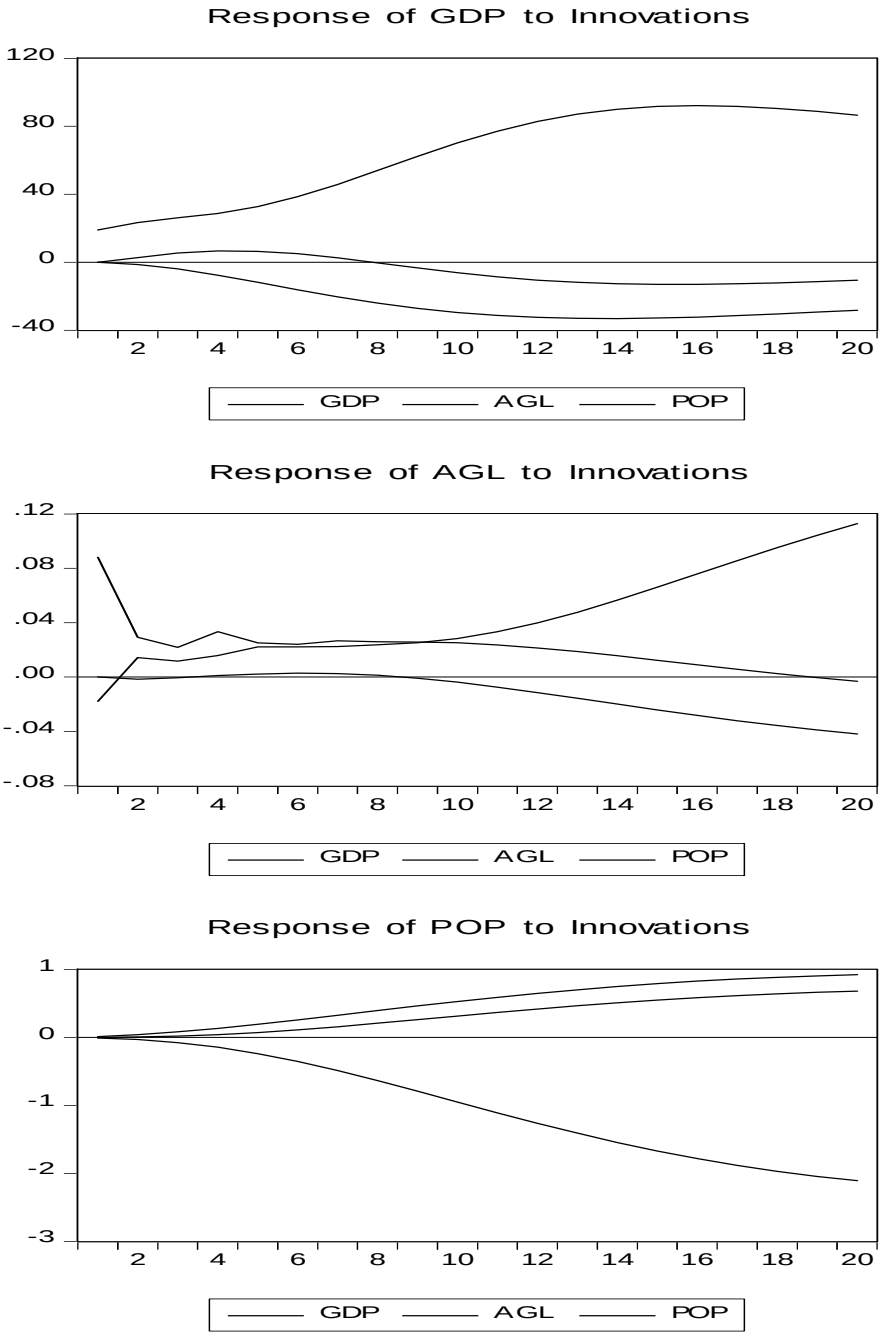
4.7. Impulse Response Function

In addition to the variance decomposition analysis, the current study also applied the Cholesky Impulse Response Function (IRF). The IRF shows the innovation response of explanatory variables in the target variable by graphical representation. The IRF of each variable is shown in Fig. 6. First, the response of agricultural land to a shock of economic growth shows that it starts from zero and moves positively till period 10. Then after period 10 it becomes negative in the long run. The impulse response of population density reveals that it remains negative in the whole period.

Observing one standard deviation response of agricultural land to innovations reveals that in the beginning, GDP is negative, but suddenly it becomes positive and remains to stay positive till period 10. After period 10 it moves positively in an upward direction. The population density response towards agricultural land shows that till period 10 it moves along with zero lines, then it becomes negative and finally. The growth feedback response to population density shows that one standard deviation disturbance in POP will negatively impact the growth. Response of agricultural land to POP shows that it begins from zero and moves positively after period 2. Then, in the long run, it increases and moves in a positive direction. Finally, it disappeared with the time horizon. Due to the rapid increase in the population in India, the size of land holdings continues to decline. Around 82 percent of farmers are small and marginal in India (FAO). Therefore, people are moving towards the industrial and service sector from agriculture. That is the primary reason behind the declining share of agriculture in the GDP of India continuously since independence.

Figure 6

Impulse Response Function



5. Conclusion and Policy Recommendations

Looking at the significance of the variables in the economic growth, the present study examined the linkage between agricultural land, population density, and India's economic growth. Further, the variance decomposition (VDC) and impulse response function (IRF) was employed for a detailed explanation of the variables' relationship and innovation responses of explanatory variables. The Granger causality test results suggested that agricultural land and the gross domestic product have a neutral relationship (studies results consistent with Lubowski, 2006; Fitton et al., 2019). The population density and gross domestic product support the feedback hypothesis (studies results consistent with Sali, 2012; Fitton et al., 2019; Hinz et al., 2020). Further, population density affects agricultural land (studies results consistent with Purnami and Santini (2017), Digha, 2018), whereas agricultural land does not affect population density (studies results consistent with Lubowski, 2006; Purnami, Santini, 2017; Digha, 2018; Fitton et al., 2019). As a result, population density is significant in nations that specialise in resource development and farming.

From a policy viewpoint, the policymakers should make efforts and frame strategies to decide the comprehensive significance of population density in the nation. In harvesting economies, such as those reliant on agriculture and food security, population size is critical. Overcrowding reduces environmental resources per capita, but it facilitates infrastructural improvement, resulting in the ideal population density for growth in the economy. The appropriate size of a country can also be influenced by population density. While there are numerous other variables to consider, geographical organisation is also critical. A country's land area is seen as a form of capital that generates revenue from resource utilisation. The first sort of cost is the distance of a border, which necessitates protective measures. Another expense is commuting to and from the capital, and population density also has a role here.

The present study also has certain limitations. The study was based on aggregate level data as disaggregate level data was not available. In the future, a panel study of disaggregated level data can be analysed in various states or on a multi-country basis. Recent techniques can be applied over the disaggregate level data like autoregressive distributed lag (ARDL), panel data, quantile regression, and time series analysis. Moreover, additional variables like energy as input in agriculture, energy prices, and agricultural production at a disaggregated level can be studied along with economic growth.

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SUMMARIES

Leke Pula, Florentina Xhelili

GOVERNMENT PUBLIC SPENDING EFFICIENCY: A COMPARATIVE ANALYSIS BETWEEN KOSOVO AND EU COUNTRIES, ESPECIALLY WESTERN BALKAN COUNTRIES

Nowadays, it is evident that government public sector activities are one of the significant factors influencing economic and social indicators. The evaluation of public sector performance and efficiency is very important when we evaluate the relationship between public spending and the benefits that society derives from these public resources. The primary objective of this study is to evaluate the efficiency of Kosovo's government public spending in comparison with EU countries and, in particular, Western Balkans countries over the period 2007-2016. The Public Sector Performance Index (PSP) and the Public Sector Efficiency Index (PSE) were used to assess the performance and efficiency of the public sector in Kosovo. Also, this study uses the non-parametric method DEA (Data Envelopment Analysis) to evaluate the input-output efficiency along with the Production Frontier Technique. The study results show that the PSP value ranges from 0.78, the minimum, to 1.39, the maximum. Kosovo ranks 30th out of 35 countries in the sample, with a performance index of 0.86, which is 15 percent below the average of 1.00. In terms of PSE, results vary from 0.76, the minimum to 1.35, the maximum. Kosovo ranks 23th out of 35 countries in this sample with an efficiency index of 0.96, 5 percent below the average, which is 1.00.

Analyzing input-output efficiency results, it is found that the average of the countries included in the study achieves an efficiency of 46.70. This shows that countries are able to reduce total public spending by 54% and maintain the same level of total Public Performance. From the results of the output-oriented efficiency analysis, the countries in the sample achieve an efficiency of 73.64%, which means that the countries in the sample could have increased the level of outputs by 27% if they had used the same level of inputs.

Keywords: Government Public Spending; Public Sector Performance and efficiency Index; Data Envelopment Analysis (DEA)

JEL: H5; D60; D61

S. Kannadas, T. Viswanathan

VOLATILITY SPILLOVER EFFECTS AMONG GOLD, OIL AND STOCK MARKETS: EMPIRICAL EVIDENCE FROM THE G7 COUNTRIES

Economic cooperation of countries across the world has led to the integration of stock and commodities markets. The group of seven countries (G7) represents the world's most industrialised and developed economies. In an integrated market, understanding the price discovery mechanism and volatility spillover across markets is crucial for traders, investors and other stakeholders. This paper investigates the return dynamics and volatility Spillover among the stock markets of G7 countries, oil and gold. We apply VAR and GARCH to examine the relationship between the returns and the transmission of volatility between commodities and stock markets. The research is based on the major stock indices of G7 countries for the years between 2009 and 2018. Oil and gold are taken as a proxy for the commodities market. This study begins by examining the cointegration of the stock and commodities market using the Johansen cointegration test. Stochastic volatility models are used to estimate the volatility and its spillover effect. We estimate the volatility spillover index using variance decomposition. The results indicate the presence of an asymmetric volatility spillover effect between the stock and commodities market. The outcome of the study would facilitate the investors and

portfolio managers to understand the return dynamics and volatility spillover effect, which is a prerequisite for an investment decision.
Keyword: Return dynamics; Volatility spillover; Cointegration; Commodities market
JEL: C23; O51; O52; O57; Q02

Svetoslav Borisov

DEFI – POTENTIAL, ADVANTAGES AND CHALLENGES

Blockchain technology may decrease transaction costs, promote decentralised platforms and build distributed trust, paving the road to new business models. In the financial sector, blockchain technology approves the progress of more innovative, boundless and clear decentralised financial services. Decentralised financial services can broaden financial encompassment by promoting open access and innovation. By scraping out several restrictions, they reveal new opportunities for entrepreneurs and innovators. A year ago, the whole value locked in DeFi (Decentralised finance) systems was almost $600 million, and by May 2021, it was about $88 billion. The frantic development of the ecosystem requires newcomers to understand its basic characteristics. The purpose of this paper is to estimate the advances of decentralised finance, classify current business models, and outline potential challenges and constraints.
Keywords: decentralised finance; blockchain; cryptocurrencies; smart contracts
JEL: O31; D86; L14

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THE BEHAVIOUR OF TAX REVENUE AMID CORRUPTION IN NIGERIA: EVIDENCE FROM THE NON-LINEAR ARDL APPROACH

One of Nigeria's greatest challenges is the generation of adequate tax revenue to meet her rising expenditure, and the country has continued to contend with corruption, particularly in its public sector. We employ the non-linear autoregressive distributed lag (NARDL) technique to examine tax revenue behaviour amid corruption using Nigeria's quarterly data over the 1999-2019 period. The result of the NARDL bounds test to cointegration demonstrates the presence of a long-run relationship between tax revenue and corruption along with income level, agriculture, inflation rate, foreign aid and female labour force participation. The results of estimation indicate the existence of asymmetry in tax revenue behaviour. We find evidence of a significant positive impact of negative changes in the control of corruption and a significant negative effect of positive changes in the control of corruption on tax revenue in the long run. Other long-run significant determinants of tax revenue in Nigeria include income level, foreign aid and female labour force participation. Based on these empirical outcomes, this study offers some recommendations.
Keywords: Tax revenue; Corruption; NARDL technique; Nigeria
JEL: D73; E62; F13; H26; H32

Ylber Aliu, Lavdim Terziu, Albulena Brestovci

COVID-19 AND LABOUR MARKET IN KOSOVO

The purpose of this paper is to understand the impact of the pandemic on the labour market in Kosovo, as well as the response of institutions to address the challenges produced by the pandemic. The research model was based on the quantitative approach and comparative study. Furthermore, this

study focused on the official data about the impact of Covid-19 on the labour market in Kosovo and Government reactions, as well as comparing it with the best practices of European countries. The pandemic has had a significant impact on the labour market in Kosovo; Kosovo institutions have adopted an emergency package as well as the economic recovery package as a response to the challenges produced by the pandemic. The pandemic has had a significant impact on the labour market in Kosovo. The Government of Kosovo has drafted and approved two packages in order to support employment. However, the number of people who have benefited from these measures is small compared to the needs.
Keywords: Kosovo; Covid-19; labour market; measures; institutions
JEL: J45; JEL: E24; JEL: J01

Mariana Humeniuk, Diana Shelenko, Natalia Kovalchuk, Ivan Balaniuk, Iryna Kozak-Balaniuk

THE IMPACT OF INNOVATION ON THE STRUCTURE OF THE ASSETS OF THE ENTERPRISES

The article evaluates the impact of the intensity of innovation of the enterprise on the structure of its assets. The importance of optimising the structure of assets to ensure the efficient operation of the enterprise is substantiated and the optimal structure of the company's assets is determined in terms of minimising the duration of the operating cycle. It has been established that the process of optimising the structure of enterprise assets in order to ensure the efficiency of its operation should be considered through the prism of comprehensive optimisation of all components. The study of enterprises by the method of alternative valuations gave grounds to determine the ratio between non-current and current assets of 80:20, which may be optimally provided that automated and high-tech production. The sequence of stages of the asset structure optimisation model has been proposed and described, the mechanism of determining the optimal structure at each of the stages is outlined, the expediency of practical application of the model is proved.
Keywords: innovative activity; assets; optimal structure; operating cycle
JEL: O14; D24

Vehbi Ramaj, Anita Cucovic, Gezim Jusufi

INNOVATION AS A SUCCESS KEY FOR MANUFACTURING SMEs: EMPIRICAL INSIGHTS FROM KOSOVO

The purpose of this research is to analyse the impact of innovation types on the sales growth of manufacturing SMEs in Kosovo. The production base of the Western Balkan countries is very low, so innovations should be developed which are perceived as catalysts for increasing the production capacity of SMEs in these countries. In terms of methodology, the research sample consists of 200 SMEs from the manufacturing sector. The manufacturing sector is not very developed in Kosovo, so this number constitutes 90% of manufacturing SMEs. The achieved results were analysed through logic regression, processing them in the statistical program SPSS. The findings confirm the hypotheses that Marketing innovations and product innovations have a positive impact on increasing sales of these SMEs. Meanwhile, organisational innovations do not have an impact on increasing sales of manufacturing SMEs. This study was conducted with manufacturing SMEs in Kosovo, so the main limitation of this research is the non-inclusion of SMEs in other sectors. This research is of particular importance because there is no research that aims to study the impact of innovation types on increasing sales of manufacturing SMEs in Kosovo. Therefore, the results of this research can serve government bodies in drafting policies and strategies for the development of innovative activities of manufacturing SMEs.

Keywords: Innovation; Sales growth; Manufacturing SMEs; Kosovo; logic model
JEL: L25; L26; M20

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SMALL FIRMS' CAPITAL STRUCTURE AND PERFORMANCE

The article examines the existence and strength of capital structure determinants on SMEs' financial performance. We tested predictions using a panel of 230 SMEs during 2015-2019 in Kazakhstan.
The study is one of the few studies investigating the capital structure of small business companies' profitability in developing countries.
The empirical analysis's main conclusions show the negative impact of all debt levels on the return on assets and the direct interaction between the debt burden and equity. The findings show that industry effects are significant in explaining SMEs' capital structure decisions. The results generally suggest that following the pecking order theory, owners of small firms maximize their retained earnings and raise debt only when additional funding is needed.
Keywords: capital structure; firm performance; profitability; small companies; ROA; ROE; emerging markets
JEL: C23; G32; L26

Plamena Yovchevska, Mihaela Mihailova, Nina Koteva

LAND USE IN BULGARIAN AGRICULTURAL HOLDINGS AND THE COMMON AGRICULTURAL POLICY

The research on the utilisation of agricultural land in agricultural holdings has the aim to present the problems and opportunities European CAP policy brings in Bulgarian agriculture. We have used statistical methods as well as academically approved approaches to systematically assess how changes in CAP policy, have changed the landscape of agriculture and what positive and negative changes are the result of the implementation of EU norms. For competitiveness, we have presented data from the pre-EU accession and, using the graphic method, showed the changes during the research period. We try to highlight some processes in public relations regarding land use as an indispensable factor for production, as well as to define certain reasons for the registered changes.
Keywords: agriculture holdings; land use; CAP policy
JEL: Q1; Q18; C82

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STRATEGIC DIRECTIONS FOR ENSURING FOOD SECURITY OF UKRAINE IN THE CONTEXT OF ECONOMIC INTEGRATION

A methodological approach to assessing the stability of the agri-food sector based on a system of production stability indicators, food shortages, effective demand and balanced diet has been justified in order to identify threats to food security related to the instability of agro-industry and market imbalance. The methodology for assessing the sustainability of the country's agri-food market makes it possible to quantify the threats to food security associated with the instability of agricultural production and market balance and to substantiate the directions of stabilising the functioning of the agri-food markets in Ukraine.
It has been defined that the key measures include an adaptation of the regulatory framework in accordance with the requirements of the WTO and the EU in the field of product quality and safety,

consumer protection, mandatory audit of food industry enterprises for the compliance with safety and quality requirements, mandatory control of imported food products and import restrictions in accordance with sanitary and phytosanitary measures. It is supposed to use the mechanism of tariff quotas within the framework of bilateral trade agreements and also bans and restrictions on imports on the basis of sanitary and phytosanitary measures.

The directions of strengthening the role of Ukraine in ensuring international food security are to increase quotas for food imports to the EU on the basis of amendments to existing trade agreements, expand foreign sales markets for Ukrainian exporters, stimulate exports and attract small and medium-sized agricultural enterprises to participate in exports.

Keywords: food security strategy, strategic priorities, food security, economic integration, food import and export, a system for monitoring the quality and safety of agricultural products and food
JEL: Q10; Q18; Q17; O13; O21

Deepak Kumar, Kamaljit Singh, Sunil Phougat

IMPACT OF AGRICULTURE LAND AND POPULATION DENSITY ON ECONOMIC GROWTH: AN EMPIRICAL EVIDENCE FROM INDIA

India is an agrarian economy and stands 2nd in the world population. India is in sixth place in the list of the most significant economies globally and 3rdin the purchasing power after the United States and China. However, India still has many growing concerns like a declining share of agriculture in the GDP, rapid increment in the population, unemployment, and others. The present study investigated the linkage between agricultural land, population density, and economic growth in India. The data from 1970 to 2019 was analysed using a vector error correction model (VECM) and Granger causality test. Further, the variance decomposition (VDC) and impulse response function (IRF) was employed for a detailed explanation of the variables' relationship and innovation responses of explanatory variables. The Granger causality test results suggested that agricultural land and the gross domestic product have a neutral relationship. The population density and gross domestic product support the feedback hypothesis. Additionally, population density affects agricultural land, whereas agricultural land does not affect population density. From a policy perspective, policymakers should frame strategies to decide the nation's comprehensive significance of population density. Too high populace density diminishes the natural endowment per capita. However, it facilitates infrastructure development, prompting an ideal populace density for economic development.

Keywords: Agricultural Land, Population Density, Granger Causality, Economic Growth
JEL: N55; O13; Q10; Q56; F43