Yuliia Sonko, Ph.D., Kyiv National
University of Trade and Economics,
Ukraine.

Iryna Lazebna, Ph.D., Kyiv National
University of Trade and Economics,
Ukraine.

Larysa Lebedeva, Ph.D., Kyiv
National University of Trade and
Economics, Ukraine.

Yuliia Sonko (Ukraine), Iryna Lazebna (Ukraine), Larysa Lebedeva (Ukraine)

MATERIAL PRODUCTION AND GDP IN UKRAINE: THEORETICAL CONCEPT AND FINANCIAL ASSESSMENT

Abstract

The article considers the relevant problems concerning the correlation between the development of priority economic sectors and sustainable economic growth in Ukraine. The assumption is made that development at the macroeconomic level can only be achieved when the positive dynamics of material production sectors is observed. The resource potential of Ukraine allows to distinguish two main sectors: agriculture and industry.

Many scholars have repeatedly considered ways of achieving positive economic dynamics at the level of the national economy. But despite the existing research on the problems of economic growth, its' financial assessment and modelling, as well as the dominant factors of influence, remain unsolved. The aim of the article is to identify the factors of economic growth and assess their influence on the overall economic dynamics within two main material production sectors of Ukraine: industry and agriculture. In order to achieve this, the influence factor model of economic growth has been composed, where GDP growth was selected as a result indicator. The choice of influencing factors is substantiated by: quantity of goods and services sold, number of employees in the industry, investments, fixed assets value and the consumer price index. The most influential factors that significantly impact the overall economic dynamics have been revealed in the article.

INTRODUCTION

Ukraine is a European state and modern European integration tendencies require it to set the key trends in the development of the national economy. Achieving a sustainable economic growth is one of the most important challenges for Ukraine. The world community demands from it a coordinated and mutually beneficial cooperation that, in modern conditions, is impossible due to the unstable socio-economic situation. All stated above raises the question of finding ways to ensure positive economic growth.

Ukraine, having defined further vector of development, having clearly declared its European orientation, needs to determine the key factors for the restoration of economic growth and the development of a sound economic system. As the real sector of economy is the basis for economic growth, mainly an industry that provides any country with the necessary tools for development, it is necessary to focus on the study of the current state and factors of growth in the material economy: agriculture and industry. These areas should be turning points in ensuring the restoration of economic growth in the context of the complicated socio-political situation that has developed in Ukraine today.

1. LITERATURE REVIEW

Problems, general theoretical positions, methodological approaches to the analysis of factors contributing to economic growth are investigated in the works of well-known foreign and local researchers.

Schumpeter (1934) associated economic development with the emergence of "new combinations" in the economy: the benefits, methods of production and commercial use of goods, markets, etc. At the same time, new combinations do not always lead to the implementation of scientific and technological progress in the country. They can be implemented through the usual marketing policy and changing the structure of the market in favor of individual firms (Schumpeter, 1934). Therefore, Schumpeter mainly focused on those new combinations that result in the development of the material and technical basis of production.

Galbraith (1967) understood economic growth as the overall increase in supply of goods and services, and socio-economic development. He points at the existence of spheres of life, which the industrial system does not pay enough attention to, but which are necessary for normal life and human development – health, education, environmental protection, culture (Galbraith, 1967).

Economic development in the concept of post-industrial society is presented as a consistent transition from agrarian to industrial and further to post-industrial economy. At the same time, qualitative characteristics of economic growth change. Thus, Inozemcev (2000) notes that in his opinion, using the notion of economic growth as a synonym of GDP growth rate is not correct. Economist points to a number of problems that arise in a post-industrial society in an attempt to reflect the processes of economic development in statistics as traditional indicators of economic growth do not take into account qualitative changes in output and human potential.

Recent studies consider different factors for country's development. Umantsiv and Ishchenko (2017), Jayakumar and Pradhan et al. (2018), Azam et al. (2017), Syed Ahsan Jamil and Faris Nasif Al Shubiri (2016) focus on the banking sector as a leading one stating that there is a close correlation between the development of a real sector of the economy and banking investments. Further studies on the topic of financial factors influencing economic growth state that countries below certain finance threshold grow slower and those above the threshold grow faster. Ruiz (2018) states that, in the industrialized economies, institutional investors have a positive effect on the growth of GDP per capita. Voskoboynikov (2017), Shvets (2017) state that overall positive economic dynamics can be achieved by efficient reallocation of resources and an institutional environment that can stimulate technology diffusion among firms.

Haraguchia et al. (2017), Gerasymenko et al. (2017), Fatenok-Tkachuk et al. (2017) in their studies concerning the influence of the real sector on economy growth claim that manufacture still has the dominant role in the economic development as "achieving economic development by following the path of industrialization will likely remain important for low-income countries because they are able to take advantage of their backwardness relative to those countries which have already experienced rapid industrialization". McFarlane, Blackwell investigate changes in rural economy from agriculture to mining industry and its impact on overall development of a country (McFarlane et al., 2016). Moreover Đokić and Jović (2017) link industry and agriculture to the economic development showing that the agriculture sector has higher influence than industry sector on the GDP health and growth. Summing all stated above it was concluded that existing work of local and foreign scientists has created a scientific basis for further research. The problem of achieving a sustainable economic growth requires specified ways of solving it. In particular, the question of factors of economic growth that should be distinguished as the main ones, taking into account current realities, is urgent.

2. AIMS

Explore the state of the priority sectors of the economy; identify and analyze the factors of economic growth in such sectors of economic activity as agriculture and industry.

3. METHODS

Historical and logical methods were used to research the nature of economic growth in the modern world in the article. In order to investigate the features of economic growth of priority sectors of economy, recent statistical data on this matter were analyzed. Based on correlation-regression analysis methods, the factors influencing economic growth of agriculture and industry have been analyzed. The present problems of these sectors' development have been considered, as they create obstacles on the way to economic growth.

4. RESULTS

The concepts of "economic growth" and "economic development" are highly interconnected. Economic growth is an increase of quantitative indicators in the economy that can be measured, for example, as the growth of GDP per capita. Economic development is a quantitative increase in economic parameters and their qualitative improvement, based on a new technology, which leads to an improvement of life. Usually economic activities are grouped according to the Classification of Types of Economic Activities (CTEA) in Ukraine, which is part of the system of national classifiers. Development of CTEA is based on the international statistical classification of activities of the European Union (Nomenclature of Activities European Community (NACE, Rev. 2)). In this research, analysis of the level of economic development will be focused on the production sector, namely agriculture and industry.

Economic growth can be identified by analyzing the dynamics of gross domestic product. In fact, its positive growth, in the vast majority of cases, indicates an economic growth. The foregoing determines the choice of resulting variable for construction of the model – the growth of gross domestic product by sectors. In our expert opinion, the following factors that influence GDP by sectors were selected: sales (Q), employment (N), inflation (consumer price index) (In), investment (I), availability of technical support (fixed asset value) (F). The total income of economic entities, that is, the final result of their activity is considered as "sales" in this study. Employment of the population

by sector is chosen as a factor because of the considerations that human labor is the main resource for any production. The profitability of enterprises depends on its effective use. The level of inflation is considered an important macroeconomic indicator, which is formed objectively depending on the existing socio-political climate and defines strategic goals not only in the sector, but also at the national level. Investments are a fundamental source of industry development, they are inextricably linked with innovation processes and are one of the key elements of sustainable economic growth. The cost of fixed assets, as a factor of economic growth, is chosen due to the fact that current realities make economic growth impossible without the existing material and technical base that meets the requirements of a market economy, and helps to reduce the cost price of products and increase their quality.

In 2016, a sociological study "12 Steps to Peace. Economy of Ukraine: Real State and Prospects" was conducted, according to which the majority of Ukrainians consider agriculture and industry to be the main drivers that will help raise the country's economy. So more than 50% of Ukrainians have chosen agriculture as the priority sector for development. Agriculture is a main type of economic activity that ensures the existence of people as biological beings, producing raw materials for food production, providing livestock. Agricultural products are used as a raw material for the manufacture of everyday items (clothing, footwear, furniture, etc.).

As already noted above, in our expert opinion, the factors that determine economic growth in the investigated sectors are sales of goods and services, employment, capital investment, fixed assets value and the consumer price index. Table 1 illustrates the dynamics of these factors in the agriculture sector.

Agriculture is heavily dependent on the development of industry, mostly on mechanical engineering, which provides it with the machinery necessary for the processing of land. It is also dependent on the state of chemical industry, which supplies chemicals and fertilizers. Food industry and partly textiles process the agricultural raw materials. In Ukraine, agriculture is one of the main sources of

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Table 1. Main indicators of agricultural development in Ukraine

Year	Production in agriculture sector	Sales of goods and services	Employment	Capital investment	Fixed assets value	Consumer price index
	Mln. UAH	Mln. UAH	Thousand	Mln. UAH	Mln. UAH	
2010	189373	119248,2	6098,9	22125,2	114443	118,3
2011	253485	128359,4	6226	32932	118992	111,2
2012	261707	167332,5	6260,7	37767,4	138660	102,7
2013	306998	166277,9	6267,6	37174,8	307846	103,1
2014	381227	220163,3	5723,7	37591,4	338675	114,5
2015	558788	372033,4	5197,6	60309,4	415744	139,6
2016	577197	414799,9	5114,8	100968	535326	110,8

economic growth, providing 11% of GDP growth on average. This is due to the fact that agriculture generates a significant share of GDP, despite that more than 60% of the country's population lives in cities.

Agriculture is one of the leaders in terms of investment growth rate (+64.3% in 2016), at the same time, the capital investments in this sector also have increased by 26.1% in 2015 (Fatenok-Tkachuk et al., 2017). In an open market economy, sustainable economic growth is possible only with the appropriate level of competitiveness of products manufactured by industrial enterprises.

Industry is one of the leading segments in the economy of Ukraine, it determines the level of economic development, opportunities for participation in the World Trade Organization. Ukraine inherited a powerful industrial complex, with a predominance of traditional mining and manufacturing industries. It is in the industry that a

larger share of GDP is produced. Also, in Europe, according to the European Commission, industry in the EU plays an important role in economic development, since every fifth person in the EU is employed in industry production (European Commission, Directorate-General for Research and Innovation, 2017).

Ukraine's industry is in a state of deep crisis associated with both the deterioration of the overall economic situation in the country and the specific factors inherent to particular industries, which generally leads to increased competition in the domestic market, blocking of access to foreign markets, investment cuts and a decrease in financial and economic performance of industrial enterprises. Let us see the dynamics of the main indicators of development in the industry of Ukraine (Table 2).

The main institutional features of functioning of industrial enterprises in Ukraine are: significant

Table 2. Main indicators of the industry development in Ukraine

Year	Production in industry sector	Sales of goods and services	Employment	Capital investment	Fixed assets value	Consumer price index
	Mln. UAH	Mln. UAH	Thousand	Mln. UAH	Mln. UAH	
2010	792317	1374244,6	3112,6	55384,4	1101199	103,9
2011	948757	1477817,9	3206,6	78725,8	1116367	101,5
2012	952726	1517617,7	3236,7	91598,4	1603646	99,6
2013	883426	1493850,1	3170	97574,1	1749110	108,4
2014	975675	1567714	2898,2	86242	1937821	114,5
2015	1206047	1917185,6	2573,9	87656	3842517	139,2
2016	2866161	2343000,4	2494,8	117753,6	3072954	111,9
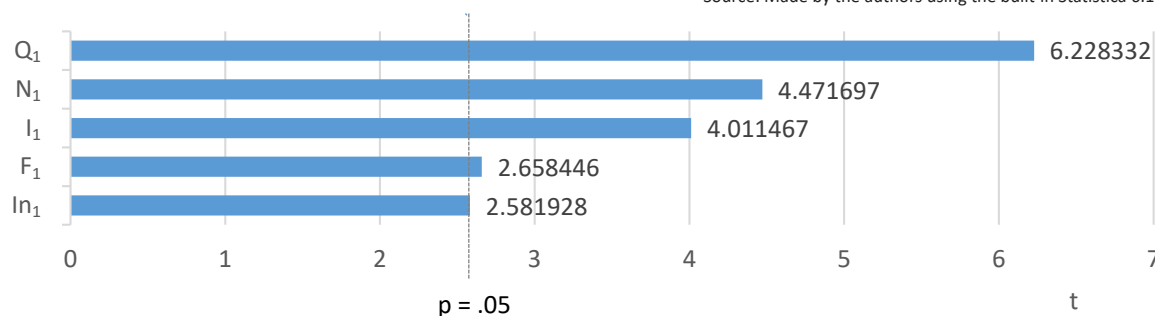
Figure 1. The significance of coefficients of the factors' influence on the dynamics of GDP model (for agriculture)

dependence on external markets; low-tech products; concentration of most enterprises in the economy in the hands of several oligarchs; deformation of branches structure towards raw materials domination; unsatisfactory share of new technologies and innovations usage; weak co-operation of business with research organizations; partial correction of legislation under the influence of sector lobbies; weak property protection and noncompetitive methods of economic activity.

The level of development of the country's industry depends on the state and functioning of its industrial enterprises. The Ukrainian economy continued a recovery trend in 2017 after a positive breakthrough in 2016, which led to an increase in gross domestic product by about 1.5%. Production in key sectors has ceased to decline and began to recover, first of all, at the expense of industry, agriculture and metallurgy. According to statistics, the economy of Ukraine received 3.1 billion dollars of foreign direct investments in 2016, which is by 41% more than in 2015. Industrial production in Ukraine increased by 2.4% in 2016 compared to 2015. Growth in the mining industry amount-

ed to 2.3%, in manufacturing – 3.5%, in the supply and distribution of electricity and gas – 2.6% (Ekonomika Ukrainy – 2017 bolshe rosta I menU she infliatsii, 2016).

Now let us examine the way that the factors described above affect the overall economic growth within these two sectors that provide economic growth at the state level. To do this, models that reflect the impact of these factors on the growth of gross domestic product in the context of two priority sectors, namely agriculture and industry, have been built.

To determine the coefficients of pair correlation when constructing an econometric model, a dispersion analysis is required. In econometric studies, it is important to find out whether there are interdependent explanatory variables that are called multicollinearity. The latter negatively affects the quantitative characteristics of the econometric model or makes it impossible to construct at all. The most complete study of multicollinearity can be obtained using the Farrar-Globard algorithm (Dougherty, 1997, pp. 47-70). In the process of an-
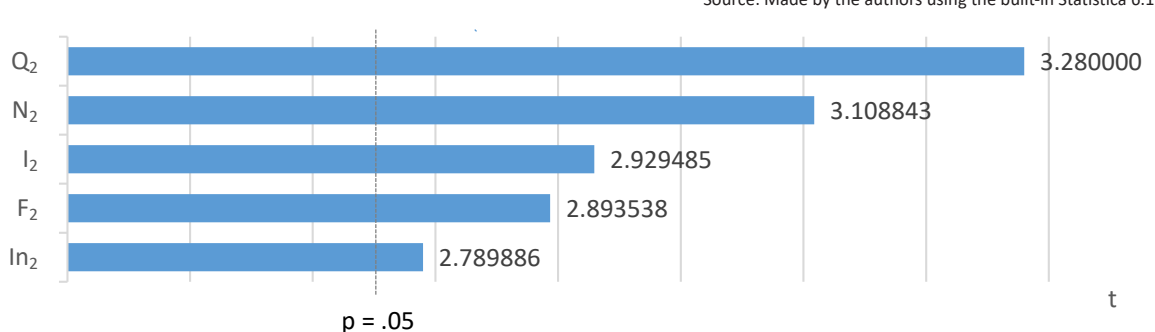
Figure 2. The significance of coefficients of the factors' influence on the dynamics of GDP model (for industry)

alyzing the interconnection of the variables of the studied models and checking them for adequacy, it was found that there is no multicollinearity between the selected factors for the model.

Analyzing the results of regression, it should be noted that the tabular value of Student's criterion (Student, 1908), with a probability $p = 0.05$ and degrees of freedom n-m-1 is 2.3. If the calculated value of the indicator exceeds the one in the table, it can be assumed that the factor is significant for the model under study.

Comparing the calculated t-statistics of coefficients with tabular values of the Student's criterion for agriculture (Figure 1), it can be concluded that the factors have statistical value.

Figure 2 illustrates great statistical significance of the selected factors for the analysis of GDP growth by sectors, namely for industry. This suggests that the selected factors do actually affect the resultant variable. The study of models using the least squares method showed a close relationship between dependent and independent variables ($R^2 = 0.96$ for agriculture and $R^2 = 0.93$ for industry) with low mean square error ($S_1 = 0.11$ and $S_2 = 0.09$, respectively).

Let us test our models and see if they meet conditions of the Gauss-Markov theorem (Dougherty, 1997, pp. 169-174). If these conditions are met, then the estimations of regression parameters are unbiased and effective. One of the main conditions of the Gauss-Markov theorem is the equation of mathematical expectation of the levels of a number of remnants to zero: $M_{(U)} = 0$ ($M_{(U)}$ – mathematical expectation of the levels of a number of remnants; n is the number of observations). According to the calculations, the average value of a number of remnants for agriculture is: $U_1 = 6,13 \cdot 10^{-6}$, and for the industry – $U_2 = 4,18 \cdot 10^{-9}$, hence, in both cases: $M_{(U)} = 0$. Thus, the models under study are adequate for the criterion of zero mean. This indicates the absence of a systematic mistake in the model.

Next let us check the property of the randomness of the final component, for this purpose, the "criterion of the picks" or the "criterion of the turning points" (Fedoseev et al., 1999) has been used.

The basis of this criterion is the verification of inequality:

$$k > \left[\left(\frac{2}{3}(n-2) - 1.96\sqrt{\frac{16n-29}{90}} \right) \right], \qquad (1)$$

where k – is the number of turning points in a series of remnants of the model, n – number of observations.

The results of the analysis showed that the number of turning points exceeds the whole part of the expression of the right-hand side of the inequality, which proves that a number of remnants possesses the property of a chance.

The next step to validate the model for adequacy is to check the presence of auto correlated residues and the phenomenon of heteroscedasticity. The Durbin-Watson test was used to determine the presence or absence of autocorrelation (Durbin & Watson, 1951, pp. 533-549). Using the tools of Statistica 6.1, the d-statistic lays in appropriate limits, and therefore there is no auto-correlation.

An important stage in the model evaluation is the verification for the presence of the phenomenon of heteroscedasticity. To test the presence of heteroscedasticity, White's Test Method (White, 1980, pp. 817-838) was used. In essence, the presence of heteroscedasticity means that in the model for one or more values of a certain factor, the remnants are different from the rest of the dispersion, which results in a shift in the estimates of the regression coefficients and a decrease in the efficiency of the model's estimates.

Consequently, according to the results of the White's test, the calculated value of the Fisher (F) criterion does not exceed the mark 5, while the table value F with probability $p = 0.05$ is higher than the calculation for all factors that indicates the absence of heteroscedasticity. Consequently, according to White's test results, there is no heteroscedasticity.

After that, the condition of the normal distribution of the random component on the basis of calculating the asymmetry (As) and excess (Ex) coefficients for some of the remnants of

the model should be checked (Dougherty, 1997). The hypothesis about the normal distribution of a random component is taken into account if the coefficients of asymmetry and excess are not greater than their two-fold mean square deviations, that is, if the following inequalities are fulfilled:

$$|As| < \frac{3}{2}\sqrt{6(n-2)(n+1)(n+3)},$$ (2)

$$\left|Ex + \frac{6}{n+1}\right| < \frac{3}{2}\sqrt{\frac{24n(n-2)(n-3)}{(n+1)^2(n+3)(n+5)}},$$ (3)

where n – number of observations.

Using the built-in elements of MS Excel the coefficients of asymmetry and excess can be calculated and compared with the right-hand side of the above expressions:

for the agriculture

As	0.8546	<	96.3412
Ex	−0.7468	<	2.1154,

for the industry

As	0.5469	<	46.4157
Ex	−0.6775	<	1.1846,

As shown, in our case, both inequalities are fulfilled. Consequently, the remnants of the models are normally distributed.

Thus, having carried out the corresponding calculations, it has been established that the models meet the Gauss-Markov conditions, and therefore can be used in practice. The following results of model estimation using the indicated factors have been obtained[1]:

for the agriculture:

$$\Delta Y_1 = 16.5 + 8.3Q_1 - 4.56N_1 + {} \\ +6.12I_1 + 3.36F_1 - 1.29In_1 + U_1$$ (4)

for the industry:

$$\Delta Y_2 = -26.2 + 12.1Q_2 - 7.9N_2 + {} \\ +5.31I_2 + 10.6F_2 - 1.2In_2 + U_2.$$ (5)

Analyzing the model obtained, it should be noted that the constant in the model, which is 16.5% for agriculture and 26.2% for industry, essentially reflects the GDP growth, without taking into account the influence of the selected factors. One of the most important factors for agriculture is investments, while for industry – an increase in the cost of fixed assets. This can be explained by the fact that agriculture requires investments in cash for agrarian enterprises to function, whereas industry depends, first of all, on the available material and technical base. Therefore, the creation of a favorable investment climate is strategically important for the development of agriculture in Ukraine. Socio-political instability of the country remains the main problem, that, despite the presence of high resource potential, still scares off perspective foreign investors. At the same time, there is a problem of direct investment lack in the industry sector, but it is not as acute as the need to upgrade the logistics. Because the obsolete equipment, outdated production methods do not allow Ukraine to take a worthy place in the world arena and contribute to the deepening of the economic downturn.

5. DISCUSSION

The purpose of constructing the models of GDP growth interdependence with selected factors was to investigate the degree of their impact on economic growth in the context of priority sectors of the Ukrainian economy. The conducted research showed that the share of sales as a factor of influence on the GDP dynamics value for more than 30% for both sectors. The results of the model analysis allowed us to reveal that the dynamics of employment negatively affect the overall GDP growth. This can be explained by the fact that one of the consequences of scientific and technological progress is the dominance of a qualitative labor in the matter of efficiency over a quantitative one. In modern conditions, as for agriculture, as for industry sector, the question of finding skilled personnel arises.

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1   Made by the authors using the built – n Statistica 6.1 tools.

CONCLUSION

Thus, an attempt to investigate peculiarities of economic dynamics of the priority sectors of the economy of Ukraine has been made in the article. Using the methods of correlation-regression analysis, the factors influencing economic growth in agriculture and industry have been analyzed, that include the following: sales, employment, inflation (consumer price index), investments, availability of technical support (fixed assets value). The conducted research showed that the share of sales as a factor of influence on the GDP dynamics value for more than 30% as in agriculture, as in industry. The dynamics of employment negatively affects the general GDP growth, that can be explained by the greater significance of the qualitative its parameter over the quantitative. An analysis of the model received allows us to say that GDP growth of Ukraine excluding industry and agriculture would be about approximately minus 26.2% and minus 16.5%, respectively. One of the most significant factors that influence agriculture growth is the availability of investments; industry growth – an increase in the cost of fixed assets.

The present problems that create obstacles for economic growth of Ukraine are: general social and political instability in the country, lack of capital investments, outdated material and technical base of production, etc. Summing up it should be noted, that a search for approaches to organize the highly profitable production, determination of directions to support business entities, that will increase the efficiency of priority sectors in order to achieve sustainable economic growth at the level of the national economy, are particularly relevant today.

ACKNOWLEDGEMENTS

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