

## EXPERT ANALYSIS AND IMPACT ASSESSMENT OF THE CONSTRUCTION SECTOR ENTERPRISES ON THE ECONOMY: THE EXPERIENCE OF UKRAINE

**Mykhailo LUCHKO**

Doctor of Economic Sciences, professor; Ternopil National Economic University, Ukraine  
m\_luchko@ukr.net  
(Corresponding author)

**Stanisław SZMITKA**

Associate professor of University in Olsztyn, Poland  
pbdmorag@interia.pl

**Yuriy PYNDA**

Associate professor of Lviv University of Business and Law, Ukraine  
yuriy\_p1@ukr.net

**Lyudmyla KUTS**

Associate professor of Ternopil National Economic University, Ukraine  
epik3403@tneu.edu.ua

### **Abstract**

The aim of the article is to establish the impact of construction sector enterprises on the economy. Using dynamic cross-sectional balance regression, it is determined that gross domestic product, the level of budget revenue, volume of capital investment, the level of employment, the coefficient of coverage of imports by exports and volume of innovative realized products depend on the development of the of enterprises in the construction sector. The model of social and economic participation of the construction sector in the economic system of the country is developed, which on the basis of dynamic cross-sectional balance regression allows to determine ranges of values of influence of the main indicators of functioning of the enterprises of the construction sector on the gross domestic product; the level of budget revenues; volume of capital investments; employment rate; coefficient of coverage of imports by exports.

**Keywords:** enterprises of construction sector, construction, impact, economy, development, dynamic cross-sectional balance regression.

**JEL classification:** L74, C61, D60, E23

### **1. Introduction**

The current economic conditions in the period of significant macroeconomic imbalances and accumulated problems against the background of an unprecedented combination of financial, economic, banking and political crises require activation of the development of enterprises of dominant industries and sectors of the national economy.

The construction industry includes a combination of many types of economic and other activities. They ensure the implementation of the investment process from the pre-project stage to the commissioning of the object. A building complex is a collection of diverse but interconnected industries and organizations. They are characterized by a combination of interests, interconnected close and stable economic, organizational and technological ties. The main thing in the activity of these enterprises is to obtain the end result – to obtain profit in order to ensure the reproduction of fixed assets and the growth of their assets. Such interconnectedness and interdependence affects not only the activity of these enterprises, but also the economy of the country and its gross domestic product.

The construction sector of the economy has a special role in the social and economic development of each country, because with its participation, the primary physiological needs of society in housing and protection are realized; provided with fixed assets (land, buildings and structures) all activities of the private, budgetary and communal spheres; capital markets, goods and services, labour resources are formed; infrastructure is developed; a base is formed for the development and concentration of productive forces; economic activity is activated;

housing opportunities for migration and the spatial concentration of an efficient working population are provided. The share of the construction sector in the gross domestic product of the countries of the world is quite significant.

A large number of able-bodied citizens are involved in the sphere of construction industry (production of building materials and other products to support the construction process), construction, activities of professional real estate agencies, design, development, mortgage, appraisal and other construction-related companies. Therefore, the issues of development of the construction sector of the national economy and research of its influence on the economic system of the country are especially relevant.

We propose the following hypotheses in order to address the basic idea of our study – assumptions that we will test experimentally for a possible solution to the problem. Firstly, is it true that the gross domestic product (Y1), the level of budget revenues (Y2), the volume of capital investments (Y3), the level of employment (Y4), the coefficient of coverage of imports by exports (Y5), and the volume of sold innovative products (Y6) depends on the development of the construction sector enterprises and if so, to what extent. Secondly, is it possible to determine the range of values of the influence of the main indicators of functioning of construction sector enterprises on the gross domestic product; the level of budget revenues; volume of capital investments; employment rate; the coefficient of coverage of imports by exports and volume of sold innovative products?

## **2. Literature review**

There are many approaches in the economic literature to the definition, organizational structure, functioning of construction and its relationship with the economic system of the country. Approaches to the interpretation and formulation of its essence differ among researchers. Researchers of industry associations in construction, in particular Fedorenko V. (2000), Bohdan N. (2012), Chekulaieva O. (2014), Asaul A. (2001) and others have substantiated the concept of “building complex”. In spite of various interpretations, the basis for it was laid the sign of the complexity (systematic) of economic, technical and technological, organizational links between enterprises and organizations of different industries related to the creation of construction products. Each of them within the limits of the research areas substantiated its functioning at different levels – meso and macroeconomic.

In our opinion, the concept of “building complex” should be considered through the prism of regional development, since the specifics of its functioning are inherently clearly expressed regional aspect, which is confirmed by the results of thorough research (Pynda, Yu.V. (2009)).

We consider the category “construction sector” much broader as a set of interrelated sectoral, technical, technological, organizational and legal, institutional characteristics, economic goals and functions of the components of the national economy involved in the formation of construction products (buildings and structures) of residential, social and cultural, commercial, industrial, agricultural and infrastructural purposes.

The problems of accessibility and security of citizens are classified in the strategy of national security of Ukraine as priority and those that need priority. At the same time, in the context of strengthening the economic security of the state in the medium term, it is of particular importance to increase the competitiveness of industries and economic complexes important for the development of the national economy, to expand the use of public-private partnership mechanisms and to create a reliable production, energy, transport, information and military infrastructure, that objectively impossible to implement without the involvement of construction (Pynda, Yu.V. (2009)).

In the context of the study of strategically important industries and sectors of the national economy, scientists mainly focus on two important aspects: 1) the range of current problems of the industry itself (economic sector; economic complex); 2) the place and influence of the industry on the real sector of the economy. Considering the significant participation of the construction sector in the formation of competitive positions of the national economy and the significant social effect of its development, we consider it relevant to study the impact of the functioning of construction sector enterprises on the economy of Ukraine.

Substantiation of the place of the construction sector of the Ukrainian economy in the process of strengthening the economic security of the state – the task of the highest level of priority and complexity, should be based on the conceptual basis of the latter with its functional and structural components, the study of the factors that determine it and features of construction, as a complex multifaceted sector and functioning of which different industrials and sectors of the national economy are involved (Vasylytsiv, T.H. (2010)). Thus, using the example of the five-sector model proposed by scientists Kuzmin A. and Pyroh O.(2013), we note the link between industries and economic sectors with construction (Table 1).

**Table 1. Relationship between the sectors of the national economy with construction \***

<b>Name of Sector (S)</b>	<b>Types of economic activity</b>	<b>Characteristics of sector</b>	<b>Relations with the construction sector</b>
<b>Primary (S<sub>1</sub>)</b>	<ul style="list-style-type: none"> <li>- the mining industry;</li> <li>- agriculture;</li> <li>- hunting and forestry;</li> <li>- fishing and fish farming;</li> </ul>	<p>The kinds of activities of the sphere of material production, providing extraction of raw materials and their processing into semi-finished products, are mainly the raw material base for processing industry and construction.</p> <p>It dominates in the countries with industrial economies. Within the sector, agriculture is considered to be the most important sector.</p>	<p>Relations with the construction sector;</p> <p>Extraction of raw materials for construction and production of building materials;</p> <p>Provision of fixed assets.</p>
<b>Secondary (S<sub>2</sub>)</b>	<ul style="list-style-type: none"> <li>- processing industry;</li> <li>- production and distribution of electricity, gas and water;</li> <li>- construction</li> </ul>	<p>The kinds of activities of the sphere of material production. The basis for ensuring a stable life of society. It dominates in the countries with industrial economy. It has the most significant impact on the economy of Ukraine.</p>	<p>Manufacture of building materials, metal and reinforced concrete elements (parts, structures), production of woodworking and other industries intended for construction;</p> <p>Construction activities;</p> <p>Provision of fixed assets.</p>
<b>Tertiary (S<sub>3</sub>)</b>	<ul style="list-style-type: none"> <li>- transport and communication activities;</li> <li>- trade;</li> <li>- repair of motor vehicles, household goods and items for personal consumption;</li> </ul>	<p>The kinds of activities of sphere of intangible production, service activity. One of the key sectors in industrialized countries. It has a significant impact on the development of national economies.</p>	<p>Wholesale and retail trade in building materials, metal and reinforced concrete elements (parts, structures), products of woodworking and other industries intended for construction;</p> <p>Provision of fixed assets.</p>
<b>Quaternary (S<sub>4</sub>)</b>	<ul style="list-style-type: none"> <li>- provision of utility services;</li> <li>- the activity of hotels and restaurants;</li> <li>- financial activity;</li> <li>- real estate transactions;</li> <li>- renting, engineering and providing services to entrepreneurs;</li> <li>- providing individual services.</li> </ul>	<p>The kinds of activities of the sphere of intangible production that shape the knowledge economy.</p> <p>One of the major sectors in post-industrial economies. It provides specialized luxury services that provide prestige and social status.</p>	<p>Services relating to investment and construction activity, engineering, rental and sale of real estate (including premium classes);</p> <p>Provision of fixed assets.</p>
<b>Fifth sector (S<sub>5</sub>)</b>	<ul style="list-style-type: none"> <li>- public administration;</li> <li>- education and science;</li> <li>- health care and social assistance;</li> <li>- cultural and sports activities</li> </ul>	<p>The kinds of activities of the intellectual sphere. Services of a professional and personal nature.</p> <p>The dominant sector in the post-industrial economies, in Ukraine is at the stage of formation</p>	<p>Scientific and research activity in the field of construction: search, development and implementation of innovations in projects, models of cooperation with counterparties, technologies, materials, elements (details, designs) for construction on the basis of socially oriented principles of environmental friendliness, energy, and resource conservation;</p> <p>Provision of fixed assets.</p>

\* Source: it is modified by [17; 18; 28]

Construction provides each branch and sector of the economy with fixed assets (buildings and structures); in addition, within each sector (sectoral model of the national economy), it is possible to distinguish an industry, type of activity or services directly operating within the construction sector, or providing and servicing it and has an impact on the value of final products (buildings, structures):

primary sector – extraction of raw materials for construction and production of building materials;

secondary sector – construction activity; production of building materials, metal and reinforced concrete elements (parts, structures), production of woodworking and other industries intended for construction;

tertiary sector – wholesale and retail trade in building materials, metal and reinforced concrete elements (parts, structures), products of woodworking and other industries intended for construction;

quaternary sector – services related to investment and construction activity, engineering, rental and sale of real estate (including premium class);

five-sector – research and development activity in the field of construction: search, development and implementation of innovations in projects, models of cooperation with contractors, technologies, materials, elements (details, structures) for construction on the basis of socially-oriented principles of environmental friendliness, energy, and resource saving.

Olufemi Adedamola Oyedele proposed the Hypothesis of Establishing a Link between the Construction Industry and Social and Economic Development on the example of Nigeria (2016). The author noted that construction projects have great potential to promote the social and economic development of any nation as a driver of growth. However, in most developing countries with huge infrastructure deficits, the construction industry is underdeveloped. A researcher has applied a metadata-based approach in this article in order to assess the impact of the construction industry on social and economic development.

Construction and construction activities are considered to be one of the main sources of growth, development and economic activity aimed at GDP growth. Raza Ali Khan (2008) holds this opinion. The article examines and reflects the contribution of the construction sector to the economy on the example of Pakistan. The relationship between the construction sector and economic growth is identified. It is also determined whether there is unidirectional or bi-directional causation.

The author points out that construction and engineering services play an important role in the economic growth and development of the country. This can be seen as a mechanism for creating employment and providing employment opportunities for millions of unskilled, semi-skilled and skilled workforce. It also plays a key role in generating revenue in both the formal and informal sectors. This is complementary to the foreign exchange proceeds from the trading of building materials and mechanical engineering services. The author also investigated the impact of the construction industry on wages.

The purpose of the article according to Weisbrod Glen (2007) is to identify the methods used to evaluate the economic impact of the construction of transport projects over the long term. Given the fact that once they largely focused on the economic benefits of time and cost savings, they can now include broader factors such as the availability of roles in the supply chain, expanding labour market, the growth of global trade and the consequences of their economic development.

This article critically examines the coverage of impacts on access to different classes of forecasted models of economic impact, and then describes new trends in applied models to assess the regional impact of transportation projects on business productivity, growth and attractiveness. The author outlines a new structure of analysis that aims to facilitate the use of advanced modelling techniques to assess the economic impact of regional investment levels.

Bellù Lorenzo Giovanni and Pansini Rosaria Vega (2009) explored analytical approaches in their article for qualitative analysis of social and economic policy implications. The authors describe the use of counterfactual analysis to analyse the impact of social and economic policies, quantitative analytical approaches that are often used to evaluate policy impact, such as Value Chain Analysis (VCA), Multiple Market Models (MMM), Calculated General Equilibrium Models (CGE), etc.

Ryan Y.C. Fan, S. Thomas Ng, James M.W. Wong (2011) consider that forecasting the construction market is an important topic for policy development and implementation, as the importance and impact of the industry for the economy and GDP are indisputable. However, little attention has been paid to the creation of construction demand forecasting models in the economic literature to predict the growth of the construction market, except for those using uniform time series methods. Given the close link between the general economy and the construction industry, it is necessary to understand the structure of the construction market and, therefore, to develop a vision for the future development of the industry. Modelling technique of vector error correction (VEC) for estimating medium-term total construction demand in Hong Kong is used in this study.

The results show that VEC models can provide a reliable forecast of about 3% in terms of the average absolute error of a percentage over ten quarters of the time. The regression model is also designed to test the reliability of the VEC model. Using the VEC model, stakeholders and policy makers can predict the medium-term trend in demand for construction and, therefore, formulate appropriate strategies to meet the challenges facing them. The obtained results and methodology of econometric modelling of this study are valuable for both developed and developing countries in exploring the future construction market.

Green Richard K. (2003) examines the impact of different types of investments on the business cycle. In particular, the impact of residential and non-residential investment on GDP, and whether each of these types of investment causes GDP growth. The survey results also allow to suggest that policies aimed at raising capital from the housing construction can lead to serious short-term GDP growth.

The main contribution of Shahandashti S. M., Ashuri B. (2013) research is to create multivariate time series models that are more accurate than modern one-dimensional time series models for forecasting. This work is expected to contribute to the development of the construction engineering and management community by helping design engineers and construction planners to prepare more accurate cost estimates and budgets for capital projects and their impact on the economy.

Researchers Ryan Y.C. Fan, S. Thomas Ng, James M.W. Wong (2010) strongly argue that the construction industry plays an important role in the country's economic development process as a driver for its growth. Despite this, the industry is vulnerable to cyclical fluctuations and at times more dramatic changes in workload. It is affected by unforeseen events as a regional or global economy. A model has been proposed in order to formulate appropriate policies and guidelines to help mitigate the fluctuating volume of construction work. Such model can reliably anticipate the work of the various construction sectors following any economic turmoil.

This study uses the Box-Jenkins approach, which is used to develop the model due to its simplicity and grounded theoretical basis. The results illustrate that Box-Jenkins models can reliably forecast medium-term overall construction and housing demand, capturing a tumultuous period of rising and falling construction demand and its impact on the economy. A multiple regression model was also developed in order to compare the reliability of the Box-Jenkins model simulation.

Chun-pong Sing, Peter E. D. Love and C. M. Tam (2012) argued in their article that, it is worth developing a mathematical model using a distributed lag model and a multiplier approach to better manage and forecast labour demand in the construction industry. The model is tested using economic statistics and labour data. This model can be used by public and private sectors to forecast future labour demand for optimal labour supply.

Despite the considerable scientific achievements of researchers, a number of issues regarding the development of construction sector enterprises in the context of macroeconomic development remain unresolved. This, in turn, actualizes the need for forming tools to determine the dependence of key macroeconomic indicators as a function of various indicators of the functioning of construction sector enterprises and to evaluate their impact in quantitative terms.

### 3. Methodology

The methods of induction, deduction, comparison, systematization, multifactorial regression analysis are used in the process of writing the article. Methodologically, our thoughts are presented in the following order. Firstly, we list the common starting points of our arguments – the preconditions and conditions of our vision. In the final phase, we settled on a model of a possible solution to the problem and tested the developed theoretical and methodological material to verify the above proposal.

The presented research problem, the need to test the hypotheses accepted in the study, the need to develop a model have led to the division of the research process into specific stages and the choice of appropriate methods in each of them. Initially, we used the following scientific methods: literature review and analysis, direct observation, documentary method. In the future, we used such research methods as surveys and interviews. The obtained information and knowledge were processed using comparison methods (sample analysis, retrospective analysis). The collected quantitative and qualitative empirical data were processed using: statistical calculations, significance tests, correlations between estimates.

A systematic approach was applied in the process of writing the work as one of the main methods of scientific research. Techniques of economic and mathematical modelling, regression dependencies, methods of analogies, retrospective analysis and classical method of hypotheses were used in this article.

### 4. Research methods

Let's analyse the multi-vector impact of main indicators on their functioning on key macroeconomic aspects to reflect the participation of the construction sector enterprises in the process of developing the state's economy.

The main indicators for characterizing macroeconomic aspects through expert analysis are: gross domestic product (Y1), the level of budget revenue (Y2), volume of capital investment (Y3), the level of employment (Y4), the coefficient of coverage of imports by exports (Y5) and volume of sales of innovative products (Y6) (all metrics per person).

The use of this toolkit, including dynamic cross-sectional balance regression, allowed us to form a large-scale general sample of (6480 observations). Statistica 10.0 software was used for the calculations. All metrics were logarithmic before loading the data set.

Let's use the method of multivariate dynamic regression modelling to identify the dependence of  $Y_1, Y_2, Y_3, Y_4, Y_5, Y_6$  on a number of different indicators of the functioning of construction sector enterprises and evaluate their impact in quantitative terms:

$$Y = a_0 + a_1x_1 + a_2x_2 + \dots + a_nx_n,$$

where  $a_1, \dots, a_n$  – parameters of model;  $x_1, \dots, x_n$  – indicators for functioning of construction sector enterprises

### 5. Research results

The use of dynamic cross-sectional balance regression allowed us to form a large-scale general sample of (6480 observations) and obtain relevant models:

$$Y_1 = 8,195 + 0,148x_2 + 0,155x_3 + 0,222x_5 + 0,206x_9 + 0,381x_{11} - 0,146x_{13} - 0,299x_{14} - 0,403x_{15} + 0,122x_{16} + 0,161x_{17} - 0,077x_{18} - 0,198x_{25} - 0,085x_{26} + 0,212x_{29} + 0,240x_{31} + 1,220x_{32} - 0,250x_{33} + 0,218x_{34} - 1,4x_{35} - 0,118x_{36} \quad (1)$$

$$Y_2 = 4,387 + 0,117x_3 + 0,389x_{11} - 0,075x_{13} + 0,173x_{14} - 0,156x_{15} + 0,068x_{16} + 0,108x_{17} - 0,104x_{18} + 0,158x_{19} + 0,214x_{22} - 0,336x_{26} + 0,287x_{29} + 0,14x_{31} + 0,821x_{32} - 0,136x_{33} + 0,339x_{34} - 1,023x_{35} + 0,278x_{36} + 0,295x_{40} \quad (2)$$

$$Y_3 = 2,304 + 0,176x_2 + 0,474x_4 - 0,341x_5 + 0,709x_6 + 0,2x_9 + 0,12x_{11} - 0,82x_{15} - 0,094x_{16} + 0,159x_{19} - 0,076x_{23} - 0,06x_{24} + 0,13x_{25} + 0,314x_{26} - 0,101x_{28} + 0,168x_{30} - 0,06x_{38} - 0,071x_{39} - 0,364x_{40} \quad (3)$$

$$Y_4 = 4,166 + 0,23x_1 - 0,227x_6 + 0,332x_7 + 0,631x_8 + 0,424x_{11} + 0,555x_{12} - 0,252x_{14} + 0,262x_{18} - 0,267x_{19} + 0,306x_{20} - 0,109x_{21} + 0,187x_{22} - 0,154x_{24} + 0,143x_{25} + 0,133x_{28} - 0,418x_{30} - 0,265x_{31} + 0,01x_{37} + 0,111x_{38} + 0,196x_{41} - 0,205x_{42} + 0,210x_{43} \quad (4)$$

$$Y_5 = -4,248 + 0,162x_2 - 0,47x_6 - 0,184x_7 + 0,192x_8 + 0,343x_{11} - 0,131x_{13} - 0,283x_{14} - 0,105x_{16} - 0,266x_{19} + 0,187x_{20} - 0,122x_{21} + 0,428x_{22} - 0,107x_{27} - 0,227x_{30} + 0,5x_{32} - 0,633x_{35} + 0,237x_{36} + 0,133x_{37} + 0,133x_{40} + 0,142x_{43} \quad (5)$$

$$Y_6 = 31,969 - 0,539x_4 + 0,697x_6 + 0,51x_{11} - 0,35x_{13} - 0,15x_{21} - 0,301x_{22} - 0,315x_{23} + 0,151x_{27} - 0,671x_{29} + 0,667x_{34} - 0,365x_{35} - 0,356x_{36} + 0,315x_{39} \quad (6),$$

where:  $x_1$  – volume of completed construction works for the construction of residential buildings for 1 person (UAH);  $x_2$  – volume of completed construction works for construction of non-residential buildings for 1 person (UAH);  $x_3$  – volume of completed construction works for the construction of engineering structures for 1 person (UAH);  $x_4$  – commissioning of housing in urban settlements per 1000 people (m<sup>2</sup> of total area);  $x_5$  – commissioning of apartments for 10,000 persons (units);  $x_6$  – commissioning of rural housing per 1000 people (m<sup>2</sup> of total area);  $x_7$  – the number of people employed in construction of the 1,000 residents of existing population (persons);  $x_8$  – the number of employed population in the field of real estate transactions per 1000 persons of the existing population (persons);  $x_9$  – average monthly nominal wage of employees in construction (UAH);  $x_{11}$  – urban housing stock per 1 person of existing population (m<sup>2</sup> of total area);  $x_{12}$  – rural housing stock per 1 person of existing population (m<sup>2</sup> of total area);  $x_{13}$  – share in the structure of monetary expenditures of households for housing construction, personal subsidiary farm (%);  $x_{14}$  – share in the structure of total household spending on housing, utility products and services (%);  $x_{15}$  – share of capital investment in construction (% to total volume of investments);  $x_{16}$  – share of capital investment in real estate transactions (% to total volume of investments);  $x_{17}$  – production of non-refractory ceramic building brick per 1000 persons (m<sup>3</sup>);  $x_{18}$  – production of blocks and bricks of cement, concrete or stone artificial for construction per 10,000 persons (t);  $x_{19}$  – production of prefabricated structural elements for construction of cement, concrete or artificial stone per 1000 persons (t);  $x_{20}$  – production of concrete solutions ready for use per 1000 persons (t);  $x_{21}$  – extraction of natural sands per 1000 persons (t);  $x_{22}$  – production of pebbles, gravel, rubble and crushed stone per 1000 persons (t);  $x_{23}$  – production of wooden windows, doors, their frames and thresholds for 10,000 persons (pieces);  $x_{24}$  – exports of stone, plaster, cement products per 1,000 persons (US \$);  $x_{25}$  – imports of stone, plaster, cement products per 1,000 persons (US \$);  $x_{26}$  – export of construction services per 1,000 persons (US \$);  $x_{27}$  – import of construction services per 1,000 persons (\$ US);  $x_{28}$  – real estate prices in the regional centre (\$ US);  $x_{29}$  – loans provided by deposit-taking corporations to construction corporations in national currency per 1 person (UAH);  $x_{30}$  – loans provided by deposit-taking corporations to construction corporations in foreign currency for 1 person (UAH);  $x_{31}$  loans provided by deposit-taking corporations to households for the purchase, construction and reconstruction of real estate in national currency for 1 person (UAH);  $x_{32}$  – loans provided by deposit-taking corporations to households for the purchase, construction and reconstruction of foreign currency real estate for 1 person (UAH);  $x_{33}$  – loans provided by deposit-taking corporations to non-financial corporations for the purchase, construction and reconstruction of real estate for 1 person (UAH);  $x_{34}$  – loans provided by deposit-taking corporations to non-financial corporations for mortgage loans for 1 person (UAH);  $x_{35}$  – loans provided by deposit-taking corporations to households for mortgage loans for 1 person (UAH);  $x_{36}$  – interest rates on loans from deposit-taking corporations to non-financial corporations (annual average weighted interest rates,%);  $x_{37}$  – interest rates on loans from deposit-taking corporations to households (annual average weighted interest rates,%);  $x_{38}$  – coefficient of availability of residential real estate;  $x_{39}$  – the level of industry production in the construction sector;  $x_{40}$  – export orientation of the construction sector;  $x_{41}$  – financial result (balance) of activity of construction enterprises per person (UAH);  $x_{42}$  – financial result (balance) of activities of enterprises specializing in real estate transactions per person (UAH);  $x_{43}$  – profitability of operating activities of construction enterprises (%).

The results of the regression models (1-6) are statistically significant, as evidenced by the corresponding indicators of Table. 2.

**Table 2. Dynamic cross-sectional balance regression results**

<b>Models</b>	<b>Correlation coefficient R</b>	<b>Adjusted coefficient of determination R<sup>2</sup></b>	<b>Fisher's test at p&lt;0.0000</b>	<b>Standard error</b>
Gross Domestic Product (per 1 person, UAH) ( $Y_1$ )	0.9604	0.9225	F(20.123)=73.241	0.1036
Average level of budget revenues (per 1 person, UAH) ( $Y_2$ )	0.9577	0.9173	F(19.124)=72.356	0.9153
Capital investment (per 1 person, UAH) ( $Y_3$ )	0.965	R2=0.932	F(18.125)=94.599	0.1278
Employment rate (per 1000 persons) ( $Y_4$ )	0.926	0.857	F(22.121)=32.958	0.0485
The coefficient of coverage of imports by exports ( $Y_5$ )	0.904			
Volume of realized innovative products, which is new in the market (per 1 person, UAH) ( $Y_6$ )		0.817	F(20.123)=27.527	0.2716

Model (1) shows that the largest impact on GDP during 2013-2018 is characterized by the volume of credit resources provided by depository corporations (except the National Bank of Ukraine) to households for the acquisition, construction and reconstruction of real estate in foreign currency ( $x_{32}=1.22$ ), which confirms the significant role of construction sector enterprises in the formation of channels for foreign exchange flows into the economy due to the multiplier effect. This means that by increasing their volumes by 1 UAH (per person), GDP will increase by UAH 1.22 (per person) (it is calculated in national currency).

The urban housing stock (0.381) has a moderate impact on GDP, which emphasizes the important role of housing in the social and economic processes of the state, in particular in the opportunities for migration and spatial concentration of the efficient working population.

The volume of credit resources provided by deposit-taking corporations to households for mortgage loans ( $x_{35}=-1.4$ ) is characterized by the strong impact on the economy. This can be explained by the "nature" of the real estate market and the specificity of mortgage lending mechanisms, which contributes to an increase in the share of real estate purchased for credit, activating market demand. And this, in turn, brings active capital out of the economy.

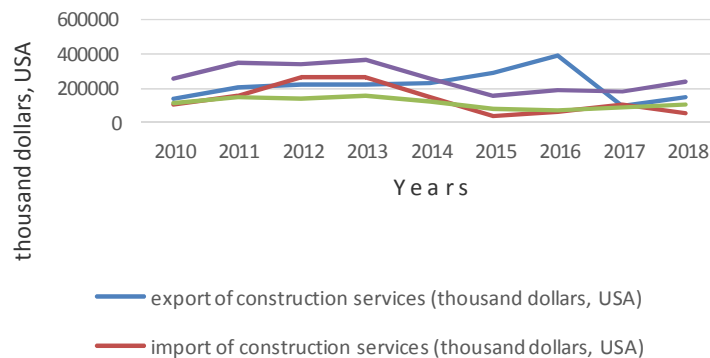
The import of building materials (stone, plaster, cement) ( $x_{25}=0.198$ ), also has a negative impact on GDP, which confirms the urgency of the development of the domestic construction industry.

Model (2) shows that the formation of budget revenues also indicates the rate of crediting of the population for the purposes of construction in foreign currency ( $x_{32}=0.821$ ) and the reverse effect – the volume of credit funds for mortgage lending to the population ( $x_3=-1.023$ ). The indicator of export orientation of construction sector enterprises (ratio of exports to output of construction products ( $x_{40}=0.3$ )) is characterized by moderate positive value.

The reverse effect on the level of budget revenues of some types of construction industry products, in particular blocks and bricks made of cement, concrete and stone, is remarkably striking. It can be explained by the presence of many shadow schemes used by manufacturers of these types of building materials, in particular to avoid tax.

Export of construction services ( $x_{26}=-0.336$ ) also inversely affects the state budget. The level of budget revenues per person will decrease by 0.34 UAH increasing this figure by \$ 1 US (per 1000 people). Despite its relatively small volumes, its dynamics from 2010 to 2016 were positive, but in 2017 there was a sharp decline in exports of construction services with further growth (Figure 1).



**Figure 1. Dynamics of foreign economic activity of enterprises of construction sector in Ukraine\***

\* Source: it is calculated and generated by [39]

The largest impact on capital investment (3) among the studied indicators is the volume of commissioning of housing in urban ( $x_4 = 0.474$ ) and countryside ( $x_6 = 0.709$ ), as well as the volume of exports of construction services ( $x_{26} = 0.314$ ). The export performance of construction sector enterprises ( $x_{40} = -0.364$ ) is indicated by the reverse effect.

The state of urban ( $x_{11} = 0.424$ ) and rural ( $x_{12} = 0.555$ ) housing stock naturally influences the increase in employment of population (4) in the state. Moderate and medium impacts are on the development of the construction industry, including the production of concrete ( $x_{20} = 0.306$ ), blocks and bricks of cement, concrete or artificial stone for construction ( $x_{18} = 0.262$ ) and minor impact – the extraction of pebbles, gravel, crushed stone and crushed stone ( $x_{22} = 0.187$ ).

The inverse effect on the employment of production volumes of prefabricated structural elements for building ( $x_{19} = -0.267$ ) and the extraction of natural sands ( $x_{21} = -0.109$ ) can be explained by the informal employment practiced at the enterprises of these areas of specialization.

The inverse dependence of the employment rate can also be traced from loans to construction corporations in foreign currency ( $x_{30} = -0.418$ ) and loans to households for the acquisition, construction and reconstruction of real estate in national currency ( $x_{31} = -0.265$ ).

The largest impact of the studied indicators on the coefficient of coverage of imports by exports (5) is made by loans granted by deposit-taking corporations to households for the purchase, construction and reconstruction of foreign currency real estate ( $x_{32} = 0.5$ ). This dependence is associated with the multiplier effect of “spraying” of currency flows through the needs of the construction related industries. Instead, the significant reverse effect is characterized by loans to mortgage loans from deposit-taking corporations to households ( $x_{35} = -0.633$ ). This can be explained by the relatively large volumes of imported building materials used for the renovation of their new premises and the aforementioned specifics of mortgage lending. Production of pebble, gravel, crushed stone and crushed stone ( $x_{22} = 0.428$ ), has a moderate influence on the dependent variable, confirming the main policy of raw material orientation of export in the foreign economic activity of enterprises of the construction sector.

Mortgage loans provided to non-financial corporations specializing in the production of innovative products ( $x_{34} = 0.667$ ) have an impact on the volume of realized innovative products. However, high interest rates on loans to deposit-taking corporations by non-financial corporations have the opposite effect ( $x_{36} = -0.356$ ). As a result, loans to construction corporations in the national currency ( $x_{29} = -0.671$ ) and households for mortgage loans ( $x_{35} = -0.365$ ) are characterized by the reverse effect.

There is also a significant effect on the dependent variable ( $Y_6$ ) of rural housing commissioning ( $x_6 = 0.697$ ). In our opinion, this is due to the fact that the construction and commissioning of housing in rural areas against the backdrop of the trend of de-urbanization is to some extent an indicator of the solvency of the population in the respective settlements and the increase of potential for the organization of production in those or other territories and

sales of innovative products. Instead, the inverse effect of housing commissioning in urban settlements ( $x_7 = -0,539$ ) is a reflection of the process of investing in urban real estate as a means of saving savings.

The considerable participation of the construction sector enterprises in the formation of the macroeconomic system is substantiated.

## **6. Discussion of the results**

The conducted study made it possible to detect that the construction sector is a key factor in the impact on the economy. Using dynamic balance cross-sectional regression, it is determined that gross domestic product (Y1), the level of budget revenue (Y2), volume of capital investment (Y3), the level of employment (Y4), the coefficient of coverage of imports by exports (Y5) and volume of realized innovative products (Y6) depend on the development of the enterprises in the construction sector.

Therefore, the use of the outlined above tools made it possible to determine the dependence of key macroeconomic data selected for analysis, which were considered as functions of different indicators of the functioning of construction sector enterprises and to evaluate their impact in quantitative terms.

## **7. Conclusions**

Summarizing the above-indicated, we can conclude that there is a close correlation between the state of development of the construction sector enterprises and the social and economic development of the country. Accurate identification of the impact of construction on the economic system will make it possible to predict macroeconomic trends and identify possible changes in the world economy. This, in turn, will provide an opportunity to apply an appropriate system of economic, financial and institutional measures to enhance social and economic development and create a favourable investment climate.

The following scientific results were obtained at the theoretical level:

It is substantiated that the construction sector is a significant component of economic development, has a significant impact on the economic security of the state and, at the same time and becomes a significant source of danger in the period of negative tendencies of its main performance indicators. The current stage of development of enterprises in the construction sector of the economy is characterized by compliance with the macroeconomic trends in the country.

We consider practical the following results:

The model of social and economic participation of the construction sector in the economic system of the country is developed, which on the basis of dynamic cross-sectional balance regression allows to determine the ranges of values of influence of the main indicators of functioning of the enterprises of the construction sector on the gross domestic product; the level of budget revenues; volume of capital investments; the level of employment; the coefficient of coverage of imports by exports and volume of realized innovative products.

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