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MULTIFACTOR MODELS FOR STUDYING THE IMPACT OF INVESTMENT ACTIVITIES OF ENTERPRISES ON THEIR PROFITABILITY: CASE OF UKRAINE

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ABSTRACT

Objectives: Understanding the processes of transformation of the investment activity of domestic business entities is decisive, when making decisions and forming effective scenarios for the further development of business activities aimed at increasing profits. There are complex economic realities for the development of production today, so, the economic agents are faced with the task of finding the optimal ratio between investments in the production restructuring processes and investments in innovative projects. This problem can be solved only by forming the optimal structure of their own capital investments. The purpose of this study is to identify the main trends in the investment activity of domestic enterprises using a comprehensive analysis of the structural dynamics of real investment projects and its impact on their financial results. ***Methods / Approach:*** During the analysis of investment process, relative indicators that characterize the shares of the components in the structure of the investments were calculated; charts and graphs were constructed, analytical tables were compiled. Multifactor linear regression models were built to determine the importance of the investment components' dominance and their impact on the profitability of the enterprise. Canonical correlation analysis was used to study the relationship between financial performance indicators of Ukrainian enterprises and using the high technologies in their production activities. ***Results:*** It was found that the dynamics of indicators that identify structural and dynamic changes in the structure of capital investments of Ukrainian enterprises and the selection of certain structural regimes indicate the dependence of the rate of growth and structural shifts on the political situation in the country, as well as on the coronavirus pandemic, which caused significant fluctuations in the investment activity of domestic business entities. ***Conclusions:*** The study confirmed that the indicator of the financial performance of Ukrainian enterprises is most influenced gross investment in existing buildings and structures, gross investment in construction and alteration of buildings and gross investment in purchased software.

Keywords: *canonic correlation, enterprises, investment activity, multifactor modelling, profitability, regression, structure.*

JEL classification: *C50, M21, D92*

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INTRODUCTION

In accordance with conditions of the post-financial and economic crisis and the difficult political situation in Ukraine, the investment activity of domestic business entities does not ensure the proper productivity and efficiency of production, which does not contribute to the stabilization of the economic development of the country in the future. This necessitates the adoption of effective management decisions regarding to the organization of investment activities of enterprises in order to obtain high financial results and increasing competitiveness. Understanding the processes of transformation of the investment activity of domestic business entities is decisive, when making decisions and forming effective scenarios for the further development of business activities aimed at increasing profits. In addition, it is also important to identify the main factors that have the most impact on the profitability of the enterprise and to identify and evaluate the relationship between them.

There are complex economic realities for the development of production today, so, the economic agents are faced with the task of finding the optimal ratio between investments in the production restructuring processes and investments in innovative projects. Usually, these two areas of investment activity are interconnected and complement each other. On the one hand, investments in repairs and equipment, modernization of management and sales systems enable the business entity to maintain its position in a competitive market environment and create conditions for the accumulation of financial sources. However, on the other hand, they do not contribute to the generation of long-term competitive advantages, as they do not ensure the stability of its market position in the long term. This problem can be solved only by forming the optimal structure of their own capital investments.

Effective management decisions in the field of investment policy organization will always be a priority among tasks related to the stabilization of the country's economic development at both levels: as for the state, so for the business entities.

There are some studies on the investment activities of enterprises. Piątkowski, M.J. (2020) analyzed the investment activity of Polish enterprises for 2007–2015, as in terms of their sizes and types, so at the regional level. He got the conclusion that the cost of fixed assets remains low despite the growing investment volumes of Polish enterprises compared to the other EU countries' enterprises. He also revealed the existence of large regional differences in the level of growth per capita of the working-age population and in the level of the growth in the value of investments among private businesses. In another study, Piątkowski, M.J. (2020) analyzed the results of material investments in enterprises of the Lesser Poland Voivodeship, in two groups of subjects, that is those who implemented investments at the expense of EU subsidies, and those who financed investments from other sources without using EU assistance. The author used a descriptive approach combined with statistical analysis. The multiple linear regression (MLR) model was used to test the hypotheses. Jędrzejczak-Gas, J. et al (2018) conducted a comparative study of Polish companies operating in different

industries using linear ordering methods (sum method and Helwig method). They found high fluctuations in investment activity in 2010–2016 and attributed this to the uncertainty Polish companies were faced during the period under study.

Wildowicz-Giegel, A. (2013) notes that investments in intangible assets enable businesses as to maintain, so to improve their competitive positions in the long term. Analyzing the investment activity of Polish enterprises, she paid special attention to the amount and structure of investments in tangible and intangible assets and concluded that not only the investment activity of business entities is low compared to the EU-27 countries, but also insufficient from the point of view of the needs of the Polish economy. Čámská, D. et al (2011, 2012) researched investment activity in the Czech Republic during 2008–2011 deduced that financial support programs can become an additional source of investment financing.

The purpose of this study is to identify the main trends in the investment activity of domestic enterprises using a comprehensive analysis of the structural dynamics of real investment projects and its impact on their financial results.

MATERIALS AND METHODOLOGY

The analysis of the investment activity of enterprises on the example of Ukraine was carried out using such methodological techniques as: comparison, generalization, grouping, calculation of dynamic series, etc. Also, during the analysis of this process, relative indicators that characterize the shares of the components in the structure of the investments were calculated; charts and graphs were constructed, analytical tables were compiled. Multifactor linear regression models were built to determine the importance of the investment components' dominance and their impact on the profitability of the enterprise. Canonical correlation analysis was used to study the relationship between financial performance indicators of Ukrainian enterprises and using the high technologies in their production activities.

RESULTS AND DISCUSSION

Since the assessment of the effectiveness of the investment policy in relation to enterprises involves the analysis of current and past results of investment activities, we consider the dynamics of the formation of the capital investment of domestic enterprises as a whole and so as by type of economic activity with a breakdown on large, medium and small (the latter also include microenterprises).

Statistical data of the State Statistics Service of Ukraine, which are presented in the national currency (UAH), were used in the research. However, taking into account the research period (2010–2020), namely the fact that in 2014 Russia's armed aggression against Ukraine was began, which caused a sharp devaluation of UAH (Figure 1), we did a recalculation of the main indicators that were used in analysis, from the national currency to the official currency of the European Union countries (the latter was chosen based on the fact that

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today Ukraine is a candidate for joining the EU). This made it possible to avoid false conclusions, since when considering the dynamics of indicators in UAH, only the growth of capital investments is observed and the real situation in the field of investment activity is not reflected. The conversion of measurement units from the national currency to the EUR was carried out according to the official exchange rate (average for the period), calculated on the basis of the data of Ukraine National Bank (2020), which were set for the EUR during the corresponding year.

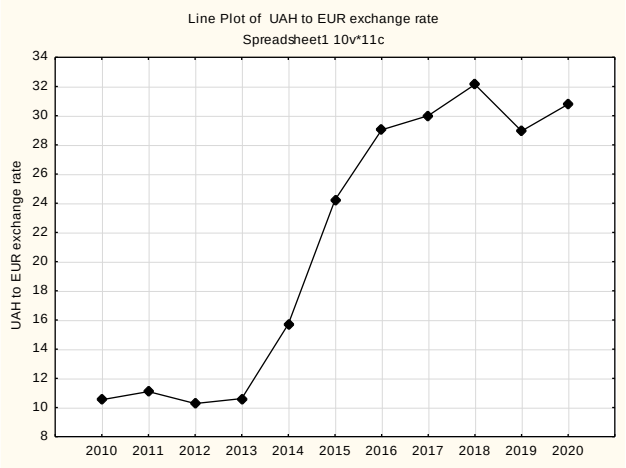

Figure 1. Dynamics of exchange rate from UAH to EUR during 2010–2020.
Source: Author's own elaboration based on National Bank of Ukraine

As can be seen on Figure 1 large-scale drop in UAH exchange rate during 2014–2016 became a stress for the country's economy; this made adjustments in most spheres of economic life, in particular, certain transformations took place in the sphere of investment activity. Therefore, it is not rational to talk about the increase of capital investments in UAH without taking into account the interaction of the national and world economies.

At the beginning of research, before detecting dynamic investment structure transformations of domestic enterprises, we considered the change in the indicator that are characterized the total volume of capital investments in entrepreneurial activity in dynamics during the studied period. For the analysis we used statistical data that were provided on the official website of the State Statistics Service of Ukraine regarding capital investments of enterprises by type of economic activity with a breakdown on large, medium, small and microenterprises in 2010–2020 (the latter two are combined into one group). In order to confirm the feasibility conversion of the national currency into EUR for further calculations, we demonstrated an infographic of the difference between the dynamic series of this indicator depending on the currency in which it is expressed (Figure 2 (a, b)).

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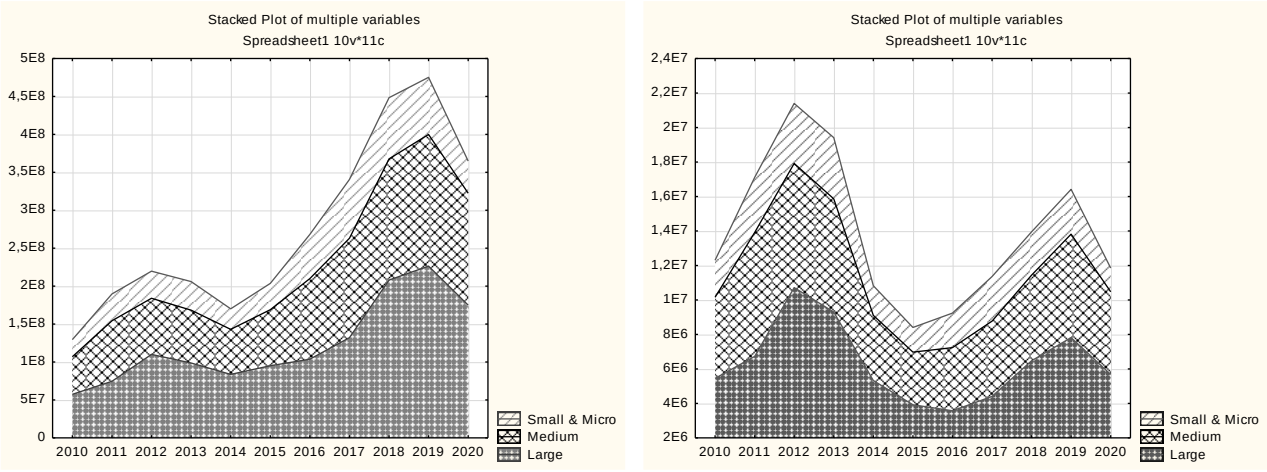

a) b)

Figure 2. Dynamics of capital investments of Ukrainian enterprises during 2010–2020: *a*) thsd. UAH; *b*) thsd. EUR.
Source: Author's own elaboration by using STATISTICA 10.

According to Figure 2 the volume of capital investments in UAH increases during the studied period of time, and a sharp increase is observed precisely with the beginning of Russia's armed aggression against Ukraine; but real situation in the investment sphere become more understandable after analyzing the capital investments of domestic enterprises in EUR, namely, taking into account political events we can see the decrease in the volume of investments and their gradual growth during the period of adaptation of the domestic economy to new realities against the background of the country's struggle for territorial integrity.

It is also important to analyze the dynamics of the financial results of the functioning of enterprises with their division into large, medium, small and micro (Table 1) because of the implementation of effective investment activity is primarily aimed at increasing the company's profit, increasing the cost of capital and/or obtaining other benefits for investors,

Data of Table 1 demonstrate us that despite the superiority of profitable enterprises of Ukraine over loss-making ones in number (they are correlated as 2:1, and sometimes 3:1, respectively, in each of the groups), the overall resulting indicator of their financial activity is presented with a negative sign, which indicates the advantage of the unprofitability of a relatively small part of economic agents over the profitability of others.

Table 1. The number of enterprises of Ukraine and the financial results of their activities, divided into groups during 2010–2020.

Group	Years	Number of active entities of entrepreneurship, units	Profitable enterprises		Loss-making enterprises	
			in % to the total number of enterprises	financial result, thsd. EUR	in % to the total number of enterprises	financial result, thsd. EUR
Large enterprises	2010	586	68,3	74278389,8	31,7	45807334,4
	2011	659	69,2	131043536,3	30,8	38471399,5
	2012	698	70,0	96928633,3	30,0	59746403,4
	2013	659	68,6	88724783,7	31,4	60721269,4
	2014	497	51,8	81040692,4	48,2	270974765,1

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	2015	423	55,7	105387895,0	44,3	250791766,1
	2016	383	65,8	158665892,0	34,2	97443205,0
	2017	399	73,3	266879072,0	26,7	109972776,0
	2018	446	76,9	277607658,8	23,1	102431494,0
	2019	518	78,4	336446436,1	21,6	104425962,4
	2020	512	69,3	244892012,5	30,7	182936600,4
Medium enterprises	2010	20983	63,4	87592330,6	36,6	46010660,4
	2011	20753	66,3	87526739,5	33,7	56436042,2
	2012	20189	66,2	111313201,3	33,8	63571191,9
	2013	18859	65,0	81498827,4	35,0	73108757,5
	2014	15906	62,6	103427946,8	37,4	302608302,5
	2015	15203	71,1	186781418,8	28,9	277943240,1
	2016	14832	76,1	177033687,9	23,9	144217155,5
	2017	14937	76,6	208842546,8	23,4	118071953,6
	2018	16057	78,2	251823440,4	21,8	104658158,1
	2019	17751	77,9	356527463,6	22,1	79332430,6
	2020	17602	76,5	273619609,1	23,5	188553885,9
Small and microenterprises	2010	357241	58,6	27770042,0	41,4	43417107,9
	2011	354283	65,0	36975655,8	35,0	42032915,5
	2012	344048	64,4	39794131,4	35,6	49048118,7
	2013	373809	66,0	39640861,7	34,0	64698765,2
	2014	324598	66,5	49156077,9	33,5	224418474,8
	2015	327814	73,9	95482992,3	26,1	207388949,0
	2016	291154	73,3	107312542,0	26,7	131463954,1
	2017	322920	72,7	117446532,1	27,3	128171349,9
	2018	339374	74,1	139462397,6	25,9	92591583,0
	2019	362328	73,7	176668204,9	26,3	72839676,1
	2020	355708	71,1	155467187,0	28,9	167754009,2

Source: Author's own calculation by using MS Excel.

The dynamics of the indicator characterizing the profit / loss of Ukrainian enterprises with a breakdown on large, medium, small and microenterprises in 2010–2020 also is quite illustrative (Figure 3). It is clearly visible that in 2014–2015 were turning points for all business activities of Ukraine.

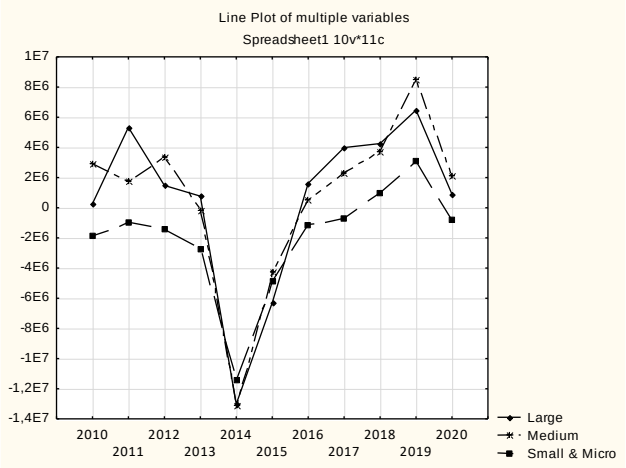

Figure 3. Dynamics of the financial result to taxation of Ukrainian enterprises in 2010–2020 (thsd. EUR) with a breakdown on large, medium, small and micro.
Source: Author's own elaboration by using STATISTICA 10.

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The reason for this fact was the political situation in the country and as a result it was a sharp change in the official exchange rate of the UAH against foreign currencies.

According to the methodological recommendations of the State Statistics Service of Ukraine (2021), the structure of capital investments of enterprises by types of economic activity is represented by the following components: gross investment in machines and equipment, thsd. EUR (X_1); gross investment in land, thsd. EUR (X_2); gross investment in existing buildings and structures, thsd. EUR (X_3); gross investment in construction and alteration of buildings, thsd. EUR (X_4); gross investment in concessions, patents, licences, trade marks and similar rights, thsd. EUR (X_5); gross investment in purchased software, thsd. EUR (X_6).

Table 2. Shares of components of capital investment of enterprises of Ukraine

Group	Years	Gross investment in machines and equipment	Gross investment in land	Gross investment in existing buildings and structures	Gross investment in construction and alteration of buildings	Gross investment in concessions, patents, licences, trade marks and similar rights	Gross investment in purchased software
Large	2010	0,476	0,004	0,007	0,460	0,032	0,023
	2011	0,491	0,007	0,008	0,467	0,009	0,017
	2012	0,498	0,004	0,012	0,459	0,015	0,013
	2013	0,427	0,001	0,004	0,515	0,038	0,015
	2014	0,414	0,002	0,004	0,554	0,012	0,015
	2015	0,394	0,002	0,004	0,466	0,110	0,024
	2016	0,444	0,001	0,012	0,500	0,017	0,026
	2017	0,500	0,003	0,003	0,444	0,021	0,030
	2018	0,466	0,001	0,013	0,406	0,099	0,015
	2019	0,508	0,002	0,008	0,443	0,021	0,018
	2020	0,478	0,006	0,005	0,480	0,008	0,023
Medium	2010	0,470	0,009	0,038	0,455	0,018	0,010
	2011	0,433	0,008	0,051	0,466	0,036	0,006
	2012	0,488	0,008	0,024	0,450	0,024	0,006
	2013	0,532	0,006	0,030	0,403	0,022	0,007
	2014	0,500	0,006	0,022	0,434	0,030	0,008
	2015	0,548	0,006	0,028	0,386	0,022	0,011
	2016	0,602	0,007	0,026	0,338	0,019	0,009
	2017	0,661	0,004	0,023	0,287	0,016	0,009
	2018	0,594	0,004	0,034	0,341	0,016	0,011
	2019	0,511	0,006	0,027	0,437	0,011	0,008
	2020	0,594	0,005	0,022	0,351	0,016	0,012
Small and micro	2010	0,301	0,022	0,074	0,593	0,006	0,005
	2011	0,300	0,025	0,064	0,594	0,011	0,005
	2012	0,369	0,020	0,061	0,542	0,004	0,005
	2013	0,339	0,016	0,055	0,580	0,006	0,004
	2014	0,426	0,015	0,040	0,512	0,004	0,003
	2015	0,528	0,016	0,073	0,372	0,006	0,005
	2016	0,606	0,013	0,069	0,306	0,003	0,004
	2017	0,624	0,013	0,036	0,316	0,006	0,005
	2018	0,613	0,010	0,029	0,338	0,005	0,006
	2019	0,546	0,011	0,051	0,382	0,005	0,006
	2020	0,606	0,008	0,020	0,355	0,002	0,009

Source: Author's own calculation by using MS Excel.

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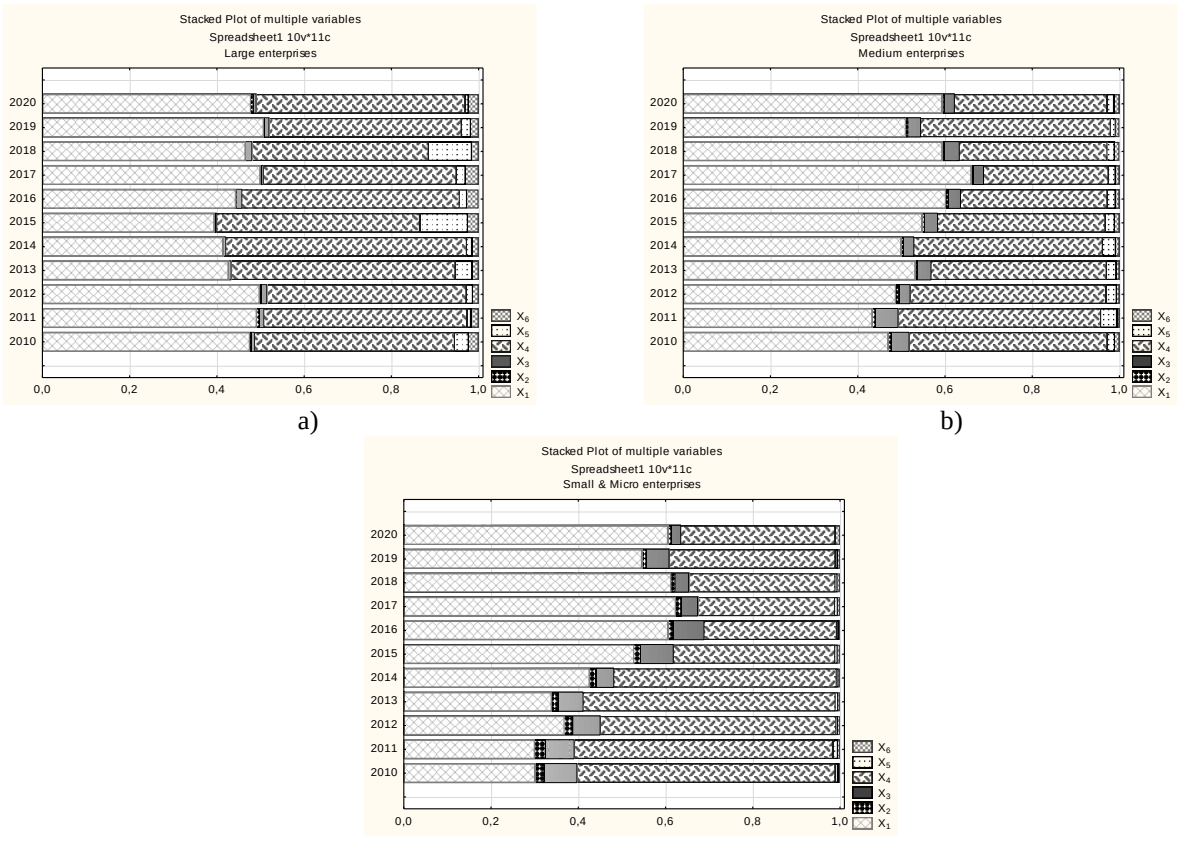
The proportions of the above-mentioned components are given in the table 2. Among them we can single out the two largest types in each group of enterprises, the shares values which range from 0.4 to 0.5, that are gross investment in machines and equipment and gross investment in construction and alteration of buildings gross investment in construction and alteration of buildings; the other four types of capital investment have significantly lower values.

Taking into account the breakdown domestic enterprises on large, medium, small and micro, let's depict the dynamics of capital investment shares in studied period on Figure 4.



a) b)

c)

Figure 4. Dynamics of capital investment shares of Ukrainian enterprises (2010–2020): a) large; b) medium; c) small and micro.
Source: Author's own elaboration by using STATISTICA 10.

According to figure 4, we can see that the share of capital investment in machines and equipment in the overall structure is growing significantly for all three group of enterprises after 2014.

Based on the results of the analysis, it can be stated that in 2014 there were structural deformations in the investment activity of all groups of enterprises. It took domestic enterprises a year or two to overcome its and enter a different structural regime, moreover, this process was accompanied by a significant decrease in the number of enterprises. Another factor in the structural recession of the investment activity of domestic enterprises was the COVID-19 pandemic in 2020.

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Thus, it follows that the situations in both 2014 and 2020 are not natural, but caused a significant reduction in the volume of capital investments in business activities, the number of enterprises of all groups and had some impact on the profitability of business entities.

In order to analyze impact of individual components of capital investments on the financial result indicator, to find out whether there is a dependence between them and to highlight the most important factors, we used multivariate regression analysis. This method is the most common and simplest for establishing the relationship between dependent and independent variables; it is used to analyze various economic phenomena and processes, Dziubanovska N., (2019). In addition, constructing the linear regression model can be the initial stage of data analysis.

So, before using multifactor regression modeling, we define *Y* as a dependent variable – profit / loss of Ukrainian enterprises, billion EUR; and we evaluate the dependence of this indicator on six types of capital investments: gross investment in machines and equipment, thsd. EUR (X_1); gross investment in land, thsd. EUR (X_2); gross investment in existing buildings and structures, thsd. EUR (X_3); gross investment in construction and alteration of buildings, thsd. EUR (X_4); gross investment in concessions, patents, licences, trade marks and similar rights, thsd. EUR (X_5); gross investment in purchased software, thsd. EUR (X_6). For analysis the data from the State Statistics Service of Ukraine in 2010–2020 were used (excluding the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol, and part of the temporarily occupied territories in the Donetsk and Luhansk regions).

Multifactor regression analysis was carried out using the Multiple Regression module of the STATISTICA 10 software product. At the first stage, we analyzed the impact of capital investments by type on the financial results of business entities of Ukraine as a whole, without a breakdown on groups. The main indicators of the regression model are presented on Figure 5.

	Summary Statistics; DV: Y (Spreadsheet1)
Statistic	Value
Multiple R	0,707716413
Multiple RI	0,500862521
Adjusted RI	0,385676949
F(6,26)	4,34830953
p	0,0036213845
Std.Err. of Estimate	3939939,35

Figure 5. The main indicators of the multiple regression model.
Source: Author's own elaboration by using STATISTICA 10.

As we can see for the modeling results, the coefficient of determination from the table of parameters of the multiple regression equation (Figure 6) also shows that some of the coefficients are not statistically significant ($t_{calculated} < t_{table}$).

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N=33	Regression Summary for Dependent Variable: Y (Spreadsheet1) R= ,70771641 RI= ,50086252 Adjusted RI= ,38567695 F(6,26)=4,3483 p<,00362 Std.Error of estimate: 3940E3 b*	Std.Err. of b*	b	Std.Err. of b	t(26)	p-value
Intercept			-9499988	2197247	-4,32359	0,000200
X_1	0,80130	0,293078	4	1	2,73408	0,011108
X_2	0,27727	0,263799	75	72	1,05105	0,302908
X_3	0,52267	0,289975	35	19	1,80248	0,083075
X_4	-1,20167	0,376149	-5	2	-3,19465	0,003651
X_5	0,01210	0,193653	0	7	0,06249	0,950653
X_6	0,98030	0,352352	106	38	2,78216	0,009919

Figure 6. Table of multiple regression equation parameters and their estimates.
Source: Author's own elaboration by using STATISTICA 10.

Therefore, the next stage of the regression analysis is to select such determinants that have a strong impact on the investigated feature. To do this, we applied stepwise analysis, which consists in sequentially excluding or including factors from the model based on certain criteria. As a result, we will get the regression equation of the species ($R^2 = 0.70766345$.):

$$Y = -9480283 + 0.79741\,X_1 - 1.19441\,X_4 + 0.98388\,X_6 . \quad (1)$$

Adequacy of the model was confirmed by analysis of residuals. The more the distribution is similar to the normal one, the better the values of the residuals lie on a straight line, as evidenced by the normal probability graph of the residuals for the constructed model (Figure 7).

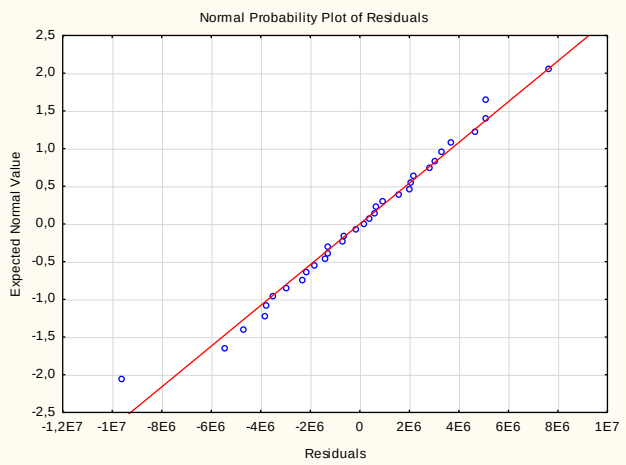

Figure 7. Normal probability plot of model residuals.
Source: Author's own elaboration by using STATISTICA 10.

On next step the dependence of profitability / loss of Ukrainian enterprises on capital investments was considered more detail in each of the groups of economic entities. So, similarly, with the using STATISTICA 10 tools, we obtained three multivariate regression models.

Thus, large enterprises ($R^2 = 0.85000535$.):

$$Y = -19782833 + 0.627479\,X_3 - 0.737240\,X_4 + 0.854895\,X_6 . \quad (2)$$

Medium enterprises ($R^2 = 0{,}95317954$):

$$Y = -15064698 + 0.92588\,X_1 + 1.02436\,X_3 - 1.56975\,X_5 . \quad (3)$$

Small and microenterprises ($R^2 = 0{,}95253293$):

$$Y = -13148195 + 1.20765\,X_3 + 1.16196\,X_6 . \quad (4)$$

Therefore, as a result of a step-by-step multifactorial regression analysis, we obtained econometric models for evaluating the impact of certain types of capital investments on the indicator of financial performance of Ukrainian enterprises, having previously rejected factors which impact is not significant on the investigated characteristic. So, according to the results of modeling, the profit/loss of domestic business entities is most affected by gross investment in existing buildings and structures, thsd. EUR (X_3), gross investment in construction and alteration of buildings, thsd. EUR (X_4) and gross investment in purchased software, thsd. EUR (X_6).

The last component is the component of capital investment into intangible assets, Corrado et al. (2005, 2009), which at the current stage are recognized in the EU as a key factor in increasing the efficiency and competitiveness of firms in the conditions of the penetration of information technologies, the creation of a single world market without national barriers, and the growing interdependence of national economies. As regards to investments in information technology, Demirhan, D. et al (2005/2006) pointed out that they have become crucial for companies to improve the quality of their products and services. Research results indicated a significant contribution of investments into intangible assets to the economic growth of countries. In particular, Fukao et al. (2009) noted that investment into intangible assets in Japan was 11.2% of GDP, in European countries this indicator was somewhat lower: 9.0% in Sweden (Edquist, 2011), 7.0% in Germany (Crass et al ., 2010), 6-7% in France (Delbecque & Nayman, 2010), 5.2% in Spain and Italy (Hao et al., 2009). According to studying at the level of economic sectors, Goodrige et al. (2012) provided evidence that the ratio of intangible investment to value added was the highest in the UK manufacturing sector.

Considering the above, investment into intangible assets, in particular, in software, is a promising direction of capital investments of domestic business entities. Computer technologies contribute to the integration of many areas and sectors of the modern complex systems functioning that evolve in conditions of instability,

crises and non-linearity. They provide an opportunity to develop models of optimal management of man-made objects, Ramazanov, S. et al. (2019) and create effective decision-making systems.

Taking into account the lack of data on the volume of investments in the purchase of software in terms of types of economic activity, we analyzed the impact of the use of high technologies in the production activities of Ukrainian enterprises on their financial results. One of the methods for solving this problem is canonical correlation analysis. Regarding its utility, Opic (2019) noted that it enables the identification of latent correlation factors, i.e. models through canonical functions.

We applied this method for studying the impact of the using of high technologies in production on the profitability of Ukrainian enterprises. For analysis the data from the State Statistics Service of Ukraine in 2010–2020 were used.

A set of dependent variables Y is Y_1 – net profit (loss) of Ukrainian enterprises, thsd. EUR, and Y_2 – volume of products sold by enterprises using high technologies in production, thsd. EUR. A set of variables X is X_1 – gross investment in purchased software, thsd. EUR, and X_2 – number of enterprises that using high technologies in production, units (Table 3).

Table 3. Data from the State Statistics Service of Ukraine for analysis

Years	Net profit (loss) of Ukrainian enterprises, thsd. EUR, Y_1	Volume of products sold by enterprises using high technologies in production, thsd. EUR, Y_2	Gross investment in purchased software, thsd. EUR, X_1	Number of enterprises that using high technologies in production, units, X_2
2010	1320256,501	437780,6682	12299883,79	1307
2011	6112434,312	845877,1345	17107943,44	1297
2012	3414335,754	524604,2101	21395453,62	1122
2013	-2152215,714	477120,6724	19413644,48	1210
2014	-37545857,67	323379,5074	10825907,14	1107
2015	-15416263,08	187339,8077	8403918,906	1068
2016	1023252,501	218728,9011	9237171,65	916
2017	5625093,09	221260,00000	11354096,37	961
2018	8970300,812	267221,5308	13950371,66	1001
2019	18092538,91	258977,5475	16416074,68	1040
2020	2210292,481	240094,1864	11853052,78	1082

Source: Author's own calculation by using MS Excel.

The mathematical problem is to find such normalized linear combinations $U = \alpha_1 Y_1 + \alpha_2 Y_2$ and $V = \beta_1 X_1 + \beta_2 X_2$, so that the correlation between U and V is maximum. The values of U and V, as well as their coefficients are called canonical. The closeness of the relationship between the canonical quantities is determined by the canonical correlation coefficient R.

Canonical correlation analysis will be performed using the software product STATISTICA 10 (Figure 8).

As a result of canonical correlation analysis, we obtained two canonical roots with the canonical value of the correlation coefficient $R = 0.85395$, which is quite large and highly significant, since $p < 0.005$. This value

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shows the closeness of the relationship between the canonical variables in the first and second plurals. Two roots describe 100% variance of the set of indicators of activity of the enterprises of Ukraine and 100% – set of the indicators characterizing attraction of investments in the acquisition of software and use by the enterprises of high technologies in their production activity.

	Canonical Analysis Summary (Spreadshe Canonical R: ,85395 Chil(4)=15,192 p=,00433	
N=11	Left Set	Right Set
No. of variables	2	2
Variance extracted	100,000%	100,000%
Total redundancy	60,7507%	59,7283%
Variables: 1	Y_1	X_1
2	Y_2	X_2

Figure 8. Results of canonical analysis.
Source: Author's own elaboration by using STATISTICA 10.

Using the values of the volume of products sold by enterprises using high technologies in production and their net profit and canonical roots, we can explain, on average, 60.8% variance of variables in the left set and 59.7% variability in the right set. These results indicate a fairly strong relationship between the variables of the two sets.

The significance of the canonical roots is checked using the correlation coefficient and the fulfillment of the condition $p < 0.005$ (Figure 9).

	Chi-Square Tests with Successive Roots Removed (Spread					
Root Removed	Canonicl R	Canonicl R-sqr.	Chi-sqr.	df	p	Lambda Prime
0	0,853948	0,729227	15,19165	4	0,004326	0,131921
1	0,716100	0,512799	5,39309	1	0,020223	0,487201

Figure 9. Checking the significance of canonical roots
Source: Author's own elaboration by using STATISTICA 10.

As it can be seen from Figure 9, the largest value is $R = 0.853948$ and it is the most significant, ($p < 0.005$) i.e. only the first canonical root is significant. The second canonical root is not significant, since the p-level = 0.2.

To calculate the values of canonical variables the canonical weights are used as of the left (Figure 10) and right (Figure 11) sets, respectively.

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	Canonical Weights, left set (Spreadsheet20)	
Variable	Root 1	Root 2
Y_1	-0,728980	-0,696070
Y_2	0,781862	-0,636095

Figure 10. Canonical scales of the left set
Source: Author's own elaboration by using STATISTICA 10.

	Canonical Weights, right set (Spreadsheet20)	
Variable	Root 1	Root 2
X_1	-0,641688	-0,808216
X_2	0,941673	-0,422170

Figure 11. Canonical scales of the right set
Source: Author's own elaboration by using STATISTICA 10.

Based on Figure 10 and Figure 11, we can make the equation of the canonical model for the variables U and V (R = 0.85):

$$U = -0.72898\,Y_1 + 0.78186\,Y_2\,; \tag{5}$$

$$V = -0.64169\,X_1 + 0.94167\,X_2\,. \tag{6}$$

Since the correlation coefficient is quite weighty, it means that there is a close relationship between linear combinations of output variables, i.e. indicators of sales of Ukrainian enterprises and their net profit are significantly related to the studied factors.

The relationship between the values of the canonical variables from the right and left sets is represented graphically (Figure 12).

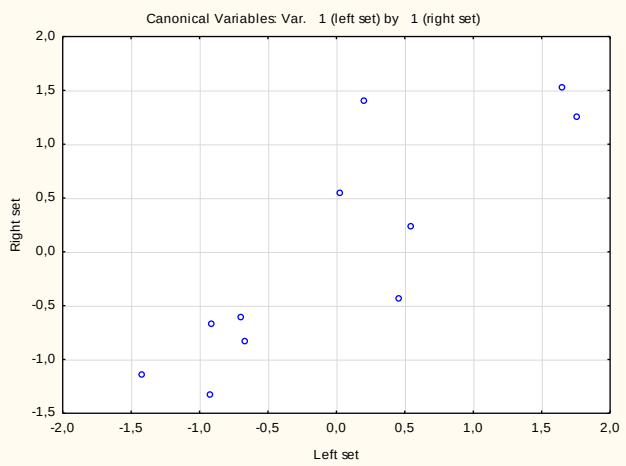

Figure 12. Scattering diagram of canonical variables.
Source: Author's own elaboration by using STATISTICA 10.

This graph shows that there are almost no pronounced deviations from the regression line. Thus, we can conclude that the basic assumptions of canonical analysis are confirmed.

CONCLUSION

Therefore, taking into account the dynamism and variability of structural interrelationships in investment activity, it is appropriate to conduct an analysis of the structure of capital investments of enterprises by types of activity, as a decision-making support tool in the formation of investment policy. It was found that the dynamics of indicators that identify structural and dynamic changes in the structure of capital investments of Ukrainian enterprises and the selection of certain structural regimes indicate the dependence of the rate of growth and structural shifts on the political situation in the country, as well as on the coronavirus pandemic, which caused significant fluctuations in the investment activity of domestic business entities. The completeness of the conducted research, the reliability of the obtained results and the understanding of transformations of the investment activity of domestic enterprises when making decisions on strategic planning of the directions of the development of the country's entrepreneurial sector will make it possible to develop an optimal scheme for the redistribution of structural components of capital investments and will allow the formation of scenarios for conducting investment activities to increase the financial result and competitiveness of domestic enterprises on the world market.

In addition, the study confirmed that the indicator of the financial performance of Ukrainian enterprises is most influenced gross investment in existing buildings and structures, gross investment in construction and alteration of buildings and gross investment in purchased software. This conclusion prompted us to carry out an additional assessment of the impact of the use of high technologies in the production activities of Ukrainian enterprises on their financial results. Thus, as a result of the method of canonical correlations, we investigated that the indicators of the volume of products sold by enterprises of Ukraine that use high technologies in their production and the net profit received by them are significantly related to the gross investments in the acquisition of software and the number of enterprises of Ukraine that use high technologies in its production.

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