Alina Herasymenko
Ivan Franko National University of Lviv, Ukraine
E-mail: alina91herasymenko@gmail.com
ORCID: https://orcid.org/0000-0001-6942-7211
ResearcherID: GXF-8090-2022

The Impact of the Macroeconomic Environment on Bank Lending to Industrial Enterprises: the Case of Ukraine

Abstract

In today's world, the development of any economy is characterised by numerous financial, socio-economic and political challenges. Ukraine's experience is particularly special, as its macroeconomic environment is undergoing significant shifts and changes due to the unprecedented armed invasion of its sovereign territory by a neighbouring aggressor country. Given the importance of the industrial production sector in the country's economic growth, the problem of additional financial sources for the development of industrial enterprises in the dynamic macroeconomic environment of Ukraine is particularly relevant. Since banks are the dominant link in the financial system of Ukraine, the study of the impact of the macroeconomic environment on bank lending to industrial enterprises is of particular scientific interest. The *article is aimed* at identifying and analysing the key economic factors of the macroeconomic environment of Ukraine that influenced the state of bank lending to industrial enterprises in 2009-2022, using economic and mathematical modelling methods. *Methodology*. The study is based on the data that showed the highest correlations between the outcome variable – the volume of bank lending to industrial enterprises (in billion UAH) and the explanatory variables – economic factors of the macroeconomic environment of different groups (general indicators of economic development; indicators of industrial development; indicators of socio-economic development; indicators of the monetary market; indicators of public finance; indicators of the external sector; indicators of the foreign exchange market) for the period 2009-2022. Based on these data, a multiple linear regression model is built and the results are interpreted. *Practical implications*. The practical results can serve as a basis for further research on ways to improve the risk management of bank lending to industrial enterprises in a dynamic macroeconomic environment; ways to improve the management of problem debts of industrial enterprises; ways to intensify bank lending to industrial enterprises in Ukraine as a prerequisite for post-war economic reconstruction on the basis of sustainable development, etc. *Value/Originality*. The results of the research provide a deeper understanding of the role of the country's macroeconomic environment, its dynamics and the impact of certain economic factors on the development of bank lending to industrial enterprises as an important source of additional financial resources for industrial enterprises.

Keywords

macroeconomic environment, industrial enterprises, bank lending to industrial enterprises, sustainable development, Russian-Ukrainian war

JEL: E44, E47, G21, O11

DOI: https://doi.org/10.30525/2500-946X/2023-3-3

1 Introduction

The macroeconomic environment of a country plays an extremely important role in the development of bank lending to industrial enterprises. Macroeconomic factors directly or indirectly affect the supply and demand for bank loans, the level and intensity of risks associated with lending to certain industries, the overall level of non-performing loans, etc.

As a result of the study of scientific literature (Smaha & Hnativ, 2007; Zampara, Giannopoulos & Koufopoulos, 2017; Odnoroh, 2019; Ivakhnenkov, Hlushchenko & Sverenko, 2020; Foglia, M., 2022), it is advisable to distinguish the following groups of macroeconomic factors that affect the lending activities of banks:

– *Economic growth*. The overall level of economic growth increases the need for additional financial resources for enterprises to expand production capacity, modernise, implement investment and innovation projects, bring production in line with EU standards, etc.

– *Inflation rate*. Depending on the inflation rate, the lowest and highest levels of key interest rates in the economy may vary. In particular, high inflation usually leads to higher interest rates on loans and, accordingly, to higher costs for servicing existing loan

debt and for deciding whether to use loan funds in future periods.

– *Monetary policy*. In particular, the central bank can determine the level of the key policy rate and the volume of money supply in the economy, and thus influence the availability and cost of bank loans for businesses.

– *Fiscal and monetary policies*. Government policy (incentive financial support, public-private partnerships, etc.) and measures related to its implementation (regulation of interest rates on loans, preferential lending, etc.) also affect the development of bank lending to industrial enterprises.

– *Political stability*. Political conflicts and political instability create an environment of uncertainty and high risk for investment.

– *External factors of the macroeconomic environment*. First of all, the development of bank lending to enterprises (especially in countries with a high level of dollarisation of the economy) is influenced by the dynamics of the exchange rate, external public debt, and international trade relations.

– *Geopolitical conflicts*. Geopolitical conflicts, which manifest themselves in both economic and armed dimensions, usually lead to a significant deterioration in the dynamics of the country's macroeconomic environment and, accordingly, have a sharply negative impact on the development of bank lending to enterprises.

It should be noted that in recent years, and especially with the outbreak of a full-scale war by the aggressor country on the sovereign territory of Ukraine, the development of bank lending to industrial enterprises in Ukraine has experienced a significant decline. In particular, from December 2008 to June 2023, the share of bank loans to industrial enterprises in the total volume of bank loans to non-financial corporations decreased from 36.43% to 30.27%. At the same time, as of June 2023, the share of non-performing loans to industrial enterprises in the total volume of loans to industrial enterprises remained high at 31.32% (*Official website of the National Bank of Ukraine*). It is worth noting that in countries where the financial system is dominated by banks, as in Ukraine, the share of industrial lending is higher. For example, in Germany, the share of industrial loans in the total loan portfolio of banks averaged 55% over the same period (*Official website of Deutsche Bundesbank*).

The downward trend in bank lending to industrial enterprises in Ukraine and a significant number of macroeconomic factors affecting banks' lending activities necessitate the identification of the key factors that have a decisive impact on the development of bank lending to industrial enterprises in Ukraine. This is advisable in order to find effective ways to solve the long-standing problem of low bank lending to industrial enterprises and to develop measures to stimulate bank lending to industrial enterprises in Ukraine as one of the important prerequisites for its post-war reconstruction in line with the principles of sustainable development.

2 Identification of Key Economic Factors of the Macroeconomic Environment

It is advisable to analyse and assess the nature of influence of key economic factors of the macroeconomic environment on the development of bank lending to industrial enterprises in Ukraine for the period 2009-2022 by building a multiple linear regression model. Thus, the output variable characterising the development of bank lending to industrial enterprises is the volume of bank lending to industrial enterprises (in billion UAH), and the explanatory variables are certain economic factors of the macroeconomic environment with which the output variable has strong correlations.

The study of the correlation between the volume of bank lending to industrial enterprises (in billion UAH) and a number of economic factors of the macroeconomic environment in the period 2009-2022 (namely, *general indicators of economic development*: GDP (UAH billion), inflation index (in %), NBU discount rate (at the end of the year, in %); *industrial development indicators*: industrial output index (in %); construction output index (in %); volume of sold/produced industrial and construction products (works, services) (in billion UAH), producer price index (in %); *indicators of socio-economic development*: unemployment rate (in %), the amount of wage arrears in the country as a whole (in billion UAH); *indicators of the money market*: total money supply M3 (billion UAH), refinancing volume (billion UAH), interest rates on loans granted to non-financial corporations in the reporting period (in %), non-performing loans granted to industrial enterprises (billion UAH); *foreign exchange market indicators:* official exchange rates for the USD and EUR; *public finance indicators*: budget deficit (in billion UAH), public debt to GDP ratio (in %); *external sector indicators*: the ratio of gross external debt to GDP (in %), foreign direct investment (in billion USD), and the consolidated balance of payments (in billion USD) suggests that there is a strong correlation with such economic factors as the amount of non-performing loans to industrial enterprises (in billion UAH), the ratio of public debt to GDP (in %), the official USD exchange rate, and the volume of industrial and construction products (works, services) sold/produced (in billion UAH).

3 Building and Interpreting the Results of Multiple Linear Regression

It is advisable to analyse the impact of key economic factors of the macroeconomic environment on the volume of bank lending to industrial enterprises (in billion UAH) using a multiple linear regression model of the following form (*Rohalskyi, 2001*) (1):

$$Y = f\left(x_1, x_2, ..., x_i, ..., x_n; b_o, b_1, b_2, ..., b_i, ...b_m\right), \quad (1)$$

where Y – output variable;
x_i – explanatory variable;
$b_0, ..., b_i$ – model parameters;
m – the number of explanatory variables.

The theoretical linear multiple regression equation is as follows (*Rohalskyi, 2001*) (2):

$$Y = \beta_0 + \beta_1 \times x_1 + \beta_2 \times x_2 + ... + \beta_m \times x_m + \varepsilon, \quad (2)$$

where Y – output variable;
β_0 – coefficient that determines the value of the output variable when all explanatory variables are equal to 0;
$x_1, ..x_m$ – explanatory variables;
m – the number of explanatory variables;
ε – random error (deviation).

The initial data for the multiple linear regression model are presented in Table 1.

The correlation matrix (Table 1) shows that the volume of bank lending to industrial enterprises (in billion UAH) is most strongly influenced by two factors: the volume of non-performing loans to industrial enterprises (in billion UAH) – 0.825 and the ratio of public debt to GDP (in %). The volume of industrial and construction products sold/ produced (works, services) (billion UAH) has the least influence – 0.466. This factor could have been excluded from the model, but it is of particular scientific interest because it is directly related to the subject of this study.

Based on the results of the calculation of the regression coefficients, it is possible to construct a multiple linear regression equation (3):

$$Y=62,91+0,66X1+3,64X2-7,15X3+0,03X4. \quad (3)$$

The analysis of the results of statistical significance of the constructed multiple linear regression equation shows the following: the value of R is close to 1, which means that the constructed equation describes the actual data and factors that most affect the output variable (Table 3); the F value is less than 0.05 (1-0.95), which means that the regression equation is statistically significant with a confidence level of 95% (Table 4); according to the P-values obtained for each coefficient (less than 0.05), all the calculated coefficients of the regression equation are statistically significant (Table 5).

Based on the calculated value of Y, it is possible to build a graph of correspondence between the values of Y and Y-calculated (Fig. 1).

TABLE 1 Initial data for building a multiple linear regression model

Number of explanatory variables	Output variable	Explanatory variables			
Year	Volume of bank lending to industrial enterprises (billion UAH)	Volume of non-performing loans to industrial enterprises (billion UAH)	Public debt to GDP ratio (in %)	USD exchange rate	Volume of industrial and construction products (works, services) sold/ produced (billion UAH)
n	Y	X1	X2	X3	X4
1	165,51	17,54	34,81	7,99	806,55
2	190,27	24,41	39,49	7,96	1 086,03
3	198,99	20,93	36,34	7,99	1 366,98
4	200,14	18,80	36,67	7,99	1 430,86
5	233,33	19,78	39,90	7,99	1 380,99
6	290,86	44,64	69,40	15,77	1 479,95
7	288,05	86,73	79,00	24,00	1 834,12
8	309,68	115,21	80,90	27,19	2 231,76
9	308,62	121,16	71,77	28,07	2 731,55
10	318,30	173,56	60,94	27,69	3 186,42
11	273,04	135,71	50,24	23,69	3 201,08
12	267,17	63,38	60,44	28,27	3 438,45
13	244,62	61,62	49,02	27,28	4 936,98
14	230,33	69,10	78,51	36,57	2 926,52

Source: compiled by the author based on data from (Official website of the National Bank of Ukraine; Official website of the State Statistics Service of Ukraine)

TABLE 2 Correlation matrix of the outcome variable and explanatory variables

Variable	Y	X1	X2	X3	X4
Y	1	-	-	-	-
X1	0,825169	1	-	-	-
X2	0,77443	0,590019	1	-	-
X3	0,673424	0,721009	0,796205	1	-
X4	0,466611	0,555528	0,323434	0,776572	1

Source: calculated by the author

TABLE 3 Regression statistics of the multiple linear regression equation

Name	Results
Multiple R	0,96
R-squared	0,92
Normalised R-squared	0,89
Standard error	15,16
Observations	13,00

Source: calculated by the author

TABLE 4 Analysis of variance of a multiple linear regression equation

Name	Results				
	df	*SS*	*MS*	*F*	**F significance**
Regression	4,000	22296,081	5574,020	24,267	0,000
Balance	8,000	1837,584	229,698	-	-
Total	12,000	24133,664	-	-	-

Source: calculated by the author

TABLE 5 Indicators of statistical significance of the multiple linear regression equation

Name	Results					
	Ratios	**Standard error**	**t-statistics**	**P-value**	**Lower 95%**	**Upper 95%**
Y-intersection	72,422	29,285	2,473	0,039	4,890	139,954
17,53728827	0,657	0,121	5,445	0,001	0,379	0,935
34,80657602	3,456	0,709	4,874	0,001	1,821	5,091
7,985	-6,731	1,816	-3,706	0,006	-10,919	-2,542
806,5506	0,032	0,010	3,127	0,014	0,008	0,056

Source: calculated by the author

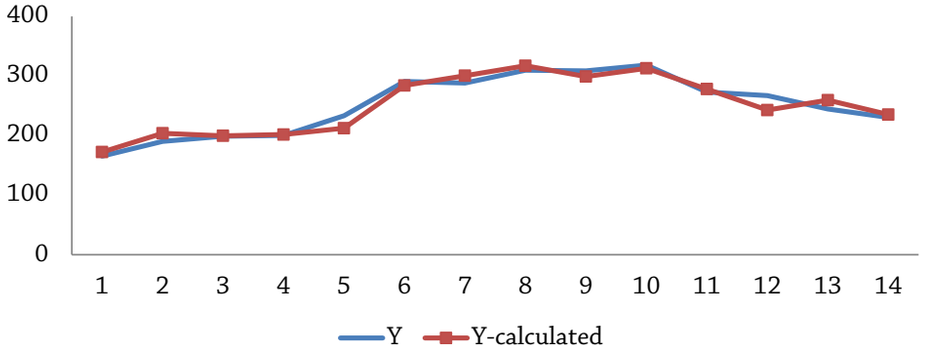

FIGURE 1 Correspondence between Y values and Y-calculated values

Source: calculated by the author

The dynamics of Y and Y-calculated coincide (Fig. 1), which indicates the adequacy of the built multiple linear regression model.

Therefore, the obtained multiple linear regression equation should be interpreted as follows:

– an increase in X1 (volume of non-performing loans to industrial enterprises, billion UAH) by 1 unit will lead to an increase in Y by 0.66 units on average;

– an increase in X2 (public debt to GDP ratio, in %) by 1 unit will lead to an increase in Y by 3.64 units on average;

– an increase in X3 (the USD exchange rate) by 1 unit will lead to a decrease in Y by -7.15 units on average;

– an increase in X4 (volume of sold/produced industrial and construction products (works, services), billion UAH) by 1 unit will lead to an increase in Y by 0.03 units on average.

Based on the maximum value of the correlation coefficient (0.825), factor X1 (volume of non-performing loans to industrial enterprises, billion UAH) has the greatest impact on the outcome variable Y.

The statistical significance of this multiple linear regression equation was tested using the coefficient of determination and the F (Fisher) criterion. It was found that in the studied model, 96.12% of the total variability of the output variable Y is explained by

changes in the explanatory variables X1, X2, X3, X4. It was also found that the model parameters are statistically significant.

4 Conclusions

The results of the multiple linear regression model built in this paper allow to draw the following conclusions:

1. The most depressing impact on bank lending to industrial enterprises in Ukraine in 2009-2022 was the rise in the USD exchange rate. In economies with a high degree of dollarisation, such as Ukraine's, an increase in the USD/EUR exchange rate has a number of negative consequences for bank lending to industrial enterprises: an increase in the cost of credit liabilities, an increase in the cost of servicing credit liabilities of industrial enterprises and, accordingly, an increase in the threat to their financial position; changes in interest rates and other monetary measures as a reaction of the central bank; a decrease in the total volume of new loans granted by banks to industrial enterprises due to their cautious policy on lending to industrial enterprises in foreign currency, etc.

2. A significant correlation between the volume of bank lending to industrial enterprises (in billion UAH) and the ratio of public debt to GDP (in %) in Ukraine in 2009-2022 indicates the existence of certain financial and economic conditions, for example:

– low availability of financial resources: the high level of public debt affects the liquidity of banks and their willingness to issue new loans, and increases interest rates on loans;

– financial system riskiness: large public debt poses risks to the stability of the financial system and thus affects banks' decisions to provide new loans to industrial enterprises;

– macroeconomic situation: in times of economic instability or recession, with high public debt, banks are less inclined to issue new loans to industrial sectors, etc.

4. The volume of non-performing bank loans to industrial enterprises (in billion UAH) in Ukraine in 2009-2022 had a significant impact on the volume of bank lending to industrial enterprises (in billion UAH). This close relationship can be explained both qualitatively (an increase in NPLs to industrial enterprises affects banks' decisions to issue new loans to industry) and quantitatively (NPLs to industrial enterprises are included in the total volume of bank lending to industrial enterprises). This correlation can also be explained by the complex interaction of a number of financial and economic factors. In particular, the results obtained may serve as an indicator of financial risks in certain industries: if a significant portion of loans is not repaid, this may indicate financial problems in certain industries, and thus be a risk factor for banks and affect the cost of loans to industrial sectors and the volume of their lending.

5. The lowest correlation between the volume of bank lending to industrial enterprises (in billion UAH) in Ukraine in 2009-2022 and the volume of industrial and construction products (works, services) sold (in billion UAH). Accordingly, this variable could be excluded from the model, but the volume of industrial and construction products (works, services) sold is a directly related economic factor to the subject of this study. Thus, based on the results obtained, it can be stated that in 2009-2022, the volume of industrial and construction products (works, services) sold in Ukraine (billion UAH) as a special macroeconomic factor characterising the importance of industrial and construction enterprises, their contribution to production, creation of economic value, etc. was the least significant of the explanatory variables present in the model that influenced the volume of bank loans granted to industrial enterprises (billion UAH).

Based on the results obtained, the author is convinced that there is a need to study ways to improve the risk management of bank lending to industrial enterprises, to improve the management of bad debts of industrial enterprises, as well as to develop ways to intensify bank lending to industrial enterprises in Ukraine as an important prerequisite for post-war reconstruction on the basis of sustainable development, which will be the subject of further research.

References

Smaha, L. & Hnativ, O. (2007) Vplyv makroekonomichnykh chynnykiv na kredytnu diialnist bankiv [Influence of macroeconomic factors on credit activity of banks]. *Problemy i perspektyvy rozvytku bankivskoi systemy Ukrainy: zbirnyk naukovykh prats – Problems and prospects of development of the banking system of Ukraine: a collection of scientific papers*. Sumy: Ukrainian Academy of Banking of the National Bank of Ukraine. E-source: https://essuir.sumdu.edu.ua/bitstream-download/123456789/53883/5/Smaha_economic_crisis.pdf;jsessionid=733FE4F3E2ABF84F7D7BD8CFC7E06351 (in Ukrainian) (accessed October 02, 2023).

[1] Zampara, K.; Giannopoulos, M.; Koufopoulos, D. N. (2017) Macroeconomic and industry-specific determinants of Greek bank profitability. *International Journal of Business and Economic Sciences Applied Research (IJBESAR),* 10 (1), 13-22. E-source: https://www.econstor.eu/bitstream/10419/185655/1/v10-i1-p13-22-industry-specific-determinants.pdf (accessed October 02, 2023).

[2] Odnoroh, D. (2019) Makroekonomichni faktory ta efektyvnist kredytiv komertsiinykh bankiv u Hani [Macroeconomic Factors and Efficiency of Credits of Commercial Banks in Ghana]. *Naukovyi zhurnal «ΛΌΗΟΣ. Mystetstvo naukovoi dumky» – Scientific journal «ΛΌΗΟΣ. The art of scientific mind»,* 3, 32-36. E-source: https://www.researchgate.net/publication/308044960_Bank-Specific_and_Macroeconomic_Determinants_of_Commercial_Banks_Profitability_in_Ghana (in Ukrainian) (accessed October 02, 2023).
[3] Ivakhnenkov, S., Hlushchenko, S. & Sverenko, K. (2020) Macroeconomic factors that influence the bank loans rate in international and Ukrainian practice. *Economics of Development*, 19(4), 35-47. E-source: https://doi.org/10.21511/ed.19(4).2020.04 (accessed October 02, 2023).
[4] Foglia, M. (2022) Non-Performing Loans and Macroeconomics Factors: The Italian Case. *Risks*, 10, 21. DOI: https://doi.org/10.3390/risks10010021 (accessed October 02, 2023).
[5] Official website of the National Bank of Ukraine. E-source: https://bank.gov.ua/ (accessed September 20, 2023)
[6] Official website of Deutsche Bundesbank. E-source: https://www.bundesbank.de (accessed September 20, 2023)
[7] Rohalskyi, F. (2001) Mathematical methods of analysing economic systems. Kyiv: "Scientific thought", 422 p.
[8] Official website of the State Statistics Service of Ukraine. E-source: http://www.ukrstat.gov.ua (accessed September 20, 2023).
[9] Official website of the Independent Association of the Banks of Ukraine (IABU) E-source: https://nabu.ua/ua/ (accessed September 20, 2023).

Received on: 15th of October, 2023
Accepted on: 21th of November, 2023
Published on: 30th of November, 2023