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## **DETERMINANTS OF NON-PERFORMING LOANS IN EUROPEAN UNION COUNTRIES**

### **Abstract:**

Using a panel data model, we study the macroeconomic and microeconomic determinants of non-performing loans across European Union countries during the period from 2005 to 2018. According to our estimation, the following variables are found to significantly affect NPL ratio: unemployment rate, gross domestic product per capita, capital adequacy, private debt ratio, nominal effective exchange rate and the net interest margin. As the NPL ratio is found to respond to macroeconomic conditions, such as GDP and unemployment, the analysis also indicates that there are substantial effects from the banking system to the real economy, thus suggesting that the high NPL that some European countries recorded after the financial crisis could be adversely affected in the future by the downturn in economic recovery due to the pandemic.

### **Keywords:**

Non-performing loans, Microeconomic determinants, Macroeconomic determinants

**JEL Classification:** G21, E44

## 1 Introduction

The recent financial crisis has left in the European banking sector many loans, which their debtors have not been able to pay over time. It creates not only a bank but also an economic problem. With the increasing value of non-performing loans, the uncertainty for banks increases, which at the same time leads to a lower willingness of banks to lend. It may affect the value of investments and, consequently, the development of the country, since, as stated in Šoltés and Gavurová (2014), innovation activities lie in the development of future competitiveness, improving the efficiency of the economy as well as its ability to act. The issue of non-performing loans (NPL) has been addressed by the European Central Bank (ECB) since 2005 when it clearly defined the concept of NPL. ECB also introduced an indicator for its measurement, the most commonly used modification being expressed in the form of ratio of non-performing loans to the total value of provided loans (NPL ratio). With this step, the ECB expressed its concern at the pre-crisis times when the indebtedness of countries started to rise enormously.

The determinants of NPL are indicators that directly or indirectly influence the development of NPL in the financial sector. The determinants can be divided into two groups: microeconomic and macroeconomic. Microeconomic determinants can also be identified as the bank-specific variables. Such determinants include profitability indicators like the return on equity, return on assets, or net interest income (Makri et al., 2014). Other microeconomic determinants include the bank's capital and reserves (Rahman et al., 2016). In the case of the capital adequacy Klein (2013) states that its growth should decrease the value of NPLs. The banks become credible; so the banks become abler to meet their obligations. With higher capital formation, they will provide free funds in the form of loans to a lesser extent, but clients with a lower probability of default, which should decrease the amount of NPLs. Some authors include liquidity indicators among the microeconomic variables. These indicators refer to the inverse relationship to NPL, where it is assumed that if banks increase their liquid assets, the effect of the reducing NPL should occur. On the contrary, for the loan to deposit indicator (LD), with the increasing LD, the value of the NPL should also increase, as with higher volume of provided loans we can expect more frequent insolvency of clients, with a probability of future inability to repay their liabilities (Klein, 2013, Makri et al., 2014).

The second group of determinants involve macroeconomic variables like gross domestic product (GDP), unemployment, interest rates on the market, and real effective exchange rate. Non-performing loans lead companies to difficulties that later distort financial stability, also hamper economic growth and reduce efficiency. As mentioned by Bonfoni and Ropele (2011) or Williamson (1987), NPL and the stage of the economic cycle are closely linked. The macroeconomic environment also has an impact on the assessment of debtors and their ability to obtain a loan. Determinants have a different effect on the NPL according to the phase of the economic cycle in which the economy is located. The negative relationship is based on the assumption that the increase in the GDP means a higher level of income, which improves the borrower's ability to pay its debts, thereby reducing the defaulting debt. The negative relationship between economic growth and the NPL has been confirmed by Messai and Jouini (2013), Beck et al. (2015), and Noah et al. (2018). On the other hand, the relationship between unemployment and the NPL should be positive, as with the increase of unemployment persons the probability that these debtors will not be able to pay their debts also increase which is states by Staehr and Uusküla (2017). In the case of interest rates, we can expect that the value of NPL will increase as interest rates rise. As pointed out by Boofoni and Ropele (2011), the increase in interest rates

increases the debt, which may also lead to an increase in NPL. Based on the Khemray and Phah (2009), it was found that also the real effective exchange rate (REER) could have a positive impact on NPL. The appreciation of the currency should lead to a weakening of the export position of firms, thus contributing to the increase of the NPL. However, there is also a view (e.g. Festiæ and Bekő, 2008) that the REER may have an adverse impact on the NPL when by the appreciation of the domestic currency borrowers owed in foreign currencies can pay better for their liabilities, thereby reducing the NPL.

Besides to the macroeconomic factors mentioned above, we can include into this group also private debt of households, inflation and stock market capitalisation. For example, the private debt of households can have a positive impact on NPL. The growing value means that household debt is increasing, which in turn can lead to an increase in NPL. As shown by Rinaldi and Sanchisk-related (2006), inflation has an ambiguous impact on NPLs. While some are considering a positive effect on the NPL (Staehr and Uusküla, 2017), others point to the negative relationship (Makri et al., 2014). From the theoretical point of view, inflation should decrease the value of debt and make it easier for debtors to repay. As mentioned by Beck et al. (2015), the stock market capitalisation also has no clear impact on NPLs. This variable is introduced into the model with two faces. It primarily reflects the size or the development of the financial market, which assumes that the more developed the market is, the more the country prospers economically, and thus the NPL will be lower. On the other hand, some authors expect that share prices are correlated with real estate prices, mainly in countries with an underdeveloped stock market. These authors assume that if the value of the real estate falls, this may have an adverse impact on the value of credit protection and, therefore, on the quality of the banks' loan portfolio.

Factors that may affect the development of NPL at both the microeconomic and the macroeconomic levels are numerous depending on the geographical location of the countries, historical development, the openness of the economy, and so on. It is therefore up to the economist to consider the choice of appropriate determinants depending on all the factors that will have the greatest impact on the NPL.

## 2 Data, methodology and results

As the dependent variable, we use the NPL ratio representing the ratio of non-performing loans to total provided loans. Independent variables that affect the development of the NPL ratio can be divided into macroeconomic variables and banking variables. The list of considered variables, their descriptive statistics, the data source, as well as the expected impact on the NPL ratio, is displayed in Table 1. The model assumptions are based on previous empirical studies. The analysis was carried out on a sample of 28 European Union countries from 2005 to 2018.

**Table 1 Data description**

Indicator	Acronym	Source	Min	Max	Average	St.dev	Impact
Non-performing loans ratio (%)	NPL	The World Bank	0.1	48.6759	6.5882	7.8572	
Gross domestic product per capita (% to purchasing power parity)	GDP	Eurostat	13.1	322.3	94.3063	61.5623	-
Unemployment rate (%)	UN	Eurostat	1.9	17.3	5.6448	2.7163	+
The harmonised index of consumer prices (index)	HICP	Eurostat	64.9	108.05	94.4026	8.0007	-/+
Nominal effective exchange rate (index)	NEER	Eurostat	77.17	125.44	99.3367	4.5893	/+
Private debt (% to GDP)	PD	International	82.0258	483.8096	214.2296	83.6791	+

		Monetary Fund					
Stock market capitalisation (% to GDP)	SMC	The World Bank	3.7287	247.17	48.4268	36.4941	-
Net interest margin (%)	NIM	Global Economy	0.12	7.09	2.1847	1.1855	-/+
Liquidity (%)	LI	The World Bank	3.4479	127.969	34.7885	17.6303	-
Loans to deposits (%)	LD	The World Bank	54.4778	367.077	127.1084	54.2384	+
Capital adequacy (%)	CAR	International Monetary Fund	7.3426	35.6526	15.8946	4.1714	-

Source: Prepared by authors

The model is based on panel data. We use the R programme with its package (plm). To take into account the elasticity of the data, we work with logarithmically adjusted variables. The model is designed from multiple types of variables as described below:

$$\log(NPL)_{i,t} = \beta_0 + \beta_1 \log(GDP)_{i,t} + \beta_2 \log(UN)_{i,t} + \beta_3 \log(HICP)_{i,t} + \beta_4 \log(NEER)_{i,t} + \beta_5 \log(PD)_{i,t} + \beta_6 \log(SMC)_{i,t} + \beta_7 \log(NIM)_{i,t} + \beta_8 \log(LI)_{i,t} + \beta_9 \log(LD)_{i,t} + \beta_{10} \log(CAR)_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (1)$$

The model has also been tested for basic assumptions such as heteroscedasticity, autocorrelation, stationarity, cross-sectional dependence and serial correlation in the context of the methodology presented by Baltagi (2005).

Based on an analysis of NPL ratios in the EU countries, we can say that we observe the highest levels of NPL ratios in Greece and Cyprus. These countries are followed by Ireland, Italy, the Baltic countries with a higher value of NPL ratio as in the rest of the EU countries. The European average of NPL ratio is approximate 5.2% over the analysed period 2005-2018. The countries above the EU average were Bulgaria, Croatia, Cyprus, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, Portugal, Romania, Slovenia and Spain, thus, from the point of view of the development of NPL ratio, we can consider them riskier.

When analysing panel data, we know that this is not only one country for the years under examination, but a larger number of countries for the years and therefore it can be said that the analysis is done in several ways or dimensions. We try to capture this fact by testing individual or time effects. For example, a change in GDP will lead to the change in NPL, but this change will vary from country to country or years differently, creating heterogeneity. This heterogeneity can be tested through the Langranger effects test (Honda). The results of the test show that the time effect is insignificant, but individual effects can be considered significant.

The next step is to test the basic statistical assumptions for the panel model. The first condition is stationarity. According to Lukáčik and Pekár (2009), non-stationarity causes a false regression and misinterpretation of the results. Two tests tested the stationarity because some authors claim that the ADF test and Maddala Wu test (Novák, 2007, Nkoro and Uko, 2006). The results off both tests confirmed that there is stationarity in the dataset. Another prerequisite for the panel model is the serial correlation tested by Breusch-Godfrey/Wooldridge test. The results confirmed the presence of serial correlation. The next, cross-sectional dependency was tested by Pesaran CD test. The results confirmed the presence of cross-sectional dependency. Also, the results of the studentised Breusch-Pagan test confirmed the presence of heteroscedasticity.

We assumed such a situation because almost all authors dealing with this issue encountered this situation. In the panel analysis, the problem of heteroskedasticity is very frequent and is not uncommon. As mentioned above, variables were smoothed by the log form to represent their elasticities better, and thus their sensitivity to the explained variable. Therefore, as the other authors (Croissant and Millo, 2008; Zeileis, 2004), we use a robust variance-covariance matrix.

**Table 2 Estimation of models (EU-28 countries, fixed-effects model)**

	<b>Model A</b>	<b>Model B</b>	<b>Model C</b>	<b>Model D</b>	<b>Model E</b>
GDP	1.209436 (**)	1.20938 (**)	1.22003 (**)	0.94561 (*)	1.60615 (***)
UN	1.66263 (***)	1.66617 (***)	1.66019 (***)	1.73668 (***)	1.88646 (***)
HICP	1.208616	1.19608	1.12400	1.49612	-
NEER	-1.84166 (.)	-1.81947 (.)	-1.84774 (*)	-2.16337 (*)	-2.96765 (**)
PD	0.622708	0.66101	0.63810	0.96035 (*)	1.16150 (**)
SMC	-0.095406	-0.10014	-0.10315	-	-
LI	0.051589	0.04045	-	-	-
LD	0.087918	-	-	-	-
CAR	0.892321 (**)	0.85569 (*)	0.87335 (*)	0.51513 (.)	0.75912 (***)
NIM	-0.158753	-0.15998	-0.15898	-0.18683	-0.23405 (.)
Adj. R <sup>2</sup>	0.75062	0.75147	0.75225	0.74098	0.73472
Sample size	n = 28, T= 3-12 N= 283	n = 28, T= 3-12 N= 283	n = 28, T= 3-12 N= 283	n = 28, T=10-12 N= 334	n =28, T=10-12 N= 334
Individual effect	Yes	Yes	Yes	Yes	Yes
Time Effect	No	No	No	No	No
Pesaran CD test	Yes	Yes	Yes	Yes	Yes
Breusch- Godfrey/Wooldridge test	Yes	Yes	Yes	Yes	Yes
Studentized Breusch- Pagan test	Yes	Yes	Yes	Yes	Yes
ADF test/ Maddala Wu test	Yes	Yes	Yes	Yes	Yes

Notes: Models A, B, C, D, E represent changes to the basic model after exclusion of non-significant determinants for achieving significant variables affecting NPL. Statistical significance is shown as \*\*\*  $p < 0,001$ ; \*\*  $p < 0,01$ ; \*  $p < 0,05$ ; .  $p < 0, 1$ . n - number of countries, T - length of time series, N - number of observations

Source: Prepared by authors

We performed the regression analysis of the model in several repetitions. We consider a backward stepwise regression, through which we removed the insignificant determinants. We have come to the final model through five adjustments. The final model reaches the value of the adjusted R-square at 73.472%. A comprehensive summary of the results is given in Table 2.

As can we see the most critical determinant is unemployment (UN). The unemployment confirmed our assumption of its positive impact on the NPL. It shows the need for economic policy to be linked to monetary policy. If the country does not create jobs, it affects not only on the banking sector in the form of high NPL but also the whole economy, which opens the eternal question of the penetration and scope of economic and monetary policy.

The second important determinant is the gross domestic product per capita. The assumption was not confirmed as we assumed that GDP as an indicator of the country's prosperity would lead to a decrease in the NPL. Positive dependence can also be influenced by the analysed period from 2005 to 2018, which includes a crisis period. It may indicate that while national economies have prospered and GDP per capita has been growing, there have still been many NPL in the banking sector, indicating a positive relationship between GDP and NPL. It may indicate that while the economy is doing well and its GDP is growing, it probably does not mean that with better economic results, for example, employees have received higher wages making them abler to pay their liabilities, which would, in turn, result in the reduction of NPL.

The third significant determinant is capital adequacy. The results pointed to the positive relationship between NPL and CAR, which did not meet our assumption. It may be influenced by the analysed period (2005-2018), as the increase in NPL occurred at the same time as the increase in the CAR by the adoption of ECB post-crisis measures on the growth of capital buffers and by tightening compliance with the Basel Capital Accord. The increase in the CAR has shown its justification only in the last years of the analysed period, in the slight decrease of the NPL.

Private debt of households also plays an important role as the determinant of NPL. The expected positive relationship to the NPL was confirmed. This suggests the structure of NPL, which is largely made up of the NPL of households. The growing volume of loans to households, therefore, requires regulatory measures that should prevent the subsequent growth of NPL in this segment.

Another determinant was a nominal effective exchange rate (NEER). The regression results indicated the negative relationship between NPL and NEER. We assumed the significance of the variable, as Central and Eastern Europe are characterised by high levels of foreign currency loans, and therefore NPL will respond to foreign exchange volatility. Through the inverse relationship between the NEER and NPL, we can state that the exchange rate volatility developed positively in favour of debtors in foreign currencies. By the appreciation of the domestic currency, debtors become abler to pay for their liabilities, thus reducing the NPL. This situation may also be affected by the lowering of interest rates on foreign loans and the adoption of measures by the ECB.

The last determinant of NPL, the net interest margin (NIM), was drawn on the borderline of significance. Our assumption of an inverse relationship has been met. The negative relationship between NIM and NPL may be affected by a period of low interest rates when in order to minimise the adverse effects of falling interest income due to a fall in interest rates, the banks tried to offset the increase in the volume of loans. In order to minimise the negative impact of falling interest rates, banks could also accept loans that are riskier and which could not have been accepted at higher interest rates. A higher level of risk taken to minimise the decreasing profitability could lead to a growing value of NPL. The indicator shows that there is a close relationship between the NPL and the banks' profitability. We know that in connection to NPL, banks have to create provisions that negatively affect banks' profitability. Although NIM does not directly include the value of provisions, we can see that at times when the value of NPL has significantly increased, there is a decline in profitability in the European banking sector.

### **3 Conclusion**

The paper aimed to analyse the NPL within the European Union countries, as well as to identify determinants with a significant impact on its development. Significant determinants have been acquired through the application of backward stepwise regression. The two most important determinants were the unemployment rate together with the gross domestic product per capita. Both these determinants show a positive relationship to the NPL. Subsequently, capital adequacy, the private debt ratio, the nominal effective exchange rate and the net interest margin proved to be other important determinants.

The results of the regression analysis were surprising on specific determinants, which contradicted the results of other researchers. However, this situation is not unique because, by another location, as well as the time series, the results acquire a specific and unique character. The result of a review in one country over five years may, but may not be the same as for

research in twenty-eight countries in thirteen years, and in particular if the economy has experienced significant fluctuations during this period. Another reason is the structure of the individual determinants, whose components may not have the same impact on the development of the NPL. Finally, the results of the regression analysis indicate the interconnectedness of economic and monetary policy. It reopens the space for the “dilemma” of state and supervisory intervention in the economy.

The examination of the effects between the banking system and economic activity broadly confirms the strong macro-financial linkages in European countries. As the NPL is found to respond to macroeconomic conditions, such as GDP and unemployment, the analysis also indicates that there are substantial effects from the banking system to the real economy, thus suggesting that the high NPL that some European countries recorded after the financial crisis could be adversely affected in the future by the downturn in economic recovery due to the pandemic. Given the results of our analysis, we can say that it is essential to strengthening supervision to prevent a significant increase NPL in the future, including by ensuring that banks avoid excessive lending, maintaining high credit standards.

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