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Determinants of the non-performing loan ratio in the European Union banking sectors with a high level of impaired loans¹

Radosław Ciukaj², Krzysztof Kil³

Abstract: In the article an attempt is made to identify the quality of credit exposure determinants of banks in European Union countries that were characterized by a high level of impaired loans at the end of 2017 (Bulgaria, Croatia, Cyprus, Italy, Ireland, Greece, Portugal). Using the static panel-based approach the non-performing loan (NPL) determinants for the period from 2011 to 2017 were analyzed. The results showed that the high level of NPLs can be explained mainly by both macroeconomic and microeconomic factors. In particular, it has been shown that in the surveyed countries supervisory authorities should pay special attention to smaller banks with high dynamics of new loans and a low return on assets due to the fact that these entities are characterized by a higher NPL ratio. A higher level of NPL is also affected by a high concentration of the banking sector and higher interest rates on newly granted loans. As a result of research it was also shown that the majority of NPL determinants are the same in all types of banks, regardless of the business model and the scope of banking supervision. The differences were noticeable in characteristics regarding the housing market as well as the profitability of operations and lending dynamics of the analyzed entities.

Keywords: non-performing loans, European Union banks, credit risk.

JEL codes: G21, G28.

Introduction

Proper credit policy is considered to be a fundamental determinant of the financial stability of banks. The management of banks has been aware of the significance of credit risk in banking operations for many years and since 2013 it considers them as the greatest threat to the financial stability of banks in sur-

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veys (Kil & Miklaszewska, 2017). A very important factor affecting the profitability of individual banks and the entire banking sector is the quality of assets.⁴ Loans are the main asset hence their impact on the level of profits is expected to be positive.

The increased number of banks with high-risk loans leads to an increase in the value of loans not repaid on time and an increase in provisions created on this account and consequently reduces the profitability of the entire banking sector. Comparative research on loan quality are very important for at least three reasons. First of all, the quality of loans is one of the major criteria for assessing the financial stability of banks and the probability of its bankruptcy. Credit quality analysis also allows the assessment of the level of credit risk in the bank. Non-performing loans are the result of a credit function carried out in banks. Their high level and rapid growth presages the appearance of credit risk in the bank. Secondly, the quality of loans is used to measure the financial stability of the entire banking sector. Credit quality assessment is therefore also important for the micro-prudential and macro-prudential supervising institutions.⁵ Finally, the analysis of loan quality is important for the entire economy. High credit risk and bank losses related to their lending activities may lead to a limitation of the scale of lending activities which will have a negative impact on economic activity.

There are many indicators that are used by both banks and supervisors to measure the quality of credit exposure. However the most frequently used indicator is non-performing loans (NPL), also called non-performing exposures (ECB, 2017b). Standardization and definition of this indicator was proposed by the Basel Committee on Banking Supervision (BCBS, 2016). Supervisory authorities are particularly interested in the credit risk and the potential financial losses related to its materialization. This is reflected both in the regulations regarding capital adequacy (in the European Union (EU) as the CRD IV/CRR package⁶) and in the Basel Committee on Banking Supervision's supervisory guidelines (BCBS, 2015).

⁴ European Central Bank (ECB) simulations suggest that a resolution of NPLs could improve the aggregate return on equity of euro area banks by at least 1 percentage point, with some sectors gaining 3 or 5 percentage points. These estimates do not account for the benefits of a lower funding cost or lower capital requirements that would be forthcoming from a reduction of NPLs (Constâncio, 2017).

⁵ More information on macro-prudential supervision models and their impact on financial stability: see (Matysek-Jędrych, 2018).

⁶ Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC and Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.

The high level of non-performing loans in many European countries is the result of the recent financial crisis and a prolonged period of slow growth. They reflect the fact that the credit risk in the economy is still high. This has an impact on the risk aversion of both borrowers and the readiness of banks to grant loans which, in turn, result in a reduction in lending at a time when support for economic recovery is badly needed. The macroeconomic importance of non-performing loans is due to the risk of a vicious cycle of low-quality assets, low profitability of banks, rising capital requirements and limited lending, all of which have a negative impact on the growth and deterioration of NPL problems.

In a deeply integrated area such as the EU, especially in the euro area, with highly related financial systems problems with the NPL may adversely affect credit supply and economic growth not only in the effected Member States but also in the euro area as a whole.

A sizeable part of the NPL stock is no longer a risk to balance sheets of banks operating in European Union countries. Provisions made under applicable accounting standards amount to about 46% of the stock of NPLs (Constâncio, 2017). The remaining value of NPLs is supported by expected future recoveries. Despite this fact according to the recent Single Supervisory Mechanism (SSM) risk map for 2020 NPLs continue to pose significant risks (in terms of scale and potential impact) to economic growth and financial stability, in particular in connection with the current phase of the business cycle in the European Union (ECB, 2019).

Important activities aimed at quickly reducing the level of NPL in the banking sectors of the euro area were undertaken by the ECB. They consisted of identifying the possible strategies to improve the quality of the loan portfolio and obliging banks to introduce additional analytical activities in order to constantly monitor the effectiveness of achieving the target (ECB, 2017a). However the effectiveness of the actions proposed by the ECB was limited by: information asymmetry, inefficient and uncertain debt enforcement frameworks, licensing requirements, restrictions on transferability of loans, unwillingness to realize losses, first-mover disadvantage, the high cost of debt recovery not recognized in NPL book values (ESRB, 2017).

The poor quality of credit exposures is undoubtedly one of the most important premises for a critical assessment of the banks' increase in value. In particular, this is strongly reflected in the share price valuations of banks which are listed on the stock market. For several years a significant number of credit institutions have had a market value below their book value.

The aim of this article is to analyze the panel data to assess the impact of both macroeconomic and microeconomic factors on the NPL level in banks operating in EU countries with a high level of NPL at the end of 2017 (Bulgaria, Croatia, Cyprus, Italy, Ireland, Greece, Portugal). The determinants of the loan portfolios with impairment of 629 commercial, cooperative and specialized

banks operating in this region in the entire available period of analysis after the financial crisis are examined.

The first section of the article discusses the existing literature and research on the determinants of NPL (macroeconomic variables and specific for each bank) and their impact on the quality of loans. The second section presents the current situation regarding the quality of loans in the banking sectors of the analyzed countries and its post-crisis changes. The third section demonstrates the data and research methodology used in researching this paper and the results and conclusions from the analyzes. Post-crisis supervisory changes in the NPL area in the analyzed countries constitute the fourth section of the article and Discussion and conclusions close the article.

1. Previous research on the determinants of the non-performing loan in the literature

The literature indicates two basic sets of factors influencing changes in the level of non-performing loans. The first group concerns external factors which include general macroeconomic conditions that may have a potential impact on the borrowers' ability to repay loans. The second group includes bank specific factors (resulting from their functioning), which, according to the results of previous analyzes, have a smaller impact on the volatility of non-performing loans.

Literature devoted to the interaction between macroeconomic factors and the quality of bank assets is extensive and diverse. Current research most often presents the positive relationship between the quality of assets and the dynamics of economic growth. In their research on a group of 85 banks from Italy, Greece and Spain Messai and Jouini (2013) showed that thanks to the improvement of the macroeconomic situation the financial situation of borrowers is also improving along with the possibility of timely repayment of their debts. Studying a group of 75 banks in the years 2000–2010 Beck, Jakubik and Piloiu (2015) proved that the increase in GDP contributed to the decline in the share of non-performing loans in the entire loan portfolio. Similar conclusions were found in researches of Espinoza and Prasad (2010), Jakubik and Reininger (2013), Marki, Tsagkanos and Bellas (2014) or Bykova and Pindyuk (2019).

Another macroeconomic determinant described in the literature is the unemployment rate, the increase in which has a negative impact on the quality of the loan portfolio. The loss of employment by borrowers results in a lower quality of banks' loan portfolios. Such dependencies were found in the research of e.g. Dimitrios, Helen and Mike (2016). Using the Generalized Method of Moments (GMM) model and the quarterly data of the euro area banks in 1990–2015 they stated that the increase in the unemployment rate has a strong impact on the deterioration of their loan portfolio quality. The conclusions from the analyzes concerning the seven countries of Central and Eastern Europe

(CEE) in the years 2007–2012 conducted by Skarica (2014) also confirm the positive relationship between the unemployment rate and the value of non-performing loans. Similar conclusions from their research have been drawn, among others, by Messai and Jouini (2013).

The results of previous studies regarding the relationship between the inflation rate and the quality of banks' loan portfolios are not straightforward. Research conducted by Klein (2013), which included the largest banks from CEE countries showed that the level of unpaid loans regularly increases with the increase in inflation. However in the studies of Dimitrios and others (2016), it was shown that an increase in the inflation rate makes debts cheaper which contributes to improving the quality of banks' loan portfolios.

Among the studies on macroeconomic determinants of the quality of banks' loan portfolio there is also research regarding the influence of sovereign debt on the number of loans that are not repaid by borrowers (Dimitrios et al., 2016; Ghosh 2015; Marki et al., 2014). The increase in public debt causes an increase in fiscal burdens imposed on citizens and thus a deterioration in their repayment capacity. These studies confirm a positive correlation between public debt and non-performing loans. Fiscal problems in the euro area countries may lead to a significant increase in non-performing loans. In his research Cifter (2015) focused on how the concentration of the banking sector affects the NPL. However his analysis did not have an unambiguous result.

The purpose of the study conducted by Ozili (2019a) was to examine the impact of financial development on the level of nonperforming loans. In a multi-country analysis he stated that the level of financial development, which takes the form of the presence of foreign banks in the domestic system and the development of financial intermediation, are positively linked to the level of non-performing loans which means that non-performing loans increase along with greater financial development. According to the author the reason for this situation may be poor supervision over the credit standards of banks and non-banking financial institutions actively involved in the financial intermediation process.

In connection with the significant share of mortgage loans in bank portfolios the literature also indicates a significant impact of the situation in the real estate market on the level of NPL in banks. Herring and Wachter (1999) claim that banks are more eager to grant mortgage loans in the period of real estate prices rising while at the same time compensating their credit risk with the increased value of collateral. Niinimaki (2009) presents a view that rising property values increase the profitability of banks and reduce the likelihood of financial problems in the banking system. Davis and Zhu (2011) in their analysis of the member countries of the Organization for Economic Cooperation and Development (OECD) also show a significant impact of real estate prices on banks' credit policy. In the papers of Allen, Madura and Wiant (1995) and He, Myer and Webb (1996) it was stated that the prices of bank shares are very

sensitive to changes in returns from the real estate market. In addition King (2001) concludes in his article that the Asian financial crisis was triggered by Japanese commercial banks which had been significantly weakened by the collapse of real estate markets.

There is also a series of studies devoted to the influence of variables dependent on banks on the NPL level. Hu, Li and Chiu (2004) analyzed non-performing loans in the banking sector in Taiwan in the years 1996–1999. They showed that the size of banks measured by the value of their assets is negatively related to the NPL indicator. Larger banks are more likely to take credit risk than smaller ones.

Studies, carried out by authors such as Klein (2013) and Marki and others (2014), confirm, that a higher value of indicators describing the quality of bank management (Return on Assets—ROA, Return on Equity—ROE, Net Interest Margin—NIM) contributes to a lower share of non-performing loans in total loans. Better managed banks have, on average, better asset quality and generate higher profits. NIM is a good indicator of how optimal the investment decisions of banks are. However, studies conducted by Salas and Saurina (2002) showed that this variable does not affect the value of the NPL index. On the other hand Espinoza and Prasad (2010) found that there is a significant relationship between NIM and NPL. A fall in the NIM indicator can cause a change in lending policy making it more risky. The increase in risk will create a portfolio of loans with a higher probability of default in the future.

In their study Podpiera and Weill (2008) verified the relationship between NPL and cost effectiveness as an indicator of the quality of bank management. This trend is also included in the study of the Argentine banking system instability in 1993–1996 conducted by Bercoff, Giovanni and Grimard (2002). It showed that the factors present in banks which influence the NPL rate are asset growth and operational costs incurred in connection with the entity's core business. However, the relationship between cost effectiveness and the NPL index is ambiguous. Banks that allocate less funds to investigate the creditworthiness of borrowers and for risk monitoring in the short term will be more profitable. On the other hand this may be reflected in the increased number of non-performing loans in the long term.

The literature also showed that an excessive level of lending (measured by the ratio of loans granted to the sum of total assets) leads to an increase in the NPL ratio in banks. The increase in bank lending activity is often associated with lower standards when granting loans which increases the number of unpaid loans. Such results have been achieved by (Keeton, 1999; Klein, 2013; Messai & Jouini, 2013).

One of the indicators which is characteristic for banks is the Total Capital Ratio (TCR). It indicates whether the bank has sufficient equity to be solvent. TCR measures the level of equity in relation to the risk taken by the bank. In general, although capital adequacy ratios are extensively analyzed in similar studies, the results regarding the impact of this indicator on the level of non-

performing loans are ambiguous (Rime, 2001; Espinoza & Prasad, 2010; Marki et al., 2014). On the one hand there are studies in which banks with a lower TCR rate are characterized by a higher NPL level while on the other there are also analyzes showing that banks with a higher TCR level create risky loan portfolios. That can cause a growth in non-performing loans.

In the research carried out by Ghosh (2015) the size of the bank (measured by the value of its assets) is also a factor that influences the quality of the loan portfolio. Large banks using financial leverage may excessively increase their lending activity which is usually associated with a lowering of credit standards and thus expose themselves to the risk of losses on granted loans. Garcia-Marco and Robles Fernandez (2008) drew similar conclusions from their studies. In addition to the research mentioned above there are many empirical studies suggesting that bank-specific factors such as size, market power, concentration and risk profile are important determinants of the NPL as they may cause an increase in risky loans in the portfolio (Salas & Saurina, 2002).

Among the bank-specific variables that affect the quality of the loan portfolio of banks the increase in the number of loans granted by banks can also be mentioned. The literature indicates that the rapid increase in lending is often associated with an increase in loan impairment. Sinkey and Greenwalt (1991) in their research tried to explain the losses of the banking sector in the United States. They confirmed a significant positive relationship between the credit loss rate and internal factors such as excessive lending. Bercoff and others (2002) examined the Argentine banking system and showed that the increase in granted loans has an impact on the increase in the NPL ratio in these banks. The excessive amount of loans offered by banks is usually associated with a less restrictive credit policy and weaker monitoring of the creditworthiness of borrowers used by banks. This could also be a driver for the number of borrowers who do not pay their liabilities on time. Keeton and Morris (1987); Sinkey and Greenwalt (1991); Keeton (1999); Salas and Saurina (2002); Jiménez and Saurina (2006) came to similar conclusions in their research.

Ozili (2019b) in his study on the determinants of the NPL ratio in systemically important banks and non-systemic banks indicates that more profitable banks show a higher level of non-performing loans, regardless of whether they are systemic or non-systemic. A characteristic feature of systemic banks is also that they have fewer non-performing loans during periods of economic boom and periods of increased lending while non-systemic banks experience a higher number of non-performing loans during periods of increased lending. After the recent financial crisis the NPL of systemic banks is negatively linked to the economic cycle which means that the NPL of systemic banks is pro-cyclical in relation to the state of the economy and the NPL of systemic banks is positively related to credit supply and bank profitability. Also according to Ozili (2019b) non-performing loans of non-systemic banks are negatively associated with regulatory capital ratios and are positively related to the profitability of non-systemic banks.

2. Credit policy in the EU banking sectors with a high level of impaired loans

High NPLs are not a new phenomenon in the EU Member States but after the recent economic and financial crisis there has been a significant increase in non-performing loans in many countries. The development of the high level of the NPL indicator varies considerably across Member States reflecting various problems and cycles in national banking systems (Schüler, Hiebert & Peltonen, 2015). In addition, Member States have proactively addressed the emerging problems of the NPL using different methods including political and legislative reforms, which partly explains the various changes in NPL levels in individual countries (Aiyar et al., 2015). The average values of NPL indicators in the European Union countries and the euro area countries reached the highest level between 2012–2013 (see Figure 1).

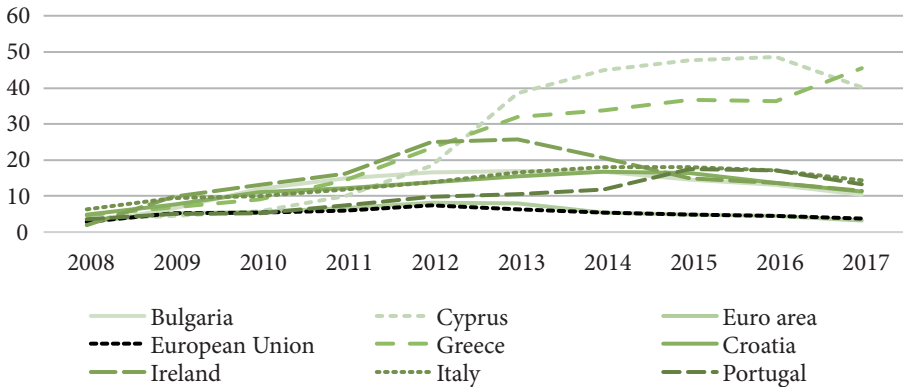


Figure 1. NPL ratio in EU banking sectors with a high level of impaired loans in 2008–2017

Source: Own study based on data from the World Bank.

Since then in both cases the NPL indicators have fallen but their values are still more than twice those before the crisis. In addition there are significant differences in the evolution of non-performing loans in the European Union. Countries that were relatively more affected by the debt crisis (Cyprus, Greece, Ireland, Italy, and Portugal), experienced a significant increase in NPL ratios from 2010 and still maintain the high values of this indicator. In particular, in the case of Cyprus in the years 2013–2017, the value of the NPL ratio oscillated around 40–50% and in the case of Greece around 30–45%. However for the other euro area countries the downward trend started already in 2012 (Figure 1). In 2017 the average NPL value in European Union banks was 3.72% and in the euro area 3.2%. Among the countries with the best quality credit

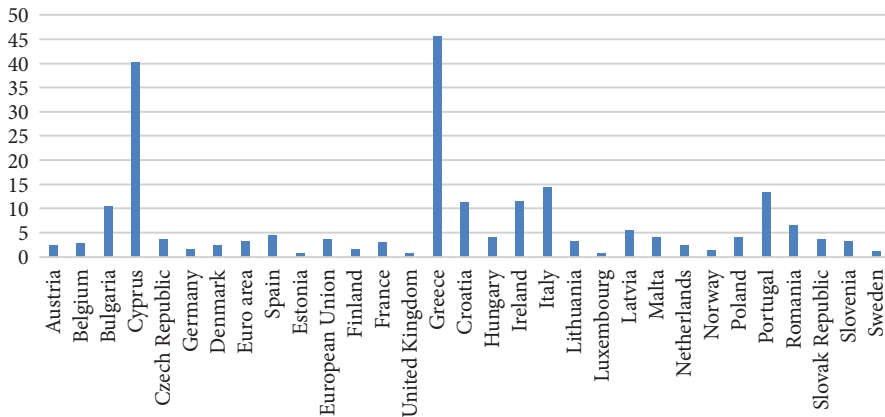


Figure 2. The level of the NPL ratio in European Union countries in 2017

Source: Own study based on data from the World Bank.

exposures were Estonia, Great Britain and Luxembourg with the NPL below 0.8% at the end of 2017 (Figure 2).

Based on the methodology of the European Central Bank and the World Bank data from 2017 the authors distinguished a group of countries characterized by high levels of impaired loans, i.e. those where the value of NPL exceeds 10%. In the European Union this is the case in Greece (NPL 45.57%), Cyprus (40.17%), Italy (14.38%), Portugal (13.27%), Ireland (11.20%), Bulgaria (10.43%) (see Figure 2). These values remain significant despite the fact that in 2017 in all countries of this group the process of reducing the NPL rate began (the only exception was Greece).⁷ Banks from these countries are the subject of the NPL determinants analysis further in the study.

The analyzed group of countries differs significantly in many aspects (Tables 1, 2, 3, 5, Figure 3). Five countries (Cyprus, Italy, Ireland, Greece, Portugal) have the single currency of the euro and are part of the Euro system thus having limited influence on the shape of the monetary policy in their country. Bulgaria and Croatia have their own currency and a much wider range of tools for shaping the monetary policy. The concentration of the market is also diversified in the analyzed countries. The group of countries with a high concentration includes Greece, Cyprus, Portugal, Croatia while the group with a reasonable concentration is: Italy, Ireland, Bulgaria (see Table 1).

⁷ There was also a slight decrease in the level of NPL in Greece in 2018 with improvements made only in the consumer loan portfolio. The NPL ratio for business loans remains unusually high—above 60%. In addition it should be noted that the NPL reduction was mainly due to write-offs and the sale of loans (Mourmouras, 2019).

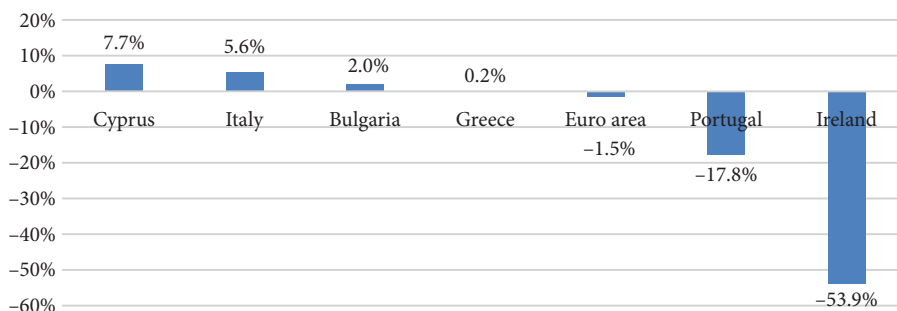
Table 1. Selected characteristics of the HL NPL EU banking sectors in 2017

Country	Number of employees	HHI	CR5 (%)	TCR (%)	ROA (%)
Bulgaria	30070	0.0906	56.4762	19.5257	0.5433
Cyprus	10632	0.1964	84.1481	15.5251	-1.1400
Croatia	20434	0.1387	72.7870	17.0958	0.0039
Greece	41707	0.2307	96.9800	17.0113	-0.1751
Ireland	26891	0.0658	45.5129	21.1279	0.8421
Italy	281928	0.0519	43.4264	17.0825	0.5798
Portugal	46238	0.1220	73.1000	14.9122	-0.2762

Source: Data from EBC (Consolidated Banking data, <http://sdw.ecb.europa.eu>).

In terms of employment the largest banking sector is in Italy. Among the countries surveyed in 2017 three (Cyprus, Greece and Portugal) had negative profitability of assets and equity. In other countries the banking sector made profits with the return on assets not exceeding 1% (see Table 1).

The credit policy of banks operating in the countries covered by the study was strongly determined by the financial crisis and its consequences in the last decade—both within the financial sector and in the real economy. In the analyzed countries there is a huge variation in the dynamics of bank lending activity for the non-financial sector in the post-crisis period. Among the analyzed countries in 2008–2015 there was a slight increase in the value of the loan portfolio in four of them (Cyprus, Italy, Bulgaria, Greece) (at the level of 0.2–7.7%). At the same time the value of total loans decreased in Portugal by 17.8% and in Ireland by 53.9% (see Figure 3).

**Figure 3. Growth of loans granted to the non-financial sector in December 2008–October 2015**

Source: Own study based on (NBP data, <https://www.nbp.pl/home.aspx?f=/systemfinansowy/stabilnosc.html>, figures for the February 2016 report).

Mortgage loans, in particular those granted to households for housing purposes, have the greatest importance in the loan portfolios of the analyzed countries. Ireland and Cyprus had the highest share of mortgage loans in total credit exposure at the end of 2017 (Table 2). This means that banks operating in the analyzed countries are strongly dependent on the situation on the real estate market.

The diversification of the banking sectors of the analyzed countries is expressed through the share of consumer loans in the loan portfolio. In Bulgaria and Greece consumer loans for households account for 18.6% and 12.1% respectively while in Croatia only 5.6% (see Table 3).

Table 2. Share of mortgage loans in total loans (%) in the analyzed countries in 2017

Country	Share of mortgage loans granted to non-financial corporations in the total loan portfolio (%)	Share of mortgage loans granted to households and non-profit institutions in the total loan portfolio (%)	Share of total mortgage loans in the total loan portfolio
Bulgaria	N/A	N/A	47.29
Greece	23.88	35.88	59.76
Ireland	N/A	N/A	65.99
Portugal	10.08	50.25	60.33
Italy	13.34	26.32	39.66
Cyprus	27.52	35.94	63.46
Croatia	17.78	23.46	41.23

Source: Data from EBC (Consolidated Banking data, <http://sdw.ecb.europa.eu>).

Table 3. Share of consumer loans in total loans (%) in the analyzed countries in 2017

Country	Percentage of households with a loan other than a mortgage (%)	Share of consumer loans in total loans (%)
Bulgaria	N/A	18.6
Greece	17.1	12.1
Ireland	41.4	9.1
Portugal	22.6	7.7
Italy	13.9	7.4
Euro area	28.2	6.7
Cyprus	37	6.2
Croatia	N/A	5.6

Source: Own study based on (NBP data, <https://www.nbp.pl/home.aspx?f=/systemfinansowy/stabilnosc.html>, figures for the December 2018 report).

3. Data, methodology and results

Studies were conducted on determinants of the non-performing loan ratio in banks operating in the European Union member states with a high level of NPL at the end of 2017 (Bulgaria, Croatia, Cyprus, Italy, Ireland, Greece, Portugal—see Figure 3). The analyzes were carried out based on unit data obtained from Orbis Database. Panel data cover the years 2011–2017 and include information on the financial ratios of 629 banks (164 commercial banks and 465 cooperative and specialized banks) operating continuously since 2011. Macroeconomic data were taken from the websites of Eurostat and the World Bank. Characteristics related to the real estate market were obtained from the Hypostat 2019 report comprising a review of Europe’s mortgage and housing markets and the ECB database (Table 4).

The collected data have the characteristics of panel data which means that it is possible to observe changes in two cross-sections simultaneously, i.e. in the cross-section of units and time. The main advantage of this data type is the fact that by using them in the construction and estimation of econometric models they facilitate the verification of hypotheses, increase the number of degrees of freedom and reduce the problem of data collinearity and also limit or eliminate the burden of estimators (Dańska-Borsiak, 2011).

Static panel models were used for the research. The Hausman test was used to select the right model which provides an answer to the question as to which individual effects occurred in the analyzed population—fixed effects (FE) or random effects (RE). The RE estimator is consistent and no less effective than the FE estimator if the assumption of the independence of variables observed from individual effects is fulfilled. Due to the significance of Hausman’s statistics for all models, models with fixed effects were used, whose general notation takes the form:

$$NPL_{it} = a_0 + a_1 \times MACRO.VAR_{i(t,t-1)} + a_2 \times MICRO.VAR_{i,t} + v_{it}, \quad (1)$$

where: *NPL* is a measure of the credit exposures quality used in research; *MACRO.VAR* is a vector of the country and values of the sector macroeconomic variables, affecting the quality of the bank’s credit exposures in period *t* or *t* – 1; *MICRO.VAR_{it}* is a vector of the values of control variables, that characterize a specific bank; *v_{it}* is a fixed effect for the bank in period *t*.

Descriptions of the variables used in the research and information on previous publications confirming their significance in the study of the NPL determinants are presented in Table 4 and descriptive statistics of control variables are presented in Table 5.

The results of the research using the static panel model are presented in Table 6.

Table 4. Characteristics of independent variables used in panel studies regarding NPL determinants in the European Union banking sectors with a high level of impaired loans in 2011–2017

Variable	Description	Data source	Previous research
Macroeconomic characteristics			
ΔGDP	Real GDP growth rate—measure of the rate of economic growth and impact of the business cycle	Eurostat, http://ec.europa.eu/eurostat/web/gdp/data/database (17.01.2019)	Messai & Jouni (2013); Beck et al. (2015); Espinoza & Prasad (2010); Marki et al. (2014)
HICP	Harmonized Index of Consumer Prices—measure of inflation	Eurostat, http://ec.europa.eu/eurostat/web/hicp/data/database (20.01.2019)	Klein (2013); Dimitrios et al. (2016)
UN	Unemployment rate defined as the ratio of the unemployed to the employed (BAEL)	Eurostat, http://ec.europa.eu/eurostat/web/hicp/data/database (20.01.2019)	Dimitrios et al. (2016); Skarica (2014); Messai & Jouni (2013); Ozili (2018)
HHI	Herfindahl-Hirschman Index—a measure of concentration of the banking sector	ECB: Banking Structural Financial Indicators	Cifter (2015); Ozili (2018); Ozili (2019a)
RRL	Representative Interest Rates on New Residential Loans	European Mortgage Federation: Hypostat 2019, September 2019, p. 120	Wu, Chang & Selvili (2003)
IH	Real Gross Fixed Investment in Housing	European Mortgage Federation: Hypostat 2019, September 2019, p. 131	Zhang, Cai, Liu & Kutan (2018)
HP	House Price Indices	European Mortgage Federation: Hypostat 2019, September 2019, p. 134	Wu, Chang & Selvili (2003)
Microeconomic characteristics			
Lg_A	The logarithm of the bank's total asset as a measure of the size of the bank	Own calculations based on data from Orbis	Salas & Saurina (2002); Ghosh (2015)
C_I	Cost-to-income ratio—measure of cost effectiveness	Data from Orbis	Bercoff et al. (2002); Podpiera & Weill (2008); Ozili (2019a)

L_A	Share of loans in total assets—a measure of the bank's credit exposure	Own calculations based on data from Orbis	Keeton (1999); Klein (2013); Messai (2013)
ΔL	Annual change in the value of the loan portfolio—a measure of the bank's credit policy	Own calculations based on data from Orbis	Sinkev & Greenwalt (1991); Salas & Saurina, (2002); Jiménez & Saurina (2006)
ROA	Average return on assets—a measure of profitability	Data from Orbis	Salas & Saurina (2002); Klein (2013); Marki et al. (2014); Espinoza & Prasad (2010); Ozili (2019a)
D_A	The share of non-financial sector deposits in total sources of financing—a measure of the bank's business model	Own calculations based on data from Orbis	Marki et al. (2014); Ghosh (2015); Dimitrios et al. (2016); Ozili (2019a)
TCR	Total Capital Ratio—bank's stability measure based on the bank's solvency in a broad sense	Data from Orbis	Rime (2001); Espinoza & Prasad (2010); Marki et al. (2014); Ozili (2019a)

Source: Own study.

Table 5. Descriptive statistics of control variables

Characteristic	NPL	GDP	HICP	UN	HHI	RRL	IH	HP	Ig_A	TCR	L_A	ΔL	ROA	C_I	D_A
Mean	14.44	0.26	1.17	12.09	0.08	3,95	-3,9	-1,03	6,58	21,02	53,83	10,18	0,18	68,66	55,96
Median	12.03	0.60	1.13	11.90	0.05	3,50	-5,0	-1,90	6,27	17,07	56,36	1,06	0,30	65,28	57,97
Standard deviation	12.36	2.27	1.34	2.75	0.04	1,45	24,1	6,94	1,95	17,12	20,38	147,1	4,98	63,07	22,68
Minimum	0.00	-9.10	-1.60	6.20	0.04	1,59	-53,3	-17,05	0,80	-20,27	0,00	-88,3	-1,60	-903	0,00
Maximum	92.31	7.80	3.60	27.50	0.26	7,93	102,1	16,49	13,74	381,5	100,0	6216,7	73,92	980,9	97,95

Source: Own study.

Table 6. Results of panel research (static model, fixed effects) of NPL determinants in the European Union banking sectors with a high level of impaired loans in 2011–2017

Control variables	2011–2017
const	23.911***
	(5.664)
Δ GDP	-0.936***
	(0.260)
HICP	-0.102
	(0.175)
UN	1.184***
	(0.195)
HHI	55.853***
	(15.894)
RRL	0.942***
	(0.339)
IH	-0.005
	(0.012)
HP	0.235***
	(0.071)
Lg_A	-3.902***
	(0.647)
TCR	-0.029
	(0.019)
L_A	-0.055***
	(0.019)
Δ L	0.003***
	(0.001)
ROA	-0.918 **
	(0.386)
C_I	-0.005
	(0.004)
D_A	0.015
	(0.017)
Number of observations	2847
Number of banks	629
Hausman Test Relevance	0.000

Note: *** significance at the level of 1%, ** significance at the level of 5%, *significance at the level of 10%. The heteroscedasticity—consistent error standard is given in brackets.

Source: Own study.

As a result of the research a significant impact of macroeconomic factors on the quality of banks' credit exposures in the analyzed member states of the European Union was demonstrated. In particular it was shown that GDP dynamics negatively affect the level of NPL (at 99% significance level)—a higher economic growth is related with an improved quality of banks' credit exposure in a given country. In addition the tested sample showed a positive impact of the unemployment rate on the NPL value. Considering the values of both the aforementioned macroeconomic variables in the second phase of the economic crisis in the analyzed countries the conclusions of the econometric studies are in line with the existing analyzes of the European Commission. The group of analyzed countries with the highest level of NPL remains almost entirely convergent with the list of EU member states most affected by the crisis. A positive relationship has also been proven between the level of concentration of the banking sector and NPL values for banks which means that in conditions of greater competition between banks statistically a better quality of their loans is observed (Table 6).

However there are no grounds to indicate the inflation rate (measured by HICP index) as a significant determinant of the NPL level in the group of surveyed banks. Among the characteristics of the real estate market two variables significantly affected the level of banks' NPL: Representative Interest Rates on New Residential Loans and House Price Indices. In both cases the relationship is positive.

Among the microeconomic factors affecting the NPL level, at a significance level of 1%, the study confirmed the importance of the bank's size (measured by the logarithm of its assets) and its lending policy (analyzed using the value of the bank's loan portfolio on a year-to-year basis and the share of loans in assets). Banks with a higher value of assets are characterized by a better quality of their loan portfolio, while banks having a more expansive lending policy (with a higher portfolio dynamics) are characterized by a worse quality of loans. Among microeconomic variables the study confirmed the impact of profitability of the bank (measured by return of assets) on the level of the NPL indicator and the dependence is negative (significance at the level of 5%).

Due to the considerable diversity of banks in the analyzed group research was also conducted on two types of entities—commercial banks (group 1) and cooperative and specialized banks (group 2). The average value of the NPL ratio in the group of cooperative and specialized banks, in relation to the group of commercial banks was lower by around 1.2 percentage points in the entire analyzed period (Figure 4), however, differentiation of results in the analyzed countries can be observed (Table 7). It should be emphasized that despite a significant number of cooperative banks they constitute an insignificant part of the banking sectors in all the analyzed countries (expressed as their share in the loan market). Among the analyzed countries cooperative banks play the most important role in Italy where their share in the total loan portfolio of the banking sector was 7.2% at the end of 2017 (EACB, 2018).

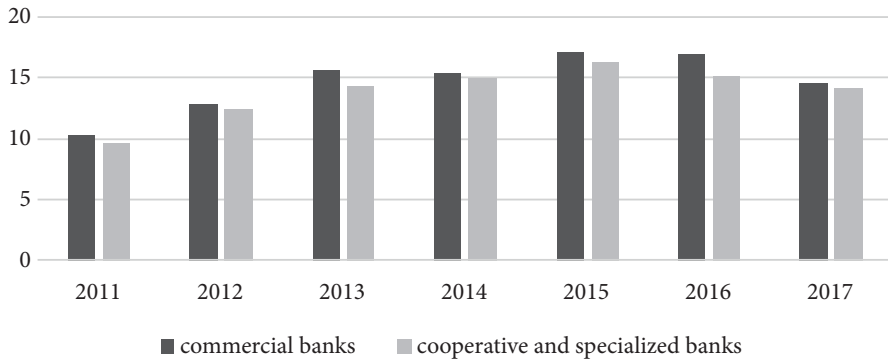


Figure 4. Average values of the NPL ratio in the groups of examined commercial, cooperative and specialized banks in 2011–2017

Source: Own study based on Orbis database.

Table 7. The value of the NPL ratio in commercial, cooperative and specialized banks in the countries studied in the years 2011–2017

Country	Bank specialization	Year						
		2011	2012	2013	2014	2015	2016	2017
Portugal	commercial	4.44	6.27	12.99	12.07	12.87	14.65	8.94
	cooperative and specialized	3.53	4.75	14.45	12.22	10.26	8.53	7.16
Bulgaria	commercial	21.03	20.43	17.80	17.30	19.18	16.83	14.00
	cooperative and specialized	37.75	40.27	40.19	33.84	36.98	16.82	15.36
Cyprus	commercial	14.15	15.72	19.75	15.81	17.27	17.31	16.78
	cooperative and specialized	4.09	3.80	14.72	23.07	32.43	32.03	31.74
Greece	commercial	18.28	21.97	32.89	32.44	40.05	42.72	40.12
	cooperative and specialized	11.06	33.94	37.58	23.14	20.81	19.33	22.20
Croatia	commercial	11.42	20.37	19.72	20.63	21.19	20.26	15.42
	cooperative and specialized	20.27	25.22	15.33	19.79	12.36	12.11	29.57
Ireland	commercial	16.48	22.32	27.55	27.04	18.16	14.54	11.02
	cooperative and specialized	7.90	9.41	7.54	8.55	8.64	17.19	19.33
Italy	commercial	7.51	8.33	10.42	11.49	14.48	14.85	13.63
	cooperative and specialized	9.47	12.16	13.86	15.43	17.60	16.50	15.16

Source: Own study based on Orbis database.

At the same time Italian cooperative banks are an example of a trend observed in many European Union countries regarding a significant deterioration in the quality of credit exposures in the post-crisis period. It consequently led to a situation in which the average NPL value for commercial banks became lower than for cooperative banks (Table 7). One of the important reasons for this situation is the fact that in 2008–2009 cooperative banks, due to the relational business model, took over a significant part of lending activity in the

Table 8. Results of panel research (static model, fixed effects) of NPL determinants in the in the European Union banking sectors with a high level of impaired loans in 2011–2017—a division into commercial and specialized banks

Control variables	Commercial banks	Cooperative and specialized banks
const	32.993*	21.147*
	(19.751)	(11.334)
Δ GDP	-0.908***	-1.234***
	(0.335)	(0.280)
HICP	0.547	-0.234
	(0.417)	(0.265)
UN	1.706***	0.790**
	(0.479)	(0.320)
HHI	63.562**	-11.216
	(25.928)	(36.452)
RRL	-0.302	1.403**
	(0.970)	(0.584)
IH	0.016	-0.094***
	(0.012)	(0.025)
HP	0.355**	0.131
	(0.155)	(0.104)
Lg_A	-5.473***	-2.947***
	(1.977)	(0.754)
TCR	-0.089	-0.003
	(0.067)	(0.024)
L_A	-0.064	-0.051**
	(0.062)	(0.023)
Δ L	0.004***	-0.001
	(0.001)	(0.003)
ROA	-0.611	-0.979***
	(0.390)	(0.092)
C_I	-0.004	-0.004
	(0.004)	(0.003)
D_A	-0.010	0.005
	(0.059)	(0.030)
Number of observations	736	2111
Number of banks	164	465
Hausman Test Relevance	0.000	0.000

Note: *** significance at the level of 1%, ** significance at the level of 5%, *significance at the level of 10%. The heteroscedasticity-consistent error standard is given in brackets.

Source: Own study.

small and medium-sized enterprise sector. On the one hand this step undertaken by cooperative banks led to a reduced decline in lending dynamics in individual EU countries during the crisis (and thus limited the recession in the real economy), while on the other hand it left behind delayed consequences in the form of a deterioration in the quality of loan portfolios in cooperative banks.

A panel study was made independently in both groups of banks (in commercial banks as well as in cooperative and specialized banks) to assess the impact of individual explanatory variables on the level of NPL. The results are presented in Table 8.

The results concerning the macroeconomic determinants of NPL are similar in both groups. Both in commercial banks as well as cooperative and specialized banks the study showed the impact of the unemployment rate and GDP growth on the quality of loan exposures. In addition, in the case of commercial banks a statistically significant impact of market concentration (measured HHI) on the NPL index was demonstrated. The dependence is positive which means that banks manage the quality of their credit exposures more efficiently when the banking sector is less concentrated (Table 8).

The analysis of the characteristics of the real estate market confirmed a strong differentiation of their impact on the NPL level in both groups of banks. In the case of commercial banks the positive relationship between the dynamics of real estate prices and the level of NPL of banks was confirmed. On the other hand in the case of cooperative banks, it was demonstrated that an increase in the level of housing investment and a decrease in the price of new housing loans improved the quality of their loan portfolio.

Among the microeconomic factors affecting the NPL value in the commercial and cooperative banks the size of the entity and the dynamics of lending can be indicated. Additionally, for cooperative and specialized banks the impact of the return on assets and the share of loans in total assets on the quality of loan exposures was found. In the case of commercial banks it has been confirmed that in this group of entities a high growth of granted loans leads to a deterioration in the quality of credit exposures.

4. Post-crisis supervisory changes in the NPL area in the analyzed countries

In September 2016 the European Central Bank (ECB) published the results of the first review of national supervisory practices and the legal framework related to nonperforming loans (NPL). ECB's decision to create a report was made as part of the preparation of uniform guidelines for banks, uniform definitions and a uniform legal framework regarding impaired loans in EU.

The review was carried out in close cooperation with eight supervisory authorities in countries with a relatively high level of non-performing loans. Based

on the results progress has been made in solving the problems of a high NPL indicator from a supervisory perspective. Based on the information in the report the national supervisory authorities in each Member State issued general guidelines on credit risk. Some of those guidelines contain information on general methods, principles and processes that banks should implement to ensure adequate and timely management of credit risk (in particular regarding the credit granting process, management and monitoring of credit risk, data collection, calculations and reporting). A number of countries (those with a low NPL index) have introduced macro-prudential measures on mortgage risk and excessive credit growth, for example with reference to debt servicing amounts, limits regarding the loan-to-value (LTV) and loan-to-income (LTI) ratios.

The appropriate process of recognition and classification of loan exposures in banks facilitates timely and effective management of problematic loans thus reducing their negative effects. Proper classification of these loans is also essential for a correct presentation of the banks' situation to stakeholders including external investors and market analysts. It is therefore desirable for banks to adopt and apply uniform accounting principles for classification and valuation purposes.

All national supervisors have indicated that they use the definition issued by the European Banking Authority (EBA) to recognize a credit exposure as being a risk which was presented earlier in the article. In addition some countries have introduced further methods for identifying credit exposures in their legal frameworks that could indicate the debtor's difficulties in their repayment obligation (Table 9).

Table 9. Additional supervisory methods regarding NPL recognition and classification (except for current regulations)—countries with a high NPL index

	CY	GR	IE	IT	PT
Additional performing loan/NPL sub-categories	NO	YES	YES	YES	NO
Additional forbearance criteria	YES	YES	YES	NO	YES
Additional specific data collection requirements for forborne exposures	YES	NO	YES	NO	YES
Additional exit criteria from NPL/ forbearance category	NO	NO	NO	NO	NO

Source: Stock take of national supervisory practices and legal frameworks related to NPLs (https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.stock_taking2017.en.pdf).

Additional guidelines regarding the recognition and classification of impaired loans have been developed and implemented primarily in countries with a high level of NPL. The guidelines also concerned the introduction of

additional subcategories or the collection of additional data for restructured loans or impaired loans (Table 9). The introduction of additional guidance on renewed reclassification of non-performing loans into performing loans is rare and has not been introduced by any country with a high NPL ratio during the considered period (ECB, 2017a).

Discussion and conclusions

The considerations presented in this article on the quality of the credit exposure of banks operating in the European Union countries constitute a significant contribution to the discussion on the possibility of solving the problem of a significant increase in the value of impaired loans in the post-crisis period. A very favourable macroeconomic situation in the European countries in 2015–2017, in particular a significant decrease in the unemployment rate (in many countries to the historical lows of the post-transformation period) has contributed to the improvement of the NPL level (with the exception of Greece) but without completely eliminating the negative effects of the financial crisis of 2007–2009. This means that in the event of a deterioration in the economic situation the quality of credit exposure may deteriorate again and consequently the profitability and solvency of the region's banks may also deteriorate. Additional regulations regarding impaired loans discussed above and implemented primarily in countries with a low credit portfolio quality may protect these countries against significant negative consequences of the economic downturn.

The results of the panel research carried out show that the value of the NPL ratio of the analyzed banks is statistically significantly affected by both macroeconomic factors, such as GDP, the unemployment rate, as well as bank-specific factors such as the size of the bank or the dynamics of lending. Despite the differences in the business models of banks (commercial, cooperative and specialized banks) and regulatory regimes the determinants of the NPL ratio are similar. Although the increase in the NPL ratio in the European Union has been partly limited the current level of non-performing loans remains far too high compared to international standards and their level of the pre-crisis period (ECB, 2019). Further efforts by both the ECB and national regulatory authorities are necessary to ensure that in the long term the quality of credit exposure will not adversely affect the stability and efficiency of credit institutions. Unfortunately these activities may be significantly impeded in the near future due to the deteriorating macroeconomic situation in many European Union member states. At the same time it should be noted that an excessive concentration of supervisory authorities and banks on the strategy of improving the quality of credit exposures may lead to negligence in other areas, in particular in the area of new technological challenges, including fintech, blockchain

and the digital transformation of payment systems, optimization of human resources and branch networks.

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Aims and Scope

The **Economics and Business Review** is a quarterly journal focusing on theoretical, empirical and applied research in the fields of Economics and Corporate and Public Finance. The Journal welcomes the submission of high quality articles dealing with micro, mezzo and macro issues well founded in modern theories and relevant to an international audience. The EBR's goal is to provide a platform for academicians all over the world to share, discuss and integrate state-of-the-art Economics and Finance thinking with special focus on new market economies.

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