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Aneta Kosztowniak*

Changes in the quality of bank loan portfolios in EU countries – with the particular case of Poland[1]

1. Introduction

The size of non-performing loans (NPLs) plays a key role in the stability of banking sector of every country. Rising NPLs are often referred to as a failure of banks to manage credit policy and bank losses. After global crises, NPLs are of interest to banks in connection with asset management as they are considered failures and crises of the banking system (Gosh, 2015). A growing level of non-performing loans in the longer term will affect commercial banks first and then the financial situation of a country's economy (Souza, Feijó, 2011).

According to Handley (2010) and Ivanovic (2016), NPLs affect a country's economic growth by reducing credit development. Low NPLs indicate a strong monetary system, while high NPLs suggest a weak financial situation. The negative impact of NPLs manifests itself in a decline in banking efficiency, causing banking crises (Vouldis and Louzis, 2018). NPLs block interest income, limit new investments, cause liquidity crises in the financial system, resulting in bankruptcy problems and lower economic welfare. For these reasons, it is necessary to identify the factors that influence NPLs so that they do not compromise financial stability (Stijepović, 2014).

In EU countries, including Poland, where the main place of obtaining capital is the banking system, the supervision of NPLs is particularly important (Moradi et al., 2016). NPL statistics confirm the problem in European countries, although

* SGH Warsaw School of Economics, Collegium of Management and Finance, Department of Applied Economics, e-mail: akoszt@sgh.waw.pl, and NBP. ORCID ID: 0000-0001-6088-1899.

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its scale varies. The share of household loans in the euro area countries accounts for over 60% of total loans and, including over 40% for Poland, and their value is approx. 35% of GDP in 2021 (BIS, 2021). The ratio of outstanding bank loans to total gross loans according to the World Bank (2021) shows significant differences in the banking sectors of the EU countries (e.g., 27.0% Greece, 15.0% Cyprus, 5.8% Bulgaria, 4.9% Portugal, 3.7% Poland, and 1.1% Germany in 2020).

The main aim of this chapter is to identify changes in the quality of bank loan portfolios in the EU countries in 2009–2021 using the example of the Visegrad Group (Czech Republic, Poland, Slovakia, Hungary, V4) as well as France and Germany. Considering the fact that the share of loans to households in EU portfolios is approximately 60%, it has a significant impact on the share of non-performing loans (NPL) in a bank's entire portfolio. Therefore, it is important to identify macroeconomic determinants influencing the creditworthiness of households and their loan servicing capacity.

The specific aims are, first, to present the differences in NPLs, debt servicing costs, and the structure of loan portfolios in the selected EU countries. Second, to identify countries with high-quality portfolios and those undertaking restructuring. Thirdly, to examine the determinants of NPL for household loans based on the example of Poland, i.e., a country considered representative in terms of the average level of NPL and the portfolio structure in the group of countries studied.

The present chapter identifies several macroeconomic factors influencing the NPLs rate in the Polish banking system. We concentrate on macro-level factors but the quality of a loans portfolio also depends on the specificity of each bank and its customers.

2. Literature and research review

The increase in NPLs over the past decade has caught the attention of many academics around the world who have tried to explain the phenomenon. The main reasons for high NPLs are poor credit procedures, weak credit specialists, high margins, low credit rules, and the lack of a borrower monitoring policy. Most authors study changes in NPLs for entire loan portfolios and analyze various factors. However, we can define two main groups of macroeconomic and banking factors.

The following macroeconomic factors are commonly studied: real GDP growth, value of GDP/GDP per capita, the exchange rate, interest rates and the level of inflation. The results confirm that real GDP growth usually translates into a higher level of income, improving the financial standing of borrowers and decreasing NPLs. When an economy is below normal conditions or in a recession, NPL levels may rise due to the ensuing growth in unemployment, and borrowers face severe debt repayment difficulties (Salas, Suarina, 2002; Ranjan, Dhal, 2003; Fofack, 2005;

Jiménez, Saurina, 2005; Thalassinos et al., 2015, Kosztowniak, 2020; 2021). Exchange rate fluctuations may have a negative impact on the quality of assets, especially in countries with a large amount of foreign currency loans. The same applies to interest rate increases, particularly in the case of loans with flexible interest rates (Louzis et al., 2012; Zaman, Meunier, 2017). However, on the one hand, higher inflation may ease debt compensation by affecting the real value of unpaid credit, while on the other hand it may also reduce the real income of unprotected borrowers. In countries where credit rates are flexible, higher inflation may lead to higher rates resulting from monetary policy actions to fight inflation (Nkusu, 2011).

The research by Klein (2013) for NPLs in Central, Eastern and South-Eastern European countries (CESEE) in 1998–2011 confirmed that NPLs responded to macroeconomic conditions, i.e., unemployment, GDP growth and inflation, and that high NPLs in these countries have a negative effect on economic recovery. According to Mazreku et al. (2018) for 10 transition countries (Central and Eastern Europe) in 2006 and 2016, dynamic panel estimates show that GDP growth and inflation are both negatively and significantly correlated with the level of NPLs, while unemployment is positively related to NPLs. Export growth shows largely insignificant results, indicating that NPLs in the sample are mainly influenced by domestic conditions rather than external economic shocks. Vogiazas and Nikolaidou (2011) investigate the determinants of nonperforming creditors in the Romanian banking sector during the Greek crises (2001–2010) and find that inflation and external GDP information influenced the credit risks of the banking system in the country. According to Hada et al. (2020, pp. 1–19), the exchange rates (mainly EUR, USD and CHF), unemployment rate and inflation rate had a significant impact on NPLs in the Romanian banking system in the period 2009–2019.

Among the banking variables that define NPLs, research tends to focus on return on assets (ROA), bank efficiency, and bank capital. However, the specificity of each bank and its customers are very important for NPL changes. For example, Godlewski (2008) investigates the association between NPLs and return on assets (ROA) and states that the lower the rate of ROA, the higher the NPLs and vice versa. Boudriga et al. (2010) confirm from their study that there is a negative association between ROA and NPLs. They conclude that when the ROA decreases, then a bank starts to make investments in high-risk projects and as a result the level of NPLs rises. Dimitrios et al. (2016) investigate the various determinants of NPLs in the euro banking system and conclude that ROA has a significant impact upon NPLs. An insufficient control of the loan portfolio (including short-term loans) increases risk and NPLs. Fiordelisi et al. (2011) examine the various factors that increase the risk level in the EU banks and conclude that a declining efficiency hikes the risk level of banks in future. Furthermore, efficiency and performance factors had an influence on NPLs in the Greek banking sector (Louzis et al., 2012). Rachman et al. (2018) state that operating efficiency does not influence NPLs.

The effect of bank capital on NPLs works in the opposite direction. For one part, incentivised managers of low capitalized banks tend to get involved in high-risk investments and give loans that are issued without proper credit rating and monitoring (Keeton, 1999). For another part, banks with a high level of capital tend to give loans easily as they know that owing to these loans banks are not going to be bankrupt and fail; therefore, banks are highly engaged with these kinds of risky credit activities suggesting a positive association between capital and NPLs (Rajan, 1994). Moreover, the capital adequacy ratio (CAR) shows the ability of an organization to face abnormal losses and to survive that situation. Makri et al. (2014) also state that there is a negative association between CAR and NPLs. Constant and Ngomsi (2012) claim that NPLs and CAR have a positive association with each other. Bank profitability and sustainability can only be provided through a proper flow of interest income generated through the lending function. However, since banks are no longer able to generate enough interest income through classical safe credit and are required to maintain reserves in the form of provisions to cover for eventual loan losses, bank capital decreases together with their health, which is becoming fragile, increasing the trend of NPLs. Therefore, banks are required to take proactive action to deal with the phenomenon of the poor choices of borrowers, mainly by identifying and understanding the macroeconomic factors that contribute to the rise of classified credit in the banking system (Anjom, Karim, 2016).

The European Commission (EC) (Kasinger et al., 2021) has announced strategies to combat non-performing loans. The first plan was unveiled by the ECOFIN Council in July 2017. It was then extended with a new package of measures in March 2018 and a capital market recovery package in July 2020. The outbreak of the COVID-19 pandemic may additionally adversely affect household incomes and, consequently, the growth of NPL. Therefore, it is important to identify the main NPL determinants of the household loan portfolio, that is, the variable income and cost that determine the serviceability of loans. In Staeher's and Uusküla (2020) opinion, estimations show that many macroeconomic and macro-financial variables are the leading indicators for non-performing loans in the EU countries, even years ahead. Higher GDP growth, lower inflation and lower debt are robust leading indicators of a lower ratio of non-performing loans in the future.

3. Changes of NPLs in selected EU countries

Non-performing loans, with the exception of Hungary, showed relatively stable levels, with an average deviation of 1–2 pp, in the countries of the Visegrad Group (V4), as well as in Germany and France, in 2009–2020. In the case of Hungary, the financial crisis of 2007/2008 had a negative impact on the deterioration

of banks' loan portfolios, escalating the growth of non-performing loans to 18.8% in 2013. It took ten years to restore the portfolio quality to its previous levels (3.2% in 2008, 2.5% in 2018). The lowest average level of NPL was maintained by Germany (2.1%) and France (3.6%), it was comparable in Poland, Slovakia and the Czech Republic (slightly above 4%), and the highest in Hungary (8.6%). The example of Hungary shows that allowing a deterioration in the loan portfolio is difficult to repair and sometimes takes a long time (around a decade). Therefore, the supervision and prevention of a deterioration of the loan portfolio should be a permanent responsibility of banks. Moreover, the data for 2020 indicate that the COVID-19 pandemic has not yet affected NPL changes in the group of analyzed countries. They remained similar to 2019 levels. Taking into account the continued demand for loans and the lack of growth in non-performing loans, this indicates the positive impact of government assistance programs (Fig. 1).

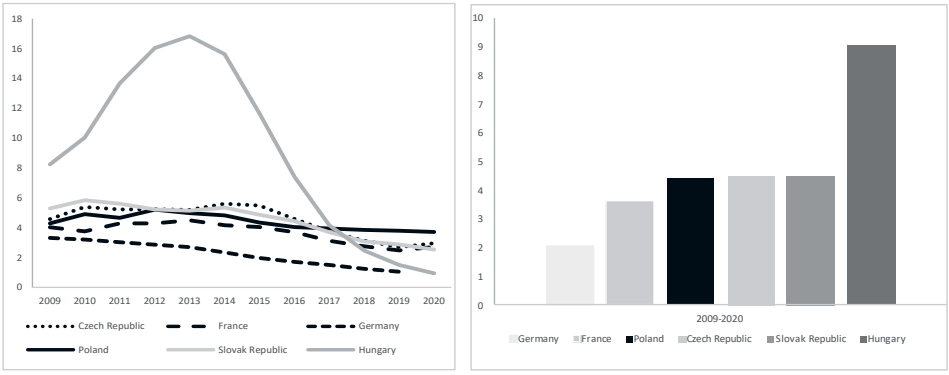

Figure 1. Bank NPLs to total gross loans in selected countries in 2008–2020 [%]

Source: The author`s compilation based on WDI (2021)

There were significant differences in the amount of debt servicing costs between the analyzed countries. While the average level of these costs for the Czech Republic and Poland was just over 7.0%, they were higher by over 4 pp in Germany and Hungary and by 11 pp for France. In 2009–2020, the Czech Republic and Poland maintained a stable level of debt servicing costs. Germany slightly decreased (by 1 pp) their level. In Hungary, along with the restructuring of loan portfolios, these costs fell significantly from Q1 2009 to Q4 2019 (by 12.3 pp). It is worth noting that while NPLs did not show changes as a result of the COVID-19 pandemic in 2020, debt servicing costs exhibited such a reaction. They climbed in France, Germany and Hungary. The increase in these costs may further affect the deterioration of the quality of the loan portfolio and the growth of NPLs in the coming year (Fig. 2).

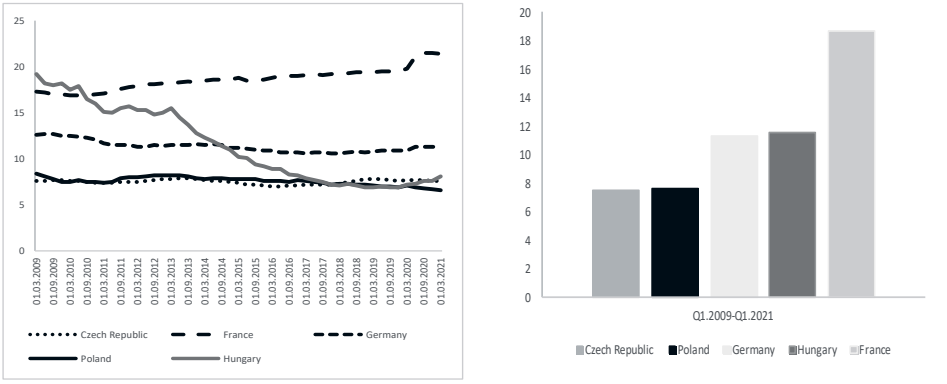

Figure 2. Debt service ratio for the private non-financial sector in selected countries in 2009–2021 (quarters, %)

Source: The author`s compilation based on BIS.org (2021)

The share of loans to households in the total loans of the analyzed countries ranges from 23.6% in Hungary to over 40% in Poland and Germany. The value of these loans accounts for nearly 30% of GDP in Hungary to around 60% of GDP in the euro area countries, including Germany and France. Thus, changes in the financial situation of households significantly affect the quality of the entire banking sector loan portfolio and the possibilities of economic growth, requiring the monitoring of the determinants of this situation (Fig. 3).

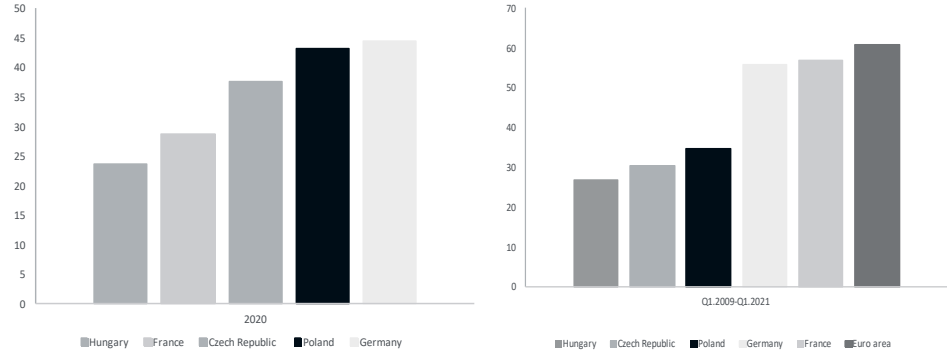

Figure 3. Household loans in selected countries (left panel, % of total loans, right panel, % GDP)

Source: The author`s compilation based onBIS.org (2021)

4. Results and discussion

4.1. Data and methodology

The National Bank of Poland (NBP) and other institutions, e.g., the International Monetary Fund (IMF), state that loans would be considered NPLs if they do not produce interest and principal amount for a minimum of 90 days. The NPL rate is calculated as the ratio of non-performing loans (impaired loans) and advances to the gross value of total loans and advances (NBP, 2021).

Poland is selected for the analysis of NPL determinants for household loans because the amount of NPLs and the structure of the loan portfolio in this country remain average among the analyzed countries. To specify the determinants of NPL for household loans (which in Poland account for 40% of total loans), it was decided to carry out research for this loan portfolio, not for the entire loan portfolio. Attention is paid to the variables determining the creditworthiness of households, i.e., mainly real income and loan servicing costs. Thus, the results of the study fill a gap in this area.

In the methodological approach used by the NBP (2021), household loans are available to: private persons, individual entrepreneurs, individual farmers, and non-commercial institutions operating for the benefit of households. The article attempts to assess the quality of the portfolio of loans granted to households, therefore, respectively, impaired loans and total loans granted to these households (included in the so-called phase III, portfolio B) are considered.

The time series of the model variables are presented in Figure 4.

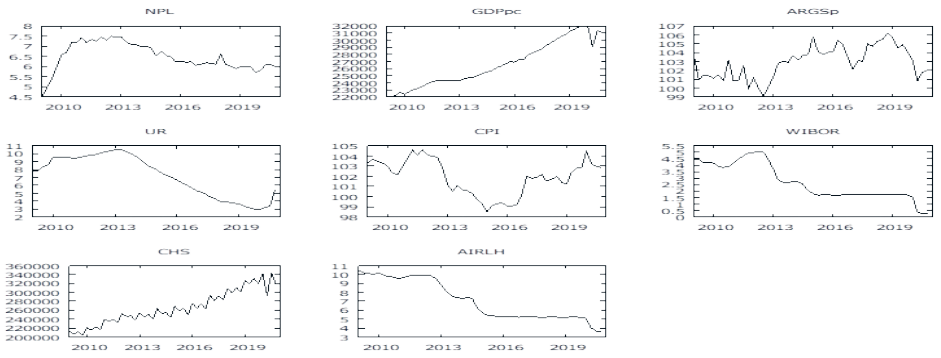

Figure 4. The time series of the model variables

Source: The author's own calculations, GRETL program

The research is based on statistics from the NBP, Central Statistics Office (CSO), Organization for Economic Co-operation, Development (OECD Internet databases), and Eurostat. EViews is employed for the purposes of calculations.

The specificity of the base equation is developed as a formula:

$$lnNPL_t = a_1 + a_2 \ln GDPpc_t + a_3 \ln ARGSp_t + a_4 \ln UR_t + a_5 \ln CPI_t + \\ + a_6 \ln WIBOR_t + a_7 \ln CHS_t + a_8 \ln AIRLH + u_t$$

where the explained variable: NPL_t – non-performed loan ratio

Explanatory variables:

GDPpc – gross domestic product per capita (*GDPpc*, fixed PPPs, seasonally adjusted, US dollars),
ARGSp – average monthly real gross salary (analogous period of the previous year = 100),
UR – unemployment rate [%],
CPI – consumer Price Index [%],
WIBOR – Warsaw Interest Board Rate [%],
CHS – consumption in the household sector [PLN million],
AIRLH – average interest rate on loans to households and non profit institution serving households [%],
ln – natural logarithm,
u – random factor,
t – period.

The methodology of changes in the quality of the loan portfolio corresponds to the methodologies used by central banks, e.g., by NBP and IMF (2003), Matthewes et al. (2007), Maggi and Guida (2010), Mazreku et al. (2018). The study period includes quarterly data for the period Q1.2009–Q2.2021 (Tab. 2).

Methods are used known from literature on international economics and international finance and econometric methods like the VECM model (*Vector Error Correction Method*) including the impulse response functions and the decomposition of variance. The expected influence of the explanatory variables on the explained variable (NPLs) is presented in Table 1.

The model data is verified on the basis of tests for unit roots, e.g., Augmented Dickey–Fuller (ADF) test, and cointegration is tested using the Johanson test and the Engle Granger test. The results confirm the applicability of the VECM model.

The sources of a changing quality of the loans portfolio are explained by means of the following methodology: (NBP, 2020), (IMF, 2003) and e.g. (Matthewes et al., 2007), (Maggi and Guida, 2010). The study period includes 50 quarterly data for the period Q1.2009–Q2.2021. All variables are smoothed by simple moving averages.

Table 1

Model variables

No.	Variables	Data source	Expected impact on the NPLs
1	*NPL*	NPB	"–"
2	*GDPpc*	OECD	"–"
3	*ARGSp*	CSO	"–"
4	*UR*	CSO	"–"
5	*CPI*	CSO	"+"
6	*WIBOR*	Eurostat	"+"
7	*CHS*	CSO	"+ / –"
8	*AIRLH*	NBP	"+"

Source: The author's own preparation

To verify the stationarity of the analyzed time series, the Augmented Dickey–Fuller (ADF) test is used, estimated by means of the regression equation in the following form:

$$\Delta y_t = \mu + \delta_{t-1} + \sum_{i=1}^{k} \delta_i y_{t-1} + \epsilon_t$$

The value of the test statistic is calculated by:

$$ADF = \frac{\tilde{\delta}}{S_{\tilde{\delta}}}$$

where δ means the parameter evaluation and s_δ is the parameter estimate error.

All the analyzed variables are found to lack the stationarity of time series, but a unit root a = 1 occurred at process I(1). A comparison between test τ statistics and critical values of these statistics shows that in the case of basic variables, the series are non-cointegrated and variables are non-stationary because the test probabilities are above 0.05. On the other hand, in the case of first differences, variables are mostly stationary and the series are co-integrated to the order of 1 (Tab. 2).

Table 2

Augmented Dickey–Fuller (ADF) test

Variable	Null hypothesis: unit root appears	With absolute term (const)	
		test statistic: $\tau\_ct(1)$	asymptotic p-value
l_NPL	$a = 1$; process I (1)	−1.62283	0.4708
l_GDPpc		−0.94158	0.7755
l_ARGSp		−1.61224	0.4763
l_UR		−1.88842	0.3381
l_CPI		−1.48913	0.5394
l_WIBOR		0.52368	0.9876
l_CHS		−0.94661	0.7738
l_AIRLH		−0.17732	0.9390

Source: The author's own calculations

To verify the conclusions drawn on the basis of the ADF test, the KPSS (Kwiatkowski–Philips–Schmidt–Shin) stationarity test is carried out, where the null hypothesis assumes a sequence stationarity, whereas the alternative hypothesis assumes the occurrence of the unit root. The initial test model can take the following form:

$$\gamma t = \beta t + rt + \xi t$$

where: $r_t = r_t - 1 + u_t$, where ξ_t and u_t are a stationary and a white-noise random component, respectively. On the other hand, the KPSS test statistic is calculated with the use of the formula:

$$KPSS = T^{-2} \sum_{t=1}^{T} (\sum\nolimits_{t=1}^{t} e_i) / \hat{\delta}^2$$

where e_i enotes residuals and $\hat{\delta}$ is a long-term variance estimator (Kufel, 2011).

An ultimate confirmation of stationarity requires an additional test, e.g., KPSS (Tab. 3).

The lag order for the VAR/VECM model is determined on the basis of estimation of the following information criteria: the Akaike information criterion (AIC), Schwartz–Bayesian information criterion (BIC), and Hannan–Quinn information criterion (HQC). According to these criteria, the best, that is, minimal values of the respective information criteria are: AIC = 2, BIC = 2 and HQC = 2, with the maximum lag order 4. Ultimately, the lag order 2 is accepted.

Table 3

KPSS stationarity test results (lag truncation = 4)

Specification		l_NPL	l_GDP-pc	l_AR-GSp	l_UR	l_CPI	l_WI-BOR	l_CHS	l_AIR-LH
Include a trend	test statistic	0.17234	0.12428	0.115756	0.22196	0.203683	0.085267	0.10575	0.101386
	critical value of the test	0.121 (10%); 0149 (5%); 0.213 (1%)							
Interpolated *p*-value		0.035	0.095	0.01	0.01	0.016	0.10	0.10	0.10

Source: The author's own calculations

In order to analyze the stability of the VAR model, a unit root test is applied. The test indicates that in the analyzed model equation roots in respect of the module are lower than one, which means that the model is stable and may be used for further analyses (Fig. 5.).

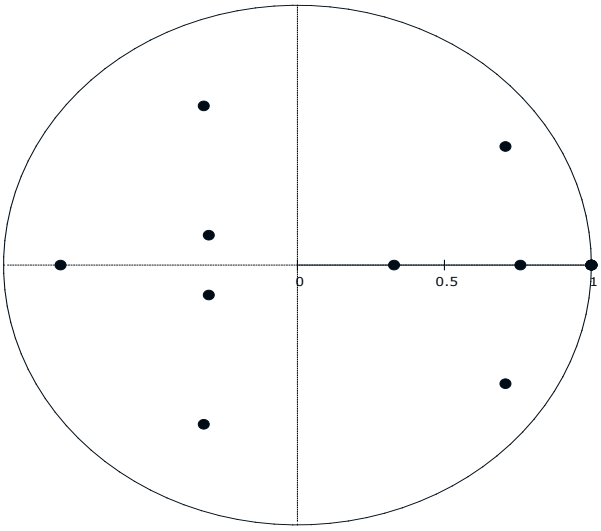

Figure 5. VAR inverse roots in relation to the unit circle

Source: The author's own calculations

Co-integration is verified using two tests: the Engle–Granger and Johansen tests (Johansen 1991, 1992, 1995). Their results comprehensively confirm co-integration for lag 1. This is proved by the values of the test statistic τ_e which are lower than critical values $\tau_{critical}$, the levels of asymptotic *p*-values and integrated processes $a = 1$ and I(1), at a significance level $\alpha = 0.05$ (Tab. 4).

Table 4

Results of the Engle–Granger co-integration test

Specification	l_NPL	l_GDPpc	l_UR	l_CPI	l_WIBOR	l_CHS	l_AIRLH
Unit root appears	$a = 1$, process I (1)						
Test statistic τ_c τ_e (asymptotic *p*-value)	−1.62283 (0.4708)	−0.94158 (0.7755)	−1.88842 (0.3381)	−1.48913 (0.5394)	0.52368 (0.9876)	−0.94661 (0.7738)	−0.17732 (0.9390)

Source: The author's own calculations

Testing cointegration is designed to find a long-term relationship between variables. Using the strong testing methods of Johansen Cointegration and cointegration relationship variables, it can be concluded there is a long-term relationship between variables. The results of the Johansen test (including trace and eigenvalue) show that at the significance level of 0.05, co-integration to the order of one occurs (Tab. 5).

Table 5

Johansen test, lag order = 4, estimation period: 2010:1–2021:2

Rank	Eigenvalue	Trace test [*p*-value]	Lmax test [*p*-value]	
0	0.93506	492.78 [0.0000]	120.31 [0.0000]	
1	0.91863	372.47 [0.0000]	110.39 [0.0000]	
2	0.90316	262.08 [0.0000]	102.73 [0.0000]	0.74557
3	0.74557	159.36 [0.0000]	60.223 [0.0000]	
4	0.68691	99.133 [0.0000]	51.095 [0.0000]	
5	0.45126	48.038 [0.0001]	26.406 [0.0066]	

Table 5 cont.

6	0.28865	21.632 [0.0044]	14.986 [0.0363]	0.74557
7	0.14020	6.6462 [0.0099]	6.6462 [0.0099]	
eigenvalue	0.93506	0.91863	0.90316	

Source: The author's own calculations

Due to the occurrence of a unit element in all the time series and the existence of cointegration between the model variables, it is possible to extend and transform the model into vector error correction models (VECM).

4.2. VECM model and results

Co-integration is verified, thus justifying the use of the VECM model for the lag order 2 and co-integration of the order 1. In accordance with the Granger representation theorem, if variables y_t and x_t are integrated to the order of I (1) and are co-integrated, the relationship between them can be represented as a vector error correction model (VECM) (Piłatowska, 2003).

The general form of the VECM can be written as:

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots \Gamma_{k-1} \Delta Y_{t-k+1} + \pi Y_{t-k} + \varepsilon_t = \\ = \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \pi Y_{t-k} + \varepsilon_t,$$

where:

$$\Gamma_i = \sum_{j=1}^{i} A_j - \mathrm{I}, \qquad i = 1, 2, \ldots, k-1, \qquad \Gamma_k = \pi = -\pi(1) = -\left(\mathrm{I} - \sum_{i=1}^{k} A_i\right)$$

and I is a unit matrix.

The results of the beta index of the VECM model indicate that the variables can be treated as the variables of long-term effect on NPL. The parameters of the alpha vector suggest that the highest rates of adaptation show their own changes in NPL, then in UR and WIBOR.

The EC1 index (containing the evaluation of the error correction index) confirms that the strongest correction of deviation from the long-term equilibrium occurs in the case of the NPL equation. Here, 14.3% of the imbalance from the long-term growth path is corrected by the short-term adjustment process. The results of the determination coefficient (R2) indicate a moderately good adjustment of the VECM model equations to the empirical data. The results of the Durbin–Watson (DW) test do not confirm the existence of a significant residual autocorrelation (Tab. 6).

Table 6

The VECM model

VECM system, lag order 2, observations 2009:3–2021:2 (T = 48) Cointegration rank = 1, Case 3: Unrestricted constant			
β (cointegrating vectors, standard errors in parenthes)			α (adjustmentvectors)
1_NPL	1.0000	(0.0000)	−0.1439
1_GDPpc	−2.6484	(1.4716)	−0.0171
l_ARGSp	4.4294	(2.1068)	−0.0158
l_UR	0.1064	(0.1649)	−0.1236
l_CPI	−2.1136	(2.5833)	−0.0036
l_WIBOR	0.5392	(0.1844)	−0.1207
l_CHS	2.7568	(0.8638)	−0.0785
1_AIRLH	−1.1109	(0.4019)	−0.0018

Specification	EC1	R2	DW
1_NPL	−0.14387	0.666641	1.972752
1_GDPpc	−0.01708	0.317993	1.692827
l_ARGSp	−0.01579	0.224475	2.189725
l_UR	−0.12361	0.855231	1.956559
l_CPI	−0.00362	0.151093	1.928489
l_WIBOR	−0.12067	0.324845	1.841010
l_CHS	−0.07852	0.694566	1.845236
1_AIRLH	−0.00186	0.268971	1.838926

Source: The author's own calculations, GRETL program

In order to verify the correctness of the VECM model results, two tests are carried out verifying the occurrence of autocorrelation, i.e.: autocorrelation Ljung-Box Q' test, lag order for test = 2, and ARCH test = lag order for test = 2. Ljung–Box tests (LMF, LM, Q) verify autocorrelation for the lag order 4. The verifying statistic using the autocorrelation coefficient function (ACF) in the form Q' and empirical *p*-value levels higher than the nominal $\alpha = 0.05$ let us conclude that there is no autocorrelation in the residual process (Kufel, 2011). The ARCH test results indicate the ARCH effect is not observed in the examined model of the residual-based process (four variables), because LM test statistics are lower than the levels of χ^2. This means that there is no autoregressive changeability of the conditional variance and there is no need to estimate model parameters by means

of the weighted least squares method. Thus, the results of both the tests confirm credibility of the VECM model and allow for conclusions drawn on their basis.

The results presented in the article are consistent with those reported by such authors as: Salas and Suarina (2002), Ranjan and Dhal (2003), Fofack (2005), Jiménez and Saurina (2005), Djiogap and Ngomasi (2012), Thalassinos et al. (2015), Mazreku et al. (2018).

4.3. Impulse response functions

The analysis of the NPL response to impulses from the explanatory variables confirms that the strength of the influence of these impulses increased over time. About 5–7 quarters of the forecast, the impact of explanatory variables on NPLs showed a stabilization (constant).

The NPLs showed increasing trends in response to change impulses from own NPL (3%), CPI (2%), and AIRLH (1%). Earlier changes in NPL (problems with servicing loans) translate into future changes, inflation lowers the purchasing power of disposable income with rising consumer prices, and changes in the interest rate of loans raise the interest due. After about 2.5 years, the NPL also shows a weak increase due to the influence of GDPpc, which may indicate a rising demand for credit accompanied by a GDPpc growth.

The NPLs show diminishing trends in response to the changes of: CHS, ARGSp, UR, and WIBOR. The increase in consumption expenditure proves that creditworthiness (the repayment of loan costs) is maintained with arise in real wages, which contribute to a reduction of NPL. The weak but negative impact of the unemployment rate and WIBOR on NPL can be explained by compliance with the requirements of creditworthiness assessment, a loan application may be rejected as it deteriorates (Fig. 6).

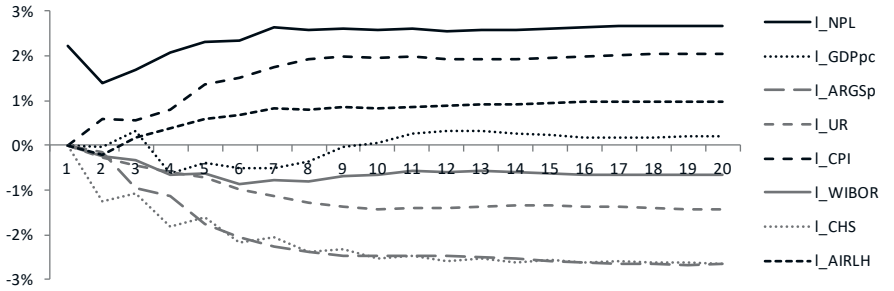

Figure 6. Responses of NPL to a one-standard error shock coming from variables

Source: The author's own calculations

To sum up, the quality of the household loan portfolio deteriorates as a result of previous unfavorable changes in this portfolio, increased inflation and interest on loans to households. The importance of the impact of inflation on NPLs implies the important role played by monetary policy and the legitimacy of monitoring the level of inflation, the increase of which may affect the quality of the household loan portfolio by approx. 2%.

4.4. The decomposition of variance

The results of the variance decomposition indicate that the previous NPL changes as well as CHS and ARGSpc have the highest share in explaining changes in NPL, deciding about 87% and 75% of changes in the 1st and 5th year of the forecast. Over time, the impact of own changes diminishes from 100% in Q1 to 28% in Q20, while the importance of CHS rises from 17.5% to 23.6% and of ARGSp from 0.3% to 23.0%, respectively. An increasing degree of explanation of NPL changes by CPI, from 3.8% to 13.7%, and UR, from 0.9% to 6.5%, is notable. Other explanatory variables (GDPpc, WIBOR and AIRLH) are significant, too, however, their influence does not exceed 6% in total (Fig. 7).

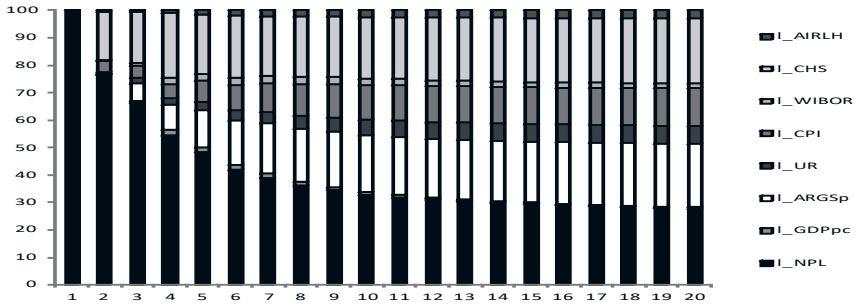

Figure 7. Forecast variance decomposition for I_NPL

Source: The author's own calculations

The results of the decomposition confirm the results of the analysis of the impulse response function, indicating three pillars of NPL changes, i.e., own changes of NPL, CHS and ARGSp.

5. Discussion

The VECM model, the impulse response function and the variance decomposition confirm the importance of the main determinants of household

creditworthiness, i.e., income (relative wages) and expenditure (consumption demand) for changes in the quality of the loan portfolio in the Polish banking sector.

The results of the research corroborate a growing influence of macroeconomic conditions, including the CPI and the unemployment rate. These two indicators have a key impact on the amount of relative household income as well as the ability to earn. Thus, they play an important role in the monetary policy pursued by the central bank and in the economic policy of the government. The importance of other variables, such as interest rates on loans to households, is less important than the aforementioned relative wages and expenses. The study is consistent with the results of other authors analyzing changes in the portfolio of total non-performing loans, which emphasize the important role of borrowers' financial conditions.

As the research results presented in the article focus on one group of borrowers (households), these results additionally specify the portfolio quality determinants for this group. Thus, they constitute the author's contribution to research into the quality of the loan portfolio. Moreover, these findings may constitute proposals for extending the assessment of the creditworthiness of borrowers, in this case of households, to include market conditions.

6. Conclusion

As a deterioration in loan quality may destabilize the situation in the banking sector and spread to the entire economy, it is important to monitor the determinants of NPL change. Compliance with macroprudential regulations in the banking sectors of EU countries reduces non-performing loans, which is confirmed by the NPL data presented for the V4 countries, France, and Germany.

The empirical data show that, first, in the V4 countries, as well as in Germany and France, it was possible to improve the quality of loans in 2009–2020. However, the greatest restructuring effort was undertaken by Hungary, which reduced the level of NPLs from 16.4% (2013) to 0.93% (2020). Secondly, the highest quality of the loan portfolio (with the lowest NPL) was maintained by Germany, France and Poland (with a stable NPL level). In 2009–2017, Hungary had the gravest problems with non-performing loans, yet managed to restructure them in 2018–2020. Thirdly, the model analysis of the VECM and the function of response to impulses and variance decomposition for Poland in the period 2009–2021 allows for the identification of the main determinants of the quality of the household loan portfolio. The NPLs showed increasing trends in response to change impulses from own changes of NPL, CPI, and average interest rate on loans to households (AIRLH). Earlier changes in NPL (problems with servicing loans) translate into future changes, inflation lowers the purchasing power of

disposable income with rising consumer prices, and changes in the interest rate of loans raise the interest due. The NPLs showed declining trends in response to the changes of: consumption in the household sector (CHS), average monthly real gross salary (ARGSp), unemployment rate (UR), and WIBOR. The results of the variance decomposition indicate that previous own NPL changes as well as CHS and ARGSpc have the highest share in explaining changes in NPL, deciding about 87% and 75% of changes in the 1st and 5th year of the forecast. The shrinking degree of explanation of NPL changes by CPI and UR is worth underlining. Other explanatory variables (GDPpc, WIBOR and AIRLH) are significant, however, their influence does not exceed 6% in total.

In the context of asset quality management, constant monitoring of NPLs is important, as a deterioration in loan service produces effects in subsequent periods. The significant impact of CHS and ARGSpc on NPLs proves the importance of changes in demand (expenditure) and real wages (income) of households, i.e., the pillars of creditworthiness. The interest rate on loans influences the NPL, however, it is weaker than in the case of expenses and income. The growing degree of explanation of changes in NPL on the part of UR and CPI indicates the importance of macroeconomic conditions determining the real incomes of households.

In the beginning of Q2.2021, the impact of the COVID-19 pandemic has not affected the growth of the NPL yet, although the costs of debt servicing have already shown an uptick in e.g., France, Germany, or Hungary. In the following year, an increase in these costs may additionally affect the deterioration of the quality of the loan portfolio in the EU countries. As the share of loans to households in total loans in the analyzed countries ranges from 24% in Hungary to over 40% in Poland and Germany and their value ranges from nearly 30% of GDP in Hungary to around 60% of GDP in the euro area, it is important to study the determinants of changes in this loan portfolio.

In summary, in the years 2009–2021 the quality of the loan portfolio improved, as evidenced by the decrease in the NPL ratio in the analyzed EU countries. Household loans are important in the structure of this portfolio. The results of the model analysis for Poland confirm the importance of demand (expenditure) and income conditions for the improvement of the quality of this portfolio as well as of changes in UR and CPI affecting these conditions. Although the NPL data in 2020 do not show a deterioration in loan quality, an increase in servicing costs found in some countries in early 2021 may affect its changes in subsequent periods. In practical terms, the conclusions from the research for Poland can be used by other EU countries, including mainly the Czech Republic and Germany (with a similar structure of the loan portfolio, i.e., 40% household loans) or Slovakia (a similar 4% NPLs level). In the case of Hungary, although they have managed to restructure the loan portfolio, the challenge is to preserve the achieved portfolio quality in the future. Moreover, the added value of the article consists in drawing attention to

the importance of the structure of the loan portfolio, including other determinants influencing the NPL of households than of enterprises or public sector institutions. The practical aspect of the study means that the results can be used to manage the portfolio of loans to households and forecast changes in banking risk.

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Summary

As non-performing loans (NPLs) can cause monetary crises that may turn into financial crises affecting an entire economy, monitoring them is very important. If NPLs are not identified and recognized efficiently, both in terms of speed and scope, NPL resolution effectiveness is undermined, which in turn will have negative effects on the banking sector and ultimately on GDP growth.

The main aim of this article is to identify changes in the quality of bank loan portfolios in European Union (EU) countries in 2009–2021, using an example of the Visegrad Group (Czech Republic, Poland, Slovakia, Hungary) as well as France and Germany. Keeping in mind the fact that the share of loans to households in EU portfolios is approximately 60%, it has a significant impact on the share of non-performing loans (NPL) in a bank's entire portfolio. Therefore, it is important to identify macroeconomic determinants influencing the creditworthiness of households and their loan servicing capacity.

The specific aims are, first, to present the differences in NPLs, debt servicing costs, and the structure of loan portfolios in the selected EU countries. Second, to identify countries with high-quality portfolios and those undertaking restructuring. Thirdly, to examine the determinants of NPL for household loans based on the example of Poland, i.e., a country considered representative in terms of the average level of NPL and the portfolio structure in the group of countries studied.

This chapter presents the changes of NPLs, debt service ratio, and household loans in selected EU countries in 2009–2021. Moreover, an NPLs econometric model for Poland is constructed, which considers the main factors determining the creditworthiness of households, i.e., macroeconomic factors, financial standing, and debt servicing costs. Tools such as the VECM model, the variance decomposition and the impulse response functions are used. The results for Poland confirm that the NPLs ratio for households was the strongest explanation of previous changes in own NPL, consumption and real wages in the household sector in 2009–2021.

JEL codes: E32, E44, G21, G26, N10, N20

Keywords: *loan portfolio quality, non-performing loans (NPL), households, credit risk, EU, Poland*