

GDP growth as a bank loan quality determinant

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ABSTRACT

Past financial crises and recessions have revealed the importance of the economy's condition for the loan quality. Macroeconomic determinants of the non-performing loans have been attracting considerable attention in recent years. The aim of this paper is to organize and summarize studies examining the role of GDP growth and its impact on bank loan quality. This approach reveals the research problem which is to specify if there exists a statistically significant relationship between economic growth and the level of non-performing loans. It is equally important to determine the direction of this link. By appealing to common knowledge, the research hypothesis states that an increase in economic activity results in improving loan quality. To verify the hypothesis, the analysis of the relevant literature and the methods of verbal as well as tabular description have been applied. Empirical results on the link between the macroeconomic environment and the level of non-performing loans appear to be quite conclusive. It has been found that an economic expansion generally improves the loan quality. This broadly proven relationship is in line with many studies which confirm the borrowers' increased willingness to repay debts in a favourable economic environment. Far less frequently, the intensified macroeconomic activity leads to future bank losses. Additionally, some studies do not provide any statistically significant effect of GDP growth on the loan quality.

JEL Classification: E30; E32; G21

Keywords: asset quality, GDP growth, macroeconomic cycle; non-performing loans

1. INTRODUCTION

A growing level of non-performing loans (NPLs) suggests that banks face high credit risk which in turn may induce banking failures (Chang et al., 2008). This worsening quality of loan portfolio may trigger threats to the financial stability of the whole economy (Staeher and Uusküla, 2020). The recent global financial crisis has uncovered this linkage, revealing vulnerabilities of the banking system and shedding the light on the importance of bank risk-taking. On the other hand, "the NPLs put increasing pressure on banks' balance sheets preventing them from pursuing their intermediation role and creating further growth" (Dimitrios et al., 2016). It means that deterioration in loan quality may result in a drop of economic activity due to the erosion of banks' profitability (Chang et al., 2008). Moreover, the connections between the business cycle and banks' behaviour are considered to play an important role for the loan quality. Therefore, macroeconomic

conditions and loan quality have been attracting growing attention of regulators and supervisors over recent years. Concerns to ensure the stability of the financial system highlight the necessity of providing macroprudential policy implications as well as NPLs resolution policies (Anastasiou et al., 2019). In consequence, the NPLs are becoming more and more frequently the major interest for many academic researchers.

The aim of this paper is to organize and summarize studies examining the role of GDP growth and its impact on bank loan quality. This purpose leads to the research problem which is to specify if there exists a statistically significant relationship between economic growth and the level of non-performing loans. Indicating the direction of GDP growth influence on loan quality is of equal importance. Based on common knowledge, the research hypothesis states that an increase in economic activity results in improving loan quality. To verify the hypothesis, the analysis of the relevant literature and the methods of verbal as well as tabular description have been applied. Moreover, the specific criteria for the literature selection have been applied. The review carried out in this paper is based on international research including GDP growth as one of the most essential variables of research interest. More specifically, these studies are mostly aimed at analysing macroeconomic determinants of the NPLs or the link between the phase of cycle and loan quality.

The paper is organised as follows. Section 2 clarifies the definition of non-performing loans and describes GDP growth as a factor influencing the loan quality. Section 3 presents the variety of samples used in analyses on linkages between macroeconomic conditions and the NPL ratio. The effect of business cycle on the loan quality is discussed in Section 4. Finally, section 5 provides more detailed evidence of changes in economic activity on the NPLs level. Section 6 concludes.

2. NON-PERFORMING LOANS AND GDP GROWTH VARIABLE – DEFINITIONS AND CHARACTERISTICS

There are several measures in empirical literature reflecting the bank risk-taking, and thus, indirectly, the bank loan quality.

The widely used ratio for assessing the bank riskiness is the Z-score (Agoraki et al., 2011; Barry et al., 2011; Zheng et al., 2017). The Z-score stands for the probability of failure. In particular, it is a risk accounting-based proxy for bank distance to default. Lower values of Z-score represent an increase in insolvency risk and are a warning of forthcoming financial instability (Barry et al., 2011; Zheng et al., 2017). According to Samet et al. (2017) a decline in Z-score might imply the bank's insufficient capital to compensate for a loan quality decrease.

An alternative way to measure bank risk is the capital adequacy ratio (Dong et al., 2014; Shehzad et al., 2010; Zhang et al., 2016). The capital adequacy ratio represents bank capitalization. Additionally, the level of bank's equity maintains a cushion against credit portfolio losses and financial difficulties. Therefore, the capital adequacy ratio is considered an indicator closely related to insolvency risk (Dong et al. 2014). Higher values of the CAR indicate lower exposure to credit risk and, in consequence, are typical for relatively safer banks (Moshni and Otchere, 2014).

Many authors examine the risk appetite adopted by banks using the loan loss provision (LLP) divided by total assets (Athanasoglou et al., 2008; Haq and Heaney, 2012; Lassoued et al., 2016). This ratio may be slightly modified and calculated as the LLP to gross loans (Cucinelli et al., 2018; Quagliariello, 2007; Samet et al., 2017). An increase in LLP level is associated with deterioration in loan portfolio quality.

Another ratio frequently selected to quantify credit risk is the level of NPLs. Nevertheless, the methods of measuring loan quality vary between papers. In a number of studies the NPL level is defined as the relation of non-performing loans to total (gross) loans (Anastasiou,

2017; Baselga-Pascual et al., 2015; Beck et al., 2015; Castro, 2013; Dimitrios et al., 2016). Less commonly used is the ratio of NPLs to total assets (Iyer et al., 2014; Vithessonthi, 2016). Definitely less often authors use the logarithm of the NPL ratio (Bertay et al., 2015; Jiménez and Saurina, 2006) or its logit transformation (Ghosh, 2017; Gulati et al., 2019; Klein, 2013). Additionally, to measure the loan quality, researchers employ the ratio of flow of new bad loans to performing loans (Bofondi and Ropele, 2011; Quagliariello, 2007). Rarely is the distinction between gross and net NPL ratio applicable among studies (Gulati et al., 2019).

Taking into consideration the crucial role of the NPL ratio for whole financial system stability and issue that some countries have to cope with high levels of NPLs in recent years, the paper focuses on this loan quality measure. Table 1 presents a short overview on the NPLs definitions used in studies analysing the macroeconomic determinants of loan quality.

Table 1

The NPL ratio definitions

Definition of the “NPLs”	Studies
flow of new bad debts / performing loans	Bofondi and Ropele (2011) Quagliariello (2007)
logarithms: log (non-performing loans / gross loans) + 1 ln (non-performing loans / total loans)	Bertay et al. (2015) Jiménez and Saurina (2006)
logit transformation: 1) the sum of total loans and leases past due 90 days or more and non-accrual loans / total (gross) loans 2) gross non-performing loans / total advances net non-performing loans / total advances 3) non-performing loans / total loans	Ghosh (2017) Gulati et al. (2019) Klein (2013)
non-performing / total (gross) loans	Alhassan et al. (2014) Anastasiou et al. (2016) Anastasiou (2017) Anastasiou et al. (2019) Baselga-Pascual et al. (2015) Bayar (2019) Beck et al. (2015) Castro (2013) Chaibi and Ftiti (2015) ¹ De Bock and Demyanets (2012) Louzis et al. (2012) Makri et al. (2014) Messai and Jouini (2013) Nkusu (2011) Salas and Saurina (2002) Shim (2013) Staehr and Uusküla (2020)

¹ More specifically, the NPLs ratio is defined as impaired loans to gross loans.

Source: Author’s own elaboration.

The one of the main scopes of empirical literature on loan quality focuses on its determinants. Identifying factors influencing the level of NPLs is crucial for foreseeing and assessing future bank losses. Authors investigate both bank-specific and macroeconomic determinants of problem loans. The bank-specific determinants include balance sheet and profit and loss account ratios describing the financial situation of a given bank or the banking sector in a given country, whereas

the macroeconomic determinants characterise general conditions for business activity. Very few studies focus solely on bank-specific determinants of the loan quality (Berger and DeYoung, 1997; Podpiera and Weill, 2008). A greater number of research analyse exclusively macroeconomic factors influencing credit risk (Anastasiou, 2017; Beck et al., 2015; Bofondi and Ropele, 2011; Castro, 2013; De Bock and Demyanets, 2012; Nkusu, 2011). Similarly, a substantial part of papers examine both bank-specific and macroeconomic determinants (Bayar, 2019; Ghosh, 2015; Gulati, 2019; Klein, 2013; Louzis et al., 2012; Messai and Jouini, 2013; Makri et al., 2014). Some research focuses on specific indicators describing the economic situation and affecting the NPLs level, for example interest rates (Delis and Kouretas, 2011) or external deficit (Kauko, 2012).

Additionally, some authors separately examine other specific factors affecting loan quality, such as the bank concentration (Chang et al., 2008; Çifter, 2015), the Basel capital requirements (Bitar et al., 2016, Podpiera, 2006; Shim, 2013), the loan concentration (Tabak et al., 2011) or the supervisory effectiveness (Delis and Staikouras, 2011).

Nevertheless, the macroeconomic determinants constitute one group of the most fundamental factors explaining the credit risk taken by banks. Therefore, the economic environment is particularly in the centre of interest for many academics. Research includes various sets of several macroeconomic variables used in analyses as regressors. However, a certain group of economic situation indicators is generally included across studies. Those most widely used include: the GDP growth, the unemployment rate, the level of inflation and the changes in interest rates and exchange rates. These indices reflect the state of the economy and are able to create favourable incentives for borrowers to repay their debts to banks. It means that an economy in growth fosters the decrease in indebtedness of individual and corporate clients. Conversely, in times of adverse macroeconomic shocks, debtors face a greater risk of financial distress, and consequently are more prone to default (Messai and Jouini, 2013). Therefore, the relationship between the macroeconomic indicators and the loan quality is highly explored in banking literature.

Several papers in the banking literature examine in particular the effect of the economic activity measured by the GDP growth on the loan quality. In line with Salas and Saurina (2002) “the GDP growth rate is highly informative on other relevant macroeconomic variables”. Not surprisingly, the term “economic growth” commonly used by authors seems to have mostly the same meaning and relates to growth in gross domestic product (Anastasiou et al., 2019; Beck et al., 2015; Dimitrios et al., 2016; Ghosh, 2017; Quagliariello, 2007; among others). However, Bayar (2019) and Bertay et al. (2015) use real GDP per capita growth and Gulati et al. (2019) measure the economic expansion by log of real GDP growth. As long as a precise definition of the explanatory variable is essential for drawing accurate conclusions, considerable attention should have been paid to this aspect.

Interestingly, not all of the authors indicate that they are interested in real values of GDP growth, as to avoid interpreting changes driven by inflation. Indeed, some assumptions can be made that real changes of GDP growth are considered by these authors, but the data treatment is not clearly stated in their papers (Makri et al., 2014; Staehr and Uusküla, 2020).

Another concern is the frequency of data, both regarding bank-specific and macroeconomic variables. The majority of authors base on annual data (Alhassan et al., 2014; Baselga-Pascual et al., 2015; Beck et al., 2015; Messai and Jouini, 2013; among others). Additionally, Chaibi and Ftiti (2015) employ seasonally adjusted annual GDP growth. Only a small number of papers includes quarterly data instead of annual data (Anastasiou et al., 2019; Dimitrios et al., 2016; Ghosh, 2017; Louzis et al., 2012; Staehr and Uusküla, 2020).

Several authors use the lag structure of GDP growth in their empirical analyses (Anastasiou, 2017; Klein, 2013; Louzis et al., 2012; Staehr and Uusküla, 2020). First of all, “banks often roll over weak loans for several quarters, the so called ‘evergreening’, before being forced to recognize their losses” (Ghosh, 2017). On the other hand, this common approach including time lags allows capturing the speed of macroeconomic shock transmission to loan quality. It is caused

by the presumption that changes in macroeconomic conditions may not immediately affect the borrowers' ability to meet their loan commitments. Thus, a possible decrease in the loan quality might take some time after an expansion or slowdown in the economy. Nevertheless, some researchers base on the GDP growth values from the same period as the NPL ratios, the so called contemporaneous ones (Alhassan et al., 2014; Bayar, 2019; Gulati et al., 2019; Shim, 2013). Sometimes, separate evidence for both current and lagged GDP growth rates are provided (Beck et al., 2015; Chaibi and Ftiti, 2015; Makri et al., 2014; Nkusu, 2011; Quagliariello, 2007; among others).

Table 2 summarizes the characteristics of the GDP growth variable, such as the definition of the “GDP growth”, the data frequency and the time lags.

Table 2
Detailed specification of the GDP growth variable

Studies	Definition of the “GDP growth”	Frequency of data	Lags of GDP growth
Alhassan et al. (2014)	Real GDP growth	Annual	no lags
Anastasiou et al. (2016)	Real GDP growth	Quarterly	no lags 1 year
Anastasiou (2017)	Real GDP growth	Quarterly	1 quarter
Anastasiou et al. (2019)	Real GDP growth	Quarterly	no lags ¹
Bofondi and Ropele (2011)	Real GDP growth	Quarterly	4 quarters, 3 quarters
Baselga-Pascual et al. (2015)	Real GDP growth	Annual	no lags
Bayar (2019)	Real GDP per capita growth	Annual	no lags
Beck et al. (2015)	Real GDP growth	Annual	no lags 1 year
Bertay et al. (2015)	Real GDP per capita growth	Annual	no lags
Castro (2013)	Real GDP growth	Annual	1 year
Chaibi and Ftiti (2015)	Real GDP growth	Annual, seasonally adjusted	no lags
De Bock and Demyanets (2012)	Real GDP growth	Annual	1 year
Ghosh (2017)	Real GDP growth	Quarterly ²	no lags, 4 quarters
Gulati et al. (2019)	Log of real GDP growth	Annual	no lags
Jiménez and Saurina (2006)	Real GDP growth	Annual	no lags, 1 year
Klein (2013)	Real GDP growth	Annual	1 year
Louzis et al. 2012	Real GDP growth	Quarterly	1 year, 2 years
Makri et al. (2014)	GDP growth	Annual	no lags 1 year
Messai and Jouini (2013)	Real GDP growth	Annual	1 year

Studies	Definition of the “GDP growth”	Frequency of data	Lags of GDP growth
Nkusu (2011)	Real GDP growth	Annual	no lags, 1 year
Quagliariello (2007)	Real GDP growth	Annual	no lags, 1 year, 2 years
Salas and Saurina (2002)	Real GDP growth	Annual	no lags, 1 year
Shim (2013)	Real GDP growth	Quarterly	no lags
Staehr and Uusküla (2020)	GDP growth	Quarterly	8 quarters

¹ An exception is FMOLS which includes two (quarter) lags for the euro area concerning each: whole, core and periphery countries (Anastasiou et al., 2019).

² According to authors, annual data on GDP have been converted into quarterly frequency using a cubic spline interpolation (Ghosh, 2017).

Source: Author’s own elaboration.

3. SAMPLES VARIETY IN GDP GROWTH-LOAN QUALITY LINK ANALYSES

The analyses on economic growth and the level of NPLs are conducted on data samples diversified in terms of both countries and years.

Numerous studies are run on individual countries, such as Ghana (Alhassan et al., 2014), Greece (Louzis et al., 2012), India (Gulati et al., 2019), Italy (Anastasiou, 2017; Bofondi and Ropele, 2011), Spain (Salas and Saurina, 2002; Jiménez and Saurina, 2006) or the USA (Ghosh, 2017; Shim, 2013). Some research cover a small group of countries, from 2 countries, namely France and Germany (Chaibi and Ftiti, 2015) through 3 countries such as Italy, Greece, and Spain (Messai and Jouini, 2013) up to 5 – the GIPSI countries (Castro, 2013).

Nevertheless, the majority of studies is done on a larger number of banking sectors (for example, Beck et al., 2015; Bertay et al., 2015; De Bock and Demyanets, 2012; Nkusu, 2011). These datasets are built using some grouping criteria. In terms of the level of economic development, Beck et al. (2015) study the panel of 75 countries including both advanced and emerging economies. Similarly, Bertay et al. (2015) analyse 111 countries using groups of developing countries (and emerging markets), and high income countries. Nkusu (2011) carries out a study on 26 advanced countries. As opposed to advanced economies, the sample of De Bock and Demyanets (2012) contains 25 emerging markets and Bayar (2019) explores about 20 emerging economies. Regarding the continents, some research is based solely on European samples. Staehr and Uusküla (2020) analyse all EU countries except Luxembourg and the United Kingdom, 26 countries in total. Klein (2013) focuses on 16 CESEE countries. Anastasiou et al. (2019), Baselga-Pascual et al. (2015), and Makri et al. (2014) examine 14 euro area countries. In addition to these studies, Dimitrios et al. (2015) provide evidence on 15 euro area countries. Castro (2013) focuses on 5 European countries (the GIPSI).

Some differences exist with regard to the timeframe considered for analysis on macroeconomic determinants of the NPLs. A few studies examine samples close to 25 years’ time horizon (Dimitrios et al., 2016; Ghosh, 2017). Some research covers nearly 20 years, for example, Anastasiou (2017), Bofondi and Ropele (2011), Dimitrios et al. (2016), Shim (2013), and Staehr and Uusküla (2020). There is a vast number of empirical works with about 15-year scope of analysis (Castro, 2013; De Bock and Demyanets, 2012; Gulati et al., 2019; Klein, 2013). Several authors base on a period of approx 10 years, as Baselga-Pascual et al. (2015), Beck et al. (2015), Bertay et al. (2015), Nkusu

(2011), Salas and Saurina (2002). Few researchers decide to conduct analysis on a shorter time period covering up to 10 years (Alhassan et al., 2014; Chaibi and Ftiti, 2015; Jiménez and Saurina, 2006; Louzis et al., 2012; Makri et al., 2014; Messai and Jouini, 2013; Quagliariello, 2007).

Moreover, the relationship between macroeconomic situation and loan portfolio quality is analysed at different data levels. In particular, the bank data may reflect either the individual characteristics of given banks or be aggregated on the country level. Just a few results are obtained on individual bank characteristics, for example Anastasiou (2017), Baselga-Pascual et al. (2015), Ghosh (2017), Klein (2013), Louzis et al. (2012), Messai and Jouini (2013), and Shim (2013). Many researchers exploit widely available country-level data on banking sectors (Bayar, 2019; Beck et al., 2015; Castro, 2013; De Bock and Demyanets, 2012; Makri et al., 2014; Nkusu, 2011; Staehr and Uusküla, 2020; among others).

Table 3 summarizes characteristics of samples used in the empirical studies. It presents particular countries and years, which constitute specific environment for research. Additionally, the level of banking data and number of analysed banks is indicated.

Table 3
Research samples description

Studies	Countries	Years	Number of banks	Level of data
Alhassan et al. (2014)	Ghana	2005–2010	25	individual
Anastasiou et al. (2016)	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Portugal, Slovakia, Slovenia, and Spain	1990–2015	n/a	aggregated
Anastasiou (2017)	Italy	1995–2014	47	individual
Anastasiou et al. (2019)	Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, and Spain	2003–2016	226	individual
Baselga-Pascual et al. (2015)	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain	2001–2012	204	individual
Bayar (2019)	Brazil, Chile, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey, except Qatar, Taiwan, and United Arab Emirates	2000–2013	n/a	aggregated
Beck et al. (2015)	Argentina, Armenia, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Arab Rep., Estonia, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Hong Kong, China, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea Rep., Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Macedonia FYR, Malaysia, Mexico, Moldova, Morocco, Netherlands, Norway, Oman, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, the USA, Uruguay, and Venezuela RB	2000–2010	n/a	aggregated

Studies	Countries	Years	Number of banks	Level of data
Bertay et al. (2015)	Albania, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Bosnia-Herzegovina, Botswana, Brazil, Bulgaria, Burundi, Cambodia, Canada, Chile, China, People's Republic, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Ireland, Indonesia, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Malawi, Malaysia, Mauritius, Moldova, Morocco, Mozambique, Namibia, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Swaziland, Republic of Korea, Sweden, Switzerland, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, Mexico, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Vietnam, Zambia, and Zimbabwe	1999–2010	1633	individual
Bofondi and Ropele (2011)	Italy	1990–2010	n/a	individual
Castro (2013)	Greece, Ireland, Portugal, Spain, and Italy	1997–2011	n/a	aggregated
Chaibi and Ftiti (2015)	France and Germany	2005–2011	280	individual
De Bock and Demyanets (2012)	Argentina, Brazil, Bulgaria, Chile, China, Colombia, Dominican Republic, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine, Uruguay, and Venezuela	1996–2010	n/a	aggregated
Ghosh (2017)	the USA	1992–2016	100	individual
Gulati et al. (2019)	India	1998/99–2013/14	1233	individual
Jiménez and Saurina (2006)	Spain	1985–2002	not listed ¹	individual
Klein (2013)	Bosnia and Herzegovina, Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Russia, Serbia, Slovak Rep., Slovenia, and Ukraine	1998–2011	135 ²	individual
Louzis et al. (2012)	Greece	2003–2009	9	individual
Makri et al. (2014)	Greece, Italy, Portugal, Spain, France, Ireland, Germany, Belgium, Finland, Austria, Netherlands, Luxembourg, Estonia, and Malta	2000–2008	n/a	aggregated
Messai and Jouini (2013)	Italy, Greece, and Spain	2004–2008	85	individual

Studies	Countries	Years	Number of banks	Level of data
Nkusu (2011)	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Israel, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the USA	1998–2009	n/a	aggregated
Quagliariello (2007)	Italy	1985–2002	207	individual
Salas and Saurina (2002)	Spain	1985–1997	not listed ³	individual
Shim (2013)	the USA	1992–2011	not listed ⁴	individual
Staehr and Uusküla (2020)	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, and Slovenia, Spain, and Sweden	1997–2017	n/a	aggregated

¹ Authors analyse commercial and savings banks which constitute more than 95% of total assets among credit institutions (Jiménez and Saurina, 2006).

² Klein (2013) indicates that data covers the ten largest banks (commercial, savings, cooperate as well as real estate & mortgage) in each of the 16 analysed countries (Klein, 2013).

³ Researchers point out that available data present almost 100% of savings banks and more than 90% of total assets for commercial banks for every year (Salas and Saurina, 2002).

⁴ Shim (2013) underlines that analyses are conducted on the unbalanced panel of 43,217 quarterly observations for U.S. bank holding companies.

Source: Author's own elaboration.

4. THE LOAN QUALITY DURING DIFFERENT PHASES OF ECONOMIC CYCLE

The banks' responses to the shocks in GDP have been attracting growing attention of policymakers and regulators, mainly after the recent financial crisis. A vast number of academic researchers examine the relationship between the phase of cycle and bank lending activity. These analyses arise from the important necessity to guarantee both the financial and macroeconomic stability (Anastasiou, 2017). According to Quagliariello (2007) "It is crucial to understand whether, and to what extent, banks are affected by the evolution of the macroeconomic environment". This awareness allows for appropriate actions aimed to the health and soundness of the financial system since an excessive loan procyclicality is considered a source of financial instability (Bouvatier et al., 2012).

Procyclicality of bank lending activity is the subject of much empirical investigation. This may partly be explained by the research findings that variations in bank loan supply tend to emphasize the business cycle, being generally more than proportional to the changes in the economic activity (Berger and Udell, 2004). Therefore, it can be stated that banks' reaction to macroeconomic shocks, which exacerbates the effects of the downturn, are signals to establish some rules restricting the procyclical lending activity (Quagliariello, 2007). Moreover, it has been argued that a close link between the business cycle and banks' behaviour indicates the need to strengthen the "financial supervisory during recessionary phases, when banks are more likely to become fragile" (Quagliariello, 2007). This explains that the NPL ratio, among variables reflecting the banks' response to the business cycle, is considered one of the most important channels to transmit adverse macroeconomic shocks to banks' balance sheets (Quagliariello, 2007).

Overall, it is largely accepted that bank lending considerably increases during the economic expansion and then, conversely, falls markedly during the recession, sometimes to the dramatic extent called “credit crunch”. It means that banks increase their lending in boom periods, sowing the seeds of problem loans. On the other hand, banks become much more cautious during downturn times and thus curtail the loan growth when the recession occurs (Jimenez and Saurina, 2006). Consequently, another important strand of literature analyses the connection between the loan growth and bank riskiness measured by the NPL ratio (Chavan and Gambacorta, 2019; Foos et al., 2010; Sobarsyah et al., 2020; Vithessonthi, 2016).

It has been broadly confirmed that there is a significant link between the business cycle and the loan quality. In particular, problem loans appear to follow the changes in economic environment (Berger and Udell, 2005). “The expansion phase of the economy is usually characterised by a relatively low rate of non-performing loans” (Castro, 2013). This relationship results from the ability to service debts by borrowers during the booming periods. Repaying loan commitments, to a large extent, is thus possible due to a sufficient stream of cash flows. Subsequently, when the recession occurs, debtors start facing some difficulties to repay their debt. It is often reflected in the increasing the level of NPLs (Klein, 2013). Castro (2013) and Chaibi and Ftiti (2015) argue that a rise in NPL ratio, while there is an economic downturn, may have been caused by extended loans to low-quality debtors during the period of macroeconomic growth. In consequence, a drop in economic activity reveals problems with risky loans granted at prosperity times. According to Festić et al. (2011), the procyclicality of bank lending “is a signal of an economy overheating and therefore a slowdown in economic activity is likely to accelerate the growth of the NPL ratio”. Hence, the main issue to realise is that bank lending policy mistakes occur in good times, but are revealed mostly in the downturn phase of the cycle (Jimenez and Saurina, 2006). This is due to the time required for risky loans to become non-performing. In line with Bouvatier et al. (2012), it is commonly known that during the upward phase of cycle, both banks and borrowers exhibit a high level of overconfidence. On the one hand, banks pursue a more liberal loan policy, lower loan conditions and relax credit standard requirements. They represent such an optimistic attitude related to granted loan repayments and regaining their loans. On the other hand, clients are really confident about their ability to service their debt in the future. However, a decrease in creditworthiness of borrowers, problems with repaying loans, and therefore, an increase in the NPL ratio may start at the end of the expansion, and then rise dramatically during the recession (Anastasiou, 2017; Berger and Udell, 2004). Empirical literature on the GDP growth generally confirms its negative influence on the NPL ratio. The overwhelming majority of papers show that economic growth contributes to a decline in the NPLs level (Alhassan et al., 2014; Klein, 2013; Louzis et al., 2012; Messai and Jouini, 2013; Salas and Saurina, 2002; Shim, 2013; Staehr and Uusküla, 2020). Contrary to this research, the negative influence of growing economy on the level of NPLs is not always confirmed. Some papers show economic expansion resulting in decreasing loan quality (Beck et al., 2015; Ghosh, 2017; Gulati et al., 2019). Additionally, a few authors do not provide any evidence on the effect of GDP growth on the loan quality (for example, Anastasiou, 2017; Baselga-Pascual et al., 2015; Castro, 2013; Dimitrios et al., 2016; Ghosh, 2017; Makri et al., 2014). Table 4 presents the type of relationship between the phase of cycle and the level of NPLs. This table should be interpreted in accordance with table 2 which shows, among others, the lag structure of GDP growth. It allows to notice that some findings depend on time lags applied by authors.

Table 4

The relationship between GDP growth and loan quality

Studies	Impact of GDP growth on the NPLs
Alhassan et al. (2014)	Negative
Anastasiou et al. (2016)	No impact Negative
Anastasiou (2017)	No impact Negative
Anastasiou et al. (2019)	No impact Negative
Bofondi and Ropele (2011)	Negative
Baselga-Pascual et al. (2015)	No impact Negative
Bayar (2019)	Negative
Beck et al. (2015)	Negative Positive
Bertay et al. (2015)	Negative
Castro (2013)	No impact Negative
Chaibi and Ftiti (2015)	Negative
De Bock and Demyanets (2012)	Negative
Ghosh (2017)	No impact Negative Positive
Gulati et al. (2019)	No impact Negative Positive
Jiménez and Saurina (2006)	Negative
Klein (2013)	Negative
Louzis et al. 2012	Negative
Makri et al. (2014)	Negative No impact
Messai and Jouini (2013)	Negative
Nkusu (2011)	Negative
Quagliariello (2007)	Negative
Salas and Saurina (2002)	Negative
Shim (2013)	Negative
Staehr and Uusküla (2020)	Negative

Source: Author's own elaboration.

Focusing on the commonly proven link between the economic cycle and the loan quality, it is worth to investigate if this negative impact holds for diverse subsamples. And meanwhile, the strength of the relationship for varied data groups may be taken into account.

5. IDENTIFICATION OF THE GDP GROWTH-LOAN QUALITY LINK FOR VARIED SUBSAMPLES

Studies on the relationship between the GDP growth and the level of NPLs penetrate various areas of interest. Authors demonstrate their results of macroeconomic activity impact on loan quality controlling for the specific subsamples.

One strand of the literature focuses on the composition of the bank loan portfolio. Researchers identify different kinds of borrowers or types of loans granted by banks. Bofondi and Ropele (2011) distinguish two classes of bank clients, namely households and firms. On the other hand, Louzis et al. (2012) and Ghosh et al. (2017) identify loan categories, referring to the loan purpose.

Bofondi and Ropele (2011) concentrate exclusively on the macroeconomic factors influencing bank loan portfolios. Researchers examine the loan quality considering two classes of debtors separately. Surprisingly, no significant dynamic cross-correlation was found between the new bad loans ratio for lending to households or firms and the economic growth. Nevertheless, according to the authors, the macroeconomic situation may have a different influence on the loan portfolio of households and firms. It has been argued that a rise in GDP generally contributes to greater flows of income for households and a profitability increase for firms. Bofondi and Ropele (2011) confirm these relationships. Researchers show that in the case of households, economic prosperity lagged by 4 quarters reduces the flow of new bad loans in relation to performing loans. Somewhat faster, with a 3-quarter lag, the GDP growth improves the loan quality of firms.

A more detailed distinction of loan categories is presented by Louzis et al. (2012). Authors conduct a comparative analysis of mortgage, business as well as consumer loan portfolios. The main purpose of this paper is to indicate both the macroeconomic and bank-specific determinants of NPLs in each loan category. Firstly, researchers show dissimilarities in average loan quality for different loan categories. There are the lowest quality mortgage NPLs and the highest quality consumer NPLs, the latter being very close to business NPLs. Secondly, Louzis et al. (2012) highlight that some macroeconomic factors, including the GDP growth, demonstrate different quantitative impacts on particular loan classes. Namely, the NPLs for mortgage loans are the least responsive to changes in economic situation. However, a slowdown in the GDP growth is accompanied by a loan quality decrease for all loan types. This link is the most evident for business NPLs. According to authors, it confirms a strong dependence of the Greek firms' ability to service their debt on the economic cycle resulting in high vulnerability to adverse macroeconomic shocks. Additionally, "the quantitative impact of GDP growth rate on mortgage NPLs is attenuated compared to the NPLs of the other two loan types" (Louzis et al. 2012). These relationships coincide with the descriptive statistics of the NPLs level.

Another study on loan portfolio composition is run by Ghosh (2017). The author distinguishes four main categories – real estate, commercial and industrial (C&I), individual, and farm loans. Additionally, real estate loans are presented using breakdown into single-family residential, multi-family residential, non-farm non-residential, construction & land development, and farmland loans. Moreover, individual loans consist of credit cards, auto, and other individual loans. The main conclusion is that the GDP growth reduces total and real estate NPLs. However, this cyclical property has not been seen in case of commercial and industrial (C&I) and individual loans. These types of loans remain unchanged during the upturn times. Additionally, the economic expansion rises farm NPLs. According to Ghosh (2017), it means that during an increase in economic activity the banks are encouraged to engage in agricultural production loans. Unfortunately, banks are likely to grant these loans without their proper evaluation which may lead to future losses. When analysing real estate portfolio, GDP growth is linked to a reduction in residential NPLs (both single-family and multi-family) as well as commercial NPLs (non-farm and construction & land development). Surprisingly, farmland loans are not vulnerable to changes in economic conditions. Lastly, moving to the impact of GDP growth on individual loans, auto and other individual NPLs

are decreasing during expansion times. However, credit cards NPLs do not show any statistical significance to economic growth. Importantly, Ghosh (2017) confirms the evidence provided on contemporaneous values of macroeconomic variables, using them with up to four-quarter lag.

Some research analyses the influence of economic growth on the loan quality accounting for differences in the banks' presence in specific countries.

Anastasiou et al. (2019) examine both bank-specific and macroeconomic determinants of NPLs in the euro area and then, investigate if there is fragmentation between core and periphery banking markets. "Austria, Belgium, France, Germany, Finland, Lithuania, Luxemburg, Netherlands, and Slovakia are classified as euro area core with 138 banks, whereas Greece, Italy, Ireland, Portugal, and Spain are classified as euro area periphery with 88 banks" (Anastasiou et al., 2019). The authors employ the percentage change of real GDP which stands for the growth rate for each country. Analysing the euro area as a whole, the economic growth has been found to exert one of the most significant influences on the loan quality among macroeconomic indicators, just behind the unemployment rate. More specifically, there is a negative effect of the GDP growth on the level of NPLs. In addition, Anastasiou et al. (2019) run separate models for each group of countries (core and periphery). Based on FMOLS estimation, periphery banking markets are shown to be more vulnerable to worsening macroeconomic conditions. Although in the model employing only country-specific variables there is no such difference in the estimated coefficients of GDP growth between core and periphery groups, the model employing both country-specific and bank-specific variables reveals the financial fragmentation in the euro area. It means that the relation between the economic expansion and the level of NPLs is statistically insignificant for core countries, in contrast to periphery countries which are characterised by increased loan quality during the upturn times.

Differently, Chaibi and Ftiti (2015) study factors influencing the loan quality in a market-based economy, represented by France, in comparison to a bank-based economy, represented by Germany. The research is aimed to provide evidence on responses of different banking systems on the NPLs determinant, both macroeconomic and bank-specific. The results indicate a statistically significant influence of macroeconomic variables (except for the inflation rate) on the NPLs of both economies. According to the authors, it may be explained by the fact that both countries belong to the same euro area. Analysing the phases of the cycle, the economic expansion leads to a loan quality increase. However, this relationship is found to be stronger for French NPLs. It shows relatively greater vulnerability of the French banks to macroeconomic conditions. More specifically, banks in a market-based economy may experience higher credit losses during recession and higher improvement of the loan portfolio quality at times of GDP growth, respectively. "Moreover, the smaller average for the non-interest income of French banks is possibly another contributing factor to this finding. Thus, a smaller non-interest income ratio implies less diversified banks, which makes them more vulnerable to adverse macroeconomic shocks" (Chaibi and Ftiti, 2015).

Finally, Castro (2013) analyses the effect of macroeconomic environment on the level of NPLs in a particular group of countries, namely Greece, Ireland, Portugal, Spain and Italy (GIPSI). These countries have been recently affected by adverse economic conditions (recession and unemployment) and unfavourable fiscal situations (high levels of public deficits and debts). The author provides evidence of statistically significant and negative link between the GDP growth and the NPL ratio. Nevertheless, this relationship exerts some instability at sensitivity analysis. Firstly, Castro (2013) restricts the sample to the period of euro circulation (from the first quarter of 2001 onwards). Secondly, the financial crisis period is excluded from the sample (ending in 2009). In both cases, it has been found that the coefficient on the GDP growth is no longer significant after the reduction of the sample size. Additionally, the author decides to exclude particular countries from the sample one by one. In general, applied sample limitations do not change the main findings. However, the exclusion of Ireland requires special attention. For clarity,

the association of economic growth and the loan quality loses its statistical significance when Ireland is excluded from the sample. According to the author, this situation is caused by the economic expansion in Ireland at the turn of the 1990s and the 2000s which is linked to better loan quality. In the late 2000s the country experienced an increase in the NPL ratio in connection to a substantial decrease in the GDP growth. To sum up, Castro (2013) argues that Ireland has a great contribution to the statistically significant relationship between the economic conditions and the credit risk in the GIPSI sample.

Additionally, a few studies on the link of the GDP growth and the NPLs level refer to the institutional form of banks or their ownership structure. Authors analyse whether there is any difference in the effect of changes in economic environment on the loan quality regarding the legal status or the type of bank's shareholder.

Salas and Saurina (2002) investigate the bank-specific and macroeconomic determinants of problem loans in two institutional regimes: commercial and savings banks. This approach is motivated by the diverse risk-taking behaviour which may depend on the governance structure. The authors indicate that credit risk management arising from the ownership type is likely to influence the loan quality differently. Nevertheless, Salas and Saurina (2002) show the negative effect of the GDP growth the NPL ratio for both types of banks. This relationship is observed for contemporaneous as well as lagged economic growth. However, the link of GDP growth and the loan quality is more evident for commercial banks. According to Salas and Saurina (2002) this relation may be caused by the larger amount of firm loans in commercial banks, which are more sensitive to the economic situation. Additionally, the impact of the current macroeconomic fluctuations is almost three times stronger than the growth in economic activity lagged one year. It means that changes in the economic environment are immediately transmitted to commercial and savings banks. Hence, the loan quality of Spanish banks is closely connected to the phase of economic cycle.

Gulati et al. (2019) explore the key determinants of credit risk and examine if there are any differences across distinct bank ownership groups. Surprisingly, using two-step system GMM estimation, the GDP growth has been found to not exert any significant impact on both net NPLs and gross NPLs. Moreover, the authors confirm this relationship for gross NPLs using the pooled OLS, fixed effects and panel corrected standard error. It shows that an economic expansion does not lead to an improvement in debt servicing, and consequently, to an increase in loan quality. However, the impact of economic growth on the net NPLs level becomes positive and statistically significant for all estimation methods employed in the robustness tests (the pooled OLS, fixed effects and panel corrected standard error). Gulati et al. (2019) argue that this link may be explained by poorer credit standards adopted by banks during the prosperity times, as suggested by Beck et al. (2015). Considering the ownership structure in banks, authors provide mixed evidence for the public sector, private and foreign banks groups. First of all, in line with most studies, in case of public sector banks, the economic growth results in better loan quality. Secondly, foreign banks do not seem to be vulnerable to the changes in economic conditions. The link between the GDP growth and the NPLs level remains statistically insignificant. On the other hand, private banks have been found to exhibit a positive impact of the economic growth on the net NPLs. However, the gross NPLs of these banks are not sensitive to the economic environment.

To conclude, establishing the type of link between GDP growth and loan quality highly depends on characteristics of samples taken into account. In other words, this literature review shows a necessity to consider varied features of data groups while analysing and interpreting the effect of an increase in economic activity on the NPL ratio.

6. CONCLUSIONS

Credit risk is a threat banks must cope with. Identifying factors influencing the loan quality allows for anticipation of future bank losses. Macroeconomic conditions play an especially important role in controlling the NPL ratio. One of the most crucial macroeconomic determinants for the loan quality is the GDP growth. In general, empirical literature provides evidence on negative relationship between the economic expansion and the NPLs level. More specifically, the loan quality improvement is commonly observed during the economic upturn. However, some exceptions from the beneficial effects of the GDP growth for loan portfolio health have been found. Namely, authors show that an increase in economic activity leads to a deterioration in loan quality. Finally, few studies confirm no link between the phase of business cycle and the NPL ratio.

References

- Çifter A. (2015) Bank concentration and non-performing loans in Central and Eastern European countries. *Journal of Business Economics and Management* 16(1), pp. 117–137. doi:10.3846/16111699.2012.720590.
- Agoraki M.-E.K., Delis M.D., Pasiouras F. (2011) Regulations, competition and bank risk-taking in transition countries. *Journal of Financial Stability* 7(1), pp. 38–48. doi:10.1016/j.jfs.2009.08.002.
- Alhassan A.L., Coleman A.K., Andoh C. (2014) Asset quality in a crisis period: an empirical examination of Ghanaian banks. *Review of Development Finance* 4(1), pp. 50–62. doi:10.1016/j.rdf.2014.03.001.
- Anastasiou D. (2017) Is ex-post credit risk affected by the cycles? The case of Italian banks. *Research in International Business and Finance* 42, pp. 242–248. doi:10.1016/j.ribaf.2017.07.051.
- Anastasiou D., Louri H., Tsionas M. (2016) Determinants of non-performing loans: Evidence from Euro-area countries. *Finance Research Letters* 18, pp. 116–119. doi: 10.1016/j.frl.2016.04.008.
- Anastasiou D., Louri H., Tsionas M. (2019) Nonperforming loans in the euro area: Are core–periphery banking markets fragmented? *International Journal of Finance & Economics* 24(1), pp. 97–112. doi:10.1002/ijfe.1651.
- Barry T.A., Lepetit L., Tarazi, A. (2011) Ownership structure and risk in publicly held and privately owned banks. *Journal of Banking & Finance* 35, pp. 1327–1340. doi:10.1016/j.jbankfin.2010.10.004.
- Baselga-Pascual L., Trujillo-Ponce A., Cardone-Riportella C. (2015) Factors influencing bank risk in Europe: Evidence from the financial crisis. *The North American Journal of Economics and Finance* 34, pp. 138–166. doi: 10.1016/j.najef.2015.08.004.
- Bayar Y. (2019) Macroeconomic, Institutional and Bank-Specific Determinants of Non-Performing Loans in Emerging Market Economies: A Dynamic Panel Regression Analysis. *Journal of Central Banking Theory and Practice* 3, pp. 95–110. doi:10.2478/jcbtp-2019-0026.
- Beck R., Jakubik P., Piloju A. (2015) Key determinants of non-performing loans: new evidence from a global sample. *Open Economies Review* 26(3), pp. 525–550. doi:10.1007/s11079-015-9358-8.
- Berger A., DeYoung R. (1997) Problem loans and cost efficiency in commercial banks. *Journal of Banking & Finance* 21, pp. 849–870. doi: 10.1016/S0378-4266(97)00003-4.
- Berger A.N., Udell G.F. (2004) The institutional memory hypothesis and the procyclicality of bank lending behavior. *Journal of Financial Intermediation* 13 (4), pp. 458–495. doi: 10.1016/j.jfi.2004.06.006.
- Bertay A.C., Demirgüç-Kunt A., Huizinga H. (2015) Bank ownership and credit over the business cycle: Is lending by state banks less procyclical? *Journal of Banking & Finance* 50, pp. 326–339. doi: 10.1016/j.jbankfin.2014.03.012.
- Bitar M, Saad W., Benlemlih M. (2016) Bank risk and performance in the MENA region: The importance of capital requirements. *Economic Systems* 40, pp. 398–421. doi: 10.1016/j.ecosys.2015.12.001.
- Bofondi M., Ropele T. (2011) Macroeconomic Determinants of Bad Loans: Evidence from Italian Banks. *Bank of Italy (Occasional Paper)* 89.
- Bouvatier V., López-Villavicencio A., Mignon V. (2012) Does the banking sector structure matter for credit procyclicality? *Economic Modelling* 29(4), pp. 1035–1044. doi: 10.1016/j.econmod.2012.03.012.
- Castro V. (2013) Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic Modelling* 31, pp. 672–683. doi:10.1016/j.econmod.2013.01.027.
- Chaibi H., Ftiti Z. (2015) Credit risk determinants: evidence from a cross-country study. *Research in International Business and Finance* 33, pp. 1–16. doi:10.1016/j.ribaf.2014.06.001.
- Chang E.J., Guerra S.M., Lima E.J.A., Tabak B.M. (2008) The stability–concentration relationship in the Brazilian banking system. *Journal of International Financial Markets, Institutions and Money* 18(4), pp. 388–397. doi: 10.1016/j.intfin.2007.04.004.

- Chavan P., Gambacorta L. (2019) Bank lending and loan quality: an emerging economy perspective. *Empirical Economics* 57, pp. 1–29. Doi:10.1007/s00181-018-1436-5.
- Cucinelli D., Di Battista M.L., Marchese M., Nieri L. (2018) Credit risk in European banks: The bright side of the internal ratings based approach. *Journal of Banking & Finance* 93, pp. 213–229. doi: 10.1016/j.jbankfin.2018.06.014.
- De Bock R., Demyanets A. (2012) Bank Asset Quality in Emerging Markets: Determinants and Spillovers. IMF Working Paper WP/12/71. doi:10.5089/9781475502237.001.
- Delis M.D., Kouretas G.P. (2011) Interest rates and bank risk-taking. *Journal of Banking & Finance* 35, pp. 840–855. doi:10.1016/j.jbankfin.2010.09.032.
- Delis M.D., Staikouras, P. K. (2011) Supervisory effectiveness and bank risk. *Review of Finance* 15, pp. 511–543. doi:10.1093/rof/rfq035.
- Dong Y., Meng Ch., Firth M., Hou W. (2014) Ownership structure and risk-taking: Comparative evidence from private and state-controlled banks in China. *International Review of Financial Analysis* 36, pp. 120–130. doi: 10.1016/j.irfa.2014.03.009.
- Festić M., Kavkler A., Repina S. (2011). The macroeconomic sources of systemic risk in the banking sectors of five new EU member states. *Journal of Banking & Finance* 35, pp. 310–322. doi: 10.1016/j.jbankfin.2010.08.007.
- Foos D., Norden L., Weber M. (2010) Loan growth and riskiness of banks. *Journal of Banking & Finance* 34(12), pp. 2929–2940. doi: 10.1016/j.jbankfin.2010.06.007.
- Ghosh A. (2017) Sector-specific analysis of non-performing loans in the US banking system and their macroeconomic impact. *Journal of Economics and Business* 93, pp. 29–45. doi:10.1016/j.jeconbus.2017.06.002.
- Gulati R., Goswami A., Kumar S. (2019) What drives credit risk in the Indian banking industry? An empirical investigation. *Economic Systems* 43, pp. 42–62. doi: 10.1016/j.ecosys.2018.08.004.
- Haq M., Heaney R. (2012) Factors determining European bank risk. *Journal of International Financial Markets, Institutions and Money* 22, pp. 696–718. doi:10.1016/j.intfin.2012.04.003.
- Iwanicz-Drozdowska M., Witkowski B. (2016) Credit growth in Central, Eastern, and South-Eastern Europe: The case of foreign bank subsidiaries. *International Review of Financial Analysis* 43, pp. 146–158. doi: 10.1016/j.irfa.2015.11.010.
- Iyer R., Peydró J.-L., da-Rocha-Lopes S., Schoar A. (2014). Interbank liquidity crunch and the firm credit crunch: Evidence from the 2007–2009 crisis. *Review of Financial Studies* 27, pp. 347–372. doi: 10.1093/rfs/hht056.
- Jiménez G., Saurina J. (2006) Credit cycles, credit risk, and prudential regulation. *International Journal of Central Banking* 2(2), pp. 65–98.
- Kauko K. (2012) External deficits and non-performing loans in the recent financial crisis. *Economics Letters* 115, pp. 196–199. doi:10.1016/j.econlet.2011.12.018.
- Klein N. (2013) Non-performing loans in CESEE: Determinants and impact on macroeconomic performance. IMF Working Paper WP/13/72. doi:105089/9781484318522.001.
- Lassoued N, Sassi H., Attia M.B.R. (2016) The impact of state and foreign ownership on banking risk: Evidence from the MENA countries. *Research in International Business and Finance* 36, pp. 167–178. doi: 10.1016/j.ribaf.2015.09.014.
- Laux C., Rauter T. (2017) Procyclicality of US bank leverage. *Journal of Accounting Research* 55(2), pp. 237–273. doi: 10.1111/1475-679X.12163.
- Louzis D., Vouldis A., Metaxas V. (2012) Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking & Finance* 36, pp. 1012–1027. doi:10.1016/j.jbankfin.2011.10.012.
- Makri V., Tsagkanos A., Bellas A. (2014) Determinants of non-performing loans: the case of eurozone. *Panoeconomicus* 61(2), pp. 193–206. doi:10.2298/PAN1402193M.
- Messai A.S., Jouini F. (2013) Micro and macro determinants of non-performing loans. *International Journal of Economics and Financial Issues* 3(4), pp. 852–860.
- Mohsni S., Otchere I. (2018) Does regulatory regime matter for bank risk taking? A comparative analysis of US and Canada. *Journal of International Financial Markets, Institutions and Money* 53, pp. 1–16. doi: 10.1016/j.intfin.2017.08.006
- Nkusu M. (2011) Non-performing loans and macrofinancial vulnerabilities in advanced economies. IMF Working Papers WP/11/161. doi:10.5089/9781455297740.001.
- Podpiera J., Weill L. (2008) Bad luck or bad management? Emerging banking market experience. *Journal of Financial Stability* 4 (2), pp. 135–148. doi: 10.1016/j.jfs.2008.01.005.
- Quagliariello M. (2007) Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries. *Applied Financial Economics* 17(2), pp. 119–138. doi:10.1080/09603100500486501.
- Salas V., Saurina J. (2002) Credit risk in two institutional regimes: Spanish commercial and saving banks. *Journal of Financial Services Research* 22(3), pp. 203–224. doi:10.1023/A:1019781109676.

- Samet A., Boubakri N., Boubaker S. (2018) Does public–private status affect bank risk taking? Worldwide evidence. *Journal of International Financial Markets, Institutions and Money* 53, pp. 287–306. doi: 10.1016/j.intfin.2017.12.007.
- Shehzad C.T., De Haan J., Scholtens B. (2010) The impact of bank ownership concentration on impaired loans and capital adequacy. *Journal of Banking & Finance* 34(2), pp. 399–408. doi: 10.1016/j.jbankfin.2009.08.007.
- Sobarsyah M., Soedarmono W., Yudhi W.S.A., Trinugroho I., Warokka A., Pramono S.E. (2020). Loan growth, capitalization, and credit risk in Islamic banking. *International Economics* In Press. doi: 10.1016/j.inteco.2020.02.001.
- Staehr K., Uusküla L. (2020) Macroeconomic and macro-financial factors as leading indicators of non-performing loans: Evidence from the EU countries. *Journal of Economic Studies* no. ahead-of-print. doi:10.1108/JES-03-2019-0107.
- Tabak B.M., Fazio D.M., Cajueiro D.O. (2011). The effects of loan portfolio concentration on Brazilian banks' return and risk. *Journal of Banking & Finance* 35(11), pp. 3065–3076. doi: 10.1016/j.jbankfin.2011.04.006.
- Vithessonthi C. (2016) Deflation, bank credit growth, and non-performing loans: Evidence from Japan. *International Review of Financial Analysis* 45, pp. 295–305. doi: 10.1016/j.irfa.2016.04.003.
- Zhang D., Cai J., Dickinson D., Kutan, A. (2016) Nonperforming loans, moral hazard and regulation of the Chinese commercial banking system. *Journal of Banking & Finance* 63, pp. 48–60. doi:10.1016/j.jbankfin.2015.11.010.
- Zheng C., Moudud-Ul-Huq S., Rahman M.M., Ashraf B.N. (2017) Does the ownership structure matter for banks' capital regulation and risk-taking behavior? Empirical evidence from a developing country. *Research in International Business and Finance* 42, pp. 404–421. doi: 10.1016/j.ribaf.2017.07.035.