Bank i Kredyt 53(1), 2022, 47-78

BANK I KREDYT
BANK & CREDIT

The effects of IFRS 9 valuation model on cost of risk in commercial banks – the impact of COVID-19

Emil Ślązak*, Magdalena Skwarzec#

Submitted: 15 December 2020. Accepted: 1 February 2022.

Abstract

The aim of this paper is to analyse the variables determining the cost of risk in banks after the implementation of IFRS 9 with a particular focus on the COVID-19 pandemic in terms of the quality of credit portfolio. To achieve this we propose a panel research model with quarterly variables determining the cost of risk in commercial banks. The research data was taken from the domestic and European banking sector in 2018–2020 during the initial phase of the COVID-19 pandemic. We show that contrary to regulatory assumptions, procyclical tendencies with a cliff effect have not been eliminated in commercial banks under the IFRS 9 framework. In addition, we observe significant differences in the recognition of loan impairment in the domestic banks versus the EU ones under IFRS 9. However, we demonstrate that IFRS 9 did allow banks to recognise loan impairment reasonably fast in the most acute phase of the COVID-19 pandemic.

Keywords: credit risk, cost of risk, IFRS 9, COVID-19

JEL: G21, M41

* SGH Warsaw School of Economics; e-mail: eslaza@sgh.waw.pl.
# SGH Warsaw School of Economics.

1. Introduction

The financial crisis of 2007–2009 became the main trigger for numerous regulatory shifts of fundamental importance to the banking sector. Apart from the new prudential requirements within the CRR/CRD IV package, a cornerstone of the new regulatory approach was principles-based standards on how banks should recognise and provide for credit losses for financial statement reporting purposes.

One of the main conclusions of the Financial Crisis Advisory Group report (FACG 2009) was the call for changes in the standards for the valuation of financial assets. This was mainly due to the fact that before the crisis, non-performing loan write-offs were made in banks too late and too little. In the case of a severe economic downturn, this led to a sharp increase in loan impairment charges. Therefore, an abrupt and significant deterioration in the asset quality of banks (the so-called cliff effect) could be observed. Thus, the cliff effect was found to negatively affect banks' financial standings, which in extreme cases implied a breach of regulatory limits on capital requirements.

One of the main observations following the 2007–2009 crisis was that the rules on loan write-offs launched under International Accounting Standard 39 (IAS 39) since 2005 were of a pro-cyclical nature (Dolar 2019). The main trigger for developing the new rules for loan portfolio valuation, which took the shape of International Financial Reporting Standard No 9 (IFRS 9), was therefore to limit this pro-cyclicality in lending activities of banks (Skwarzec 2020).

It is important to emphasize that the crisis triggered by the COVID-19 pandemic significantly deteriorated the financial standing of the banking sector. The lockdown of the economy undermined the income growth potential of many businesses and the credit sustainability of many individuals. The above circumstances had a particularly strong impact on the quality of the banks' loan portfolio, determining, among other things, the cost of risk in the banks. In this context, regulations on credit portfolio valuation and the way they operate in the event of such a significant deterioration of macroeconomic environment factors are becoming particularly important for the banking sector.

With the development of the COVID-19 pandemic, supervisory authorities and international institutions took quick measures to protect the stability of the banking system. Among other regulatory measures, it was proposed to include a credit moratorium in the portfolio valuation process, or to amortise over time some of the loan write-offs resulting from COVID-19-related changes in the banks' external environment. Nevertheless, banks must still largely deal with the challenges of the credit valuation process in accounting terms on their own. This is primarily due to the complexity of the models operating under IFRS 9 as part of the mandatory rules on disclosure and presentation of financial results.

In a low interest rate environment and a significant reduction of bank's interest margins, the growing cost of risk due to the deteriorating quality of the loan portfolio affects the decline in banks' profitability to an even greater extent than before (Korzeb, Niedziółka 2020). It is also significant that the accounting statements are audited with the reflection of the auditor's approach to this issue. At this point, another challenge arises, i.e. the development of a unified approach of auditors to the accounting effects of the COVID-19 pandemic on bank loan portfolio valuation.

The main objective of the paper is to analyse the determinants of the cost of risk in banks compliant with IFRS 9, with the determination of the impact of the COVID-19 pandemic on the quality of the credit portfolio of selected banks based in Poland (so-called domestic banks) and banks operating within the European Union (so-called EU banks). In order to meet this goal, the authors have analysed

the extent of changes in banks' loan portfolio valuation models under IFRS 9 and changes in the cost of risk under the influence of the instability of the macroeconomic environment during the COVID-19 pandemic.

The literature review and analysis of these issues made it possible to identify three research hypotheses as follows:

H1: In the context of the COVID-19 crisis, the implementation of IFRS 9 has allowed banks to rapidly recognise credit losses due to the countercyclical loan write-off framework;

H2: Together with the implementation of IFRS 9, banks are adopting in practice very biased principles for classifying loans across three stages, which in turn triggers their specific cost of risk;

H3: There are fundamental differences in the allocation of credit portfolios across three stages between domestic and EU commercial banks, which results in significant differences in their cost of risk.

The article is divided into three parts.

Firstly, a review of available literature on the effects of the implementation of the principles of valuation of the credit portfolio in banks under the implementation of IFRS 9 has been carried out. Secondly, the main variables of the credit portfolio valuation process have been identified to determine the utmost increase in the cost of risk under the impact of the COVID-19 pandemic. Lastly, using a panel model, the impact of a selected set of variables on the cost of risk in a representative sample of domestic and EU banks has been analysed.

The research ends with a summary containing the main conclusions of the research.

2. Main triggers for IFRS 9 implementation

One of the most important consequences of the 2007–2009 crisis was the announcement of a change in regulators' approach to the valuation of banks' loan portfolios. This was one of the key requests from the declaration made at the G-20 meeting in London in April 2009. The postulate to change the valuation of the loan portfolio was a direct consequence of a highly negative assessment of the hitherto functioning international accounting standard – IAS39. The main conclusion was that the loan write--off decisions appeared in banks too little and too late, as pointed out, among others, by the Dugan (2009) and later also BCBS (2011), Gaston and Song (2014), and Bushman and Williams (2015a).

The mechanism of its pro-cyclicality has been pointed out as the main reason for the low effectiveness of IAS39. Due to impairments of loans, the write-offs were a particular burden on banks' financial standing once the economic crisis started (Kozińska et al. 2020). This issue is also broadly characterized by Crockett (2001) and Borio, Furfine and Lowe (2001) stating that during economic booms banks are less inclined to create loan write-offs, while during an economic recession the size of the cost of risk, and hence the loan write-offs, increase sharply. Similarly, Leaven and Majnoni (2003) Jiménez and Saurina (2006) pointed to the pro-cyclicality of write-offs and the need to include the determinants of loan portfolio write-offs in capital requirements regulations.

Some authors explicitly pointed out in their papers the need to implement forward looking approaches, such as Bouvatier and Lepetit (2008) among others. The framework of impairments rules under IAS 39 led to the occurrence of a "cliff effect" in times of slowdown or a massive contraction in economic activities (as pointed out by Kund and Rugilo 2019). It manifested itself by a spike in

loan write-offs that led to a significant deterioration in banks' financial standing and, consequently, to a significant reduction in the banking sector's regulatory capital. The importance of the iteration between the impact of the size of loan write-offs and the level of bank capital adequacy has been repeatedly raised in the literature by, among others, Gaston and Song (2014).

The basic rationale for the changes in the valuation rules for banks' loan portfolios after the 2007–2009 crisis, cited, among others, in the G-20 communiqués and the Financial Stability Forum working group papers, came down to the need to address the three most important issues identified in, among others, the Declaration on Strengthening the Financial System (2009) and by the BCBS (2009), namely:

– to limit the impact of pro-cyclicality on the level and dynamics of write-offs at banks,

– the need for much earlier recognition of credit losses in banks,

– to expand the data used in the credit portfolio valuation process in order to increase the transparency and comparability of banks' financial results.

Consequently, a new valuation standard compliant with IFRS 9 has been drafted that has come in force since 1 January 2018. The solution developed is based on the Expected Credit Loss (ECL) model. According to ECL model, the bank's credit portfolio is divided into three groups of loan exposures (so-called stages) depending on the level of credit risk.

The expected loss model – ECL replaced the model under the previous IAS 39 standard based on the incurred loss concept – ILM (incurred loss model). The latter assumed that the loss for the bank is related to the loan exposures for which a specific event leading to a deterioration in creditworthiness has occurred, resulting in the need for a write-off. This fact was highlighted by the Financial Stability Forum (2009) in the context of its pro-cyclical nature, cf. Borio, Furfine and Lowe (2001).

Prior to the 2007–2009 crisis, even a high probability of an event with a negative impact on the borrower's ability to meet their obligation to the bank was not a rationale for a credit write-off. From the point of view of the model, ECL, understood as the need for the bank to write off a loan, is inherent to each loan exposure over its life horizon. Consequently, write-offs should occur much earlier, i.e. at the time the bank provides financing. In this approach, it is irrelevant whether the borrower has experienced events indicating a deterioration in its economic and financial situation that determine its ability to meet its financial obligations, which follows from 5.5.5 of IFRS 9 indicating that, "if, at the reporting date, the credit risk associated with a financial instrument has not significantly increased since initial recognition, the entity shall measure a credit write-off for expected credit losses on that financial instrument equal to 12 months of expected credit losses."

In particular, the split of loan exposures categories characterised by a higher level of credit risk (stage 2), for which the loss is calculated over the entire life horizon of the credit, is supposed to be an element mitigating the volatility of write-offs. Thus, this mechanism is expected to lead to a reduction in the risk of a cliff effect in the case in which the credit portfolio was only split into two parts under ISA 39 (cf. Risaliti, Cestari, Pierotti 2013). IFRS 9 is also expected to have a positive impact on the speed of write-offs by banks. This has been pointed out, among others, by Beatty and Liao (2011) and Bushman and Williams (2015b), arguing that banks that record less delay in recognising credit losses are less likely to reduce lending during recessions. The positive effects of the IFRS 9 solution were also pointed out by Kund and Rugilo (2017), who claim that the implementation of IFRS 9 allowed to achieve the intended objective understood as a reduction in the volatility of write-offs created by banks by reducing the "cliff effect".

The issue of the credit portfolio valuation model under IFRS 9 and the attempt to value it has been widely discussed in the literature in recent years. The postulate of early recognition of losses, called for, among others, by the Financial Stability Fund (2009) and the Basel Committee, has also been met with numerous criticisms stressing that paradoxically this concept, instead of reducing the volatility of write-offs, would lead to an increase in their volatility (among others, Frykstrom, Li 2018). At the same time, they pointed out that the largest increase in write-offs would be observed at the initial stage of economic weakness, which would significantly reduce banks' profitability and, in the next step, limit the volume of accumulated capital and credit supply. This was indicated, among others, by the conclusions of a study by Barclays Bank (2017), where during a simulated recession, the CET 1 capital ratio fell by 300 percentage points using IFRS 9 solutions, compared with a drop of only 100 percentage points using the IAS 39 valuation.

Similar conclusions in the expected loss calculation are pointed out by Abad and Suarez (2017), who highlight that the assumptions used in IFRS 9 reinforce rather than reduce the volatility of bank equity, which is also reflected in the volatility of credit supply over the business cycle. Notably, a sudden increase in the level of impairments is observed when the economy slows down. Consequently, IFRS 9 may therefore have a pro-cyclical impact on the level of banks' cost of risk and their regulatory capital. In extreme cases, this could lead to another phenomenon of a collapse in the credit supply, a so-called "credit crunch".

It is worth noting the results of the analysis of Cohen and Edwards (2017), where an approach that takes greater account of forward-looking information simultaneously leads to increases in loan write-offs when anticipating a potential economic downturn. As a result, the analysis and conclusions of Cohen and Edwards (2017) indicate a correlation between the timing of write-offs and banks' loss absorbency and lending potential. Gaffney and McCann (2019), based on a study on a sample of mortgage portfolios in Ireland, have also pointed at similar conclusions. The results of the research indicated that the classification into individual stages resulting from IFRS 9 is characterised by high procyclicality (i.e. the share of stage 2 significantly increases during recession and decreases during economic growth).

Slightly different research results are presented by Seitz, Dinh and Ratherberg (2018), who claim the NPL write-offs calculated under IFRS 9 do not, in principle, exceed those under ISA 39; nevertheless, the former are higher during the economic crisis. On the other hand, the results of a study conducted by Buesa, Garcia and Tarancon (2020) on an Italian mortgage portfolio indicated that the write-offs created under IFRS 9, as assumed, were less procyclical compared to the previous solutions. Thus, empirical studies do not provide unanimous conclusions.

In the context of the research presented in this paper, it is worth emphasising that IFRS 9 does not precisely specify the list of events that determine the need to reclassify a loan exposure to stage two, limiting itself to stating that there is a significant increase in the level of credit risk. As a result, the triggers for classification into stage 2 may differ from one bank to another. The discretionary manner of rules is seen as one of the biggest drawbacks of IFRS 9 as, among others, emphasized by Miu and Ozdemir (2017). This effect is further reinforced by the wide variation in issues related to the timeliness and availability of information regarding the determinants of classification into stage 2, as discussed by Ewanchuk and Frei (2019). The call for the need to clarify and unify these rules was pointed out by Beerbaum (2015).

The loan write-offs concept based on the ECL model has introduced another important change related to the stage 1 qualified loan portfolio (cf. Seitz, Dinh, Rathgeber 2018). Under the concept adopted in IFRS 9, at the time of funding a bank is required to recognise a credit write-off reflecting the level of loss expected over a 12-month horizon. The assumptions underlying the principle that the credit loss under stage 1 is calculated over a 12-month horizon is seen as a shortcoming of this solution according to some authors. The discretionary nature of this assumption is pointed out, as well as the lack of assessment of how it conceptually relates to the overall solution and the assumptions of the ECL model, as written, among others, by Novotny-Farkas (2015). Also, Buesa, Garcia and Tarancon (2020) stress that the magnitude of the impact of write-offs on a bank's income statement at the time of funding is largely dependent on discretionary assumptions as to how much it will incorporate the information in the ECL model. Moreover, a 12-month period is relevant to significant migrations between stage 1 and stage 2. Thus, the credit risk process is the result of discretionary policy in each bank which determines the transition of loan receivables across stages, thus causing a discretional increase or decrease in the level of write-offs.

Apart from the prerequisites of credit risk growth themselves, in this case the process of data collection may be important for the dynamics of write-offs or the measure of their level in the bank Ślązak (2011). It is on their basis and based on the moment of their availability that decisions affecting the level of credit risk are made. Consequently, this can lead to a rapid increase in the level of write--offs, which is precisely what the IFRS 9 standard was intended to prevent, as particularly highlighted by Novotny-Farkas (2015) and Sanchez Serrano (2018). In turn, according to Buesa, Garcia and Tarancon (2020), potentially the greatest risk of a cliff effect appear when there is an increased migration of the loan portfolio from stage 2 to stage 3.

Such observations also appear in the EBA report with the results of the second quantitative survey related to the implementation of IFRS 9. More than 70% of banks indicated that they expected a cliff effect related to the migration of loan exposures from stage 1 to stage 2. The above element, combined with the significant scope for the discretionary application of the IFRS 9-compliant valuation model in a bank, may exacerbate the volatility of the cost of risk and negatively affect the comparability of banks in assessing the quality of their loan portfolio, as pointed out by Sanchez Serrano (2018) in his research. In contrast, Bischof, Laux, and Leuz (2019) highlight the importance of disclosure requirements when so many model elements are based on expert assumptions and discretionary estimates.

It must be emphasized that as a consequence of the above observations, there is a lack of uniformity in the approaches used by individual banks. In some cases, the discrepancies identified are of a measurable nature. Similar conclusions were also pointed out by Huizinga and Leaven (2019), highlighting the important role of supervisors in minimising this phenomenon. At the same time, he pointed out that the variables that strengthen the diversity effect are the size of the bank and the level of its capitalisation. In the case of larger banks, a higher propensity to bear more risk is observed due to the too big to fail effect, as noted Bernanke (2009). At the same time, it has also been emphasised that IFRS 9 would increase the range of data available to users of financial statements (Johannes, Dedy, Muksin 2018).

In addition to the categorization of the credit portfolio among different stages, IFRS 9 has introduced the assumption that the ECL model is based on expected credit losses conditional on their probability. The estimation of the ECL should cover all relevant information including historical data, current conditions as well as forecasts of future levels of macroeconomic indicators, in particular

forecasts of GDP, the unemployment rate, interest rates or property prices, as exemplified by Frykstrom and Li (2018). On the one hand, these indicators should refer to forecasts, affecting the level of expected loss. On the other hand, the risk estimation models used for IFRS 9 should reflect current market conditions. Thus, these are models based on an assessment of the current situation in the macroeconomic environment (Point in Time model – PIT) and not compliant with models that take into account longer data time series to reflect the business cycle (Through the Cycle models – TTC) as required by the Basel Committee and the CRR (cf. Buesa, Garcia, Tarancon 2020).

The diversity of opinions and survey results presented above only emphasize the multitude of challenges and level of difficulty associated with the implementation of IFRS 9 models in banks. This scale of challenges posed to the banking sector is also noted in the literature by Cohen and Edwards (2017), among others, who conclude that the newly guided solutions will result in significant changes in the credit risk management process of financial institutions. Similarly, Edwards (2016) himself indicates that the implementation of IFRS 9 is also a major challenge for bank management in terms of data quality and information systems.

Given the design and basic assumptions of the credit portfolio valuation model under IFRS 9, the outbreak of the COVID-19 pandemic posed a further challenge for banks to revise and update their existing credit portfolio valuation rules (Korzeb, Niedziółka 2021).

In a nutshell, there are three systemic dimensions of the IFRS 9 implementation in banks.

The first dimension is related to the need to revise and review assumptions related to the forecast of macroeconomic conditions. Indeed, according to the forward-looking concept, it is necessary for the bank to cover future macroeconomic conditions in the calculation of the ECL level. However, this assumption is defined as the ECL stemming from different scenarios for the future development of macroeconomic data. It is necessary to adopt pessimistic, baseline and optimistic scenario assumptions and, in a second step, to adopt specific weights for each of the proposed scenarios. The level of potential adjustment of the size of write-offs in the bank will depend on two variables, namely, the level of macroeconomic indicators, in particular the level of GDP for individual scenarios and the moment when the bank decides to revise the adopted models.

$$EL = w_1 EL_1 + w_2 EL_2 + w_3 EL_3$$

where:

EL – expected loss amount for the loan portfolio,

w_i – weight assigned to i this scenario (baseline, pessimistic, optimistic),

EL_j – expected loss calculated for the i-th scenario.

The second dimension is the issue of increased credit risk determining the reclassification of the loan portfolio into stage 2, which at the same time implies the need for additional loan write-offs, as the credit loss (ECL) for the stage w is calculated over the entire life of the loan.

The scale and extent of ECL will analogously depend on the bank's defined rationale for classification in stage 2 and the availability of this information, which will affect the timing of reclassification. This element of discretionary procedure may of course affect the potential scale of the incremental write-offs and cost of risk and the timing of its disclosure. Nevertheless, there is no doubt that the share of the credit portfolio classified in stage 2 will increase significantly for banks.

The third issue is related to the bank loan repayment moratoria (credit holidays) introduced by EU Member States in response to the situation caused by the COVID-19 pandemic (Zaleska 2021). The issue of including facilities to repay borrowers was originally addressed in the EBA (2017) guidelines on the definition of default exposures, in which debt restructuring, considered as one of the grounds for default, was defined by comparing the present value of contract flows before and after the change in contract terms.

$$DO = \frac{NPV\,(0) - NPV\,(1)}{NPV\,(0)}$$

where:

DO – reduce the financial burden,
NPV (0) – present value of flows for the loan agreement before change,
NPV (1) – present value of flows for the loan agreement after the change.

In case of *DO* > 1%, the guidelines assume that the bank's exposure meets the restructuring rationale and should be reclassified as defaulted. In such a COVID-19 pandemic situation, the widespread use of all facilities for borrowers, including but not limited to suspension of repayments, would lead to the creditors classified in stage 3 and to an increase in the cost of risk. In this respect, however, the European regulator reacted very quickly by issuing appropriate guidelines to take into account the applicable customer facilities in connection with adopted programmes in response to the impact of the pandemic cf. EBA (2020). According to the assumptions adopted therein, moratoria meeting the condition that they were granted due to COVID-19 and not due to the individual situation of the obligor do not meet the definition of restructured exposures (within the meaning of Article 47b of EU Regulation 2019/630) as well as the definition of default in terms of a 1% reduction in the value of future expected flows.

In line with the EBA guidelines, statutory and non-statutory moratoria resulting strictly from the COVID-19 situation should not imply an obligation to reclassify a loan exposure or a client to a higher-risk stage. At the same time, banks should closely monitor the economic and financial situation of the obligor and reclassify where necessary. In practice, it is extremely difficult to distinguish a situation in which a customer applies for a credit holiday because of the consequences of the pandemic or problems resulting from other reasons. In addition, it must be taken into account that the moratoriums/credit holidays requested by borrowers under any state support schemes will come to an end and some bank customers will probably want to benefit from their extension. Banks will therefore face another challenge with their classification, which will be reflected in the quality level of the loan portfolio and the cost of risk.

The EBA's November 2020 report on moratoria in the EU banking sector highlighted the need to monitor the credit quality of moratoria. The risk of a cliff effect in a situation of a coincidence of negative events, i.e. the expiry of moratoria on the one hand and a deterioration in macroeconomic conditions on the other, which could result in a sharp increase in the level of credit in stage 3, was identified as a potential risk. According to the EBA report, as of 30 June 2020 the value of the moratorium portfolio among EU Member States amounted to around 7% of the credit mortgage portfolio for individuals and 16% of the portfolio for small and medium-sized enterprises (SME), with the report indicating

significant differences in the values of these shares across countries. From the point of view of the classification of the portfolio subject to moratoria, 2.5% was classified in stage 3 and 17% in stage 2.

Leaving aside the fact that the principles of risk management under IFRS 9 are based on discretionary assumptions of individual banks, the scale of the impact and consequences caused by COVID-19 will have a significant impact on the level of the cost of risk in banks (Koleśnik 2020). According to the results of analyses published in July 2020 by, among others, the ECB (2020), credit risk is identified as the main source of the negative impact on bank performance and consequent reduction in regulatory capital. However, preliminary estimates of the EBA based on the results of stress tests, indicate that according to the conducted sensitivity analysis of the impact of the pandemic on the economic and financial situation of banks, the impact of an increase in write-offs (ECL) on the CET 1 ratio may be in the range of 230–380 basis points, without the impact of the moratorium (EBA 2020a). In this context, it is crucial to look at which elements and characteristics of a credit portfolio or bank types are the most influential factors to the cost of risk with conclusions regarding future levels.

3. Research characteristics

The subject of the research is the analysis of the triggers for the cost of risk of commercial banks based on financial data and information on capital adequacy. Additional sources of data were analytical data on each bank collected in the EBA, i.e. wide transparency exercise databases. The research was based on quarterly commercial bank data on a sample of 27 banks from the European Union, including 9 commercial banks operating in Poland. The source of information concerning macroeconomic data was information published by the European Statistical Office (Eurostat).

The selection of the sample was driven by the objective to replicate trends in risk cost parameters for a group of banks subject to the same regime of IFRS 9 related rules and guidance with an identical database. Thus, in terms of EU banks, this group covers financial institutions classified by the EBA as meeting the definition of Globally Systemically Important Institutions (G-SIIs) under the BIS methodology and extended under the EBA guidelines to include other significant banks. As at the end of 2019, this list included 37 commercial banks operating in the European Union and/or the European Economic Area (EEA).

The final selection of the sample of European banks was based on data availability and cross comparability. As a result of the analysis of the scope of available data, 18 European banks were selected as a sample for the research. It is worth emphasising that an important factor affecting the scope and frequency of information presented by banks is the fact that some commercial banks included by the EBA in the group of systemically important banks are non-public companies, which makes it difficult to obtain comparable data from different periods.

As regards commercial banks headquartered in Poland, the criterion for selecting banks for the research sample was status as a public company, excluding those observations in which the impact of one-off events or niche banking activities was significant.

The time horizon of the research covers quarterly data in a window from early 2018 to mid-2020, i.e. 10 reporting periods. The starting date of the time window of the research is the IFRS 9 effective date until the end of the first, most economically disastrous phase of the COVID-19 pandemic. As a result, 220 observations are included in the research.

An important element of the research is the ability to compare and assess the variables determining the level of risk costs and the dynamics of write-offs in both domestic and EU banks in the context of meeting the assumptions of the IFRS 9 valuation model.

Given the data horizon adopted for the research, the issue of the level of the cost of risk due to changes in the macroeconomic environment triggered by the COVID-19 pandemic and an attempt to assess the sources of its allocation were also analysed. This is a key aspect from the point of view of assessing and verifying how the implemented valuation models under IFRS 9 worked in practice. In particular, the aspect related to the recognition of the potential deterioration of credit risk and the consideration of the forward-looking approach in the initial phase of the COVID-19 pandemic is important here.

4. Research set of variables – characteristics

From the point of view of the economic account, the bank's cost of risk is reflected in the impairment cost presented in the income statement. Therefore, the cost of risk, i.e. the relationship between the amount of write-offs created in a given period and the average balance of the credit portfolio maintained in a given time, was adopted as the explanatory variable in the research. Observation and analysis of this value enables an assessment of factors determining the scale of burdening commercial banks with costs related to incurred credit risk, also in the perspective of subsequent periods.

In particular, the selection of variables was dictated by the study's objective of verifying the hypothesis that the IFRS 9 write-off recognition mechanism in credit risk procedures has indeed led to a reduction in the "cliff effect" affecting the volatility of the cost of risk in banks. Hence, the research identified explanatory variables characterising the loan portfolio under IFRS 9. Moreover, an important rationale for the selection of explanatory variables was the pragmatic use of data universally characterising the financial structure and activities of banks from the research sample.

In order to examine the determinants of the level of the cost of risk, the following 18 explanatory variables were adopted for the research:

1. (ST3_%) – share of stage 3 in the bank's loan portfolio
2. (ST3_CR) – write-off coverage of loan exposures in stage 3
3. (ST2_%) – share of stage 2 in the bank's loan portfolio
4. (ST2_CR) – write-off coverage of loan exposures in stage 2
5. (ST1_CR) – write-off coverage of loan exposures in stage 1
6. (PINC) – credit portfolio growth rate
7. (RET_%) – share of retail loan exposures in total bank credit portfolio
8. (CORP_%) – share of corporate loan exposures in the total credit portfolio of the bank
9. (MORT_%) – share of loan exposures to individuals secured by mortgages
10. (PORT_%) – share of the loan portfolio in the bank's total assets
11. (L/D_%) – loan portfolio to deposit ratio of the bank
12. (TCR) – total capital adequacy ratio of the bank
13. (ROA) – return on assets of the bank
14. (ROE) – return on equity of the bank
15. (GDP) – quarterly change in the level of gross domestic product

16. (IND_PR) – quarterly dynamics of the level of industrial production
17. (UN_RA) – unemployment rate
18. (RET_S) – quarterly growth rate of retail sales.

Variables 1–5 are a direct result of the principles of credit portfolio classification adopted by banks resulting from the provisions of IFRS 9. Their analysis will therefore allow, among other things, to verify the thesis often put forward in the literature concerning the discretionary application by banks of classification criteria to individual portfolios. On the other hand, the analysis of time variability of these quantities will be an important element determining the variability of the cost of risk.

The second group of variables (i.e. 6–11) are those that describe the bank's business strategy as reflected in the structure of the loan portfolio, its level of risk appetite and the level of profitability of the loan portfolio and assets.

The third group of variables (i.e. 12–14) relates to the overall assessment of the bank's position and capital stability. The selection of variables relating to the three key areas, i.e. the valuation principles under IFRS 9, credit portfolio characteristics and the institution's risk appetite, and financial and capital stability, will identify the key variables determining the level of the cost of risk.

The fourth group of variables (i.e. 16–18) includes parameters characterising macroeconomic conditions.

In the context of the statistics presented above, it is worth emphasising the wide range of values of variables relating to the quality of the credit portfolio, particularly with regard to the minimum and maximum values for the share of stage 2 in the total credit portfolio and its coverage. This observation may provide an important implication that some of the solutions introduced under IFRS 9 are characterised by a very high level of discretionary approach to the recognition of individual loan exposures in the higher credit risk portfolio.

The research also analysed whether the high proportion of the portfolio with higher credit risk is more determined by the real level of risk associated with the exposures in question, or whether it depends to a large extent on the approach to managing the valuation process and the risk appetite accepted by the bank in question.

5. Results of the research

The stepwise regression model was used in the research to analyse the data. This methodology is preferred since this regression is widely used in credit risk modelling. Moreover, it allows for a transparent analysis of the results obtained. The backward stepwise selection was applied to select explanatory variables for the final form of the model. In line with the algorithm applicable to the methodology, firstly all explanatory variables are introduced into the model. In the next iteration the regression model is recalculated, thus the variable characterised by lack of statistical significance is excluded from the set of explained variables. This criterion is verified on the basis of the p-value parameter. The algorithm is repeated until all explanatory variables are statistically significant. In addition, a restriction was introduced regarding the logical consistency of the results obtained and the number of explanatory variables at a maximum of six. Due to the relatively wide range of candidate variables, in the step preceding the first model recalculation, a correlation analysis of the variables was performed to eliminate variables that are overly correlated. For this purpose, the Pearson correlation

was used, and a value above 0.6 was considered as an excessive level of correlation. Therefore, the following variables were excluded after the correlation analysis from the stage of regression model determination: share of stage 3 in the bank's credit portfolio, coverage by write-offs of loan exposures in stage 1, share of retail loan exposures in the bank's total credit portfolio, quarterly dynamics of retail sales level and return on equity.

The results obtained indicate that the model was characterised by a high level of fit to the explanatory variable. The parameter R^2 at the level of 0.68 indicates that the size of the explained variable, i.e. the cost of risk, is 68% determined by the final form of the model. This is a very high value, which indicates the high quality of the obtained model. As a result of applying the above algorithm, a model consisting of statistically significant variables was obtained. All explanatory variables are characterised by high statistical significance (p-value of variables < 0.01).

From the point of view of the substantive explanation of the final indicators, we observe a positive relationship between the cost of risk and the credit portfolio quality parameters, which include the share of stage 2 in the total credit portfolio of banks and the level of write-offs coverage of loan exposures included in stage 2. It is worth noting that from the point of view of the data collected and the results obtained, the level of write-offs created for exposures characterised by increased credit risk (stage 2) is more important than the share of these exposures in the total credit portfolio itself.

The characteristics of both variables, i.e. the share of stage 2 in the portfolio and its coverage by write-offs, gives evidence that there is a very wide range in these figures, with an average coverage of only a few per cent for this portfolio and close to 50% for stage 3 (Table 2). This means that in the case of an increase in the share of exposures qualified to stage 3 there is a significant jump in the value of write-offs in the bank, and thus an increase in the cost of risk. The results of the model confirmed the statistical significance of the impact of credit portfolio structure on the level of the cost of risk (share of corporate customers in the total credit portfolio) and the structure of assets itself (share of loans in the level of total assets). In contrast, a negative relationship was shown between the cost of risk and the return on assets ratio, which can be interpreted to mean that a riskier loan portfolio generates a lower rate of return. Among macroeconomic variables, the variable of quarterly change in GDP level showed the statistical significance. The negative regression coefficient also confirmed the dependence of the cost of risk on the GDP variable. The fact of the dependence of the cost of risk observed in the first half of 2020 on the GDP variable serves as confirmation of hypothesis 1 that the implementation of IFRS 9 allowed the rapid recognition of losses resulting from the COVID-19 pandemic.

In order to verify auxiliary hypothesis 3, whether there are differences in the variables determining the level of risk costs for domestic and foreign banks, two separate models dedicated to these two samples were prepared on the basis of the same algorithm (Table 4).

In the case of domestic banks, 7 variables, characterised by a high level of correlation, were eliminated at the stage of correlation analysis: the share of stage 3 in the bank's credit portfolio, the coverage of write-offs of loan exposures in stage 3, the share of corporate loan exposures in the bank's total credit portfolio, the share of exposures to individuals secured by mortgages, the quarterly growth of industrial production, the return on own funds and the loan-to-deposit ratio.

For the population of EU banks, a high level of correlation was observed for a group of 4 variables: the coverage of write-offs of loan exposures in stage 1, the share of exposures to individuals secured by mortgage in the total credit portfolio of the bank, the return on own funds and the quarterly dynamics of the retail sales level.

The outcome models for domestic and EU banks are characterised by divergent sets of variables. On the one hand, this results from the difference in size and scale of banking activities. On the other hand, it is an effect related to a different policy concerning the management of the loan exposure valuation process and the approach to creating write-offs, their dynamics and, most importantly, the allocation of the credit portfolio to the given stage.

The model based on the population of domestic banks is characterised by very high model fitting (R^2 at the level of 0.76), which indicates that the explanatory variables in the model significantly determine the size of the explained variable. Some of the variables from the model are identical to those that were also found to be statistically significant for the population as a whole (i.e. share of stage 2 in the loan portfolio, write-off coverage of exposures included in stage 2 and return on assets ratio). The variable on the share of corporate customers in the total loan portfolio appears instead of the variable on the share of retail exposures in the loan portfolio in the model for the whole population. It appears with a negative sign, so there is consistency with the model for the whole population. It is worth noting that for the population of domestic banks the quarterly change in GDP turned out to be statistically insignificant, while for the whole population this condition was met.

The model determined for the remaining part of the population, i.e. the EU banks, is characterised by the lowest model fitting out of the three models finally obtained. The R^2 coefficient is 0.57, which is still a very high value indicating that the variables in the model rightfully explain the cost of risk. Two variables, i.e. write-off coverage of stage 2 and return on assets, coincide with the other two models. The third variable, quarterly change in GDP, highlights the impact of macroeconomic factors on the cost of risk.

The level of model fitting ranging from the domestic banks and EU banks with divergent sets of model variables confirms the assumption that the cost of risk of the two populations is determined to some extent by different variables. Differences resulting from different variables relevant to the evolution of the cost of risk in these populations can also be seen by analysing the changes in the cost of risk for both groups since the beginning of 2018, particularly due to the mechanism of its allocation.

The first two quarters of 2020 show a significant increase in the cost of risk due to the deterioration in the quality of loan portfolios resulting from the effects of the crisis brought by the COVID-19 pandemic. The relationship between the cost of risk and the quarterly change in the level of GDP is particularly evident (Table 4) and the consequent increase in the level of write-offs as a kind of response to, among other things, the fall in the level of GDP. It is worth noting that the cost of risk during the entire period under research was significantly higher in the group of domestic banks compared to the population of EU banks.

In the context of this analysis, the level of collateralisation, understood as the level of write-off coverage of the population in the different categories, namely in the group of exposures with default (stage 3) or exposures with increased credit risk (stage 2), is important.

The results presented below (Tables 6 and 7) indicate that the increase in the level of the cost of risk triggered by COVD-19 observed in the first and second quarters of this year resulted in different responses in terms of the policy of creating write-offs for credit risk. Domestic banks mainly created write-offs on stage 3, i.e. the portfolio in default (increase in coverage of 2.86 percentage points) calculated as the difference between Q4 2019 and Q2 2020, with a slight change in the size of this portfolio (0.21 percentage points). In contrast, despite the increase in the size of stage 2 related to the identification of elevated credit risk (2 percentage points), the coverage level on this portfolio decreased

slightly. This observation may indicate that domestic banks, by creating higher write-offs, did not really strengthen their safeguard against a potential increase in credit risk on the standard credit portfolio but focused on increasing write-offs in stage 3.

The increase in write-offs on loans in line with the default triggers for stage 3 is obviously a positive development from the point of view of reducing credit risk exposures. Nevertheless, it is also important to monitor the level of write-off coverage for stage 2. This observation could be a worrying prognostic for domestic banks in the event of a deepening COVID-19 crisis, as it implies that there is a high probability that higher write-offs will be required in the future.

A different approach to write-offs due to the COVID-19 pandemic is a characteristic of EU banks. Analogous to Poland, these banks subsidised write-offs in stage 3 (increase in coverage by 1.63 percentage points). Nevertheless, the increase in the cost of risk was mostly observed in stage 2. On the one hand, the share of exposures with higher credit risk increased by 4.44 percentage points to an average of 10.93% of the value of the total loan portfolio (a 68% increase compared to the value at the end of Q4 2019). On the other hand, this was accompanied by the increase in the coverage level (0.31 percentage points). For the population of domestic banks, these figures were, respectively, an increase in the share of the loan portfolio classified in stage 2 of 1.92 percentage points, and therefore less than half of the increase observed in EU banks, with a decrease in the level of coverage by write-offs of this portfolio of 0.15 percentage points.

The above observations confirm that the different forms of the model obtained for one and the other population are not only due to the differences in the scale and scope of operations, but are to a large extent dependent on the banks' policies regarding the allocation and changes in the level of loan write-offs. From the point of view of IFRS 9, this approach observed among EU banks is clearly more effective in preventing the cliff effect. This is mainly due to the fact that banks, in the case of increased credit risk, create more write-offs for the credit portfolio that is likely to be classified in stage 3 in the next quarters. Therefore, the EU banks are likely to act in a forward-looking manner to reduce the cliff effect associated with the increase in the level of write-offs stemming from the increased migration of loan exposures from stage 2 to stage 3. In the EU banks group, the difference in the level of coverage between stage 2 and stage 3 is 39 percentage points as of 30 June 2020, and for domestic banks this value oscillates around 54 percentage points, i.e. 38 per cent more. This means that in a situation of a further deterioration in the quality of the banks' loan portfolio and the resulting increased migration of the portfolio from the currently growing stage 2 to stage 3, it is highly likely that the cost of risk will increase even more than that observed in the first and second quarters of this year.

6. Summary

The financial crisis of 2007–2009 initiated the new accounting valuation standard for the credit portfolio IFRS 9. The implementation process lasted 10 years with crucial consequences to banks. On the one hand, IFRS 9 faced the challenge of developing a credit valuation mechanism to effectively manage the risk of unexpected credit losses. On the other hand, the IFRS 9 process was tough due to the intense and diverse discussions related to the objective of drawing up the right regulations affecting the financial standing of banks and, namely, their profitability and capital stability.

The implementation of the new rules at the beginning of 2018 entailed several changes, not only to the loan portfolio valuation process, but also to the entire system of credit risk management in banks. The results obtained in this research are characterised by a high level of model fitting, which indicates that we identify statistically significant variables crucial for the size of the cost of risk. This is particularly true for loan portfolio classification characteristics with the allocation of loan impairments to one out of three stages. A sharp change in these values thus determines the variation in the observed cost of risk. This relationship was also confirmed by the significant increase in the cost of risk caused by changes in the macroeconomic environment due to the COVID-19 pandemic observed in the first two quarters of 2020. It is worth emphasizing the statistically significant relationship between the cost of risk and the quarterly change in the level of GDP. At the same time, the fact that the effect of deterioration of credit risk is quickly reflected in the classification of the loan portfolio and consequently in the cost of risk, also confirms the assumption made in the research hypothesis H1.

On the other hand, the discretionary classification of the credit portfolio into categories of higher credit risk, which is frequently raised in the literature, can also be observed by analysing data on the allocation of loan exposures to individual categories (research hypothesis H2). The conducted research confirmed, together with the outbreak of the COVID-19 pandemic, a significant increase in the level of risk took place in the banks in the first and second quarters of 2020, with the allocation of newly created loan write-offs largely differing between the domestic and EU banks (research hypothesis H3).

The results of the conducted research give evidence that a further increase in the cost of risk under the influence of the COVID-19 pandemic is highly probable. From the point of view of the model concept resulting from IFRS 9, this increase will result primarily from the need to consider macroeconomic forecasts (forward-looking approach), in particular the level of GDP, and from the increase in impairments classified into stage 2. Nevertheless, the quality parameters of the credit portfolio of domestic banks and the increase in the level of impairments in stage 3 recorded in H1 2020 indicate that this share of the credit portfolio may also need to be provisioned.

The rising cost of risk, resulting from the prevailing conditions in the external environment and dictated by the methodological requirements under IFRS 9, may pose a significant problem for the banking sector. The potential negative scale of this phenomenon may be evidenced by actions taken by international bank regulators. One of the elements of mitigation of the negative effects related to this issue is the European Commission's proposal to amend the CRR regulation regarding the possibility to amortise in capital the increase in loan write-offs recorded in 2020–2021 into stage 1 and stage 2.

References

Abad J., Suarez J. (2017), *Assessing the cyclical implications of IFRS 9 – a recursive model,* ESRB Occasional Paper Series, 12, European Systemic Risk Board.

Acharya V., Ryan S. (2016), Bank's financial reporting and financial system stability, *Journal of Accounting Research*, 54(2), 277–340.

Barclays Bank (2017), European banks: IFRS9 – bigger than Basel IV, http://www.eifr.eu /document/file/download/1877/barclays-european-banks-ifrs9-bigger-than-basel-iv-jan-17-pdf.

BCBS (2005), *An Explanatory Note on the Basel II IRB Risk Weight Functions*, July, BIS.

BCBS (2009), *Guiding principles for the replacement of IAS 39*, Basel Committee on Banking Supervision, https://www.bis.org/publ/bcbs161.pdf.

BCBS (2011), *Financial instruments: impairment, comment letters*, Basel Committee on Banking Supervision, https://www.bis.org/bcbs/commentletters/iasb32.pdf.

Beatty A., Liao S. (2011), Do delays in expected loss recognition affect banks' willingness to lend?, *Journal of Accounting and Economics*, 52(1), 1–20.

Beerbaum D. (2015), Significant increase in credit risk according to IFRS9: implications for financial institutions*, International Journal of Economics & Management Sciences,* 4(9), 1–3.

Bernanke B. (2009), *Financial reform to address systemic risk, Remarks at the Council on Foreign Relations,* https://www.federalreserve.gov/newsevents/speech/bernanke20090310a.htm.

Bischof J., Laux Ch., Leuz Ch. (2019), *Accounting for financial stability: lessons from the financial crisis and future challenges*, CFS, 622, Goethe University.

Bholat D., Lastra R., Markose S., Miglionico A., Sen K. (2016), *Non-performing loans: regulatory and accounting treatments of assets*, Staff Working Paper, 594, Bank of England.

Borio C., Furfine C., Lowe P. (2001), Procyclicality of the financial system and financial stability: issues and policy options, in: *Marrying the macro- and micro-prudential dimensions of financial stability,* BIS Papers, 1, March, 1–57.

Bouvatier V., Lepetit L. (2008), Banks' procyclical behaviour: does provisioning matter?, *Journal of International Financial Markets, Institutions and Money*, 18, 513–526.

Buesa A., Garcia F., Tarancon J. (2020), *Measuring the procyclicality of impairment accounting regimes: a comparison between IFRS9 and US GAAP*, Banco de Espana Working Paper, 2003.

Bushman R., Williams C. (2015 a), Accounting discretion, loan loss provisioning and discipline of banks' risk-taking, *Journal of Accounting and Economics*, 54(1), 1–18.

Bushman R., Williams C. (2015b), Delayed expected loss recognition and the risk profile of banks*, Journal of Accounting Research*, 53(3), 511–553.

Cohen B., Edwards G. (2017), The new era of expected credit loss provisioning, *BIS Quarterly Review*, March, 39–56.

Crockett A. (2000), *Marrying the micro- and macroprudential dimensions for financial stability*, https://www.bis.org/speeches/sp000921.htm.

Dolar B. (2019), Cyclicality of loan loss provisioning in the U.S. banking industry: evidence from the period 1993–2007, *The Journal of Business and Economic Studies*, 23(1), 1–17.

Dugan J. (2009), *Loan loss provisioning and pro-cyclicality*, https://www.occ.gov/news-issuances/speeches/2009/pub-speech-2009-16.pdf.

Edwards G. (2016), Supervisors' key roles as banks implement expected credit loss provisioning, *SEACEN Financial Stability Journal,* 7, 1–26.

EBA (2016), *Guidelines on the Application of the Definition of Default under Article 178 of Regulation (EU) No 575/2013*, EBA/GL/2016/07, EBA.

EBA (2017), *EBA Report on Results from the Second EBA Impact Assessment of IFRS 9*, July, EBA.

ECB (2020), *COVID-19 Vulnerability Analysis. Results Review*, European Central Bank, https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr200728_annex~d36d893ca2.en.pdf.

EBA (2020a), *The EU Banking Sector: First Insights into the Covid-19 Impacts*, Thematic Note, EBA/REP/2020/17.

EBA (2020b), *Guidelines on Legislative and Non-legislative Moratoria on Loan Repayments Applied in the Light of the COVID-19 crisis*, EBA/GLA/2020/02, EBA.

Ewanchuk L., Frei Ch. (2019), Recent regulation in credit risk management: a statistical framework, *Risks,* 7(2), 1–19.

FCAG (2009), *Report of the Financial Advisory Crisis Group*, Financial Crisis Advisory Group, https://www.fasb.org/cs/ContentServer?d=Touc&c=Document_C&pagenam=FASB%2FDocument_C%2FDocumentPage&cid=1176156365880.

FSF (2009), *Report of the FSF Working Group on Provisioning*, Financial Stability Forum, https://www.fsb.org/wp-content/uploads/r_0904g.pdf.

Frykstrom N., Li J. (2018), *IFRS9 – the new accounting standard for credit loss recognition*, Sveriges Riks Bank Economic Commentaries, 3, Riksbank.

Gaffney E., McCann F. (2019), *The cyclicality in SICR: mortgage modelling under IFRS9*, Working Paper Series, 92/2019, ESRB.

Gaston E., Song I. (2014), *Supervisory roles in loan loss provisioning in countries implementing IFRS,* IMF Working Papers, WP/14/170.

Huizinga H., Leaven L. (2019), *The procyclicality of banking: evidence from the euro area*, Working Paper Series, 2288, June, European Central Bank.

Jiménez G., Saurina J. (2006), Credit cycles, credit risk, and prudential regulation, *International Journal of Central Banking*, June, 65–98.

Johannes R., Dedy D., Muksin A. (2018), The preparation of banking industry in implementing IFRS 9 financial instruments (a case research of HSBC Holdings Plc listed on London Stock Exchange of year 2015–2017), *International Journal of Economics and Financial Issues,* 8(6), 124–136.

Koleśnik J. (2020), The new European systemic approach to non-performing loans, in: E. Pohulak-Żołędowska (ed.), *The Impact of Economic Actors' Decision-making on Socio-economic Development*, Publishing House of Wrocław University of Economics and Business.

Korzeb Z., Niedziółka P. (2020), Resistance of commercial banks to the crisis caused by the COVID-19 pandemic: the case of Poland, *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 15(2), 205–234.

Korzeb Z., Niedziółka P. (2021), Determinants of differentiation of cost of risk among Polish banks during COVID-19 pandemic, *Journal of Risk and Financial Management*, 14(3), 205–234.

Kozińska M., Michalewicz J., Pycka J., Zdanowicz B. (2020), *Implikacje doświadczeń krajowych i międzynarodowych dla procesu zarządzania kryzysowego w polskim systemie finansowym*, Materiały i Studia, 336, Narodowy Bank Polski.

Kund A., Rugilo D. (2019), *Assessing the implications of IFRS9 on bank stress tests*, Occasional Paper Series, 12, July, ECRB.

Leaven L., Majnoni G. (2003), Loan loss provisioning and economic slowdowns: too much, too late?, *Journal of Financial Intermediation*, 12(2), 178–197.

Miu P., Ozdemir B. (2017), Adapting the Basel II advanced internal-ratings-based models for International Financial Reporting Standard 9, *Journal of Credit Risk,* 13(2), 53–83.

Novotny-Farkas Z. (2015), *The Significance of IFRS 9 for Financial Stability and Supervisory Rules*, European Parliament, Directorate General for Internal Policies, https://www.europarl.europa.eu/Regdata/etudes/STUD/2015/563461/IPOL_STU%282015%29563461_EN.pdf.

Risaliti G., Cestari G., Pierotti M. (2013), Global financial crisis and accounting rules: the implications of the new Exposure Draft (ED) "Financial Instruments: Expected Credit Losses" on the evaluation of banking company loans, *Journal of Modern Accounting and Auditing,* 9(9), 1141–1162.

Sanchez Serrano A. (2018), Financial stability consequences of the expected credit loss model in IFRS 9, *Financial Stability Review,* 34, 77–97.

Seitz B., Dinh T., Rathgeber A. (2018), Understanding loan loss reserves under IFRS 9: a simulation-based approach, *Advances in Quantitative Analysis of Finance and Accounting*, 16, 311–357.

Skwarzec M. (2020), Przesłanki zmian zasad wyceny aktywów finansowych w bankach jako efekt kryzysu finansowego 2007–2009, in: M. Wasilewski, J. Bereźnicka (eds), *Wybrane problemy finansów publicznych i przedsiębiorstw*, Wydawnictwo SGGW.

Ślązak E. (2011), Credit market imperfections in the theory of credit rationing, *Finansowy Kwartalnik Internetowy e-Finanse*, 7(4), 76–91.

Zaleska M. (2021), Reakcja sieci bezpieczeństwa finansowego na wybuch pandemii COVID-19, in: M. Zaleska (ed.), *Wpływ COVID-19 na finanse. Polska perspektywa*, Difin.

Appendix

Table 1
Three stages of loan impairment under IFRS 9

Low credit risk **Stage 1. Performing**	**Moderate credit risk** **Stage 2. Underperforming**	**High credit risk** **Stage 3. Non-performing**
Loan exposures for which the credit risk has not significantly increased since the initial recognition	Loan exposures for which credit risk has significantly increased since the initial recognition	Loan exposures where impairment has been identified
Credit write-off – expected loss within 12 months	Credit write-off – expected loss over the entire financing horizon	Credit write-off – expected loss over the entire funding horizon

Source: own compilation based on the provisions of IFRS 9.

Table 2
Descriptive statistics of the variables (in %)

Variable	Average	Median	Standard deviation	Minimum value	Maximum value
ST3_%	3.74	3.04	2.75	0.50	14.53
ST3_CR	47.21	45.57	13.38	20.73	80.00
ST2_%	8.12	7.42	3.41	2.80	26.18
ST2_CR	4.04	3.40	2.50	1.18	12.16
ST1_CR	0.26	0.21	0.24	0.02	1.26
PINC	1.49	1.23	4.04	-7.05	37.40
RET_%	50.37	50.66	11.82	25.89	80.62
CORP_%	38.99	36.65	10.35	21.34	58.50
MORT_%	38.56	39.24	13.82	7.07	67.69
PORT_%	58.61	63.01	13.48	25.62	83.29
L/D_%	96.12	89.85	26.51	51.03	172.00
TCR	19.27	18.99	3.31	12.32	32.10
ROA	0.57	0.55	0.50	-3.32	1.65
ROE	7.94	9.01	5.29	-21.20	19.20
GDP	-1.02	0.40	4.40	-19.50	3.70
IND_PR	-0.56	-0.30	4.84	-28.10	13.80
UN_RA	5.15	3.90	3.55	-10.60	16.00
RET_S	-0.11	0.20	3.75	-22.40	17.00

Source: own calculations.

Table 3
Results of the linear regression model for the sample of banks

Variable	Regression coefficient	p-value
Share of stage 2 in the bank's loan portfolio	0.0379	0.0000
Loan write-offs coverage in stage 2	0.1779	0.0000
Share of corporate customers in total loan portfolio	0.0128	0.0000
Share of the loan portfolio in total assets of the bank	0.0097	0.0000
Return on assets ratio	-0.6320	0.0000
Quarterly change in GDP level	-0.0285	0.0001
Number of observations – 220		
R^2 value for the model – 0.68		

Source: own calculations.

Table 4
Average level of cost of risk and average quarterly change in GDP for the research population of banks (in %)

Period	Average cost of risk for the population	Average quarterly change in GDP
Q1 2018	0.47	1.17
Q2 2018	0.41	0.96
Q3 2018	0.35	0.53
Q4 2018	0.46	0.90
Q1 2019	0.37	1.10
Q2 2019	0.57	0.49
Q3 2019	0.54	0.73
Q4 2019	0.46	0.14
Q1 2020	1.00	-1.65
Q2 2020	1.32	-11.48

Table 5
Results of the linear regression model for the population of domestic and EU banks

Variable	Regression coefficient	p-value	Variable	Regression coefficient	p-value
domestic banks			**EU banks**		
Share of stage 2 in the bank's loan portfolio	0.0466	0.0083	Write-off coverage of loan exposures in stage 2	0.0840	0.0000
Write-off coverage of loan exposures in stage 2	0.1532	0.0000	Return on assets ratio	-0.2048	0.0090
Share of retail loan exposures in total loan portfolio	-0.01266	0.0069	Quarterly change in GDP level	-0.05427	0.0000
Return on assets ratio	-0.9717	0.0000			
Number of observations – 82			Number of observations – 138		
R2 value for the model – 0.76			R2 value for the model – 0.57		

Source: own calculations.

Table 6
Average level of the cost of risk for the research population of banks (in %)

Period	Average cost of risk for the population	Domestic banks	EU banks
Q1 2018	0.47	0.68	0.14
Q2 2018	0.41	0.80	0.16
Q3 2018	0.35	0.76	0.14
Q4 2018	0.46	0.87	0.25
Q1 2019	0.37	0.68	0.18
Q2 2019	0.57	1.19	0.22
Q3 2019	0.54	1.01	0.26
Q4 2019	0.46	0.76	0.32
Q1 2020	1.00	1.26	0.86
Q2 2020	1.32	1.89	1.03

Source: own calculations.

Table 7
Share of stage 2 in the total loan portfolio and its coverage level (in %)

Period	Share of stage 2 in the portfolio		Write-off coverage of stage 2	
	domestic banks	EU banks	domestic banks	EU banks
Q1 2018	9.43	7.26	5.75	2.33
Q2 2018	9.90	7.78	5.46	2.87
Q3 2018	9.14	7.19	5.46	2.86
Q4 2018	8.82	6.81	6.36	2.85
Q1 2019	9.35	6.89	5.93	2.87
Q2 2019	8.47	6.62	6.20	2.76
Q3 2019	8.95	6.59	5.88	2.84
Q4 2019	8.15	6.49	6.32	2.84
Q1 2020	9.06	8.07	6.01	3.07
Q2 2020	10.07	10.93	6.17	3.15

Source: own calculations.

Table 8
Share of stage 3 in the total loan portfolio and its coverage level (in %)

Period	Share of stage 3 in credit portfolio		Loan write-offs coverage of stage 3	
	domestic banks	EU banks	domestic banks	EU banks
Q1 2018	6.07	3.74	63.98	36.76
Q2 2018	5.64	3.00	60.93	37.17
Q3 2018	5.55	2.92	61.03	39.65
Q4 2018	5.23	2.73	59.74	37.84
Q1 2019	5.35	2.70	60.05	39.98
Q2 2019	5.37	2.59	58.37	36.50
Q3 2019	5.53	2.55	59.11	39.58
Q4 2019	5.46	2.38	57.15	40.52
Q1 2020	5.56	2.49	59.15	44.15
Q2 2020	5.67	2.51	60.01	42.15

Source: own calculations.

Table 9
Cost of risk – key observations for the population of the domestic and EU banks

IFRS 9 framework	
domestic banks	**EU banks**
1. Cost of risk is higher than in EU banks (1.26% in Q1 2020 and 1.89% in Q2 2020)	1. Lower cost of risk (0.86% in Q1 2020 and 1.03% in Q2 2020)
2. Cost of risk increase in H1 2020 is less related to the increase in stage 2 exposures (from 8.15% of the portfolio to 10.07%)	2. The increase in cost of risk in H1 2020 is mainly due to an increase in exposures classified in stage 2 (from 6.49% of the portfolio to 10.93%)
3. Higher write-off coverage levels of bank loans in stage 3 than EU banks (60.01%) and stage 2 (6.17%)	3. Lower write-off coverage level in stage 3 is 42.15% and 2.51% for loans in stage 2
4. In the case of increased migration of loans from stage 2 to stage 3, a higher cliff effect than EU banks resulting from the difference in write-off coverage between stage 3 and stage 2 – 53.84 pp	4. Lower cliff effect resulting from the difference in write-off coverage between stage 3 and stage 2 – 39.64 pp

Table 10
Main opportunities and threats under IFRS 9 identified in the research

Opportunities	**Threats**
1. Rapidly reflect in the level of write-offs the effect of adverse changes in the macroeconomic environment, in particular those resulting from a decrease in GDP	1. Discretionary definitions as the rationale for loan classification into stage 2, which affects comparability of sectoral data
2. Introduction of classification into stage 2 as a measure to reduce the cliff effect in the case of a potential deterioration in the quality of the loan portfolio	2. Despite the introduction of stage 2, the cliff effect indicated as one of the weaknesses of the previous solution persists at a high level – the difference in the average level of coverage of stages 3 and 2 is 43.17 p.p. on the survey sample

Table 11
Correlation analysis of variables for all banks

Variables	ST3_%	ST3_CR	ST2_%	ST2_CR	ST1_CR	PINC	RET_%	CORP_%	MORT_%	PORT_%	L/D_%	TCR	ROA	ROE	GDP	IND_PR	UN_RA	RET_S
ST3_%	1.0000																	
ST3_CR	0.3949	1.0000																
ST2_%	0.3556	0.3488	1.0000															
ST2_CR	0.6577	0.3437	0.1376	1.0000														
ST1_CR	0.8056	0.3457	0.2483	0.8296	1.0000													
PINC	0.0136	0.1154	-0.0086	0.1130	0.1173	1.0000												
RET_%	0.1483	-0.2367	0.0962	0.1459	0.1646	-0.0514	1.0000											
CORP_%	-0.1778	0.3489	0.1960	-0.1900	-0.1687	0.0334	-0.4726	1.0000										
MORT_%	-0.1928	-0.4075	-0.0169	-0.2378	-0.2960	-0.1160	0.7535	-0.2626	1.0000									
PORT_%	0.2557	0.0456	-0.1893	0.1623	0.2297	0.0828	0.0152	-0.1552	0.0835	1.0000								
L/D_%	-0.3561	-0.5276	-0.3375	-0.4048	-0.4212	-0.0690	-0.0156	-0.2177	0.3056	0.3910	1.0000							
TCR	-0.4593	-0.4588	-0.1798	-0.4745	-0.4902	-0.0973	0.2163	0.0071	0.3956	-0.0562	0.4780	1.0000						
ROA	0.0204	0.3633	-0.0473	0.0795	-0.0174	0.0909	-0.1622	0.2309	-0.0577	0.2602	-0.0470	-0.0862	1.0000					
ROE	-0.0940	0.0743	-0.1807	-0.0611	-0.1498	0.0485	0.0213	0.1186	0.0843	0.3071	0.2958	0.1741	0.6507	1.0000				
GDP	0.0540	0.0146	-0.3452	0.0156	-0.0409	0.1485	-0.0397	-0.0627	-0.0328	0.2387	0.1649	-0.0427	0.3836	0.3804	1.0000			
IND_PR	0.0331	0.0465	-0.1506	0.0541	0.0616	-0.0561	0.0049	-0.0454	-0.0001	0.1208	0.0473	-0.0059	0.0374	0.0881	0.0758	1.0000		
UN_RA	0.0652	-0.1418	-0.1063	-0.0956	-0.0346	-0.1086	0.1036	-0.0146	0.2204	0.0193	0.0113	-0.1515	-0.1101	0.0845	-0.1569	0.0183	1.0000	
RET_S	-0.0343	-0.0672	-0.1191	-0.0270	-0.0118	-0.0191	-0.0420	-0.0490	-0.0204	-0.0567	0.0247	-0.0265	-0.0097	-0.0354	-0.0788	0.7438	0.0035	1.0000

Table 12
Statistical parameters of variables for all banks

Variable	Regression coefficient	Standard error	t Stat	Value-p value
Write-off coverage of loan exposures in stage 3 (ST3_CR)	0.0065	0.0026	2.4823	0.0138
Share of stage in total loan portfolio (ST2_%)	0.0380	0.0090	4.1970	0.0000
Write-off coverage of loan exposures in stage 2 (ST2_CR)	0.1780	0.0117	15.2669	0.0000
Loan portfolio growth rate (PINC)	0.0100	0.0068	1.4727	0.1423
Share of corporate loan exposures in total loan portfolio (CORP_%)	0.0129	0.0029	4.3726	0.0000
Share of loan exposures to natural persons secured by mortgages (MORT_%)	-0.0022	0.0023	-0.9703	0.3330
Share of the loan portfolio in total assets of the bank (PORT_%)	0.0097	0.0022	4.3668	0.0000
Loan portfolio to deposit ratio (L/D_%)	0.0005	0.0016	0.3431	0.7319
Total bank solvency ratio (TCR)	0.0119	0.0111	1.0792	0.2818
Return on bank assets (ROA)	-0.6321	0.0640	-9.8706	0.0000
Quarterly change in GDP level	-0.0285	0.0073	-3.8968	0.0001
Quarterly dynamics of the level of industrial production	0.0083	0.0057	1.4665	0.1440
Unemployment level	-0.0220	0.0079	-2.7808	0.0059

Table 13
Correlation analysis of variables for domestic banks

Variables	ST3_%	ST3_CR	ST2_%	ST2_CR	ST1_CR	PINC	RET_%	CORP_%	MORT_%	PORT_%	L/D_%	TCR	ROA	ROE	GDP	IND_PR	UN_RA	RET_S
ST3_%	1																	
ST3_CR	-0.4545	1.0000																
ST2_%	0.2805	0.3100	1.0000															
ST2_CR	0.7107	-0.6307	-0.2801	1.0000														
ST1_CR	0.8508	-0.5989	0.0520	0.7535	1.0000													
PINC	-0.1297	-0.1702	-0.1422	-0.0515	0.0097	1.0000												
RET_%	0.2292	-0.5535	-0.2415	0.2542	0.2650	0.0062	1.0000											
CORP_%	-0.4448	0.6936	0.4260	-0.6435	-0.5456	-0.0077	-0.7534	1.0000										
MORT_%	-0.2207	-0.1534	-0.0436	-0.1961	-0.3277	-0.0077	0.7399	-0.2908	1.0000									
PORT_%	0.4131	-0.7581	-0.0364	0.4198	0.3411	0.0909	0.5054	-0.4400	0.4042	1.0000								
L/D_%	0.2430	-0.5600	-0.1164	0.3063	0.1278	0.0827	0.4790	-0.4242	0.5178	0.8915	1.0000							
TCR	-0.2746	0.0945	-0.3022	-0.3121	-0.2774	-0.0749	0.4676	-0.1838	0.5266	-0.1360	-0.0404	1.0000						
ROA	-0.3964	0.2602	-0.0732	-0.2230	-0.3863	0.0291	-0.1992	0.2780	0.1319	-0.0988	0.0305	0.0558	1.0000					
ROE	-0.4203	0.0336	-0.2577	-0.1643	-0.3667	0.1088	-0.1649	0.2133	0.1203	0.0885	0.1426	0.0701	0.8628	1.0000				
GDP	-0.0154	0.0124	-0.0942	-0.0279	-0.0776	0.3025	-0.0966	0.0694	-0.0320	0.1593	0.2363	-0.0639	0.4292	0.4342	1.0000			
IND_PR	0.0107	0.0406	0.1201	0.0091	0.0612	-0.2122	0.0304	-0.0177	0.0213	-0.1198	-0.1747	0.1156	-0.1890	-0.2232	-0.7661	1.0000		
UN_RA	0.0126	0.1567	0.0912	-0.0543	-0.0025	0.1269	-0.1054	0.0880	0.0011	0.0126	0.0303	0.1152	0.2984	0.2655	0.1666	0.2709	1.0000	
RET_S	-0.0021	0.0166	0.0568	0.0047	0.0323	-0.1429	0.0009	-0.0040	0.0021	-0.0440	-0.0560	0.0710	0.0067	-0.0689	-0.4759	0.7890	0.3161	1.0000

Table 14
Statistical parameters of variables for the population of domestic banks

Variable	Regression coefficient	Standard error	t Stat	Value-p value
Share of stage 2 in total loan portfolio (ST2_%)	0.0466	0.0172	2.7106	0.0083
Write-off coverage of loan exposures in stage 2 (ST2_CR)	0.1532	0.0196	7.7969	0.0000
Write-off coverage of loan exposures in stage 1 (ST1_CR)	0.3575	0.2899	1.2333	0.2214
Loan portfolio growth rate (PINC)	0.0182	0.0088	2.0640	0.0425
Share of retail loan exposures in total loan portfolio (RET_%)	-0.0127	0.0046	-2.7747	0.0069
Share of the loan portfolio in total assets of the bank (PORT_%)	0.0050	0.0077	0.6511	0.5171
Total bank solvency ratio (TCR)	0.0538	0.0283	1.8997	0.0614
Return on bank assets (ROA)	-0.9717	0.0856	-11.3502	0.0000
Quarterly change in GDP level	-0.0123	0.0206	-0.5982	0.5516
Unemployment level	-0.1181	0.1550	-0.7617	0.4487
Quarterly retail sales growth	0.0489	0.0175	2.7973	0.0065

Table 15
Correlation analysis of variables for EU banks

Variables	ST3_%	ST3_CR	ST2_%	ST2_CR	ST1_CR	PINC	RET_%	CORP_%	MORT_%	PORT_%	L/D_%	TCR	ROA	ROE	GDP	IND_PR	UN_RA	RET_S
ST3_%	1.0000																	
ST3_CR	0.4416	1.0000																
ST2_%	0.3108	0.2618	1.0000															
ST2_CR	0.1856	0.2700	0.3000	1.0000														
ST1_CR	0.5222	0.3354	0.3213	0.6942	1.0000													
PINC	-0.0336	0.1058	0.0313	0.1235	-0.0014	1.0000												
RET_%	0.1070	-0.2753	0.2672	0.0911	0.1382	-0.1318	1.0000											
CORP_%	-0.1444	0.0967	-0.0180	0.0485	0.0248	0.0176	-0.2847	1.0000										
MORT_%	0.0409	-0.5256	0.0877	-0.0556	-0.0159	-0.1855	0.8165	-0.1773	1.0000									
PORT_%	-0.0308	-0.1689	-0.3706	-0.3770	-0.2079	-0.0147	-0.1579	-0.1518	0.0807	1.0000								
L/D_%	-0.3851	-0.3866	-0.3285	-0.5452	-0.6438	-0.0231	-0.0980	-0.1409	0.2292	0.5767	1.0000							
TCR	-0.4062	-0.4178	-0.0302	-0.4228	-0.5880	0.0023	0.1567	0.2338	0.2715	0.1350	0.4557	1.0000						
ROA	0.0703	0.0492	-0.2264	-0.1438	-0.2082	0.0122	-0.1822	0.0570	-0.1063	0.3401	0.1886	0.0903	1.0000					
ROE	-0.0262	0.0298	-0.1886	-0.1456	-0.2565	-0.0061	0.0859	0.0672	0.1039	0.3459	0.3861	0.2589	0.6934	1.0000				
GDP	-0.0376	-0.1982	-0.5026	-0.1737	-0.3466	0.0250	-0.0247	-0.1823	0.0170	0.2112	0.2553	0.0402	0.3763	0.3607	1.0000			
IND_PR	-0.0573	-0.0927	-0.3253	-0.0429	-0.1026	0.0469	-0.0117	-0.1021	0.0280	0.1575	0.1533	0.0125	0.1621	0.1820	0.3433	1.0000		
UN_RA	0.4789	0.2374	-0.0350	0.3119	0.5720	-0.0906	0.1547	0.0697	0.2157	0.1768	-0.1611	-0.3955	0.0305	0.1255	-0.1271	0.0660	1.0000	
RET_S	-0.0482	-0.1111	-0.1792	-0.0436	-0.0338	0.0722	-0.0582	-0.0729	-0.0401	-0.0558	0.0285	-0.0650	-0.0098	-0.0260	0.0200	0.7487	-0.0142	1.0000

Table 16
Statistical parameters of the variables for EU banks

Variable	Regression coefficient	Standard error	t Stat	Value-p value
Share of stage 3 in total loan portfolio (ST3_%)	0.0285	0.0131	2.1747	0.0314
Write-off coverage of loan exposures in stage 3 (ST3_CR)	0.0010	0.0033	0.2931	0.7699
Share of stage 2 in total loan portfolio (ST2_%)	0.0059	0.0104	0.5630	0.5744
Write-off coverage of loan exposures in stage 2 (ST2_CR)	0.0841	0.0186	4.5225	0.0000
Loan portfolio growth rate (PINC)	-0.0053	0.0088	-0.6025	0.5479
Share of corporate loan exposures in total loan portfolio (CORP_%)	0.0036	0.0022	1.6705	0.0972
Share of retail loan exposures in total loan portfolio (RET_%)	0.0062	0.0029	2.1234	0.0356
Share of the loan portfolio in total assets of the bank (PORT_%)	0.0013	0.0024	0.5428	0.5883
Loan portfolio to deposit ratio (L/D_%)	0.0028	0.0011	2.4930	0.0139
Total bank solvency ratio (TCR)	-0.0008	0.0111	-0.0674	0.9464
Return on bank assets (ROA)	-0.2048	0.0773	-2.6509	0.0090
Quarterly change in GDP level	-0.0543	0.0056	-9.6143	0.0000
Quarterly dynamics of the level of industrial production	0.0038	0.0052	0.7286	0.4676
Unemployment rate	-0.0145	0.0071	-2.0538	0.0420

Table 17
Statistics of the linear regression model describing the dependence of the cost of risk on statistically significant variables for the sample of all banks

Regression statistics	Value
The multiple of R	0.8262
R square	0.6826
Matching R square	0.6736
Standard error	0.0041
Number of observations	220

Table 18
Statistics of the linear regression model describing the dependence of the cost of risk on statistically significant variables for the sample of EU banks

Regression statistics	**Value**
The multiple of R	0.7591
R square	0.5763
Matching R square	0.5668
Standard error	0.0030
Number of observations	138

Table 19
Statistics of the linear regression model describing the dependence of the cost of risk on statistically significant variables for the sample of domestic banks

Regression statistics	**Value**
The multiple of R	0.8730
R square	0.7620
Matching R square	0.7497
Standard error	0.0045
Number of observations	82