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Contents

A WORD FROM THE EDITOR

The nineteenth year of publishing "Safe Bank" magazine comes to a close. During this period, the magazine's profile evolved from the narrow subject of deposit guarantee and bank security to the financial stability and financial market instruments themes. These 19 years of the Safe Bank presence constitute over 60 percent of the transformation period of the Polish banking system, which has been initiated at the National Bank of Poland in 1986. However, the subject matter of studies of no 69 do not concern issues considered from the perspective of the 30th anniversary of transformation. Nevertheless, observing the processes taking place in these years, it is worth to briefly recall the most important characteristics of the banking system in Poland.

In contrast to many banking systems in Europe and in the world, the Polish banking system is distinguished by a specific path of transformation - not only in the last three decades but also in secular terms. Without touching the history of banks on Polish territory before the 17th century the development of the three system-wide banking infrastructures with clear influence of the occupants, i.e. Austria, Prussia and Russia until the beginning of the 20th century needs to be mentioned. This affected primarily the capital weakness of financial institutions that began to develop in Poland after 1918. Another important system discontinuity were the events and regulations related to the Second World War and the destruction of the relatively young financial services market that was successfully built during the Second Republic of Poland in the years 1918–1939. In comparison to other market economy countries it is impossible to treat the period 1945–1990 as one in line with the development of the market banking system in Poland. This is where the system of the centralized economy reigned supreme with the typical accounting role of cash, and above all the lack of capital accumulation, propensity to save or credit history.

The banking reform begun in 1986 by Prof. Władysław Baka – the President of the National Bank of Poland – gave rise to the intensive development of credit institutions in Poland during the systemic transformation. This concerned, in the first place, the separation of nine commercial banks from the structure and

resources of the Polish central bank. In this period, apart from transforming several state-origined banks into market-based business rules, new and relatively numerous commercial banks have been also established. This was favored, amongst others, liberal licensing policy. In this period, apart from transforming several state-owned banks into market rules, there were also new and relatively numerous commercial banks. This was favoured, among others, by liberal licensing policy. In the peak of expansion, over 100 commercial banks had a business operations license. A lot of changes took place also in the state-cooperative organizational structure of cooperative banks, the number of which at the beginning of the market transformation constituted ca. 1650. The dynamics of system changes in Poland and the lack of experience in the functioning of banks quickly led to numerous insolvency crises in both commercial and cooperative banks. Initially, the weakness of the safety net and, in addition, the inability to quickly recapitalize problematic commercial banks favored the acquisition of industry foreign investors, who ensured the stability of the acquired entities. On the other hand the cooperative banks benefited mainly from various reliefs and assistance from state bodies and mergers and acquisitions. The banking supervision policy was aimed at diversification of the presence of foreign capital in the Polish banking sector. In the then system conditions, the cost of a financial institution takeover together with the market potential for a foreign industry investor was relatively low. However, it helped to overcome the banking crisis of the 1990s. A special emphasize should be put on the fact that the Polish banking system did not require a real-life intervention during the global financial crisis in the first decade of the 21st century. During this period, not only that no bank collapsed, but there was even no need to use the funds accumulated in the Bank Guarantee Fund for the restructuring of even one credit institution. Yet, the creation of legal infrastructure and prudential standards limiting the potential consequences of problems in banks in Poland echoed the turbulence triggered on foreign financial markets.

For a number of years, consolidation processes are being noticeable in the Polish sector, which apart from typical business processes in the domestic market constituted a consequence of consolidation of foreign parent companies of daughter banks in Poland, especially after 2008. In this context, it is worth pointing out that after 2015, the purchase of foreign investors' shares in banks was initiated by subsidiaries of the State Treasury, as a part of the so-called banks repolonization policy while Law and Justice ("Prawo i Sprawiedliwość") government.

Apparently it concerned the purchase of 33 percent of shares of Bank PeKaO S.A., the second largest bank in Poland, from the Italian Uni Credit, as well as increasing the share of a state-owned investor in the largest Polish bank PKO BP S.A. In the banking community, we also talk about the merger, in 2018, of the two largest banks in Poland into one entity. It would give 26.3 percent. market share of around 15 million clients. Such a merged bank would also be the largest

company on the Warsaw Stock Exchange with a capitalization of approximately PLN 84,000 million (ca. EUR 20,000 million). According to projections, the second largest bank BZ WBK SA (dependent on the Spanish Santander Bank), even after the possible takeover of Deutsche Bank Polska would have to satisfy with 10 percent share in the assets of the Polish banking sector; likewise the next one: ING Bank Śląski (dependent on the Dutch ING Bank). In comparison to other markets of Central and Eastern European countries, the projected changes in Poland will still not cause a serious increase in the concentration of thee three or five largest domestic banks. While PKO BP and PeKaO merger will trigger that the newly created entity will significantly improve its position in the European banks ranking.

In the presented issue of «Safe Bank», the subject matter of structural changes in the Polish banking sector is not tackled, at least in historical terms. We publish seven studies on various topics, concerning the banking system and banking-related institutions, not only in the Polish perspective. We also hope that the review of Henryk Dembiński›s book entitled «Ethics and responsibility in the world of finances" will contribute to popularization of its content not only among Polish readers.

With wishes of fruitful reading

Jan Szambelańczyk
Editor-in-Chief

Problems and Opinions

Karol Strzeliński[*]

RISK MANAGEMENT AND PROCYCLICALITY IN BANKS. SOME OBSERVATIONS FROM EU BANKING SECTOR SURVEY[**]

1. INTRODUCTION

Last financial crises brought doubts regarding efficiency of existing solutions in the field of capital adequacy to ensure the safety of the worldwide banking system, and induced a "regulatory tsunami" – launched a number of initiatives among various international bodies such as the Basel Committee on Banking Supervision, the European Commission and the European Banking Authority (EBA, formerly CEBS) to supplement or modify existing regulations to prevent similar crisis in the future. Among shortcomings of the regulations and supervision then in force one can distinguish procyclicality of capital adequacy regime, microprudential approach to supervision and microprudential nature of regulations. To remedy these drawbacks international prudential standards (so called Basel regulations) have been modified and supplied with elements aimed to strengthen bank capital base and bank liquidity position as well as reduce excessive risk taking and cyclicality of credit granting. In European Union (EU) these modifications have been finally connected with "single rule book" concept[1] in order to prevent regulatory arbitrage among

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[1]   While Basel prudential standards and directives implementing them to EU law before 2014 (*Directive 2006/48/EC of the European Parliament and of the Council of 14 June 2006 relating to the taking up and pursuit of the business of credit institutions*, European Parliament;

various European jurisdictions and to facilitate creation of single EU financial market. In this paper procyclicality issue and some solutions to deal with it are only tackled. The term procyclicality, in context of banking regulation, describes a situation where interaction between financial sector and real economy reinforces each other increasing business cycle fluctuations and financial instability[2]. The basis for this phenomenon is close connection among the presence of financial market, availability of credit and economic growth. Such a relationship indicates for example Levine and Zervos[3], Koivu[4] or Demetriades and Hussein[5]. Last financial crisis clearly showed this kind of mechanism in practice when many financial institutions, mostly banks, facing troubles with reconstruction of own funds and fulfilling regulatory requirements (capital adequacy ratios) were forced to deleverage and limit credit granting (credit crunch). This move, in turn, induced decrease of economic activity and further decrease of economic growth.

Literature indicates several sources of procyclicality and many of them are closely interlinked with each other. Probably the most common are:

❖ construction of capital adequacy regime, variable risk perception and variable risk appetite,

❖ information asymmetry and insufficient level of control (both on ownership and customer side),

❖ interconnectedness of financial institutions, and their herding behaviour leading to firesale and abrupt fall of asset prices.

The philosophy of capital adequacy regime is procyclical by nature – the higher the risk of particular exposure the higher capital requirements should be and it is harder, ceteris paribus, to maintain similar capital adequacy ratio, but risk perception and risk appetite also vary in procyclical manner. Bankers have the higher risk appetite and during prosperity period they perceive risk as lower

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Directive 2006/49/EC of the European Parliament and of the Council of 14 June 2006 on the capital adequacy of investment firms and credit institutions, European Parliament) assumed minimum level of harmonization of the rules among different jurisdictions, new EU law force full harmonization of most rules and introduce them using directly applicable Regulation of The European Parliament and Of The Council (*Regulation (EU) No 575/2013 of The European Parliament and Of The Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012*, European Parliament).

[2] *Addressing financial system procyclicality: a possible framework. Note for the FSF Working Group on Market and Institutional Resilience*, Bank for International Settlements 2008, p. 1.

[3] R. Levine, S. Zervos, *Stock Markets, Banks, and Economic Growth*, American Economic Review 1998.

[4] T. Koivu, *Do efficient banking sectors accelerate economic growth in transition countries?*, The Bank of Finland Institute for Economies in Transition 2002.

[5] P.O. Demetriades, K.A. Hussein, *Does financial development cause economic growth? Time-series evidence from 16 countries*, Journal of Development Economics 1996, 51(2), 387–411.

than it actually is and they take excessive risk. This mechanism became even more evident a few years before the onset of the financial crisis after introduction of so called Basel II banking capital regulations. New standards linked more closely the capital requirements with riskiness of particular activities of banks, especially various types of assets and off-balance sheet items. The improved risk measurement helped with daily risk management in banks, but simultaneously it increased influence of current macroeconomic situation on particular market on bank capital requirement. Additionally, Basel II allowed to use more advanced capital requirements calculation methods based on statistical models[6], which are said to be more procyclical than a standardized method, that is more close to previous capital adequacy regime – Basel I[7]. Higher capital requirements for riskier activities are intended to limit excessive risk taking and provide enough capital for potential losses. However, during economic prosperity period, optimism among risk dissidents raised, increasing risk appetite and risk tolerance in banks which resulted in eased criteria and conditions of credit granting. This led to excessive risk taking but simultaneously capital and liquidity buffers were not rising enough for potential trend reversal despite the fact it was cheaper than in downturn period. Excessive risk taking by bankers was also possible because of information asymmetry between banks and their customers and shareholders. Bankers did not bear direct responsibility for their decisions, did not risk their own money and were concentrating on achieving short-term goals. Depositors did not know the real level of risk their funds were exposed to and did not move to less risky institutions. Shareholders also rarely knew the real level of risk taken by bank managements and did not appeal these managers from the post. Even rules set in the field of market discipline, which were a part of Basel II regulations (pillar 3), were not able to improve this situation.

Capital requirements and market discipline did not limit excessive risk taking and was not able to internalize external costs from the crisis induced by regulated institutions. The assumption made by capital adequacy originators, in which the whole system will be safe if the safety of each individual institution is guaranteed, turned out to be false[8]. At the beginning of last financial crisis individual banks and other financial market participant, wanting to protect themselves against losses or deleverage in order to maintain capital adequacy ratio, started selling assets considered as risky. Since significant number of market participants behaved in

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[6] Internal Rating Based Approach (IRB) for calculation of capital requirement for credit risk.

[7] E. Jokivuolle, I. Kiema, T. Vesala, *Credit allocation, capital requirements and procyclicality*, Bank of Finland Research Discussion Paper 2009 No. 23/2009, 1–43; C. Goodhart, B. Hofmann, M. Segoviano, *Bank Regulation and Macroeconomic Fluctuations*, Oxford Review of Economic Policy 2004, 20 (4), 591–615.

[8] A. Persaud, *Macro-Prudential Regulation Fixing Fundamental Market (and Regulatory) Failures, Crisis Response Note number 6*, July, World Bank 2009.

the same manner they induced the fire-sale and brought danger on every market participant. Decreased asset price started a spiral of price reductions, which ended with liquidity and capital problems of these institutions.

Since the crisis procyclicality issue has been recognized as important one more and more initiatives to reduce it are taken. Generally applicable banking capital adequacy regulations have been changed (Basel III[9] or CRDIV/CRR regulatory package[10] in EU) and these changes enabled authorities in every country to conduct macro-prudential policy and implement tools directly countercyclical such as countercyclical capital buffers. Other new tools in macroprudential arsenal are the leverage ratio limit, the possibility to increase risk weights for exposures posing systemic risk (like in standardized approach possibility to increase risk weights for exposures secured by mortgages on immovable property in order to prevent asset bubble on real estate market) or to use other non-harmonized measures like tools based on limits on Loan-to-Value (LtV)[11] ratio or Debt-to-Income (DtI)[12] ratio to prevent systemic risk. Some researchers[13] and international organisations[14] consider also adjusting these tools anticyclical to supplement countercyclical

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[9]   Basel III is a comprehensive set of reforms of Basel Committee on Banking Supervision standards regarding banks' capital adequacy, in force in those days, which aim is to strengthen the regulation, supervision and risk management of the banking sector. Presently Basel III regulatory framework among other thing consists of *Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework – Comprehensive Version*, Bank for International Settlements, Basel Committee on Banking Supervision 2006; *Revisions to the Basel II market risk framework*, Bank for International Settlements, Basel Committee on Banking Supervision 2009; *Basel III: A global regulatory framework for more resilient banks and banking systems*, Bank for International Settlements, Basel Committee on Banking Supervision 2011; *Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, Bank for International Settlements, Basel Committee on Banking Supervision 2013; *Basel III: the net stable funding ratio*, Bank for International Settlements, Basel Committee on Banking Supervision 2014.

[10] The package consist of: *Directive 2013/36/EU Of The European Parliament and of The Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC* and *Regulation (EU) No 575/2013 of The European Parliament and Of The Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012*, and it implements Basel III rules into EU law.

[11] LtV – the ratio of the value of loan outstanding to current value of property on which the loan was secured.

[12] DtI – the ratio of expenses related to the operation of credit obligations and/or other liabilities to income of the debtor.

[13] See e.g. D. Igan, H. Kang, *Do Loan-to-Value and Debt-to-Income Limits Work? Evidence from Korea*, IMF Working Paper 2011.

[14] See e.g. *Recommendation Of The European Systemic Risk Board of 4 April 2013 on intermediate objectives and instruments of macro-prudential policy (ESRB/2013/1)*, European Systemic Risk Board.

buffer. Obviously, the question arises whether they constitute the most appropriate solution to the procyclicality problem. This research focuses only on anticyclical use of tools based on LtV and DtI.

General motivation to conduct the research, which is the topic of this paper, is widespread uncertainty regarding use of proposed macroprudential tools and work carried by central banks or macroprudential supervisory bodies analysing transmission mechanisms of all prudential regulations on financial stability. There is still small experience with the use of macroprudential tools over the world and most of the tools regulators have experience with, have been primary used for microprudential purpose. Since their use was rather not coordinated with monetary policy, it might have entailed loss in efficiency of monetary policy or weaken economic growth. Particular aim of this research is to give some insight on the issue of procyclicality of banking activity stemming from Basel banking regulations and banks' management practices. This research tries to verify whether the Basel banking regulation procyclicality issue is a common problem among EU banks and whether it applies to all portfolios. Therefore, it analyses influence of prudential regulations regarding capital requirements and capital adequacy on the credit granting since their first formation and implementation– whether they are in fact the source of procyclicality and make credit granting fall during recession periods. This is also an occasion to verify whether more advanced methods of calculation of capital requirements are equally procyclical as the standardized method[15] – standardized approach under Basel II regime or method of calculation of capital requirement for credit risk from Basel I. Finally, the author wants to check whether application of efficient anticyclical tools based on LtV or DtI limits is always possible or whether it requires additional supporting actions. Testing this involves determining jurisdictions, time periods and credit segments where such regulatory limits were in force and whether banks used then own limits regarding credit granting (LtV, DtI and other own limits) more stringent than supervisory ones.

In order to answer those questions an attempt of survey research among individual banks from EU was taken. Questions in the survey tried to investigate presence of regulatory limits as well as bank's own limits based on LtV, DtI or other limits regarding credit granting (e.g. maximum maturity, liquidity standards) in different periods of time. The survey asked also about the method used by bank in calculation of capital requirement for credit risk and the use

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[15] Standardized methods are not free from procyclicality problem because external ratings assigned by External Credit Assessment Institutions (ECAI), that are used in standardized approach to risk weighting for capital requirement purpose, can behave procyclically (J.D. Amato, C.H. Furfine, *Are credit ratings procyclical?*, BIS Working Papers 2003, No. 129, Bank for International Settlements), and accounting rules cause cyclical behavior of bank balance sheet and regulatory capital.

of statistical methods in its credit granting process. Finally, the survey tried to determineinfluenceoftheabovementioned limits, changes in bank's capital position and other bank's characteristics on changes in credit supply in different period of time.

The author decided to conduct the survey because data at individual bank level, covering simultaneously regulatory constraints and bank's own credit policy constraints, are unavailable. Most papers with empirical studies on procyclicality issue focus on regulatory side only. They base their analysis on information about presence of certain regulatory constraints or values of general indices of banking supervision stringency and ignore procyclical changes of banks' risk appetites and risk tolerances. Even if there are some papers trying to determine cyclicality of credit granting studying changes of banks' internal decisions regarding risk appetite and risk tolerance, they are based on information from central banks' bank lending surveys. The range of information from these surveys that can be useful in analysis of changes of risk appetites in banks' credit portfolios is limited and the history of these surveys in Europe is relatively short. What is more, information on LtV and DtI limits became the subject of research in recent years and mostly among regulators, central bankers or policymakers (e.g. European Commission) but they focus mostly on international experience of using regulatory limits or analyse actual values of LtV or DtI ratios in particular portfolios of banks under their supervision.

Because the final number of survey participants was very low performance of meaningful econometric analysis was not possible and the author decided to conduct a kind of a case study analysis. However due to confidentiality obligations presentation of results may differ from typical case study analyses. It is because the author cannot always present exact number of banks with particular characteristics (e.g. country of origin connected with relative asset size and/or method of calculation of capital requirement). This also means that a reader has to be cautious while drawing more general conclusions from this research. Nevertheless, this paper can be considered as a presentation of the research methodology and a signpost showing areas worth further research.

The rest of this paper is organized as follows. Section 2 presents main trends in empirical research on Basel banking regulation procyclicality issue with brief literature review. It also explores some shortcomings of using some of these approaches. Section 3 describes the author's survey research, including motivation behind its every question. Section 4 contains results of the survey and attempts of their interpretation. Section 5 summarizes the author's work and *submits proposals of research modifications* that could be performed by the central banks or bank supervisory authorities.

2. EMPIRICAL RESEARCHES ON PROCYCLICALITY
OF BASEL BANKING REGULATIONS

There are several major trends in empirical research on capital adequacy procyclicality issue. In particular, one can distinguish three groups of papers:

❖ papers using the calibrated general equilibrium model or dynamic stochastic general equilibrium model with financial sector where the capital adequacy procyclicality mechanism is mimicked and its mitigation using anticyclical capital buffer or other tools is tested;

❖ papers with econometric models (often panel models) examining relationship between credit growth or lending and deposit spreads and various bank balance sheet data, credit portfolio quality indicators (e.g. nonperforming loans ratio), indicators of business cycle phase or gdp growth, indices of stringency of banking regulations and supervision or indicators based on the results from bank lending surveys;

❖ official reports prepared by bank supervisory authorities based on bank level data presenting effects of supervisory actions like imposition of regulatory limits on LtV or DtI that bank must comply with while granting new credits, or examining changes in capital requirements for credit risk, components taking part in their calculation and credit growth in various segments of the credit market.

As a great example of the first group of papers, one can indicate papers by Repullo and Suarez[16] or Clerc et al.[17] In the first paper Repullo and Suarez[18] present dynamic equilibrium model developed and calibrated (based on data from US banks) focusing on microprudential role of capital requirements and capital adequacy regime and their procyclical effects on bank credit supply. In this model we have banks granting credits, their investors – a source of additional equity capital – and enterprises that need a credit to realize their investment projects. In this setup different capital regulation regimes are compared – Basel I, Basel II and a hypothetical one that maximizes the measure of social welfare. Authors show that Basel II regime is more procyclical than its predecessor, but makes banks safer since it reduces banks probabilities of failure. They also try to prove that for high values of social cost from bank failure, introduction of Basel III capital adequacy regime may be a good solution, with higher but less cyclically-varying

[16] Repullo R., Suarez J., *The procyclical effects of bank capital regulation*, CEMFI Working Paper 2012, No. 1202.

[17] L. Clerc, A. Derviz, C. Mendicino, S. Moyen, K. Nikolov, L. Stracca, J. Suarez, A.P. Vardoulakis, *Capital Regulation in a Macroeconomic Model with Three Layers of Default*, Banque de France Working Paper 2014, No. 533.

[18] R. Repullo, J. Suarez, *The procyclical effects…*, *op. cit.*

capital requirements. The next paper presents dynamic general equilibrium model not calibrated to any specific country, but more sophisticated than many models previously designed and better reflecting some mechanisms behind banking activity, which allows to consider it as a workhorse for future studies on macroprudential solutions. It contains intermediation chain linking depositors – households – with borrowers – households and enterprises – via banks that are subject to capital adequacy regulation, and allows for explicit default in every sector included in the model. In other such models the default option is ruled out in the optimum. Some results presented in this paper show that lower leverage and a larger cost of equity funding in the short run, make banks less fragile, but, too high levels of capital requirements may unduly restrict credit availability. All of the abovementioned papers focus on selected macroprudential issues and do not take into account some elements of complex procyclicality mechanism as well as specificity of prudential regulations and supervisory actions (like imposing additional regulatory measures), which differ in various countries and individual bank lending policies that vary dependent, inter alia, on competition level, business cycle or segment of the credit market. Another group of papers is partly free of these disadvantages but these papers have their own drawbacks.

Most papers involving econometric analysis on procyclicality issue focus on regulatory side. They base their analysis on information about presence of certain regulatory constraints or values of general indices of banking supervision stringency and ignore procyclical changes of banks' risk appetites and risk tolerances. Many of them are based on the survey research conducted under the auspices of the World Bank by Barth, Caprio, Levine[19] who conducted several times[20] the research survey among bank supervisory bodies in countries around the globe and create database which is still unique source of comparable data on some aspects of banking activities and on how banks are regulated and supervised around the world[21]. This database covers many aspects of banking including: capital requirements, activity restrictions, loan classification and requirements provisioning troubled bank resolution actions, and the quality of supervisory personnel and their actions. Unfortunately, in case of some papers analysing procyclicality of banking activity, the use of these pieces of data may constitute an abuse. Barth, Caprio and

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[19] J. Barth, G. Caprio, R. Levine, *The regulation and supervision of banks around the world – a new database*, Vol. 1, 2001.

[20] J. Barth, G. Caprio, R. Levine, *The regulation…*, *op. cit.*; J. Barth, G. Caprio, R. Levine, *Rethinking Bank Regulation: Till Angels Govern*, Cambridge University Press, New York 2006; J. Barth, G. Caprio, R. Levine, *Bank Regulations Are Changing: For Better or Worse*, World Bank 2008; J. Barth, G. Caprio, R. Levine, *The Evolution and Impact of Bank Regulations*, World Bank 2012.

[21] 2012 edition of this survey covers information from 143 jurisdictions.

Levine[22] provide readers with general indices of the regulatory restrictiveness or supervisory power[23], but these measures do not have much in common with capital adequacy mechanisms *i.e.* there is no measure like restrictiveness of rules regarding capital requirements calculation behind those indices. What is more, their database in many aspects contains only information on legal possibilities of actions of financial supervision authorities and not on the real scale of their use. It also ignores supervisory requirements being the soft law in the form of recommendations or industry standards. An example of paper abusing these data might be the one by Olszak et al.[24] where authors try to determine whether cyclicality of loan loss provisions and income smoothing through loan loss provisions contribute to procyclical impact of capital ratio on credit growth in banks in the EU. For this purpose, they use financial data on individual banks of the EU from Bankscope database, stringency indices from Barth, Caprio and Levine[25] and estimate panel model. They claim that more stringent regulations and supervision reduce the magnitude of negative effect of capital ratio on bank lending. What is more, their capital ratio represents rather reversed traditional leverage ratio[26], which does not have much in common with procyclical capital adequacy ratios. Another paper using almost the same set of data is one by Fonseca et al.[27] In their research the authors created a panel model to inspect influence of the capital buffer – the excess over minimum regulatory capital – on lending and deposits rate spreads. Results of their analysis show that well-capitalized banks are less constrained by capital requirements, have lower interest spreads on their loans and lower interest

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[22] J. Barth, G. Caprio, R. Levine, *Bank Regulation and Supervision in 180 Countries from 1999 to 2011*, World Bank 2013.

[23] These indices are: Index of restrictiveness in permitting banks to engage in non-bank activities such as insurance, investment banking and real estate; Index of the stringency of bank capital regulations measuring categorized amount of capital banks must hold; Index of official supervisory power measuring the degree to which supervisor has the authority to take specific actions; Overall capital stringency categorizing information whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined (see J. Barth, G. Caprio, R. Levine, *Bank Regulation...*, *op. cit.* for more details).

[24] M. Olszak, M. Pipień, S. Roszkowska, I. Kowalska, *The effects of capital on bank lending of EU large banks – The role of procyclicality, income smoothing, regulations and supervision,* paper presented at NBP's Economic Institute seminar on 24 February 2015.

[25] J. Barth, G. Caprio, R. Levine, *Rethinking Bank Regulation...*, *op. cit.*

[26] It differs substantially from the leverage ratio defined in CRDIV/CRR regulatory package. The former is based on the exposure measure which includes among other thing off-balance sheet items.

[27] A.R. Fonseca, F. González, L. Pereira da Silva, *Cyclical Effects of Bank Capital Buffers with Imperfect Credit Markets: international evidence*, Banco Central do Brasil Working Paper Series 2010, No. 216.

spreads on deposits they offer. They also put a dummy variables in the model to separate period of time with different capital adequacy regimes. Their analysis, though, do not provide statistically significant differences in procyclicality between Basel I and Basel II. However, their analysis does not take into account any proxies for changes in demand for credit or changes in bank lending policies.

Papers trying to determine cyclicality of credit granting studying changes of banks' internal decisions regarding risk appetite and risk tolerance are based on information from central banks' bank lending surveys – the source of information of which main goal is to cognize banks' opinion on changes of trends in credit standards, conditions and terms and also opinion on changes in demand for credit. An example of such papers can be the one by Blaes[28], who analysed slowdown in bank lending to non-financial corporations in Germany during recent financial crisis. He used data on individual bank level from the survey and combined them with data on loan quantities and prices. His findings confirm the link of credit supply factors with slowdown in lending during crisis. Another example of a paper using bank lending survey results in explaining procyclicality is the one by Labonne and Lamé[29], where they use dataset for the French banking sector combining confidential bank-level bank lending survey answers with the discretionary capital requirements set by the supervisory authority (pillar 2). They found that on average, more capital favours credit growth, but the regulatory capital elasticity of lending depends on the severity of the supervisory capital constraint and more constrained banks (capital requirement higher than supervisory minimum) tend to have a credit growth less sensitive to the capital ratio. But this effect weakens close to the supervisory minimum capital requirement. Despite the fact that bank lending surveys are conducted in every EU country and questions' coverage is more or less standardized, their usage in assessing bank capital adequacy procyclicality seems limited. Their results are publicly available only in aggregate form and in most cases as weighted net percentage[30] only. This makes almost impossible for researchers out of central banks to conduct such analysis and to cover different countries in one analysis. Additionally, weights used for this aggregation of answers – bank's share in outstanding amount of loans in particular segment of the credit market – may have few in common with actual size of credit granted

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[28] B. Blaes, *Bank-related loan supply factors during the crisis: an analysis based on the German bank lending surv*ey, Discussion Paper Series 1: Economic Studies No 31/2011, Deutsche Bundesbank.

[29] C. Labonne, G. Lamé, *Credit Growth and Bank Capital Requirements: Binding or Not?*, Banque de France Working Papers 2014.

[30] Weighted net percentage (tightened minus eased or reverse), based on the share of each bank in the total loan outstanding amount of the banks in the bank lending survey sample. See J. Berg, A. Rixtel, A. Ferrando, G. Bondt, S. Scopel, *The Bank Lending Survey for The Euro Area*, European Central Bank Occasional Paper Series No. 23 / February 2005., p. 26–27.

in accordance with the credit policy from this particular period. Instead of outstanding amount of loans, the use of the share in flows of credits granted in particular period would be desired. What is more, for some EU countries time series of data from a bank lending survey is limited to the last few years[31]. The content of the questions also does not meet all the needs. There is no information regarding method of calculation of capital requirements used by bank. Results contain only general information on changes of costs related to bank's capital position, but this position can be influenced either by the composition of bank's credit portfolio and changes in exposures value or method of calculation of capital requirements used by a particular bank. Based on data from bank lending surveys it is also not possible to derive more detailed findings regarding existing liquidity constraints or availability of various categories of funding (like households deposits, operations in the wholesale interbank market, equity or debt instruments issuance, loans from the parent company). Finally, information regarding the use of LtV limit for other categories of credit than credit for the house purchase is practically not available and information on DtI limits is not available at all.

Still negligible presence of LtV and DtI limits in bank lending surveys can partly be explained by the fact that these limits became the subject of intense research in recent years and the scope of bank lending surveys do not change that fast. However, more and more articles on these limits nowadays may influence content of the future surveys. An example of a paper investigating use of LtV and DTI regulations in a particular country can be the one by Igan and Kang[32], presenting Korean experiences. Korean authorities imposed the first LtV regulation in 2002 and the first DtI regulations in 2005. Both limits were differentiated based upon the housing prices, their geographical location, loan type and the characteristics of the borrowers and they were adjusted frequently in a broadly counter-cyclical manner. Igan and Kang prove that imposing those limits had material impact on stopping house prices appreciation in Korea and advocate including them in macroprudential toolkit. Also Barth, Caprio and Levine[33] in the last edition of their survey, tackled elements of macroprudetnial policy and included a question about the usage of countercyclical LtV ratios for the purpose of such policy. But simultaneously situations where these tools were being used initially for microprudential purpose, in the form of static limits[34], were omitted in this survey. In many cases supervisory authorities have advantages over other researchers.

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[31]   Among these countries: Cyprus since 4Q2008, Denmark since 2Q2008, Czech Republic since 2Q2012, Estonia since 2Q2011, Romania 3Q2009.

[32]   D. Igan, H. Kang, *Do Loan-to-Value…*, *op. cit.*

[33]   J. Barth, G. Caprio, R. Levine, *Bank Regulation…*, *op. cit.*.

[34]   In fact in some jurisdictions these limits were changed several times e.g. Poland.

For instance, they have access to data from obligatory prudential reporting of individual banks or can easily conduct a survey among banks as a part of broader supervisory actions. *Report on the pro-cyclicality of capital requirements under the Internal Ratings Based Approach, prepared by European Banking Authority*[35]. It presents the results of empirical analyses on sixty individual banks from twelve countries. Data is available in a Basel II portfolio breakdown[36] on a semi-annual basis covering period from the second half of 2008 till the second half of 2012. This analysis reveals some statistically significant negative correlations between a total capital requirement as well as requirements for individual types of risk (market, credit and operational risk) and macroeconomic environment but other evidence on procyclicality of capital requirements turn out to be weak. Authors have found some evidence that capital requirements change in cyclical manner in corporate and retail portfolios, but this cyclicality is mitigated to a large extent at bank level due to changes in composition of bank overall credit portfolio. Data reveal shifts towards portfolios with lower risk profiles, as exposures in retail and sovereign portfolios have increased while there has been a decline in exposures in financial institutions and corporate portfolios. The drawbacks of this analysis is that it does not assess whether portfolio reallocations have caused undesired restrictions for some borrowers and short data history which additionally does not cover periods before the financial crisis. During crisis behavior of banks could additionally change through government interventions (loans, guarantees or acquisition by the state). Next drawback is the number of banks, which is relatively small, and the fact that it includes only banks using IRB Approach. Authors of this report claim also that for better assessment of procyclicality issue more granular data, on the level of individual exposure, is necessary. Saurina and Trucharte[37] used more granular data in their analysis. They used data on individual mortgage loans from the Spanish Central Credit Register[38], developed a probability of default model and calculated capital requirements using different approaches: point in time, through the cycle, averages along the cycle and corrected for the cycle. They show how sensitive to the risk measurement methodology can be the minimum regulatory capital. They argue, however, that the procyclicality of capital adequacy mechanism depends on the way internal rating systems are implemented and their outputs are utilized.

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[35] *Report on the pro-cyclicality of capital requirements under the Internal Ratings Based Approach*, European Banking Authority 2013.

[36] Prudential regulation risk types and exposure classes.

[37] J. Saurina, C. Trucharte, *An assessment of Basel II procyclicality in mortgage portfolios*, Banco de España Working Paper 2007.

[38] https://www.bde.es/bde/en/secciones/servicios/Particulares_y_e/Central_de_Infor/Central_de_Info_04db72d6c1fd821.html

Because most of the drawbacks mentioned in this section are actual even for researchers from central banks or bank supervisory authorities, one possible solution to fill some gaps is to conduct appropriate research survey among individual banks from different jurisdictions. Such survey should analyze simultaneously trends in credit demand and credit supply together with deep look into various credit supply factors including method used for calculation of capital requirement for credit risk, bank capital position (excess on regulatory minimum) and presence of regulatory limits as well as bank's own limits based on LtV, DtI or other limits regarding credit granting. Next sections are devoted to author's attempt to conduct and utilize such a survey.

3. DESIGN OF AUTHOR'S SURVEY

Shortcomings of existing sources of information regarding bank risk management practices and credit policies pushed the author to develop and conduct his own survey research among banks across EU. The author's intention was to determine the impact of banking prudential regulations regarding capital requirements and capital adequacy on credit granting – whether they are in fact procyclical – and to investigate the possibility of applying countercyclical solutions such as countercyclical adjusted limits on LtV ratio and limits on DtI ratio to conduct macroprudential economic policy. Simultaneously, we wanted to verify whether more advanced methods of calculation of capital requirement were equally procyclical as the standardized ones.

The survey was addressed to banks in the EU that were subject to the CRD regulations[39] since this guaranteed that banks in the sample were subject to more or less uniform rules on capital adequacy[40]. Thirteen out of sixteen questions in the survey were asked in four variants similarly as central banks do in their bank lending surveys, broken into four segments:

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[39] By the end of 2013 set of legal acts introducing so-called Basel II rules (*Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework – Comprehensive Version*, 2006) in UE – *Directive 2006/48/EC of the European Parliament and of the Council of 14 June 2006 relating to the taking up and pursuit of the business of credit institutions* and *Directive 2006/49/EC of the European Parliament and of the Council of 14 June 2006 on the capital adequacy of investment firms and credit institutions*, from the beginning of 2014 rules of CRDIV/CRR package – *Directive 2013/36/EU Of The European Parliament and of The Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC* and *Regulation (EU) No 575/2013 of The European Parliament and Of The Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.*

[40] Full harmonization was introduced in 2014 together with CRDIV/CRR regulatory package.

❖ consumer credit,
❖ loans to households for house purchase,
❖ short-term loans to enterprises,
❖ long-term loans to enterprises.

In contrast to central banks' surveys, which are cyclical and conducted every quarter, this survey was retrospective and it repeated a set of questions for four consecutive periods:

1) prior to the introduction of Basel II regulation (CAD[41], before CRD, until the end of 2006),
2) since the introduction of Basel II (CRD) to the beginning of the financial crisis (second half of 2008),
3) since the beginning of the financial crisis until the end of 2013,
4) prospects from the beginning of 2014 for the period of the next four years (since CRDIV/CRR package entered into force and until the end of most of the transitional periods in this regulation).

Basically these periods reflect major changes in the regulatory regime, but also pre and post crisis periods of Basel II regime. The reason for additional separation of post crisis Basel II period is the fact that the European Parliament and the Council updated some areas of banking prudential regulations in the EU shortly after beginning of the crisis as a response to it[42].

First question referred to the country where a bank-respondent was incorporated and it was possible to choose from 28 countries that were the EU members during

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[41] Set of legal acts implementing so-called Basel I rules (*Basel Committee: International convergence of capital measurement and capital standards*, 1988) in UE; set consists of: *Council Directive 93/6/EEC of 15 March 1993 on the capital adequacy of investments firms and credit institutions* and *Directive 2000/12/EC of the European Parliament and of the Council of 20 March 2000 relating to the taking up and pursuit of the business of credit institutions*.

[42] These updates are called CRD II – *Commission Directive 2009/27/EC of 7 April 2009 amending certain Annexes to Directive 2006/49/EC of the European Parliament and of the Council as regards technical provisions concerning risk management*, *Commission Directive 2009/83/ EC of 27 July 2009 amending certain Annexes to Directive 2006/48/EC of the European Parliament and of the Council as regards technical provisions concerning risk management*, *Directive 2009/111/EC of the European Parliament and of the Council of 16 September 2009 amending Directives 2006/48/EC, 2006/49/EC and 2007/64/EC as regards banks affiliated to central institutions, certain own funds items, large exposures, supervisory arrangements, and crisis management*; aimed at improving the management of large exposures, liquidity risk, risk of securitised products and improving the quality of banks' capital – and CRD III – *Directive 2010/76/EU of the European Parliament and of the Council of 24 November 2010 amending Directives 2006/48/EC and 2006/49/EC as regards capital requirements for the trading book and for re-securitisations, and the supervisory review of remuneration policies*; improvement of capital requirements for the trading book and for resecuritisations and introduction of bank obligations to implement remuneration policies among managers to promote sound risk management in long term perspective.

time period when the survey was conducted. Information regarding country of incorporation (according to the existing European law most of the activity should be carried out there) can be useful to capture country specific features, like trends in gross domestic product growth or specific non harmonised banking supervision approaches, that are not directly included in a survey.

The second question was intended to assign proxy for the scale of bank activity – the value of assets at the end of 2012, in millions of euros[43] – into one of the three intervals: below EUR 2276.45 million, between EUR 2276.45 million and EUR 227645.33 million; above EUR 227645.33 million. These thresholds corresponds to ECB Consolidated Banking Data (CBD)[44] criteria for division of banks into three size groups – small, medium-sized and large – but here it was calculated using non-consolidated bank assets. The reason for dividing banks into small, medium and large, using the absolute value was to allow further comparison of obtained results keeping anonymity of answers.

The third question in the survey investigated bank's opinion on the dominant trend in his relative share in newly granted loans in particular segment of his domestic credit market – whether it was relatively high, relatively low or equal to zero – if bank was not engaged in a particular segment of the credit market. Answers to this question were used to facilitate crosscheck of "no answer" option in other questions, whether a bank was not active in particular segment of credit market or did not want to give an answer.

Aim of another question was to assess the dominant tendency in changes of the demand for credit – whether it was decreasing, rising or at the similar level for most of the time. Questions regarding demand for credit were important to disentangle credit supply effects from demand-related effects. Since these changes in demand for credit could have been influenced by the existence of special public aid for some borrowers (to stimulate the economic growth in certain sectors of the economy or in order to combat unemployment by facilitating access to credit in certain sectors of economy), a dedicated question was also placed in the survey. There was also one supplementary question on bank's opinion whether the existence of such a program had material impact on its volume of lending.

Next two questions were devoted to methods of calculation of capital requirement for credit risk and the use of advanced statistical methods for credit granting process purpose. The first question took part in assessment whether more advanced methods of calculation of capital requirements are equally procyclical as standardized methods – standardized approach under Basel II regime or method of calculation of capital requirement for credit risk in Basel I. It might be

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[43] For countries outside the euro zone based on the exchange rate of their central bank on 31.12.2012.
[44] https://www.ecb.europa.eu/stats/money/consolidated/html/index.en.html.

truth that in case of many banks using more advanced methods – their models' parameters are appropriately stable through the economic cycle and their capital requirements for credit risk are not more procyclical than requirements from standardized method. Importance of parameters stability through the cycle was highlighted in Catarineu-Rabell, Jackson, Tsomocos[45] and Altman, Resti, Sironi[46]. Since regulatory available methods of calculation of capital requirement for credit risk changed with introduction of Basel II rules, answer in the first of these two questions, differ slightly in the first period from those for next periods. For this first period respondents were given a chance to choose answer that their method of calculation of capital requirement for credit risk was in large part consistent with the Basel I framework or substantially different from the Basel I framework and more conservative. For the next periods respondents could have chosen whether they use standardized approach, which often is considered to be similar in many respects to the Basel I framework[47] [48], and Internal Rating Based Approach (IRB), which is more advanced and based on bank's own estimates of borrower's probability of default. The use of IRB for capital requirement purpose requires supervisory approval and bank is obliged to use this framework in its whole activity (for most of its portfolios), including credit granting process and provisioning. Since using advanced methods solely in these last two areas of bank activity does not require supervisory approval and can have significant influence on credit supply, we decided to include a question whether bank uses so-called advanced methods (internal ratings system, credit scoring etc.) in its credit decisions only.

The next group of questions was devoted strictly to LtV, DtI and other regulatory limits on granting credits (other than capital requirements or LtV, DtI limits) including liquidity standards. Some researchers[49] and EU official bodies responsible for financial market and banks oversight[50] claim that limits on LtV, limits on DtI and liquidity standards may become part of macroprudential tools arsenal.

[45] E. Catarineu-Rabell, P. Jackson, D.P. Tsomocos, *Procyclicality and the new Basel Accord – banks' choice of loan rating system*, Bank of England, London 2003.

[46] E.I. Altman, A. Resti, A. Sironi, *The link between default and recovery rates: effects on the procyclicality of regulatory capital ratios*, BIS Working Papers 2002, No. 113, Bank for International Settlements.

[47] C. Goodhart, B. Hofmann, M. Segoviano, *Bank Regulation…*, *op. cit.*

[48] Basel I framework of calculation of capital requirement for credit risk was based on appropriate classification of borrower or his credit protection supplier to one of the groups of counterparties with assigned constant risk weights. Standardized approach in Basel II differs from the method used in Basel I regime. In standardized approach in Basel II borrower's credit is assigned to risk exposure class based on the counterparty and purpose of the credit and credit risk protection variant, each risk class possess his own gradation of risk weights, generally there are more risk weights and they are higher than in Basel I framework, and for some exposure classes these risk weights depend on rating from external credit assessment institutions.

[49] See e.g. D. Igan, H. Kang, *Do Loan-to-Value…*, *op. cit.*

[50] See *Recommendation Of The European Systemic Risk Board of 4 April 2013…*, *op. cit.*

However, anticyclical adjustments of these limits as a part of macroprudential policy may encounter asymmetric response because bank's own limits may remain stricter than regulatory ones in the downturn period[51]. In the author's opinion anticyclical adjusting of regulatory limits solely may be inadequate since the lack of appropriate incentives may result in a situation in which banks will keep their own limits on more stringent levels than desired by prudential authorities and as a consequence will reduce credit granting. Regulators or central banks have limited capabilities to influence banks to loosen their credit standards. In such situation using countercyclical adjustments of LtV or DtI limits may be ineffective. Therefore, in the next three questions the author tried to examine to what extent banks used their own limits on LtV, DtI or other limits, like liquidity standards or maximum term of the loan, stricter than regulatory ones and in what periods they used them. The survey asked also for banks' opinion whether the abovementioned limits should be constant or countercyclically adjusted.

In the next set of questions the author focused on analysing the existence of procyclicality issue. Since correlations between changes of credit supply and changes in capital adequacy ratio or the excess of capital over the capital requirement, are not sufficient evidence of procyclicality of capital adequacy regime, banks were asked to mark how their credit supply behaved in response to change of predetermined factors (if particular situation/factor occurred). In case of each factor two variants of its change were available – increase/improvement and decrease/slowdown – as well as "not applicable" option, in order to include all possibilities that bank might have been exposed to. This set of questions, created special credit supply reaction matrix. The list of factors included: changes in capital requirement for credit risk, changes in the capital adequacy ratio, changes of quality of credit portfolio, changes of economic growth (including tendencies being a result of situation in particular industries), changes in borrower's insolvency risk (probability of default), changes in the availability of financing using interbank market and changes in the availability of financing using issuance of securities, changes of income due to changes in pressure on lending margins, changes of LtV limits set by supervisory authority, changes of DtI limits set by a supervisory authority, changes of other limits set by a supervisory authority, changes of bank's own LtV limits and changes of bank's own DtI limits. The matrix includes also reaction of credit supply to changes in demand for loans or credit lines since the observed changes of credit supply (stock of newly granted credits) represents equilibrium values. This was to distinguish between demand and supply factors affecting credit supply.

Last question in the survey was devoted to the bank asset-liability management and financing strategy – the way a bank finances both loans already granted

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[51]   This problem can also occur while using counter-cyclical capital buffer.

and those being newly granted. The author decided to look for credit granting constraints stemming from financing strategy because financial crisis had revealed its importance and the need to introduce minimal standards in liquidity management in banks that assure them stable sources of funding, especially in the situation of abrupt retreat from an interbank market. Answers in this last question were intended to allow determining the outline of the bank's loans financing strategies during our predefined periods of time. Respondents were to choose to what extent ("to high extent"; "to low extent"; "to similar extent as the others") they used every source from the list: household deposits, operations in the wholesale interbank market, loans from the parent company, issuance of debt securities and/or issuance of equity.

4. FINDINGS FROM THE SURVEY

The research was conducted between May and August 2014. The sample of institutions invited to participate in the survey counts for 6248 institutions from the list of banks included in the EBA Credit Institutions Register[52]. However, 40 letters with invitation have never reached the addressees because of liquidation of an institution, merger processes, bankruptcy and liquidation or nationalization. The survey was anonymous and in electronic form, placed on the web server belonging to a trusted public organization. The response rate to the survey was lower than 1%[53] with rather small coverage within countries[54] made results unrepresentative. But the number of surveys, allowing for full analysis that had been planned, was even smaller. Many survey forms were incomplete. It is because in order to provide enough flexibility to keep anonymity, respondents did not have to fill in all questions and there was optional default answer: "no answer" in every question. Additionally, for most of the questions answer "not applicable" was also available to provide flexibility for respondents that did not operate in every period in every segment of the credit market, or they did not encounter some factors affecting credit supply or credit demand (restriction/limit). In fact, from the correspondence with some respondents, it turned out that they classified their activity as the wealth management, private equity or generally as investment

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[52] Data on CRD credit institutions gathered from EBA Credit Institutions Register at the end of December 2013, https://eportal.eba.europa.eu/cir/.

[53] This could be partly caused by the fact that the survey form for the respondents outside Poland was prepared only in English.

[54] Number of answers received from every country in the sample was substantially smaller than number of all banks in that country and the lack of exact size of the asset make it impossible to check real credit market coverage.

banking and claimed that they did not conduct ordinary credit activity[55]. It was not possible to filter out such institutions from EBA Credit Institution Register and include only banks involved in traditional banking activity. Therefore, the actual number of usable surveys (covering at least for one credit segment and one period, at least information on country of incorporation, the method of calculation of capital requirement for credit risk, presence of any information on LtV or DtI limits or some information on credit supply reaction including demand) was equal to 22 and all the results in this paper concern answers from these respondents. Despite the low response rate the author decided to summarize the survey and made an attempt to interpret it in order to prove usefulness of this kind of research methodology. However, it has to be stressed that findings from this research survey are limited to the sample of banks that decided to take part in it and should be treated with caution while formulating any general conclusions on the banks in the European Union. Some results were intentionally presented in this article in a very general form without showing their interaction with others, in order to prevent identification of the respondents.

Most answers were received from Poland (63.6%), the rest came from: Greece (9.1%), Belgium (4.5%), Finland (4.5%), Germany (4.5%), Italy (4.5%), Malta (4.5%) and Portugal (4.5%). 63.6% of these banks marked their scale of activity (assets value) at the end of 2012 below EUR 2276.45 million, 27.3% of them indicated that their assets were between EUR 2276.45 million and EUR 227645.33 million, and the rest of respondents left this question unanswered. Most participants – between 68.2%–81.8% (dependent on the segment of credit market and period) – assessed their share in newly granted loans as relatively low. Only between 9.1%–18.2% of the respondents indicated that they had relatively high share in newly granted loans in particular segments of their domestic credit market.

Most of participants i.e. 77.3%–86.4% (dependent on the segment of the credit market) assessed that the demand for credit in every segment in the period before introduction of Basel II and in the period before crisis, was rising or staying at the similar level for most of the time. In the period since the beginning of financial crisis, but before introduction of CRDIV/CRR package, this proportion decreased and ranged between 63.6%–77.3%. For the period after introduction of CRDIV/CRR most respondents – between 77.3%–90.9% (dependent on the segment of credit market) declared rise or the same level of demand for credit. In case of some countries this demand might have been positively affected by presence of special state sponsored programs which covered the part of borrower's burden of the debt obligation or provided a surety or guarantee for a loan in the bank. Number of respondents declaring presence of such programs increased since the beginning of the financial

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[55]   Though investment activity for client's account often involve granting credit limit to this client.

crisis. Most of these programs related to loans for house purchase and loans for enterprises. During first two periods, such programs were present in Greece, Poland[56] and Portugal. In the next period such programs were present additionally in Italy, and in the last years (since 2014) Malta decided on this kind of stimulus. Most respondents, among those who declared that their government conducted such a program, claimed that these programs had an impact on their volume of lending.

Regarding the calculation method of capital requirement for a credit risk, for the period before Basel II, 81.8%–90.9% of respondents (dependent on the segment of credit market) used the method in large part consistent with Basel I framework. The rest of them marked "no answer" or "not applicable" option. In the next two periods, only respondents from Belgium and Finland indicated use of more advanced method of calculation of capital requirement (IRB). Since the beginning of 2014 number of banks using IRB increased substantially – some banks from Greece, Italy and Poland moved from a standardized approach to an advanced method. Turning to the IRB method among these banks might have been dictated by increased capital needs after introduction of stricter definition of regulatory capital[57] as well as desire of better risk and resource management to speed up their business development. The survey did not investigate motivation behind such change in these banks and it is doubtful that anyone would have answered direct question on the main reason of moving to the IRB method, differently than pointing the need of a better risk and resource management. It can be also a coincidence that more banks moved to the IRB method recently, because building the so called IRB system and obtaining permission from supervisory authority for using it for capital requirement purpose is a long process[58] and on that year might have simply reached its end. Worth noticing is the fact that among participants, the IRB method was used mostly in an enterprise credit segment. For this segment moving from the standardized approach to IRB is probably most beneficial in terms of cost of regulatory capital and implementation costs. For instance, in the Standardized Approach exposures from larger enterprises without external rating that cannot be classified as retail exposures, receive risk weight 100% while the same exposure under IRB can receive smaller risk weight reduced by tens of percentage points. In the same time, loans for house

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[56] In Poland program helping with house purchase "Rodzina na Swoim" was available between September 2006 and December 2012. A few banks in Poland indicated also presence of public aid in consumer credit segment. This could result from misunderstanding since banks could have classified special credits for students, offered with the help of the state, as such special program.

[57] See *Regulation (EU) No 575/2013…*, *op. cit.*, p. 36–64.

[58] Involve possession of appropriate time series covering between five to seven years and rebuild of some business process.

purchase, that in the Standardized Approach are frequently classified to the class of exposures secured on immovable property (mortgage loans) can receive 35% risk weight if certain conditions are met, or 75% risk weight if it can be classified as a retail exposure[59]. Most respondents denied using internal ratings systems or credit scoring in their credit decisions independently from capital requirements purpose. Those who did not have the IRB system were granting a credit based on calculation of creditworthiness of the borrower, availability of the collateral or based on external scoring from a credit register[60]. However, the number of banks using advanced methods in credit decisions was on average two times larger than those using it for the capital requirement purpose and their number was increasing every period. Based on these we can conclude that advanced methods in capital requirements calculations and credit granting process are becoming increasingly popular and investigation of procyclicality stemming from these methods is worth the effort.

LtV limits set by supervisory authorities also gain popularity. Results of the survey indicate that in the period before introduction of Basel II these limits were present only in Poland[61], but in the following periods number of countries using them increased. After introduction of Basel II, till begin of the financial crisis, such limits were introduced in Germany and Greece and since 2014 also in Finland in the segment of loans for house purchase. In case of DtI limits set by supervisory authority, evolution of their utilization was similar. The only difference was introduction of such limit in 2014 in Portugal for short term loans for enterprises. Generally DtI limits were more frequently adopted to households, both consumer credits or loans for house purchase. Simultaneously, other supervisory constraints on credit granting (e.g. maximum term of the loan, liquidity standards) in the periods before financial crisis, were present in Poland, Italy and Portugal and after financial crisis additionally in Belgium in case of short term loans for enterprises. This growth of popularity of regulatory limits on LtV and DtI after financial crisis, might have been influenced by ESRB recommendations[62] and the entry into force of CRDIV/CRR package. In case of bank's own LtV limits one can also find growth in their utilization after financial crisis. 22.7%–27.3% of respondents (dependent on the segment of the credit market) used such limits (stricter than those imposed by the supervisory authority or if regulatory limits were not imposed at all) during Basel I period. These banks come from: Greece, Italy, Malta, Poland

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[59] For more see articles 123–125 of *Regulation (EU) No 575/2013…*, *op. cit.*

[60] For example in Poland Biuro Informacji Kredytowej (Credit Information Bureau) https://en.bik.pl/.

[61] In Poland constant LtV limit was initially put in place in order to stop fast growth of loans for house purchase denominated in foreign currency.

[62] *Recommendation Of The European Systemic Risk Board of 4 April 2013…*, *op. cit.*

and Portugal. Since then in every subsequent period number of banks using own LtV limit was growing though number of countries stayed stable. After the financial crisis the growth of number of banks using such limits was higher and the number of respondents using them ranged between 36.4%–45.5%. What is more, after introduction of the CRDIV/CRR package larger proportion of banks uses such limits in parallel to regulatory ones. In the same time, bank's own DtI limits were less popular than LtV limits and were mostly used in: Poland, Greece, Finland, Italy and Portugal. After the financial crisis the growth of proportion of banks using such limits took place and the number of respondents using them ranged between 36.4%–45.5% (dependent on the segment of credit market). These limits were used more frequently in case of households. After crisis also more respondents used these limits in parallel to regulatory ones. Similar tendency can be observed in case of other bank's own limits. For the period after crisis more respondents declared to use such limits than in earlier periods. In general, the use of other own limits after crisis declared 27.3%–31.8% of respondents and they came from: Malta, Portugal, Poland, Finland (loans for house purchase and long term loans for enterprises), Belgium (short term loans for enterprises only) and Italy. A few banks from those using other own limits, used fields for additional explanations in the survey and shared more information regarding their limits. They claimed to use limits for the acceptable forms of collateral, limits for total exposure on the group of related entities, limits for investing into a single financial instrument, limits for exposures from individual industries, from the same region or in the same sector of the economy, maximum duration of credit, estimate of customer's ability to amortize the debt, taking into account available income and assets. The above mentioned answers regarding bank's own LtV and DtI limits may indicate procyclical reaction of banks after the crisis. What is more, relatively large proportion of banks using limits stricter than regulatory ones may indicate that the anticyclical adjustments of regulatory limits on LtV, DtI or other limits, considered as element of macroprudential policy, may be ineffective. In order to confirm that increased number of respondents declaring use of LtV or DtI limits diminished lending, we looked into our survey at the answers regarding reaction of credit supply due to changes in bank's own LtV limits or bank's own DtI limit. For the period of time of Basel II regime before financial crisis only two respondents from different countries declared diminishing lending in portfolios where they tightened limits on LtV. One of these respondents diminished also lending through tightening DtI limit. Between 2008 and 2014 number of respondents whose lending was sensitive to changes in their own LtV limits grew to three but in the next period this number went back to previous value. The reason for this was most probably connected with simultaneous tightening of regulatory LtV limit in this particular country.

The opinions on the way of adjusting regulatory limits, in order to minimize procyclicality, varied among respondents. In the opinion of 36.4%–50% of respondents (dependent on the segment of the credit market) LtV limits should be adjusted countercyclicaly, 27.3%–31.8% of respondents claimed that such limit should be constant and 4.5%–13.6% indicated other way of adjusting. If we look at DtI limit we can see that 36.4%–50% of respondents (dependent on the segment) claimed that it should be adjusted countercyclicaly, 18.2%–27.3% claimed that such limit should be constant and 4.5%–13.6% indicated other way of adjusting. Opinion that liquidity standards should be adjusted countercyclically was supported by 36.4%–40.9% of respondents (dependent on the segment), 36.4% claimed that these standards should be constant and up to 9.1% indicated other way of adjusting. Some of the respondents that advocate adjusting above-mentioned limits, proposed to adjust them individually for every bank according to its profile, scale of business activity and its own historical data in this matter or in accordance with business activity and collateral value.

However, it is the capital adequacy regime with capital ratios and capital requirements that are considered as a main source of procyclicality in banking regulations. In order to verify this, we looked into the answers to our survey regarding reaction of credit supply due to changes in capital requirements for credit risk and capital adequacy ratio. Results indicate that during period before Basel II 50%–59% of respondents (dependent on the segment of the credit market) were insensitive for changes of capital requirement for credit risk and 41%–50% of respondents (dependent on the segment of the credit market) were insensitive to capital adequacy ratio. During period after introduction of Basel II till the crisis 45%–50% of respondents (dependent on the segment of the credit market) were insensitive to changes of capital requirement for credit risk and 36%–41% of respondents (dependent on the segment of the credit market) were insensitive for capital adequacy ratio. This moderate increase of sensitivity of lending for changes in capital adequacy ratio in the period after introduction of Basel II rules was probably the result of growth of overall capital requirement due to inclusion of capital requirement for operational risk. During period after beginning of crisis till the end of 2013, 41%–59% of respondents (dependent on the segment of the credit market) were insensitive to changes of capital requirement for credit risk and 36%–50% of respondents (dependent on the segment of the credit market) were insensitive tp capital adequacy ratio. Finally, in the period beginning in 2014 (after CRDIV/CRR package entered into force) 36%–55% of respondents (dependent on the segment of the credit market) were insensitive to changes of capital requirement for credit risk and 27%–45% of respondents (dependent on the segment of the credit market) were insensitive to capital adequacy ratio. This moderate increase of sensitivity of lending for changes in capital adequacy

ratio in the period after introduction of CRDIV/CRR package could be the result of harmonization of definition of regulatory capital (some capital instruments were excluded) and introduction of three capital ratios[63] instead of one. However, this insensitiveness was not linear since in some periods and particular credit segments different number of banks was insensitive to increase and decrease of capital requirements and the same behaviour could be seen for capital adequacy ratio. Generally, in the periods after introduction of Basel II more banks were sensitive for changes in capital adequacy ratio and increase of capital requirements or decrease of the level of regulatory capital was increasing probability of decrease of credit supply. Unfortunately, in case of some respondents results might seem counterintuitive since the increase of capital adequacy ratio caused decrease of credit supply. In some of these banks, simultaneous comparison of changes in all their credit portfolios revealed changes in the composition of the whole credit portfolio and the decline in one segment was accompanied by an increase in the level of loans belonging to other credit segments, probably more profitable.

In some banks using IRB decrease of lending due to increase of capital requirement for credit risk and simultaneous decrease of capital adequacy ratio were observed. However, this phenomenon was not seen more frequently than in banks using standardized method for similar segment of credit market. This could have led us to the conclusion that banks using IRB are equally procyclical as those using the standardized method only but evidences in this matter are rather vague. The sample of banks is unbalanced – there is more banks and more portfolios where standardized method was used. Some IRB respondents' lending was insensitive to changes in capital requirement for credit risk and changes of capital ratios. Some of them did not reveal their reaction for changes in capital requirement and capital ratios. What is more, banks might have use IRB only to small portion of portfolio and marked answer regarding use of the IRB method while for the rest of portfolio still might have used the standardized method. This is possible within every credit segments from our survey and this may have influenced obtained results. The elimination of such drawback seems hardly possible in our research setup.

Another threat to banking system that may affect lending is connected with bank liquidity. Therefore, strategies of financing loans have been investigated. It turned out that for every period over 80% of respondents indicated that they used, to large extent, household deposits,, to finance loans and only 5% of respondents used, to large extent, operations in the wholesale interbank market for this purpose. . In the period before introduction of Basel II, for a half of respondents declaring financing loans to large extent using household deposits, it was the only source of funding. In the next periods this concentration was slightly smaller – 44.4%, and it reached the lowest level during period since the beginning of the financial

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[63] See Article 92 of *Regulation (EU) No 575/2013…*, *op. cit.*

crisis until the end of 2013 – 33.3%. Loans from the parent company were used in high extent only by 5% of respondents and only in the period since the beginning of the financial crisis (the second half of 2008) until the end of 2013. 68%–82% of respondents (depending on the period) did not use loans from the parent company, 68%–73% of them (depending on the period) did not use issuance of debt securities and 55%–68% of them (depending on the period) did not use issuance of equity. Since household deposits are considered as a stable source of funding with low outflow factors under Basel III liquidity regulations[64], our respondents might have been considered as liquidity stable, and liquidity factors rather did not harm lending in our sample. However, if we look into our matrix of lending reactions and analyse reaction on changes in issuance of securities or the so called availability of interbank market, one can see three countries where some respondents after 2008 were sensitive to such changes. For respondents from two of these countries the IRB method was a dominant method of calculation of capital requirements (in terms of answers from the survey). Unfortunately, based on our research survey we are not able to distinguish which factor could prevail – decreasing capital ratio due to rising capital requirement or some liquidity constraints. These respondents also declared diminishing lending connected with tightening of LtV and DtI limits and diminishing of demand for loans in segments where limits were imposed. Further research on this topic should better differentiate to what extent each of these factors influence lending.

5. CONCLUSION

The aim of this paper was to give some insight on the issue of procyclicality of banking activity stemming from Basel banking regulations and banks' management practices, and on the risk of ineffectiveness of some macroprudential tools. The author tried to investigate the impact of banking prudential regulations regarding capital requirement for credit risk and capital adequacy ratio on credit supply, since their formation and implementation. If the procyclicality of banking regulation occurs one should observe decrease of credit supply caused by squeezed excess of regulatory capital over minimum regulatory capital ratio being consequence of either growth of capital requirement or decrease of regulatory capital. Simple analysis of results of conducted survey may indicate potential procyclicality problem among some banks that decided to take part in the survey. In some segments of the credit market from period to period number of banks whose credit supply was insensitive to changes in capital adequacy ratio was decreasing. What is more, analysis of the

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[64]   *Basel III: The Liquidity Coverage Ratio…, op. cit.*

bank credit portfolio does not indicate that changes in banks' business mix and reallocation towards less risky portfolios (to benefit from lower capital charges similarly as presented in EBA report[65]) was a common phenomenon. Conducted survey was also occasion to check whether advanced methods of calculation of capital requirements are more procyclical than standardized approach. Among respondents there were banks using the IRB method and diminishing lending together with increase of capital requirement for credit risk and decrease of capital ratio. Unfortunately, small number of respondents and some lack of answers make results in this matter inconclusive. Additionally, it turned out that our research methodology may lack precision since banks might have use IRB only to small portion of portfolio and still marked answer regarding the use of the IRB method while the substantial part of portfolio still would have been under influence of the standardized method. There was also a problem with disentangling prevailing factor influencing credit supply in some IRB banks since they also pointed on some liquidity constraints as a factor decreasing lending. Therefore, we cannot reject hypothesis that advanced methods of calculation of capital requirement are equally procyclical as standardized methods. However, this requires re-examination since a number of banks using advanced methods of calculation of capital requirements is rising and it may seriously change cyclical characteristics of credit aggregates in some countries. In particular it may intensify procyclicality problem.

Another goal of this research was to investigate the possibility of applying in effective manner countercyclical solutions like countercyclical adjusted limits on LtV, DtI or other limits, like liquidity standards or the maximum term of the loan. There is risk that anticyclical adjusting of regulatory limits without creation of appropriate incentives may result in situation in which banks will keep their own limits more stringent than desired by macroprudential authorities and as a consequence credit granting will be reduced. Answers regarding presence of bank's own LtV limits[66] and presence of bank's own DtI limits indicate that number of banks using these limits is growing after onset of financial crisis and the problem with countercyclical adjustment of such regulatory limits may be material. Answers for questions regarding lending reaction do not indicate that bank's own limits already increased procyclicality but in some jurisdictions they could have been overridden by stricter regulatory limits. The hypothesis that application of efficient anticyclical tools based on LtV or DtI is always possible without the need of any supporting actions cannot be unambiguously rejected but further observation of functioning both regulatory and banks' own limits in banking sector is needed. This would also help to choose proper way of adjusting

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[65] *Report on the pro-cyclicality of capital requirements…, op. cit.*
[66] Banks use also this kind of limit as a covenant limiting adverse selection among borrowers.

regulatory limits. An opinion whether these limits should be adjusted somehow through the cycle is supported by most of the respondents. Gathered international experience on the use of supervisory LtV limits and DtI limits concerns mostly the use of constant LtV limits and constant DtI limits. Constant LtV ratio limit seems efficient only in preventing excessive credit granting leading to bubble on particular market (e.g. real estate). DtI limit may be useful to prevent situation where credits are granted to people or companies who cannot afford them. However, these experiences of the use of LtV ratio limits or DtI ratio limits are rather short and hardly cover the full phase of the cycle on credit market and full phase of the business cycle. What is more, experiences from different countries must be analysed carefully to isolate effects of the use of LtV or DtI limits from other country specific characteristics of banking sector and economy. Chance to fulfil this stipulation might have been the attempt of econometric analysis of the influence of predefined credit supply factors on probability of decreasing credit supply in particular segment of credit market. However, small number of respondents connected with a lot of missing data in individual questions influenced heavily econometric analysis (common problem – collinearity or perfect prediction) forced the author to resign from this step.

As mentioned above, the research hypotheses cannot be clearly verified due to very small response rate to the survey. There are many potential causes why so small number of banks took part in the survey. One of the reasons might have been the fact that the survey was too time consuming and banks did not see any value added for themselves from filling the survey. Small response rate might have resulted also from a lot of merger processes, bankruptcy and liquidation or nationalisation. Another reason could have been lack of confidence to provide anonymity. The author of the research could neither use the trusted third party to assure that filling in the survey is in 100% anonymous nor used direct interviews since these would be very time consuming and costly processes. Instead, the author provided potential participants with a brief description of mechanisms responsible for keeping anonymity, placed the survey in the certified domain and provided a set of information that allow to confirm who is responsible for the survey and for what purpose it is conducted. An effect of this lack of confidence to provide anonymity, or time-consuming filling-in the survey could have been heightened by the Asset Quality Review (AQR)[67] and EU-wide stress testing exercise[68] that were conducted nearly simultaneously with the survey (November 2013–October 2014). AQR was a wide inspection of the credit portfolios quality and of adequacy of provisions in EU banks, before

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[67] https://www.bankingsupervision.europa.eu/banking/comprehensive/2014/html/index.en.html
[68] http://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2014

the Single Supervisory Mechanism[69] becomes fully operational. Managers of many institutions included in AQR might have been afraid to reveal that their credit granting practices were too loose in the past (credits granted to substandard borrowers and too small provisions relative to their quality) or they did not use recommended supervisory limits. Additionally, information in EBA Credit Institutions Register could have been out of date and for some countries it was highly incomplete (addresses were often missing and the author needed to find ones himself). Therefore, a number of respondents could have been affected negatively.

The proposed research methodology, though not very successful in the author's own research, may prove to be useful for international organisations like the World Bank or the International Monetary Fund, authorities responsible for macroprudential policy or central banks cooperating in various research initiatives on macroprudential issues. International Banking Research Network[70] can be indicated as such initiative. In this initiative its participants conduct research using their national micro-level banking data and unified research methodology that allows further international comparison of obtained results. It is also a simple remedy to obey problems stemming from statistical confidentiality in attempt to conduct international research based on micro-level data that are not publicly available. Additionally, a central bank or a national financial supervision authority, having access to confidential bank-level data on credit flows and capital adequacy ratios or bank specific supervisory requirements[71] or capital requirements add-ons from pillar 2[72], are able to more precisely assess the influence of capital requirements and capital adequacy ratios on lending growth. Adding to this information on changes of bank credit policy, its risk appetite and demand for

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[69] New system of banking supervision in Europe, comprising the ECB and the national supervisory authorities of the participating countries (all euro area countries and volunteers from EU); SSM conducts direct supervision on the significant banks of the participating countries; it is one of the two pillars of EU banking union (To see more visit: https://www.bankingsupervision. europa.eu/home/html/index.en.html).

[70] http://www.ny.frb.org/IBRN/index.html

[71] For example Polish Financial Supervision Authority in 2015 required nonsystemically important banks to maintain capital ratios far above regulatory minimums (CET1 capital ratio >= 9%, Total capital ratio >= 12,5%) and scores from Supervisory Review and Evaluation Process above certain levels if they would like to be allowed to pay dividend up to 100% of profit earned in 2014 (*Stanowisko KNF w sprawie polityki dywidendowej instytucji finansowych* http://www. knf.gov.pl/Images/KNF_polityka_dywidendowa_2_12_2014_tcm75-39873.pdf, PFSA).

[72] Banking supervisory authorities are allowed to impose additional capital requirements under Supervisory Review and Evaluation Process. See articles 97–98 and 104 of the *Directive 2013/36/ EU Of The European Parliament and of The Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC*, European Parliament.

credit, one can receive complete set of information needed to asses Basel banking regulation procyclicality. The article by Labonne and Lamé[73] supports accuracy of such approach. What is more, the research survey that could be carried out by a central bank or a banking supervisory authority could be much shorter since there is no need to question an institution on their scale of activity or whether they were subject to supervisory limits. Probably in most cases it would be also possible to derive changes in demand for credit from the results of ordinary bank lending surveys. One more advantage of conducting such research by a central bank or a bank supervisory authority is the possibility to exert, even informally, influence on banks to fill in the survey. Conducting such a research on an international scale, based on coordinated methodology, may bring answers on the real scale of procyclicality of Basel banking regulations and indicate the most efficient ways of mitigating it.

Abstract

This article brings up the issue of procyclicality of banking activity stemming, among other things, from Basel II banking regulations and banks' management practices. It also tries to examine the applicability of tools aimed to limit excessive credit granting (limits on LtV, DtI) as potential macroprudential solutions. It explores dominant trends in empirical studies on the issue of Basel banking regulation procyclicality and some of their shortcomings, including data used. To remedy these drawbacks and lack of some information, which seem crucial from the author's point of view, the research survey is proposed. This article describes construction of the survey and comments on some results obtained from the survey conducted among banks from the European Union. The author attempted to verify, among other things, whether advanced methods used in calculation of capital requirements or in credit granting process, increase probability of decreasing credit supply. It was also investigated whether banks had their own limits on credit granting that were stricter than regulatory ones and thereby anticyclical use of such limits may be limited. However, the results obtained by the author do not allow to verify them in statistically significant manner and should not be used in formulating more general proposals. Further research using the proposed methodology should be conducted under auspices of respected international organisation like World Bank, national supervisory bodies or national central banks.

Key words: capital requirement, procyclicality, bank lending survey, countercyclical buffer, macroprudential supervision

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[73] C. Labonne, G. Lamé, *Credit Growth and Bank Capital Requirements…*, *op. cit.*

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APPENDIX

Survey pattern with complete list of possible answers

General questions	1.	**Country of incorporation/ country where the seat is placed**	1 – Austria; 2 – Belgium; 3 – Bulgaria; 4 – Croatia; 5 – Cyprus; 6 – Czech Republic; 7 – Denmark; 8 – Estonia; 9 – Finland; 10 – France; 11 – Greece, 12 – Spain, 13 – Netherlands; 14 – Ireland; 15 – Lithuania; 16 – Luxembourg; 17 – Latvia; 18 – Malta; 19 – Germany; 20 – Poland; 21 – Portugal; 22 – Romania; 23 – Slovakia; 24 – Slovenia; 25 – Sweden; 26 – Hungary; 27 – United Kingdom; 28 – Italy; NA – no answer
	2.	**Approximate scale of activity – the value of assets at the end of 2012, in millions of euro (for non-eurozone countries based on the exchange rate of the central bank on 31.12.2012)?**	1 – below EUR 2276.45 million, 2 – between EUR 2276.45 million and EUR 227645.33 million; 3 – above EUR 227645.33 million; NA – no answer

Questions about changes of trends in predefined periods	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
3.	**Relative share in newly granted loans in the particular segment of the domestic credit market (the dominant trend)?**			
Before Basel II (CAD, before CRD)	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer	2 – relatively high; 1 – relatively low; 0 – zero; NA – no answer

4.	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
	Changes in the demand for credit (the dominant trend)?			
Before Basel II (CAD, before CRD)	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer	NA' – not applicable; 2 – most of the time rising; 0 – most of the time decreasing; 1 – most of the time at the similar level; NA – no answer
fields for additional explanations/ remarks -->				

	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
5.	**Did/Does/Will government or central bank conduct any special program to stimulate the economic growth in certain segment or in order to combat unemployment (protection of existing jobs) by facilitating access to credit in certain sectors of economy / for specific purposes (e.g. programs in which the state budget covers part of the burden of the debt obligation of the borrower or the ones in which the state budget provides surety / guarantee for a loan in the bank)?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations/ remarks -->				
5.1.	**If the answer for Question no. 5 is YES, please express Your opinion whether this had/has/will have an impact on the volume of lending?**			
Before Basel II (CAD, before CRD)	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer

	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer	1 – yes; 0 – no; NA – no answer
fields for additional explanations/ remarks -->				
	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
6.	**What method of calculation of capital requirement for credit risk did/does/will your bank use for most of particular period?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 0 – method in large part consistent with Basel I framework; 1 – method substantially different from Basel I framework; NA – no answer	NA' – not applicable; 0 – method in large part consistent with Basel I framework; 1 – method substantially different from Basel I framework; NA – no answer	NA' – not applicable; 0 – method in large part consistent with Basel I framework; 1 – method substantially different from Basel I framework; NA – no answer	NA' – not applicable; 0 – method in large part consistent with Basel I framework; 1 – method substantially different from Basel I framework; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (answer second half of 2008)	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer
Since the beginning of the financial crisis (answer second half of 2008) until the end of 2013	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer

	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer	NA' – not applicable; 0 – Standardised Approach; 1 – Internal Rating Based Approach (IRB); NA – no answer
fields for additional explanations				
	Loans to households		**Loans or credit lines to enterprises**	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
7.	**Did/Does/Will your bank use so-called advanced methods (internal ratings system, credit scoring etc.) in its credit decisions (under Basel II regime bank can use the internal ratings based approach (IRB) for credit decision purpose despite not having permission to use it for the purpose of calculation of capital requirements)?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. details on the method used in credit granting process -->				

	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
8.	**Did/Does/Will the supervisory authority impose particular LtV limit?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. construction of the limit and types and characteristics of exposures it is applied to -->				
	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
9.	**Did/Does/Will the supervisory authority impose a particular DtI limit?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer

Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. construction of the limit and types and characteristics of exposures it is applied to -->				
	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
10.	**Did/Does/Will the supervisory authority impose other particular constraints on granting credits (e.g. maximum term of the loan, liquidity standards)?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the begining of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. construction of the limit/s and types and characteristics of exposures it is/ they are applied to -->				

		Loans to households		Loans or credit lines to enterprises	
		Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
11.		**Did/Does/Will bank use LtV limits other than those imposed by the supervisory authority?**			
Before Basel II (CAD, before CRD)		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. regulatory limit should be less restrictive -->					
		Loans to households		Loans or credit lines to enterprises	
		Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
12.		**Did/Does/Will bank use DtI limits other than those imposed by the supervisory authority?**			
Before Basel II (CAD, before CRD)		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)		NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer

	Loans to households		Loans or credit lines to enterprises	
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer	NA' – not applicable; 1 – yes; 0 – no; NA – no answer
fields for additional explanations, e.g. regulatory limit should be less restrictive -->				

	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
13.	**Did/Does/Will bank use limits regarding credit granting other than those imposed by the supervisory authority (e.g. maximum maturity, liquidity standards)?**			
Before Basel II (CAD, before CRD)	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer

Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer	NA' – not applicable; 1 – yes (please provide more details on these limits in the field for additional explanations); 0 – no; NA – no answer
fields for additional explanations, e.g. regulatory limit should be less restrictive, construction of the limit and types and characteristics of exposures it is applied to -->				

	Loans to households		Loans or credit lines to enterprises	
	Consumer credit	Loans for house purchase	Short-term loans	Long-term loans
14.	**Does in your bank's opinion the limits on LtV, DtI, liquidity standards should be fixed permanently at a certain level, or should be adjusted similarly as a countercyclical capital buffer (anti-cyclically; discretionary but based on at least one quantitative criterion)?**			
LtV	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer
DtI	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer
liquidity standards/limits	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer	NA' – not applicable; 1 – constant; 2 – adjusted countercyclical; 3 – adjusted in different manner (please provide more details in the field for additional explanations); NA – no answer
fields for additional explanations/ remarks -->				

		Loans to households		Loans or credit lines to enterprises			
		Consumer credit	Loans for house purchase	Short-term loans		Long-term loans	
		Did/Does/Will Bank decrease, increase or keep unchanged credit supply in case of (for every variant):					
	15.	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)
Before Basel II (CAD, before CRD)	– increase (decrease) in capital requirements for credit risk	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– (decrease) increase in the capital adequacy ratio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– improvement (decrease) of quality of credit portfolio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– improvement (slowdown) of economic growth (including tendency being a result of a situation in particular industries, such as construction)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

– increase (decrease) in the insolvency risk of the borrower (probability of default)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of using financing interbank market	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of financing using: issuance of securities	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
(decrease) increase of income due to (pressure) decrease in pressure decreasing lending margins	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of LtV limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

– increase (decrease) of DtI limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of other limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of own LtV limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of own DtI limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of demand for loans or credit lines	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
fields for additional explanations/ remarks -->								

		increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)
Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	– increase (decrease) in capital requirements for credit risk	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– (decrease) increase in the capital adequacy ratio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– improvement (decrease) of quality of credit portfolio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– improvement (slowdown) of economic growth (including tendency being a result of situation in particular industries, such as construction)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) in the insolvency risk of the borrower (probability of default)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

– increase (decrease) in the availability of financing using:interbank market	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of financing using:issuance of securities	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
– (decrease) increase of income due to (pressure) decrease in pressure decreasing lending margins	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of LtV limits set by a supervisory authority	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of DtI limits set by a supervisory authority	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer

	– increase (decrease) of other limits set by supervisory authority	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of own LtV limits	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of own DtI limits	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of demand for loans or credit lines	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer
fields for additional explanations/ remarks -->								
		increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	– increase (decrease) in capital requirements for credit risk	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/slowdown; 2 – increase/improvement; 1 – keep unchanged; NA – no answer

– (decrease) increase in the capital adequacy ratio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– improvement (decrease) of quality of credit portfolio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– improvement (slowdown) of economic growth (including tendency being a result of a situation in particular industries, such as construction)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the insolvency risk of the borrower (probability of default)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of financing using interbank market	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

– increase (decrease) in the availability of financing using issuance of securities	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
(decrease) increase of income due to (pressure) decrease in pressure decreasing lending margins	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of LtV limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of DtI limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of other limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

	– increase (decrease) of own LtV limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of own DtI limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of demand for loans or credit lines	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
fields for additional explanations/ remarks -->								
		increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)	increase/ improvement	(decrease/ slowdown)
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	– increase (decrease) in capital requirements for credit risk	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– (decrease) increase in the capital adequacy ratio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

– improvement (decrease) of quality of credit portfolio	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– improvement (slowdown) of economic growth (including tendency being a result of situation in particular industries, such as construction)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the insolvency risk of the borrower (probability of default)	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of financing using:interbank market	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) in the availability of financing using:issuance of securities	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

(decrease) increase of income due to (pressure) decrease in pressure decreasing lending margins	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of LtV limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of DtI limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of other limits set by a supervisory authority	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
– increase (decrease) of own LtV limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer

	– increase (decrease) of own DtI limits	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
	– increase (decrease) of demand for loans or credit lines	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer	NA' – not applicable; 0 – decrease/ slowdown; 2 – increase/ improvement; 1 – keep unchanged; NA – no answer
fields for additional explanations/ remarks -->									

	16.	To what extent did/does/will Your bank finance both loans already granted and those being newly granted using:
Before Basel II (CAD, before CRD)	household deposits?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	operations in the wholesale interbank market?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	loans from the parent company?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of debt securities?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of equity?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer

Since the introduction of Basel II (CRD) until the beginning of the financial crisis (the second half of 2008)	household deposits?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	operations in the wholesale interbank market?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	loans from the parent company?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of debt securities?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of equity?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
Since the beginning of the financial crisis (the second half of 2008) until the end of 2013	household deposits?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	operations in the wholesale interbank market?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	loans from the parent company?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of debt securities?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of equity?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
Prospects for the period after the introduction of CRDIV / CRR (from the beginning of 2014)	household deposits?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	operations in the wholesale interbank market?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	loans from the parent company?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of debt securities?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
	issuance of equity?	3 – to high extent; 1 – to low extent; 2 – to similar extent as the others; 0 – not used; NA – no answer
field for additional explanations/ remarks -->		

Juliusz Jabłecki[*]

THE VALUE OF A PREPAYMENT OPTION IN A FIXED RATE MORTGAGE: INSIGHTS FROM BREAKEVEN VOLATILITY

1. INTRODUCTION

A fixed rate loan – i.e. a contract wherein the interest rate paid by the client   is fixed throughout the duration of the contract – carries three main sources of risk for the originating bank. The first one, as in any other loan, there is the credit risk related to the default of the borrower. The second one, there is interest rate risk, namely the risk that market rates increase and exceed the rate at which the contract was concluded. Finally, there is a prepayment, or callability, risk related to the fact that borrowers may decide to pay their loan back prior to its maturity (i.e. "prepay"). If originators hedge the interest rate risk of their mortgage portfolios with simple interest rate swaps, then whenever such prepayment occurs, they have to unwind some or all of the hedging positions which – given that prepayment tends to occur at lower interest rates – results in losses. The cost of a fixed rate mortgage – the interest rate being agreed in the contract – should compensate the originator for bearing these three sources of risk. Therefore, the rate on a fixed rate mortgage can be decomposed into three elements: (i) fixed-for-floating interest rate swap rate with maturity corresponding to the maturity of the loan; (ii) credit spread; (iii) pre-payment spread. Out of these three, this is the prepayment spread that is most difficult to estimate. After all, the borrower's option to call the loan at face

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value is essentially American in nature, i.e. it can be exercised at any time prior to maturity. Hence, estimating the fair value of a prepayment option requires not only a pricing model to handle the early exercise feature, but also a rich enough universe of plain vanilla calibration instruments – in this case ideally co-terminal European interest rate swap options, i.e. swaptions[1]. A basic requirement for any model used for valuing exotic derivatives – such as options with early exercise features – is that it prices exotics consistently with their simpler counterparts quoted on the market. This ensures that the price of an illiquid exotic product is "at par" with prices of plain vanilla liquid products often used to hedge or replicate it. In the absence of such a liquid market in basic interest rate derivatives, estimates of prepayment option value can be biased and the resulting prepayment spreads distorted. Thus, underdevelopment of an interest rate derivatives market can be a hindrance for the fixed rate mortgages and other products with callability features.

This paper tries to contribute to the vast literature on managing prepayment risk[2] by proposing a methodology for estimating the value of a prepayment option in the absence of a deep and liquid market in interest rate swaptions. In such circumstances there is no implied volatility surface of plain vanilla European swaptions with which the more exotic early-exercise pricing model can be made to agree, which compounds the uncertainty surrounding the valuation of American-style payoffs. The proposed approach builds on the concept of breakeven volatility Dupire[3], i.e. the volatility level at which the price of the option on a historical date may be replicated by the P&L from continuously delta hedging it until expiry. Although Dupire originally proposed the concept for commodities and currencies with illiquid or non-existent options markets[4], we show that it can be readily applied to options on interest rate underlyings, and in particular swaptions. Such breakeven volatilities can be calculated for different swaption maturities, strike rates and underlying swap tenors yielding a full co-terminal swaption volatility surface conditioned on the realized historical zero coupon bond prices and swap rates. By construction, the resulting implied volatilities will be backward-looking. However,

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[1] This is the so called option-theoretic or endogenous approach to the estimation of prepayment risk, see e.g. Davidson A., Levin A., *Mortgage Valuation Models: Embedded Options, Risk, and Uncertainty*, Oxford University Press 2014 or Qu D., *Manufacturing and managing customer-driven derivatives*, John Wiley & Sons, Chichester 2016, West Sussex, United Kingdom chap. 19 for a comprehensive discussion and alternative perspectives.

[2] See e.g. Kau J.B., Keenan D.C., *An overview of the option-theoretic pricing of mortgages*, Journal of Housing Research 1995, 6(2), 217; Collin-Dufresne P., Harding J.P., *A closed form formula for valuing mortgages*, The Journal of Real Estate Finance and Economics 1999, 19(2), 133–146; Agarwal S., Driscoll J.C., Laibson D.I., *Optimal Mortgage Refinancing: A Closed-Form Solution*, Journal of Money, Credit and Banking 2013, 45(4), 591–622.

[3] B. Dupire, *Pricing with a smile*, Risk 1994, 7(1), 18–20.

[4] Dupire's breakeven volatility approach has been implemented in the widely-used Bloomberg system e.g. for Nigerian Naira and Kenyan Shilling.

they can serve as a rough guide for where volatility levels should be given historical data. Applying this method to the Polish historical interest rate curve, we find that the implied (breakeven) volatility surface exhibits a pronounced dependence both on strike and swaption term/tenor, i.e. so called smile and term structure. The dependence of swaption implied volatilities on strike is a well documented phenomenon in markets where swaption quotes are available. However, it is also inconsistent with the Black-Scholes valuation framework as it suggests that some swaptions are priced as if the same underlying swap rate moved by 4 bp a day and some – 8 bp a day, which is nonsense. To accommodate market patterns while retaining the completeness and simplicity of the Black-Scholes framework we propose a local volatility model in which the swap rate volatility is made time and state dependent, consistently with the breakeven volatility surface. Concretely, building on Gatarek and Jabłecki[5] we derive an equation for the unique state-dependent diffusion coefficient consistent with breakeven swaption volatilities, linking it to the dynamics of the entire interest rate curve. We then use the diffusion to price the prepayment option, *qua* a Bermudan receiver swaption implicitly contained in a fixed rate mortgage contract using data from the Polish market as of January 2017. The mortgage spread component related to the prepayment option price proves to be quite significant, stressing the importance of an adequate risk management of the inherent callability feature and possibly explains why fixed rate mortgage products have so far struggled to develop in Poland.

2. NOTATION AND DEFINITIONS

2.1. Financial market instruments

We start by defining the main instruments and a notation we are going to work with throughout. At this point, our approach is an independent model, but we assume an interest rate model of the Heath-Jarrow-Morton type to facilitate the presentation. Concretely, let $P(t,T)$ be time t price of a zero coupon bond maturing at time T such that $P(t,t) = 1$ for every t. We assume there exists a frictionless and arbitrage-free market for zero coupon bonds such that $P(t,T)$ exists for every $0 < t < T < \infty$ and for a given t, $P(t,T)$ is differentiable with respect to maturity time T. The instantaneous forward rate $f(t,T)$ with maturity T contracted at t is defined by

$$f(t, T) \equiv -\frac{\partial \ln P(t, T)}{\partial T} \iff P(t, T) = \exp\left(-\int_t^T f(t, s)ds\right). \quad \text{(Eq. 2.1)}$$

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[5] D. Gatarek, J. Jabłecki, *A local volatility model for swaptions smile*, Journal of Computational Finance 2016, Forthcoming.

The instantaneous spot rate $r(t)$ – i.e. the short rate – is defined by the condition

$$r(t) \equiv f(t, t) \tag{Eq. 2.2}$$

and can be interpreted as capturing the locally risk-free return from a continuously compounded money market account $B(t) \equiv \exp\left\{\int_0^t r(s)ds\right\}$. The short rate is not to be confused with a continuously compounded spot interest rate, $R(t,T)$, defined as

$$R(t, T) \equiv -\frac{\ln P(t, T)}{\delta(t, T)}, \tag{Eq. 2.3}$$

where δ, year fraction, stands for the chosen time measure between t and T. Finally, we also introduce simply compounded spot interest rate, referred to as LIBOR rate $L(t,T)$:

$$L(t, T) \equiv \frac{1 - P(t, T)}{\delta(t, T)P(t, T)}, \tag{Eq. 2.4}$$

along with a time t forward rate between two dates T and S:

$$L(t; T, S) \equiv \frac{P(t, T) - P(t, S)}{\delta(T, S)P(t, S)}. \tag{Eq. 2.5}$$

Define now a uniformly spaced tenor structure:

$$0 = T_0 < T_1 < ... < T_M \tag{Eq. 2.6}$$

and set $\delta_n = T_n - T_{n-1}$ for $n = 1, ..., M$. A **fixed-for-floating interest rate swap** (IRS) with unit notional, fixed rate (coupon) K, and a specified tenor structure $\mathcal{T} = \{T_n\}_{n=\alpha+1}^{\beta}$ is a contract whereby two parties exchange differently indexed cash flows over a pre-agreed time span. Specifically, on each date $T_n \in \mathcal{T}$, the fixed leg pays $\delta_n K$, whereas the floating leg pays the floating LIBOR rate given by the formula:

$$\frac{1 - P(T_{n-1}, T_n)}{\delta_n P(T_{n-1}, T_n)} \delta_n. \tag{Eq. 2.7}$$

When the fixed leg is paid, the IRS is called a "payer," conversely the swap is called a "receiver." The forward swap rate $S_{\alpha,\beta}(t)$ corresponding to the tenor structure $\mathcal{T}$

is the rate in the fixed leg that sets it equal to the floating leg and hence makes the net present value of the transaction equal zero:

$$S_{\alpha,\beta}(t) \equiv \frac{P(t,T_\alpha) - P(t,T_\beta)}{\sum_{n=\alpha+1}^{\beta} P(t,T_n)\delta_n}. \qquad \text{(Eq. 2.8)}$$

When setting $\alpha = 0$, it can be immediately noticed that the spot swap rate for a contract maturing at T_β reduces to $(1 - P(0,T_\beta))/\sum_{n=1}^{\beta} P(0,T_n)\delta_n$.

A **European payer (receiver) swaption** with strike K, maturity T_α and tenor $T_\beta - T_\alpha$ (henceforth referred to also as $T_\beta \times (T_\beta - T_\alpha)$, or T_α-into-$(T_\beta - T_\alpha)$) is simply an option that gives the holder the right to enter at T_α into a payer (receiver) swap which matures at T_β and entitles to pay (receive) fixed rate K in exchange for floating LIBOR rate on the tenor dates $\mathcal{T}$. Thus, the payoff of the payer swaption with notional unit is given by

$$\max\left(S_{\alpha,\beta}(T_\alpha) - K, 0\right) \sum_{i=\alpha+1}^{\beta} \delta_i P(T_\alpha, T_i). \qquad \text{(Eq. 2.9)}$$

The expression $\sum_{i=\alpha+1}^{\beta} \delta_i P(T_\alpha, T_i)$ is sometimes called the annuity or present value per basis point (PVBP). Before the crisis it was a market practice to quote swaptions prices using a Black-like formula. Nowadays, to account for the all-too-real possibility of negative rates, market participants have shifted to using the so called Bachelier or normal model instead, in which the risk-neutral dynamics of the forward swap rate is normal rather than log-normal. In this approach, the time zero price of the above payer swaption is given by:

$$\mathbf{PS}_{\alpha,\beta}(0,K) =$$

$$\text{(Eq. 2.10)}$$

$$= \sum_{i=\alpha+1}^{\beta} \delta_i P(0,T_i) \left[(S_{\alpha,\beta}(0) - K)\Phi\left(\frac{S_{\alpha,\beta}(0) - K}{\sigma\sqrt{T_\alpha}}\right) + \varphi\left(\frac{S_{\alpha,\beta}(0) - K}{\sigma\sqrt{T_\alpha}}\right)\sigma\sqrt{T_\alpha} \right],$$

where Φ and φ are the Gaussian cumulative and probability distribution functions respectively.

Finally, a Bermudan receiver (payer) swaption is an option to enter at any time T_i, $i \in \{\alpha, \alpha + 1, ..., \beta - 1\}$, into a swap which terminates at T_β and gives the holder the right to receive (pay) a pre-determined fixed rate K in exchange for floating Libor. The period up to T_α is called the lockout or no-call period, and hence a Bermudan swaption with final exercise date $T_{\beta-1}$ and first exercise T_α is often called "T_β no-call T_α," or "$T_\beta$ncT_α." For instance, a 11nc1 swaption with annually

spaced exercise dates can be trained at the beginning of any year, starting from year 1. By exercising the option, the holder enters a swap starting at the time of exercise (i.e. years 1, 2, 3,..., 10) and ending at year 11[6].

2.2. A loan contract

To fix ideas we focus in this paper on mortgage loans – i.e. loans taken for the purchase of a dwelling – since they tend to have relatively long maturities (ranging up to 30 years) that make the choice of a fixed vs. floating rate and the inherent prepayment optionality most acute. However, since we focus on the economics of the transaction rather than its legal characteristics, the ensuing discussion of the loan contract nature is purposefully somewhat vague and general. Broadly speaking, a mortgage loan is simply a contract whereby one party ("Client") borrows a certain notional amount N at T_0 from another party ("Bank") and commits to return it to the lender by T_N under the conditions stipulated in the contract. A loan contract will therefore specify i.a. the following features:

❖ applicable interest rate: this can be either a fixed rate K set at T_0 for the entire duration of the contract or a variable (floating) rate determined according to the prevailing market conditions which typically amounts to using the going 3M LIBOR (EURIBOR, WIBOR etc.) rate plus a spread compensating the bank for credit risk and potentially reflecting also other business considerations (competitive pressure etc.)[7];

❖ amortization schedule: the capital can be either returned in a single payment at maturity – with only periodic interest cash flows in the interim – or repaid gradually at a predefined pace in equal or decreasing installments; to facilitate the presentation the focus is put below on the case of constant installment only, but the results carry over naturally also to other mortgage types;

❖ early termination conditions: whether and at what extra charge – if any – the outstanding loan can be paid back (or refinanced) prior to maturity, so called prepayment.

In a competitive market the pricing of a loan is determined in such a way that both the bank and the client are in principle indifferent between the fixed and floating rate mortgages with the same maturity, amortization schedule etc. This equivalence of the two rates ensures that no risk-less arbitrage is possible and the quoted fixed rate reflects the time-zero path of forward LIBOR rates. Thus, the net

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[6] Alternatively, such structure can be called a 1Y × 10Y, or one-into-ten, receiver, exercisable annually after the first exercise date.

[7] Hybrid options are also possible whereby the interest rate is fixed for some initial part of the contract duration (e.g. 5 or 10 years) and floating thereafter. Since this specification does not present any additional technical difficulties, it is ignored below to ease the presentation.

present value of installments for a client paying on a floating rate basis – i.e. LIBOR plus spread – should be equal to the net present value of installments calculated according to a fixed rate K. Let us assume for the sake of the demonstration that the mortgage in question is non-amortizing ("interest rate only") with no prepayment allowed. Then the remarks above can be formally restated as:

$$N \sum_{i=1}^{M} \delta_i \left((L(T_0; T_{i-1}, T_i) + s) - K \right) P(T_0, T_i) = 0. \qquad \text{(Eq. 2.11)}$$

This in turn implies that the fixed rate K on an interest rate only mortgage loan is equal to the par forward swap rate plus spread and hence – given the spread s – can be calculated using the term structure of interest rates using:

$$K = \frac{\sum_{i=1}^{M} \delta_i L(T_0; T_{i-1}, T_i) P(T_0, T_i)}{\sum_{i=1}^{M} \delta_i P(T_0, T_i)} + s = \frac{1 - P(T_0, T_M)}{\sum_{i=1}^{M} \delta_i P(T_0, T_i)} + s. \quad \text{(Eq. 2.12)}$$

In the more common case of a mortgage with amortizing capital $\{N_i\}_{i=1}^{M}$, (2.12) would feature instead a par forward swap rate for a contract with notional corresponding to the chosen amortization schedule[8]. Equation (2.12) makes clear that the interest rate risk inherent in a fixed rate mortgage without prepayment option can be perfectly offset using an interest rate swap with corresponding maturity and notional.

When clients are allowed to prepay their outstanding notional equation (2.12) should be adjusted by the spread component s_{opt} reflecting the fair value of the prepayment option:

$$K_{fixed} = K + s + s_{prepay}. \qquad \text{(Eq. 2.13)}$$

Note that since the prepayment option gives the client the right to "put" the loan principal to the bank, it is effectively a Bermudan receiver swaption, **RBS**, with first exercise date T_1 and swap termination date T_M. This involves a circular reference, since s_{prepay} depends on the value of the swaption and the value of the swaption in turn depends on the strike (fixed rate of the loan). The circularity can be overcome through the use of the following iterative procedure. Start by calculating **RBS**$^{(0)}$ for the initial strike $K+s$. Since s_{prepay} represents the annuity-weighted value of the swaption, we have:

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[8]   However, since this case does not alter anything in the substance of the argument but makes presentation less streamlined, it is omitted below.

$$s_{prepay}^{(1)} = \frac{\mathbf{RBS}^{(0)}}{\sum_{i=1}^{M} \delta_i P(T_0, T_i)}. \qquad \text{(Eq. 2.14)}$$

We can now re-price the swaption at a new strike, $K + s + s_{prepay}^{(1)}$, obtaining $\mathbf{RBS}^{(1)}$ which by analogy with (2.14) yields $s_{prepay}^{(2)}$. We continue in this fashion until the calibration stabilizes and the difference $s_{prepay}^{(n)} - s_{prepay}^{(n+1)}$ is, say, of the order of one basis point.

3. BREAKEVEN VOLATILITY

The concept of breakeven volatility was originally introduced in an unpublished note by Dupire (2006) who raised the problem of determining implied volatilities for options with different strikes and maturities given as sole information the historical price series of the underlying instrument[9]. Classical volatility estimation techniques typically yield a single number defined as the annualized standard deviation of log-returns:

$$\sigma_{hist} \equiv \sqrt{\frac{252}{N-1} \left(\sum_{i=1}^{N} \ln \left(\frac{S_i}{S_{i-1}} \right)^2 - \left(\frac{\ln (S_N/S_0)}{N} \right)^2 \right)}. \qquad \text{(Eq. 3.1)}$$

where S_i is the price of the underlying on day i. This procedure – inherently based on the assumption of constant volatility – would produce a single volatility parameter for all options on S. However, there is ample evidence that volatility is not in fact constant, and as a result the market participants tend to price options in such a way that different strike levels and maturities are associated with different implied volatility levels for the underlying – so called implied volatility "smile" or "skew" (Figure 1).

To account for this, Dupire[10] suggests an approach based on back-testing of delta-hedged option strategies. The underlying idea bases on the recognition due to Black and Scholes[11] that dynamically hedging an option by removing its delta, i.e. first-order dependence on the price of the underlying instrument – the process referred to as "delta hedging" – transforms an initial premium into the final payoff

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[9] Thus, Dupire: writes: "Many people have devoted considerable time and effort to develop models that are calibrated to the market, usually in view of pricing exotic options. However, a possibly more fundamental question is: what the market should be?"

[10] B. Dupire, *Pricing…, op. cit.*

[11] F. Black, M. Scholes, *The pricing of options and corporate liabilities*, Journal of Political Economy 1973, 81(3), 637–654.

Figure 1. Strike-dependent implied volatility pattern for S&P500 and EURPLN options with maturity 3M (as of 18 May 2017)
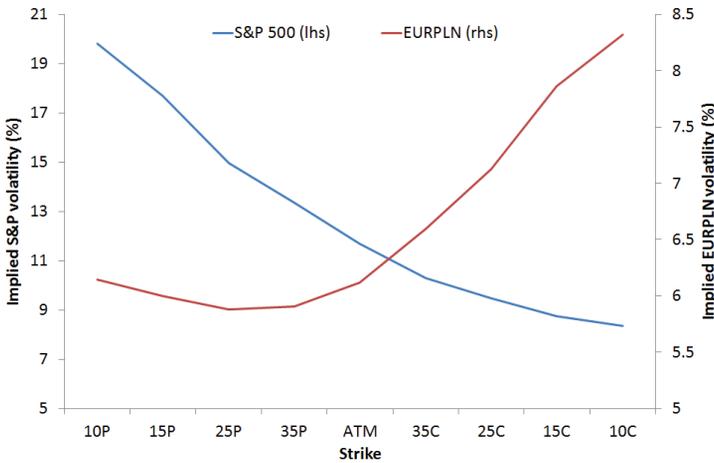
through replication. Thus, if one knows the volatility of a stock, one can replicate an option payoff exactly by continuously rebalancing a portfolio consisting of delta units of the underlying instrument and a risk-free bond. If no arbitrage is possible, then the value of the option should be equal to the cost of the replication strategy. In other words, given a path of the underlying instrument, hedging an option along this path using the model delta in principle allows to replicate the option. Leveraging this insight, if we sell an option for a premium corresponding to some volatility σ and then use the σ to calculate the option's delta along a path of the underlying instrument then by rebalancing the replication portfolio we finally end up with a profit or loss that depends on the volatility parameter σ. The value of σ that sets this profit and loss equal to zero is called the breakeven volatility. Figure 2 demonstrates this procedure for a stylized case of a call option on a generic asset S with strike price $K = 110$ and 1 year maturity. Here, breakeven volatility turns out to be 15.33%. Crucially, a different strike would lead to a different breakeven volatility. For instance, with a strike $K = 80$ instead, profit-canceling volatility would be just 3.5%. An alternative approach of producing a strike-dependent volatility pattern would consist in modeling the time series as a parametrized stochastic process then estimating the parameters to eventually price swaptions. A popular example is the Heston[12] (1993) model which features a classic Black-

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[12]   S.L. Heston, *A closed-form solution for options with stochastic volatility with applications to bond and currency options*, Review of Financial Studies 1993, 6(2), 327–343.

Scholes dynamics for the underlying instrument, but with a stochastic variance which follows a mean-reverting process of the type proposed by Cox, Ingersoll and Ross[13]. Atiya and Wall[14] show how to obtain the maximum likelihood estimates of Heston model parameters (in the physical measure). However, the problem with such an approach is that parameter estimates are maturity-specific, so that option prices with different maturities are priced using different sets of parameters. Moreover, the model is significantly more numerically involved and drops the completeness inherent in the Black-Scholes framework by an introduced new stochastic driver for the volatility process, which complicates delta hedging.

Figure 2. The stylized path of the underlying instrument (the left hand panel) and the associated breakeven volatility (the right hand panel)
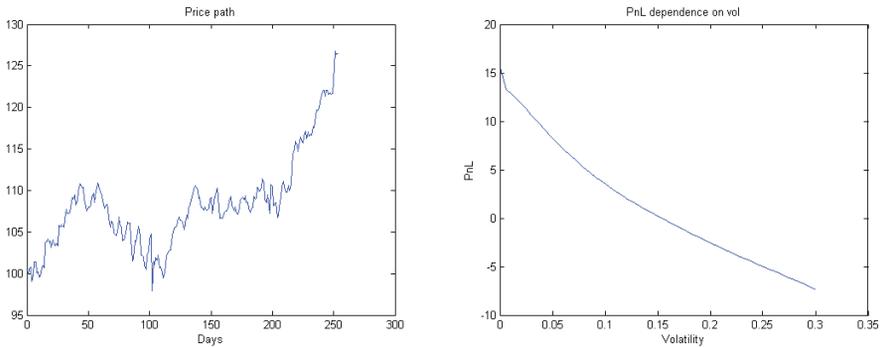
3.1. Swaption delta hedging

We now show how to adapt the Dupire's breakeven volatility concept to the case of interest rate swaptions. One might recall that the market quotes option prices using the Bachelier or normal model so that the fair value of a payer swaption is given by (2.10), i.e. expressed explicitly as the sum of the underlying swap and a portfolio of zero coupon bonds – the annuity. By analogy with the Black-Scholes approach, these two quantities become hedging instruments and the hedge ratios can be inferred directly from the equation. In particular, the hedge replicating the swaption

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[13] Heston model is in fact a continuous time analogue of models in the GARCH family. J.C. Cox, J.E. Ingersoll Jr, S.A. Ross, *A theory of the term structure of interest rates*, Econometrica: Journal of the Econometric Society 1985, pp. 385–407.

[14] A.F. Atiya, S. Wall, *An analytic approximation of the likelihood function for the Heston model volatility estimation problem*, Quantitative Finance 2009, 9(3), 289–296.

(short position in a payer) consists in going long $\Delta = \Phi\left(\frac{S_{\alpha,\beta}(0)-K}{\sigma\sqrt{T_\alpha}}\right)$ units of the

underlying forward swap contract and going short $\varphi\left(\frac{S_{\alpha,\beta}(0)-K}{\sigma\sqrt{T_\alpha}}\right)\sigma\sqrt{T_\alpha}$ units of the PVBP. The portfolio positions are then adjusted at discrete intervals as time goes by and the forward swap rate changes. Any net amount is invested/borrowed in the bond portfolio to ensure the portfolio is self-financing. If the replication was performed perfectly, with continuous re-hedging, the difference between the value of the hedging portfolio and terminal swaption payoff – i.e. the profit/loss, P&L – would be exactly zero, irrespective of the path taken by the swap rate. This observation justifies the statement that the Bachelier's model provides a fair value of the swaption. Insofar as the replication strategy involves discrete rather than continuous rebalancing the P&L may deviate from zero but should be distributed symmetrically around it.

As an illustration considers a 1Y-into-5Y payer swaption in the Polish market struck at the money and sold at implied normal volatility of 70 bp.

We simulate the replication error using 10,000 paths for the underlying swap rate and use Polish interest rate curve data as of 30 December 2016. The simulation is carried out on a set of discrete equi-spaced times between time $t_0 = 0$ and swaption maturity, $T_1 = 1$. The hedging proceeds as follows:

❖ at $t_0 = 0$ short one unit of the 1 x 5 swaption, $\mathbf{PS}_{1,6}(0)$, long Δ_0 units of the underlying forward swap and short $\varphi(0)\sigma\sqrt{T_\alpha}$ units of the $PVBP_0$ so that the value of the portfolio (net cash flow from all transactions) is zero;

❖ at t_1 the underlying swap rate grows to $S_{1,6}(t_1)$ and swaption price changes to $\mathbf{PS}_{1,6}(t_1)$; thus we go long $\Delta_1 - \Delta_0$ units of the underlying forward swap and borrow/invest the resulting cash flow in the annuity bond portfolio whose value in the meantime has grown to $PVBP_1$;

❖ at each successive step until swaption expiration the hedge ratio is adjusted to keep the portfolio delta neutral and the resulting cash flows are invested/borrowed in the numeraire account.

Figure 3 shows the simulated PnL distribution in two cases – when the rebalancing is performed once per week (52 times per year) and daily (250 rehedgings). As expected, both distributions are centered around zero, but more frequent hedging produces visibly less dispersed the results.

Figure 3. Effect of delta hedging the 1 x 5 swaption: simulated profit and loss distributions (10,000 Monte Carlo runs)
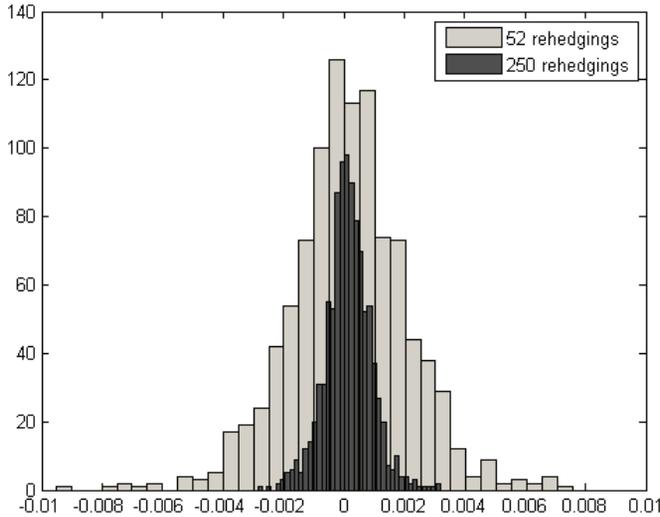
3.2 Breakeven volatility for PLN swaptions

As of this writing there is no liquid market for swaptions involving Polish zloty (PLN). Hence, to come up with an assessment of what swaption prices could conceivably be, we can resort to the estimation of breakeven volatility surface using historical interest rate data. As explained above, in this approach the volatility at a given strike is chosen in a way to nullify the P&L accrued by daily delta-hedging of a swaption at that strike. Since our ultimate goal is to price a prepayment option in a mortgage contract we need estimates of volatilities for swap rates terminating at a common fixed date corresponding to the maturity of the mortgage which we set to 20 years[15]. Thus, we will estimate implied breakeven volatilities of the following 19 co-terminal swaptions: 1 x 19, 2 x 18, 3 x 17,...,19 x 1 as of January 2017. To mimic the convention in developed derivatives markets and provide a sufficiently broad set of calibration instruments, for each term/tenor we derive swaption implied volatilities for a range of strikes covering the par forward swap rate (the at-the-money, ATM contract) and ATM±200bp, ±100bp, ±50bp and ±25bp. For each term $T=1,2,...,19$ years we select a corresponding historical time point t such that $t+T$ is exactly the end of our data sample, i.e. 30 December 2016. We then calculate the

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[15] According to the Polish Bank Association (ZBP) data, roughly 64% of mortgages taken out in q4 2016 had contractual maturity between 25 and 35 years; 25% had maturity between 15 and 25 years and 11% – maturity below 15 years.

Bachelier's price of each swaption plugging a trial volatility σ into (2.10) and use historical interest rate data to calculate the P&L from delta hedging the swaption daily from origination at t until maturity on 30 December 2016. The breakeven volatility is then that choice of σ which sets the P&L from delta hedging, equals to zero and it is calculated numerically using a standard root finding algorithm. Since breakeven volatility is an estimate, it will generally depend on the time window chosen for the delta hedging. This calls for using averaged estimates over multiple non-overlapping historical time windows, which however is problematic given the long maturities of the swaptions considered. For instance, for the 19x1 swaption there is only one long enough time window. Yet, even if observations from the distant past were available, they would likely come from a different volatility regime so their practical relevance could be questionable. Moreover, even for shorter maturities for which historical data is available, running an iterative root-finding algorithm separately for each time window would be very costly in terms of computational time. Therefore, we decide against averaging breakeven volatilities, keeping in mind the approximate nature of the estimates. Figure 4 shows a sample breakeven volatility smile for the 1x19 swaption plotted against an actual implied volatility for 1x19 swaptions quoted in the most liquid US dollar market (sourced from Bloomberg as of 30 December 2016). Clearly, the pattern of the estimated breakeven volatilities is consistent with levels and shapes in more liquid markets. Figure 5 presents the entire estimated breakeven volatility surface for all term/tenor pairs. We may conclude that the surface exhibits plausible volatility levels and smile-like shapes and hence can serve as a basis for calibration.

Figure 4. Estimated breakeven volatility smile for the 1x19 swaption in Poland and actual implied volatility smile for the 1x19 USD swaption (as of 30 December 2017)
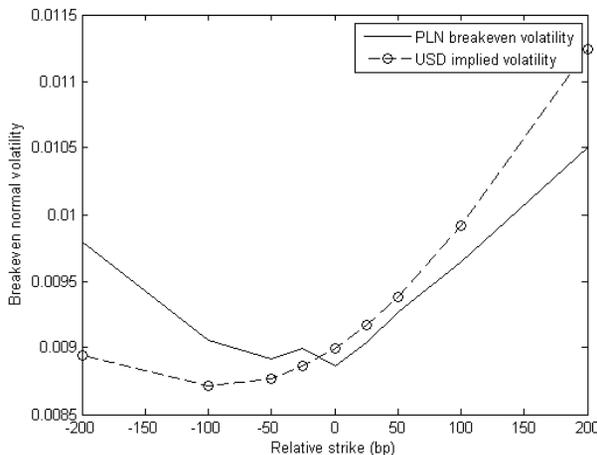
Figure 5. The estimated PLN normal breakeven volatility surface as of 1 January 2017 (fixed swap terminal is 20Y)
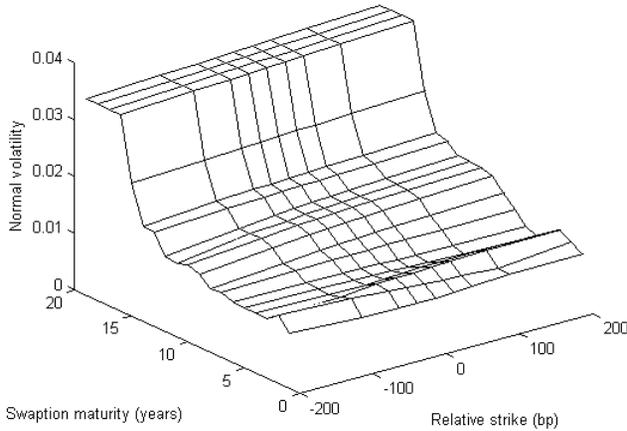
4. PRICING PREPAYMENT OPTION

As we have seen above, the estimated breakeven volatilities exhibit a consistent smile-like pattern across the maturity spectrum. This is clearly inconsistent with the Black-Scholes/Bachelier framework in which volatility is an inherent feature of the underlying instrument and should not exhibit dependence on strike. We overcome this problem by using a local, or state- and time-dependent, volatility version of the Cheyette model as suggested by Gatarek, Jabłecki, and Qu[16] and Gatarek and Jabłecki[17] whose reasoning we briefly summarize below adapting it to the case of co-terminal swaptions.

4.1 Cheyette local volatility model

Note that the introduction of non-parametric volatility in interest rate space is non-trivial. By convention, the fixing date of the swap coincides with the maturity of the option, i.e. swaptions with maturities T_α and $T_{\alpha+1}$ are written on two different underlyings evolving according to two different (forward) processes. As a result, unlike in traditional asset classes, options on swap rates are quoted only for one expiry and swaption prices cannot be differentiated with respect to

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[16] D. Gatarek, J. Jabłecki, D. Qu, *Non-parametric local volatility formula for interest rate swaptions*, Risk 2016, pp. 120–124.

[17] D. Gatarek, J. Jabłecki, *A local volatility model…*, *op. cit.*

expiration time. It is thus prima facie impossible to analyze the time evolution of swaption implied distribution functions and recover from them – via the Forward-Planck equation – the unique swap rate diffusion generating them, as originally proposed for equities by Dupire[18]. We circumvent this problem by introducing a fixed-tenor rolling maturity swap rate and deriving a spot process for it.

Let $0 < T_\alpha < T_\beta$ be two maturities and consider the forward swap rate with fixing date T_α and maturity T_β as defined in (2.8) (from here on, without loss of generality we shall, for simplicity, use continuous-time rather than discrete convention). The forward swap rate is, by definition, a martingale under the measure $\mathbb{Q}^{\alpha,\beta}$ associated to the annuity numeraire $N_{\alpha,\beta}(t) \equiv \int_{T_\alpha}^{T_\beta} P(t,s)ds$, i.e. $S_{\alpha,\beta}(t)$ has the driftless dynamics under $\mathbb{Q}^{\alpha,\beta}$:

$$dS_{\alpha,\beta}(t) = \sigma_{\alpha,\beta}(t)dW^{\alpha,\beta}(t), \tag{Eq. 4.1}$$

where $\sigma_{\alpha,\beta}$ is a continuous stochastic process and $W^{\alpha,\beta}(t)$ is a Brownian motion under $\mathbb{Q}^{\alpha,\beta}$.

For a given swap maturity date T, we define the fixed-terminal rolling swap rate as

$$S_T(t) \equiv S_{t,T}(t) = \frac{1 - P(t,T)}{\int_t^T P(t,s)ds} \tag{Eq. 4.2}$$

Note that $S_T(t)$ is a spot instrument, albeit not a traded one, and it is not a martingale. However, using (4.1), its dynamics can be derived to be:

$$dS_T(t) = Q_{t,T}(S_T,t)dt + \sigma_{t,T}(t)dW^{t,T}(t) \tag{Eq. 4.3}$$

where $Q_{t,T}(S_T,t) \equiv \left.\frac{\partial S^{u,T}(t)}{\partial u}\right|_{u=t}$ and $W_{tT}(u)$ is a Brownian motion under the measure $\mathbb{Q}^{t,T}$ defined as

$$dW_{t,T}(u) = dW(u) + \frac{\int_t^T B(u,s)\Sigma(u,s)ds}{\int_t^T B(u,s)ds}du. \tag{Eq. 4.4}$$

Having done some algebra, $Q_{t,T}(S_T, t)$ can be represented as

$$Q_{t,T}(S_T,t) = S_T(t)\left[\frac{S_T(t) - r(t)}{1 - P(t,T)}\right]. \tag{Eq. 4.5}$$

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[18]   B. Dupire, *Pricing…*, *op. cit.*

Let us assume now now that the forward swap rate volatility is a deterministic function of the swap rate and time, $\sigma_{t,T}(t) \equiv \sigma_{t,T}(t, S_T)$. It can be shown that $\sigma_{t,T}(t, S_T)$ is given in terms of swaptions prices by the following Dupire-type equation (since the common swap maturity T is fixed, swaption dependence on T is suppressed):

$$\sigma_{t,T}(t, K) = \sqrt{\frac{\partial_t C(t, K) + \partial_K C(t, K)\left(Q_{t,T}(S_T, t) + q(t, T)\right)}{\frac{1}{2}\partial_K^2 C(t, K)}}, \quad \text{(Eq. 4.6)}$$

where $q(t,T)$ is an adjustment due to the differentiation of swaption prices with respect to maturity. Since $q(t,T)$ has been found to be very small (Gatarek and Jabłecki[19]; Qu[20]), in practice the local volatility function can be approximated by:

$$\sigma_{t,T}(t, K) \approx \sqrt{\frac{\partial_t C(t, K) + \partial_K C(t, K)Q_{t,T}(S_T, t)}{\frac{1}{2}\partial_K^2 C(t, K)}}. \quad \text{(Eq. 4.7)}$$

Through straightforward differentiation of the undiscounted Bachelier swaption formula $C = (F_T - K)\Phi((F_T - K)/\sigma/\sqrt{T}) + \varphi((F_T - K)/\sigma/\sqrt{T})\sigma\sqrt{T}$, equation (4.7) can also be recast in terms of normal implied volatilities Σ[21]:

$$\sigma_{t,T}(t, K) = \sqrt{\frac{2\frac{\partial \Sigma}{\partial t} + \frac{\sigma}{t} + 2Q(t, T)\frac{\partial \sigma}{\partial K}}{\frac{1}{\sigma t}\left(1 + \frac{(F_T(t) - K)}{\sigma}\frac{\partial \sigma}{\partial K}\right)^2 + \frac{\partial^2 \sigma}{\partial K^2}}}, \quad \text{(Eq. 4.8)}$$

where $F_T(t) = S_{t,T}(0)\exp(\int_0^t Q(s, T)ds)$ is the forward rolling swap rate and $\Phi(\cdot)$, $\varphi(\cdot)$ are standard normal CDF and PDF respectively. Plugging (4.8) into (4.3) yields local volatility diffusion for the rolling swap rate.

Pricing interest rate derivatives in general requires not only the simulation of swap rate paths, but a fully-fledged interest rate model calibrated to the time zero interest rate curve. Fortunately, swap rate local volatility (4.8) can be easily virtually fed into any generic model, such as e.g. Libor Market Model or Cheyette[22]

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[19] D. Gatarek, J. Jabłecki, *A local volatility model...*, op. cit.

[20] D. Qu, *Manufacturing and managing customer-driven derivatives*, John Wiley & Sons, Chichester 2016, West Sussex, United Kingdom.

[21] Strictly speaking, these volatilities will be associated with the rolling swap dynamics (4.3), whereas implied volatilities quoted by the market are those of the forward swap process (4.1). Fortunately, under the approximation $q(t,T) = 0$, the two volatility parameters coincide.

[22] O. Cheyette, *Term structure dynamics and mortgage valuation*, The Journal of Fixed Income 1992, 1(4), 28–41.

model. The latter is a particularly convenient choice as it admits a two-dimensional Markovian representation of the entire yield curve dynamics. Specifically, the Cheyette model is given by:

$$P(t,T) = \frac{P(0,T)}{P(0,t)} \exp\left(-\frac{1}{\kappa}\left(1 - e^{-\kappa(T-t)}\right)x(t) - \frac{1}{2\kappa^2}\left(1 - e^{-\kappa(T-t)}\right)^2 y(t)\right), \quad \text{(Eq. 4.9)}$$

where x(t) and y(t) are state variables and κ is a constant positive number representing mean reversion speed. The mean reversion spead. The two state variables have the following dynamics:

$$dx(t) = (y(t) + -\kappa x(t))\,dt + \sigma(t)dW(t) \qquad \text{(Eq. 4.10)}$$

$$dy(t) = \left(\sigma^2(t) - 2\kappa y(t)\right)dt \qquad \text{(Eq. 4.11)}$$

State variable $x(t)$ has the interpretation of a centered short rate, while $y(t)$ is an upward drift representing forward curve steepening due to volatility (a "convexity correction"). Since rolling swap rates are a function of bond prices, straightforward application of Ito's lemma reveals that the volatilities of the swap rate and the short rate in the Cheyette model are linked through:

$$\sigma(t) = \left(\partial_x S(t, x(t), y(t))\right)^{-1} \sigma^{t,T}(t). \qquad \text{(Eq. 4.12)}$$

With swap rate local volatility stripped from the breakeven volatility surface (Figure 5) via (4.8) and then mapped to the short rate volatility through (4.12), Cheyette model can be implemented in a standard Monte Carlo pricer. The procedure mimics closely the well-established routine of calibrating local volatility models in equity or FX space (cf. Gatarek and Jabłecki[23] for details; see also Qu[24] for a PDE implementation).

4.2. Bermudan swaption pricing

As discussed/ presented above, the prepayment option contained in a fixed rate mortgage is of Bermudan character. The author explained above how it can be handled in a Monte Carlo setting. Consider a "T_β no-call T_α" Bermudan receiver swaption introduced above. The time t value of such a Bermudan swaption will be denoted $\mathbf{RBS}_{\alpha,\beta}(t, K)$. Assuming no prior exercise, at any time point T_n, the

[23] D. Gatarek, J. Jabłecki, *A local volatility model…*, *op. cit.*
[24] D. Qu, *Manufacturing and managing…*, *op. cit.*

swaption holder has the right to receive the exercise value V_e of the swaption, i.e. present value of the underlying swap:

$$V_e(T_n) \equiv (K - S_{n,\beta}(T_n))^+ \sum_{k=n+1}^{\beta} P(T_n, T_k)\delta_k. \qquad \text{(Eq. 4.13)}$$

The exercise value has to be compared to the so called continuation value, V_c, of holding the option beyond T_n:

$$V_c(T_n) \equiv \mathbb{E}\left(\mathbf{RBS}_{\alpha,\beta}(T_{n+1}, K)\middle| S_{n,\beta}(T_n)\right). \qquad \text{(Eq. 4.14)}$$

The value of the Bermudan swaption can now be given in terms of (4.13) and (4.14) via a dynamic programming recursion:

$$\mathbf{RBS}_{\alpha,\beta}(T_{\beta-1}, K) = P(T_{\beta-1}, T_\beta)\delta_\beta \left(K - S_{\beta-1,\beta}(T_{\beta-1})\right)^+$$

$$\mathbf{RBS}_{\alpha,\beta}(T_j, K) = \max\left(V_e(T_j), V_c(T_j)\right) \qquad \text{(Eq. 4.15)}$$

for $j = \beta - 2, \beta - 3, \ldots, n$. The evaluation of (4.15) proceeds backward in time: at $T_{\beta-1}$ the value of the Bermudan swaption is known and determined by the standard swaption payoff. This allows us to update the continuation value at $T_{\beta-2}$ by discounting and compare it to the exercise value prevailing at the time. The procedure of comparing "backwardly-cumulated" continuation value with the immediate exercise value and deciding upon swaption exercise is repeated until the initial valuation date is reached, at which point the algorithm yields a price estimate for the Bermudan swaption. Handling such a problem in a Monte Carlo setting can be challenging. The idea going back to Longstaff and Schwartz[25] is that the continuation value at each time step can be approximated by its least-squares conditional forecast, $\widehat{V}_c$, thus allowing us to resolve the decision rule (4.15) without "seeing into the future." Specifically, the continuation value is represented as a linear combination of M basis functions $\psi(\cdot)$ (see Brigo and Mercurio[26] for an excellent general discussion of the method):

$$V_c(T_n) \approx \widehat{V}_c(T_n) \equiv \sum_{j=1}^{M} \lambda_{nj}\psi_j(T_n), \qquad \text{(Eq. 4.16)}$$

[25] F.A. Longstaff, E.S. Schwartz, *Valuing American options by simulation: a simple least-squares approach*, Review of Financial studies 2001, 14(1), 113–147.

[26] D. Brigo, F. Mercurio, *Interest rate models-theory and practice: with smile, inflation and credit*, Springer Science & Business Media 2007.

with weights λ_j determined by least-squares regression. This requires first simulating a sufficient number N of yield curve scenarios which produces a set of swap rates $(S_{\alpha,\beta}(T_n),\ S_{\alpha+1,\beta}(T_n),\ ...,\ S_{\beta-1,\beta}(T_n))_k,\ n = \alpha,...,\ \beta,\ k = 1,\ ...,\ N$. With "perfect foresight" knowledge of each simulated path k, the exercise and continuation values, as well as Bermudan swaption prices $\mathbf{RBS}_{\alpha,\beta}(T_i, K)$, can be evaluated recursively along each path using (4.15). To improve quality of fit and run-time performance only in-the-money paths are considered for the estimation of the weights λ_j. With the estimated regression coefficients, the same Monte Carlo swap rate paths are then used to determine the approximate continuation values $\widehat{V}_c(T_n)$ and Bermudan swaption payoffs for each path. It should be stressed, however, that this produces a lower bound estimate of the Bermudan swaption price.

4.3. Numerical example

To demonstrate the viability of our method we price a prepayment option contained in a 20-year Polish zloty mortgage issued at the beginning of 2017. To facilitate presentation (but with no substantial loss in generality) let us assume the mortgage has a simple interest-only (no amortization) structure and a principal of PLN 250,000, which roughly corresponds to the average value of mortgage loans taken out in Poland in 2016. We also assume interest is payable on a semi- annual basis. Using interest rate curve data as of 30 December 2016 we find that the 0.5y-into-19.5y swap rate equals 0.036. From Section 2.2 one can recall that a fixed rate mortgage rate can be decomposed into the swap rate with corresponding maturity, credit spread (which we take to include also other, non-credit business considerations) and the spread compensating the bank for the prepayment risk inherent in the fixed rate mortgage. Credit spread levels can be inferred from the NBP's database on the new sale of floating rate loans as the difference between the quoted interest rate on a floating rate mortgage and the WIBOR 3M rate. Although credit exposure in a fixed rate mortgage could differ from that in a floating rate, the floating rate spread is actually the best readily available approximation to the potential spread in a fixed rate mortgage. The spread as of January 2017 stood at 280 bp, so that the fixed rate in a mortgage without prepayment option would be 6.40%.

To estimate the prepayment spread – and thus price in the prepayment option – we follow the iterative approach laid out in Section 2.2. This entails pricing a 20-year Bermudan swaption, to which end we employ the Cheyette local volatility model calibrated to the breakeven volatility surface and simulate optimal stopping time as explained in Section 4.2. The LSMC algorithm leads to fairly quick and stable convergence, so that using 10,000 paths with a time step of 1/12 seems satisfactory. The spread is found numerically to equal 184 bp and the total value of the prepayment option is PLN 155,475 – or over 60% of the mortgage capital.

This puts the fixed rate at 8.24% vs. 4.50% on floating rate mortgages in January 2017. The breakdown of the calculations is shown in Table 1.

Table 1. The simulated costs of a fixed rate mortgage (interest rate curve data for the Polish and USD market as of 30 December 2016)

	Swap rate	**Credit spread**	**FRM (no prep.)**	**Prep. spread**	**FRM**	**Prep. option price**
(share of notional)						
Poland (BEV)	3.60%	2.80%	6.40%	1.84%	8.24%	62.19%
USA	2.66%	1.00%	3.66%	1.38%	5.04%	46.84%

Note: FRM (no prep.) is the fixed rate mortgage rate if prepayment is not allowed; Prep. spread is the prepayment spread and FRM denotes the fixed rate mortgage rate accounting for the possibility of prepayment.

To provide a very basic robustness check of the results, the author compares compare the numbers found for Poland based on a breakeven volatility surface (Figure 5) to an analogous estimate for the United States based on swaption implied volatilities quoted in the USD market as of January 2017. While mortgage credit spreads for the US are not directly available, some indication as to their level may be provided by the margin for 5/1-year adjustable rate mortgage quoted by Freddie Mac. This mortgage offers a fixed rate for an initial period of 5 years and then resets to an index plus margin fixed once per year. ARM mortgage spread stood at about 270 bp in January 2017 but at least part of that reflects prepayment spread. For benchmarking purposes we thus set the credit spread in our 20y fixed rate mortgage at 100 bp. This results in a prepayment spread of 138 bp and a mortgage rate of 5.04%. This is close to the actual levels of the fixed rates on mortgages in the US market (e.g. the 30-year mortgage rate stood at 4.30% in January 2017, which given that the swap curve is virtually flat between the 20y–30y tenors should be roughly similar to the cost of a 20y mortgage for which unfortunately no national averages are reported).

Finally, to see how sensitive the total cost of prepayment option is to the assumed credit spread, we reprice the Bermudan option implicit in the respective contracts assuming credit spread levels in the range 0–300 bp (Figure 6). The results indicate that even if banks were to charge no credit spread or other margins, the cost of the prepayment option would still be substantial – about 25% and 20% of the mortgage notional for Poland and the US respectively. This suggests

that, especially in Poland where interest rates have historically exhibited relatively high volatility, the mortgage spread component related to the prepayment option tends to be quite significant, which underscores the importance of an adequate risk management of the inherent callability feature as indeed suggested by regulators.

Figure 6. The price of a prepayment option (a Bermudan receiver) in a 20Y mortgage as a function of loan credit spread
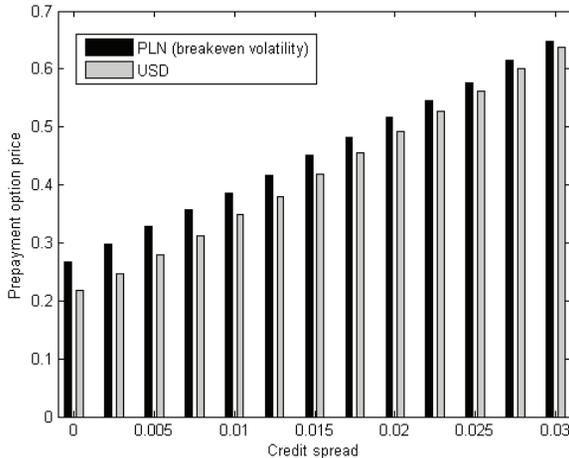
5. CONCLUSIONS

The goal of this paper was to suggest a methodology for estimating the value of a prepayment option in cases where a deep and liquid market in interest rate swaptions is not available. In such circumstances, it is a priori not clear how to calibrate the prepayment option pricing model, which compounds valuation uncertainty and possibly hinders the development of fixed rate mortgages. The proposed approach consists in adapting the concept of breakeven volatility to interest rate swaptions. In particular, to estimate what the unknown swaption volatilities could be, we suggested back-testing a delta hedged position in a theoretical swaption to find numerically the volatility level, which nullifies any accumulated hedging profit/loss. Since at that volatility the hedger breaks even, its level can be considered "fair" and serves as a basis for calibration. The proposed method has two main uses.

Firstly, it can be used to offer guidance on the likely cost of a fixed rate mortgage in markets where no such products have developed so far. This paper looks at the specific example of Poland, where the "only game in town" is a floating rate

mortgage. Specifically, having produced such a breakeven volatility surface for the Polish zloty interest rate market, we have employed the calibrated robust Bermudan swaption pricing model to estimate the fair value of prepayment spread in a stylized 20-year fixed rate mortgage. The prepayment spread component proves to be quite significant, stressing the importance of an adequate risk management of the inherent callability feature and possibly explains why fixed rate mortgage products have struggled to develop in Poland so far.

Secondly, our method can also be used in developed mortgage markets, where fixed rate contracts are available, to benchmark or assess the degree of potential mispricing in mortgage contracts, driven by the prepayment option.

Abstract

This paper presents a novel approach of estimating the value of a prepayment option in a fixed rate loan based on the concept of breakeven volatility. Since the prepayment option can be exercised essentially at any time prior to maturity, its valuing requires: (i) a pricing model sophisticated enough to handle its early exercise feature; and (ii) a broad set of interest rate derivatives prices to which the model can be calibrated to preclude arbitrage. This paper shows that when the derivatives market is not developed enough to ensure calibration, a good approximation of the fair value of a prepayment option can be derived by constructing the "missing" derivatives prices by back-testing delta hedged swaptions. This produces a "fair" volatility surface conditioned on the realized historical zero coupon bond prices and swap rates, which can be used to calibrate the prepayment option pricing model. The paper presents numerical examples for the Polish market as of January 2017. The mortgage spread component related to the prepayment option price proves to be quite significant, stressing the importance of an adequate risk management of the inherent callability feature and possibly explains why fixed rate mortgage products have struggled to develop in Poland so far.

Key words: prepayment, fixed rate loan, Bermudan swaption, breakeven volatility, Cheyette model

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tational Financ*e* 2016, Forthcoming.

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ALTERNATIVE PAYMENTS – TAXONOMY, DEVELOPMENT, AND RELATED RISKS

INTRODUCTION

Alternative payments' market is one of the fastest growing financial market segments. The dynamics of the market's growth reflects the increase in customers' and investors' interest. The number of alternative payment methods and new market players become the real competition for traditional payments and traditional financial institutions, especially banks. The changes of customers' behaviour and expectations combined with other factors, such as technology development, internationalisation, liberalisation, and regulations have already changed the structure of retail payments and impacted on the share of cash, cards, and Automated Clearing House (ACH) payments in overall payments.

Payment innovations including alternative payment methods, platforms, and business models are designed to match customers' needs. Today, they are a part of the value chain that is usually focused on delivering the convenience during the whole purchase experience. At present, it means following the e-commerce trends. The number of electronic transactions is growing rapidly all over the world and entails development of payments. These new, innovative payment methods should be an inspiration for traditional payment services' providers. It is worth

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stressing that today over 300 alternative payment schemes operate around the world with more than 200 alternative payment methods[1]. It makes understanding the alternative payments more and more difficult. Concurrently, as the relatively new segment of the retail payments' market, it generates new threats.

Despite the growing interest in alternative payment methods and instruments, there is still a lack of commonly accepted definition and precise market data. The purpose of the paper is to identify the alternative payment methods, provide their taxonomy, assess their development and describe associated risks of frauds. The paper also discusses the factors influencing their further development. The results of the study are based on the critical analysis of available, not extensive literature regarding alternative financial services (including payments), statistical data of research companies and institutions altogether with consultancy firms' reports.

1. DRIVERS OF ALTERNATIVE PAYMENTS AND THEIR USAGE IN THE WORLD

During the last few decades, the world's economies have changed significantly. The role of the government has diminished, while the role of markets has increased, the economic transactions between countries and their citizens have substantially risen, and financial transactions have grown remarkably[2]. New technology development has enabled the transition to the network economy based on information technology, connectivity and human knowledge. Its development has influenced the whole economy changing markets, enterprises, customers' expectations and purchase behaviours[3]. E-commerce and m-commerce have become one of the fastest developing fields of the economy. Today consumers' lives are increasingly digitised – more and more of them, especially younger ones, are used to services delivered online and in real time. For the new generation of customers the speed and convenience are the key values, both as regards the shopping, as well as making a payment. All these changes have caused the necessity to implement new payment methods as the traditional payments have not been able to fulfil customers' expectations concerning the speed and convenience, especially in remote transactions.

Several factors stimulate the development of alternative payment instruments, but the prior and the most important one is the technology[4]. The technology

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[1]   *Global Payments Report Preview. Your Definitive Guide to The World of Online Payments*, November, London 2015, p. 11.

[2]   J. Cichorska, M. Klimontowicz, *Financialisation as a result of network economy's development*, Internet Quarterly „e-Finanse" 2016, vol.13/ nr 2, s. 1–12.

[3]   K. Patel, M. Delen, *Payments Systems Survey 2009: Executive Summary*, Capgemini 2009.

[4]   B.J. Sullivan, Z. Wang, *Nonbanks in the Payments System: Innovation, Competition and Risk – A Conference Summary,* Federal Reserve Board of Kansas City, Economic Review 2007, No. 3, Kansas City M.O.

development has influenced other factors, such as new payments channels and ways of payment acceptance, changes in customers' behaviour and merchants' integration resulting in creating of multichannel platforms and implementing new business models, and new requirements concerning the security (see Figure 1).

Figure 1. Key drivers for the alternative payments'development


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┌──────────────────────────┐        ┌──────────────────────────┐
│ Multichannel platforms   │        │ New channels' and        │
│ • old platforms obsolete │        │ merchants' integration   │
│ • pay anywhere           │        │ • multichannel           │
│ • one-click              │        │ • convergence of the     │
│ • multiple choice        │        │   retail trade and       │
│ • common standards       │        │   payments               │
└──────────────────────────┘        │ • new acceptance methods │
                                     │ • new platforms          │
                                     │ • cross border           │
                                     └──────────────────────────┘
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- **Multichannel platforms**
  - old platforms obsolete
  - pay anywhere
  - one-click
  - multiple choice
  - common standards

- **New channels' and merchants' integration**
  - multichannel
  - convergence of the retail trade and payments
  - new acceptance methods
  - new platforms
  - cross border

- **Consumer behaviour change**
  - new behaviours
  - mobility
  - social networking
  - real-time
  - security concerns
  - simplicity

ALTERNATIVE PAYMENT METHODS

- **New regulations**
  - EMD, EMD2
  - PSD, PSD2
  - payment institutions
  - third service providers (TPPs)
  - AIS, PIS
  - XS2A

- **New business models**
  - retailers
  - phone manufacturers
  - MNOs
  - banks
  - tech/data giants
  - PSPs

- **Security**
  - demand for improvement
  - 3D Secure
  - PCI-DSS
  - tokenisation
  - HCE
  - new risks/ new fraud/ new initiatives

Source: own work.

Contemporary payments enable in store and remote transactions between different kinds of entities (personal and corporate) using devices, such as laptops, tablets, smartphones and other. Many of these payments can not be supported by traditional ACH payments and card payments' schemes. New ways of acceptance are also needed to develop contactless payments using Near Field Communication (NFC), Quick Response codes (QR codes) and Bluetooth Low Energy (BLE).

Concurrently, a new generation of customers' entrance to the market takes place. The greater use of smartphones, tablets, and e-wallets, increasing the use of social media, and customers' expectations of instant, safe and simple payment methods mean that the traditional channels are less and less aligned with users' needs and expectations. New payment service providers, such as merchants are forced to build omnichannel offers allowing matching offers with customers' needs. They require new and different payment platforms able to support crossborder operations and integration with sophisticated loyalty programs based on big data analysis. The data can be captured from electronic and mobile payments linked

with electronic or mobile point-of-sales. Furthermore, many retailers try to include payments to their value for customer chain and gain profits captured by mobile network operators (MNO) and players, such as Google, Apple or Facebook. As a result, new business and commercial models have been implemented to create the new market structure.

The rapid development of alternative payment instruments has caused new risks and frauds. The security has become a demand of the main industry stakeholders. Security initiatives include 3D Secure, Payment Card Industry Security Standard (PCI DSS), tokenisation, and host card emulation (HCE).

The last factors that entail payments' changes are regulatory initiatives. The Electronic Money Directives (EMD1 and EMD2)[5] and First Payment Service Directives supports market diversification allowing nonbank payment service providers (PSPs) – such as electronic money institutions (EMIs) and payment institutions (PIs) – entering the payment market[6]. PSD2[7] goes even further – it allows the so-called Third Party Providers' (TPPs) access to customers' payment accounts at banks (XS2A). The intention of the European legislative bodies was to boost competition and innovation on the payment market and to make room for alternative payment providers and services.

All these factors have made the alternative payment proposals rapidly and continuously changing. According to WorldPay[8] over 300 alternative payment schemes operate around the world with more than 200 alternative payment methods.

The importance and dissemination of different payment methods vary by regions and countries. Globally, the usage of alternative payment methods grown on average by 35% in 2012[9]. The value of alternative payment transactions reached the level of 734 USD billions. Their share of total e-commerce transactions was 42%. Three years later, the value of such transactions increased to the level of 1300 USD billions (see Table 1). The WorldPay predicted that the value of the

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[5]   Directive (EU) 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions amending Directives 2005/60/EC and 2006/48/EC and repealing Directive 2000/46/EC (Text with EEA relevance), http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32009L0110 [5.04.2017].

[6]   *Next Generation Alternative Retail Payments: User Requirements*, EBA Working Group on Electronic Alternative Payments 2014, Washington D.C. ; B.J. Sullivan, Z. Wang, *Nonbanks in the Payments System…*, *op. cit.*, s. 83–87.

[7]   Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC, http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32015L2366&from=EN [29.03.2017].

[8]   *Global Payments Report Preview…*, *op. cit.*, p. 3.

[9]   *Alternative Payments Pick 'n' Mix An overview of alternative payments in the global marketplace*, 2016, www.ecommera.com, p. 2.

transactions would be 2049 USD billion, and they would account for 58.2% all of the e-commerce turnover by 2020[10]. Around the world the fastest growing payment types are e-wallets. Undoubtedly, the increasing number of smartphones and app stores will help in developing mobile payments. The number and range of mobile payment systems have been systematically increasing, but very few are capable of the global reach yet. Most operate locally, in their homecountry or territory. Concurrently, the cash on delivery and direct debits are becoming less popular. The share of bank transfers remains stable.

Table 1. The value of alternative payments and their share in total payments in the e-commerce

Type of alternative payment	2012		2014		2015	
	Transaction value (bn USD)	Share in the total e-commerce (%)	Transaction value (bn USD)	Share in the total e-commerce (%)	Transaction value (bn USD)	Share in the total e-commerce (%)
Bank transfers	122	7	212	11.2	249	10.5
Direct debits	42	2	6	0.3	4	0.2
E-wallets	295	17	387	20.5	722	30.5
Cash on delivery	93	5	124	6.4	171	7.2
Mobile payments	18	1				
Local card schemes	164	10	84	4.5	154	6.4
Pre-pay instruments						
Post-pay instruments						
E-invoices						
Digital currencies						

Source: own work based on *Global Payment Report. The Definitive Guide…, op. cit.*; *Your Global Guide to Alternative Payments,* London 2014; *Global Payments Report Preview…, op. cit.*; *Alternative Payments…, op. cit.*

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[10] *Global Payment Report. The Definitive Guide to The World of Online Payments*, November, London 2016, p. 89–90.

At present, the market is very fragmented, and the market value is stretched over a broad spectrum of alternative payment schemes with paper, mobile, e-wallet, direct debit and bank transfers offerings. Although they are undoubtedly on the rise, they have not grown as fast as it was initially predicted. Except for the Asia Pacific countries, the card payments are still more popular (see Figure 2).

Figure 2. The split between cards and alternative payment methods (APM) in 2014 (%)
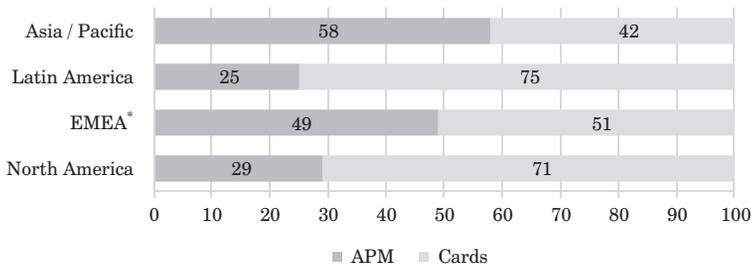
* Europe, Middle East, and Africa

Source: own work based on *Global Payments report preview…*, *op. cit.*, p. 13.

The traditional payment methods are popular in mature markets. North America, a leader in business-to-customer e-commerce, is a card dominated market (71%) where alternative payments are used less often (see Figure 3). In Europe, in 2012, 59% of payments were card payments. They were preferred in Denmark, France, Ireland, United Kingdom, Italy, Norway, Spain and Turkey. In Finland, Netherlands, and Poland bank transfers had the largest market share. Similarly, they dominated the Australian, Malaysian, Japanese, Singaporean and South Korean market in Asia Pacific Region. Among the alternative payment methods, e-wallets and cash on delivery were the most popular. E-wallets were popular in Austria, Germany, Greece, Italy, Portugal, and United Kingdom while cash on delivery was relatively often chosen by Russian, Polish, Greek, and Portuguese customers. The Latin America had a more diverse range of payment preferences while the Middle East and Africa were still dominated by cash payments[11].

Among all alternative payment methods, all over the world e-wallets are assumed to be the most popular ones (see Figure 3). Initially, a part of retail giants, such as Alipay (Alibaba) and PayPal (eBay) dominated the market. As the card providers recognised the market growth opportunity for e-wallets, they were developing their brands (V.me, MasterPass). Today they have to compete with

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[11] *Your Global Guide…*, *op. cit.*, p. 7–19.

new market players who do not traditionally focus on payments, but they try to integrate technology with customers' everyday life. Multinational corporations, such as Apple with Apple Pay, Samsung with Samsung Pay and Google with Android Pay are revolutionising the payment market.

Figure 3. The structure of global e-transaction payments in 2012 and 2014

	North America (2012)	North America (2014)	North America (2015)	EMEA (2012)	EMEA (2014)	EMEA (2015)	Latin America (2012)	Latin America (2014)	Latin America (2015)	Asia / Pacific (2012)	Asia / Pacific (2014)
■ Others	7	3	10	11	6	11	18	4	17	14	5
■ Bank transfers	1	7	7	6	17	17	13	9	5	14	12
■ Cash on Delivery	1	4	4	27	6	8	8	7	2	11	10
■ Direct Debit	2	1	1	3	1	0	4	0	0	1	0
■ E-wallet	18	14	19	9	20	20	10	5	11	23	30
■ Cards	71	71	59	47	50	44	47	75	65	37	43

Source: own work based on *Your Global Guide…, op. cit.*; *Global Payments Report Preview…, op. cit.*; *Global Payment Report. The Definitive Guide…, op. cit.*, p. 3.

Mobile devices will surely adopt and spread the modern technology increasing the potential for providers[12]. Additionally, they might be treated as a point of sales giving the opportunity to reach the customers anywhere. M-commerce strategies focused on the evolution from desktop to smartphones. The countries that drove this evolution were South Korea, Singapore, Hong Kong, United States and the United Kingdom. In mature markets, the m-commerce is just an extension to the traditional e-commerce, either via optimised sites or applications on smartphones[13].

The value and use of alternative payment methods are rising all over the world, but detailed data shows that it is not homogenous. Despite the development of traditional and innovative non-cash payments, cash is still dominant in many

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[12] N. Mallat, *Exploring customer adoption of mobile payments – a qualitative study*, The Journal of Strategic Information Systems, Vol. 16, Issue 4, December 2007, p. 413–432.

[13] *Global Payments report preview…, op. cit.*

regions[14]. Taking into account the described trends, sooner or later it will be replaced by non-cash payment instruments. Defining alternative payments and their taxonomy helps in understanding contemporary payments trends.

2. DEFINING ALTERNATIVE PAYMENTS AND THEIR TAXONOMY

Alternative payment methods (APM) are the subject of many papers and reports. However, there is still a lack of the clear, common definition. Thedefinition of alternative payment methods can vary between sectors, countries and even by individual organisations. They are defined using two basic criteria – the subjective (the entity, the issuer) criterion and the objective (the instrument specification) criterion (see Figure 4).

Figure 4. The APM's division by basic criteria

| The issuer | • merchants' payment instruments
• stores' payment instruments
• city cards with the payment function
• e-commerce platforms' payment instruments
• m-commerce platforms' payment instruments |
| The instrument | • e-wallets
• mobile payments
• contactless payments
• online payments
• digital currencies |
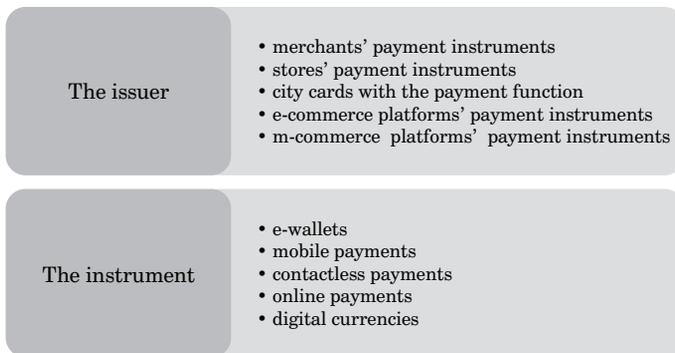
Source: own work.

According to the first criterion, they are a part of alternative finance defined as instruments and distribution channels that emerge outside the traditional financial system. They are issued and provided by nonbank institutions[15]. According to such

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[14] J. Harasim, M. Klimontowicz, *Payment Habits as a Determinant of Retail Payment Innovations Diffusion: the Case of Poland*, Journal of Innovation Management 2013, JIM 1, 2, p. 86–102.

[15] B. Zhang, P. Baeck, T. Ziegler, J. Bone, K. Garvey, *Pushing boundaries. The 2015 Alternative Finance Industry Report*, Cambridge Centre for Alternative Finance, University of Cambridge 2016; R. Wardrop, B. Zhang, R. Rau, M. Gray, *Moving Mainstream. The European Alternative Benchmarking Report*, University of Cambridge 2015, p. 9; Ch. Bradley, S. Burhouse, H. Gratton, Miller R.-A., *Alternative Financial Services: A Primer*, 2009, www.fdic.gov; R. Swagler, J. Burton, J.K. Lewis, *The Operations, Appeals and Costs of the Alternative Financial sector: Implications for Financial Counselors*, Association for Financial Counseling and Planning Education 1995, p. 93–98.

a classification, all payment instruments that are issued by nonbank institutions are thought to be alternative ones.

Basing on the second criterion, alternative payments are assumed to be payments other than traditional payment instruments. The example of this criterion's usage is the classification presented in WordPay report *Your Global Guide to Alternative Payments*[16]. WordPay defines the alternative payment instrument as the one that does not use a credit or debit card. It includes online (real time) and offline bank transfers, direct debits, e-wallet, cash on delivery, local card schemes, pre-pay and post-pay instruments, e-invoices and digital currencies. According to some reports, the check cashing should also be treated as an alternative payment method (see Table 2).

Table 2. The alternative payments' typology

Type of alternative payment	Characteristics	Example schemes
Bank transfers	Online (real time) bank transfers with immediate online authorisation via customers' bank. The settlement is usually done next day. Offline bank transfers are processed via the customer's online bank account – instead of being redirected during the transaction process, the customers are presented with a reference number, which they must then quote when logging in to an online bank account to make a payment. The customers can also choose to pay in a bank branch or via telephone banking, using the same reference number.	iDeal, eNets Sofort Banking, eNets, Przelewy24, SafetyPay PayU, Dineromail
Direct debits	A type of preauthorized payment under which an account holder authorises a bank to pay a fixed amount (such as mortgage payment or rent) or variable amounts (such as those called for in bills or invoices) directly to a landlord, bank, supplier or utility company at regular (usually monthly) intervals.	SEPA DD, ELV (Germany), Domiciliacion Bancaria (Spain)
Check cashing	A service that cashes private, government and paychecks without the necessity of having a bank account.	ACE Cash Express, Dolar Finacial Corporation

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[16] *Your Global Guide…, op. cit.*

Tabela 2 cont.

Type of alternative payment	Characteristics	Example schemes
E-wallets	An online prepaid account where one can stock money, to be used when required. As it is a pre-loaded facility, consumers can buy a range of products without swiping a debit or credit card.	Alipay, V.me, Qiwi
Mobile payments	Transactions made or received with a mobile device. They are divided into two categories: direct carrier billing and mobile wallets.	Boku, MoPay, Zong, Zapp, SEQR, Znap (MPayME), Pingit, PayBox
Person-to-person (p2p) payments	Online technology that allows customers to transfer funds from their bank account or credit card to another individual's account via the Internet or a mobile phone. There are two general approaches for initiating payment: 1) users establish secure accounts with a trusted third- party vendor, designating their bank account or credit card information to be used to transfer and accept funds; 2) customers use an online interface or mobile application (developed by their bank or financial institution) to designate some funds to be transferred.	PayPal
Cash on delivery	A transaction in which payment for goods is made at the time of the delivery. Couriers collect payments when they deliver the goods.	Merchant and delivery company services
Local card schemes	Local card schemes, specific to certain markets, often operate like traditional cards. Some aremore sophisticated offering card and bank transfer options.	MisterCash (Belgium), UnionPay (China), Carte Bleue (France)
Pre-pay instruments	Cards or vouchers bought before starting a transaction. These cards are usually authorised immediately. Most pre-pay products have a funding limit, and some do not allow multiple cards/vouchers to fund one single transaction.	Astropay, Postepay, Swiff, uKash, Neosurf, Paysafecard, Toditocash

Tabela 2 cont.

Type of alternative payment	Characteristics	Example schemes
Post-pay instruments	After buying a product online, the payment is made at an affiliated outlet or store.	Konbini, Boleto Bancario, Multibanco
E-invoices	Payments after delivery without sharing credit card or bank details by entering the email address or postcode to make payment.	Klarna, Billmelater, Afterpay
Digital currencies	An Internet-based form of currency or medium of exchange that allows for instantaneous transactions and borderless transfer of ownership.	Bitcoin, Litecoin

Source: own work.

The Euro Banking Association (EBA) uses a combined attitude. The EBA market segmentation takes into account both the issuer of the payment instrument and the innovativeness of payments. As a result, the segmentation includes quite traditional, well-known payments issued by non-bank institutions and some innovative payment instruments issued by banks. It divides the alternative payment market into eight main segments: buyers and sellers payments, secure online banking schemes, non-bank and anonymous payments, low-cost point-of-sale acceptance, remittances, non-bank closed loop payments, person-to-person (p2p) payment schemes and crypto-currencies[17].

Buyer and sellers payments include online guaranteed payments made to complete purchase during the transaction on the Internet auction site. The parties of transaction usually do not know each other. The first and the most known solution has been invented and implemented by PayPal. As card acquiring for auction sellers were too complex, banks have lost as much as 25 percent of e-commerce turnover in several EU markets[18]. Today PayPal is a strong market player and competitor for traditional financial institutions developing business in other payment fields. It is now moving into face-to-face at the POS (PayPal's pilot in the UK) and has also invented the original 'wallet' concept with ACH funding backed up by card top-up.

The rapid growth of the e-commerce turnover and increasing number of non-bank payment service providers forced banks to be more active and innovative on the retail payment market and implement their solutions. Today banks have already

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[17] *Next Generation Alternative Retail Payments…*, *op. cit.*, p. 4–6.
[18] *Ibidem*, p. 5.

offered competitive alternative payments using online banking applications, such as iDEAL in the Netherlands or MyBank, developed by EBA Clearing. They are usually ACH based alternatives.

Non-bank and anonymous payments enable consumers to convert cash to electronic value using pre-numbered vouchers, sold at the POS, which can be entered online and used for e-commerce transactions. Such products are mostly used by un- or underbanked customers and are also used anonymously for gambling and gaming. No bank-led, credible alternatives have been identified so far.

Low-cost POS acceptance was created in Germany almost 20 years ago. It is a direct debit based on ACH called ELV that also offers authorisation and payments guarantee options matching card functionality.

Other traditional alternative payment services are remittance payments (e.g. the Western Union and Moneygram). These cross-border transfers now enable cash to cash, account to cash and increasingly account to account transfers and payments.

The next alternative payments' segment consists of payments launched by many non-bank innovators, often using QR code, HFL and other developing technologies for acceptance that are linked to proprietary non-bank wallets and operate as closed loop card schemes (e.g. SEQRwallet).

One of the mobile-based alternative payment methods is person-to-person (P2P) payment scheme (e.g. Pingit, Zapp, Paym and Swish). P2P payments are thought to be a change driver of the market. There are two approaches for initiating payments. The first approach assumes that users establish secure accounts with a trusted third-party vendor, designating their bank account or credit card information to be used to transfer and accept funds. Using the third party's website or mobile application, individuals can complete the process of sending or receiving funds. They are identified by their email address and can send funds to anyone who is a member of the network. In the second approach, customers use an online interface or mobile application (developed by their bank or financial institution) to designate some funds to be transferred. The recipient is designated by their email address or phone number. Once the sender has initiated the transfer, the recipient then receives a notification to use the online interface to input his or her bank account information and routeing number to accept the transfer of funds. In this method, recipients do not need to have an account with the financial institution of the sender to receive a moneytransfer.

The last segment of alternative payments includes new currencies designed to displace traditional cash and electronic money, such as Bitcoin and others. At this stage, the application and success of these new payment methods are unclear.

The variety of payment instruments and attitudes towards the way of defining them caused the necessity to work on commonly accepted definition. According to authors defining APM should be based on payment instrument innovativeness.

As a result, traditional credit transfer, direct debit and a card-based instrument should not be treated as alternative payment instruments, similarly as cash and cheques. The innovativeness of payment instrument should include both the instruments specification and the user's experience. Such perspective leads to defining ATM as those payments that deliver specific, exceptional value for customers concerning payments' speed, convenience and safety, such as online payments, mobile payments, contactless payments (based on cards and mobile technology), e-wallets and digital currencies.

3. THE RISK OF FRAUDS OF ALTERNATIVE PAYMENTS' DEVELOPMENT

Alternative payment methods, as a new business, also bring with it new risks and threats. Most of them result from their diversity and a lack of common, cohesive standards. The different types of alternative payment methods incorporate different kinds of fraud risks (see Table 3)[19]. The lack of chargeback monitoring program and security requirements make providing the overall characteristic of APM risks and threats difficult[20].

Table 3. The characteristic of frauds related to APM

Type of frauds	Characteristic
Phishing	Scams used to drain accounts. The fraudulent practice of sending emails that look like correspondence from reputable companies to induce individuals to reveal personal information, such as passwords and credit card numbers.
Goods' wheedling	The shopper fraud consisting of clearing the account after the payment authorisation. It does not enable the settlement but enables dispatching goods.

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[19] Other risks connected with providers of these instruments are: data security risk, operational risk, liquidity risk, credit risk, compliance risk etc. – N. Chande, *A Survey and Risk Analysis of Selected Non-Bank Retail Payments Systems*, Bank of Canada Discussion Paper 2008-17, November 2008; J. Harasim, *Współczesny rynek płatności detalicznych – specyfika, regulacje*, innowacje Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach, Katowice 2013.

[20] M. Braun, J. McAndrews, W. Roberds, R. Sullivan, *Understanding Risk Management in Emerging Retail Payments*, RBNY Economic Policy Review / September 2008, p. 137–159; *Optimising your Payments: a Global View*, London 2012, p. 16.

Tabela 3 cont.

Type of frauds	Characteristic
"keylogger" software	A type of surveillance software (considered to be either software or spyware) that has the capability to record every keystroke made to a log file, usually encrypted. It can record instant messages, e-mail, and any information typed at any time using the keyboard.
Malicious software (Malware)	It means any software that brings harm to a computer system. Malware can be in the form of worms, viruses, trojans, spyware, adware and rootkits which steal protected data, delete documents or add software not approved by a user. They are distributed by malicious links and websites posted to online social networks to redirect the victim to "command and control" (C&C) server to join a botnet allowing the attacker to execute arbitrary commands and exfiltrate personal information from the device.
Partner risk	The risk that results from choosing and allowing to access bank account to the unreliable service provider.
DBOD risk	The risk is driven by an own device that results from the lack of antivirus and antispam software.

Source: own work based on *Optimising your Payments: a Global View*, London 2012, s. 16; *Security and the Internet of Things in a Self-service Banking Environment*, Diebold Nixdorf Webinar 2016, http://www.atmmarketplace.com/whitepapers/live-webinar-security-and-the-internet-of-things-in-a-self-service-banking-environment [27.11.2016].

Different threats exist by payment types what makes their identification, tracking, and management difficult. As a result, choosing experienced partners becomes more and more crucial to defend against a fraud. A fraud may happen on a large scale because of a data security breach at a payment provider or party that stores payment information anywhere along the payment chain. Massive data security breaches can occur anywhere along the payment chain, but fraudsters are likely to target the points at which data security is the weakest. Inadequate security at a non-bank service provider puts end users at risk of a fraud. Although non-banks are not more or less susceptible to a data breach than banks are, the presence of multiple providers may complicate efforts to ensure adequate security at every step of the payment chain[21]. All payment service providers should offer flexible and customised fraud rules to be set by payment and service

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[21] *Non-banks in retail payments*, Bank for International Settlements Committee of Payments and Market Infrastructure 2014, www.bis.org, p. 23–25.

types. Additionally, access to proprietary blacklists should be an advantage in the fight against alternative payment frauds[22]. Security programs should consist of three components, each delivering protection against inherent system exploits and vulnerabilities and various forms of malware attacks. The first one is access protection. It includes self-service security governance and hardening to the Microsoft operating systems based on the safety, industry and self-service best practices. They include payment card industry's data security standard (PCI DSS), SANS Institute training and certification, The National Institute of Standards and Technology (NIST) cybersecurity framework, The Federal Financial Institutions Examination Council (FFIEC) supervision and cyber security assessment tool or ATM Industry Association (ATMIA) initiatives. Most of them are aware of the fact that consumers are increasingly vulnerable[23]. The second component is intrusion protection against all forms of malware, unauthorised uses of and access to system resources as software services, memory, registry, file system, communication or devices. The last part of the security program is hard disk encryption. It delivers protection to all contents on the self-service terminal's hard disk from booting via unauthorised mediums (CD-ROM, USB sticks) and from access if removed from the original self-service environment[24].

4. PREREQUISITES FOR FUTURE DEVELOPMENT OF ALTERNATIVE PAYMENTS

Making the further development of alternative payments possible requires determining key factors that may influence the scope of their usage. The alternative payment market is increasing in value, volume, and also in breadth. Today payments are just a part of a strategy based on delivering the added value, enriching customers' lives and delighting them during shopping experience. It is supported by the fast development of immediate payments that are a potential alternative for cash payments[25]. The foundation for market success must incorporate the following pillars[26]:

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[22] *Optimising your Payments…*, *op. cit.*, p. 16.

[23] M. Coetzee, *Advanced biometric technology: Reinforcing security within payment systems*, Journal of Payment Strategy and Systems 2013, Vol. 7, No. 1, p. 77; R.J. Sullivan, *Risk Management and Nonbank Participation in the U.S. Retail Payments System*, Federal Reserve Bank of Kansas City Economic Review 2007, Second Quarter, p. 5–40.

[24] *Security and the Internet…*, *op. cit.*

[25] An immediate payment system is an irrevocable account-to-account payments transfer service that is available 24 x 7 x 365 and makes funds available to the beneficiary within seconds with an instant confirmation message to both the payer and the payee, see: *World Payment Report 2016*, Capgemini, www.capgemini.com [15.09.2016], p. 5.

[26] *Global Payments Report Preview…*, *op. cit.*, p. 22.

❖ continuity of convenience – no need to enter card details repeatedly,
❖ reach (scale) – a payment method that enables making payments in most places,
❖ omnichannel – the ability to use APMs across all environments, such as in-store, online, and in-app,
❖ personalisation and loyalty – loyalty schemes and delivery preferences should be updated automatically, and in real-time,
❖ ensured security.

According to EBA Working Group, among customers and merchants' requirements, the most important are: simplicity (the ease of the use), mobility (availability everywhere), low costs, safety and security, real-time immediacy, convenience, anonymity, flexibility and choice, preference specialisation and adequate redress processes[27].

The payments must be matched to the purchase process. The key components of any face-to-face or e-commerce transaction will surely be the mobile, tablet and wallet technology. The customer payments process, as a part of the value chain, must reflect sophisticated customisation from the payment initiation util settlement. The payment will become embedded, if not invisible, and will not be a final exit point of a transaction any longer.

According to EBA[28], in the nearest future consumers will develop improved perception of mobile security but may still limit their use of wallets to a small number of trusted schemes, banks, and merchants. The traditional differences between the card, ACH and other forms of payment will be reduced over time. Mobile payment users may no longer perceive the debit card as a logical route into the current account. Many consumers will prefer direct access to their accounts and P2P type payments. Such preferences are especially probable in the young generation target group. Younger consumers brought up on Amazon and iTunes' one-click processes will be at the forefront of demands for easy and fast payments. Using the mobile technology has already become a lifestyle. It helps to choose products and merchants, receive references from friends, take up offers. Even if the payment is a fundamental pillar of the process, all actions and activities that happen before the transaction will be more important. Geolocation, data analysis, and social media use will be used to project the loyalty offers. Payments will evolve to support omnichannel requirements with no visible differences between the mobile, point-of-sale and online purchase.

The changes in the payment paradigm will probably be a challenge for banks as they may lose relationships and some revenues. Many of them treat payments like a traditional domain and have not precisely recognised the gap between

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[27] *Alternative Retail Payments: Infrastructure Requirements*, EBA Working Group on Electronic Alternative Payments 2014, p. 6–7.
[28] *Ibidem*, p. 7–8.

their product functionality and the non-banks' payment offer. Maintaining thecompetitive advantage in this field will require managing key challenges connected with alternative payment methods (see Figure 5).

Figure 5. The challenges for banks of the alternative payments' development
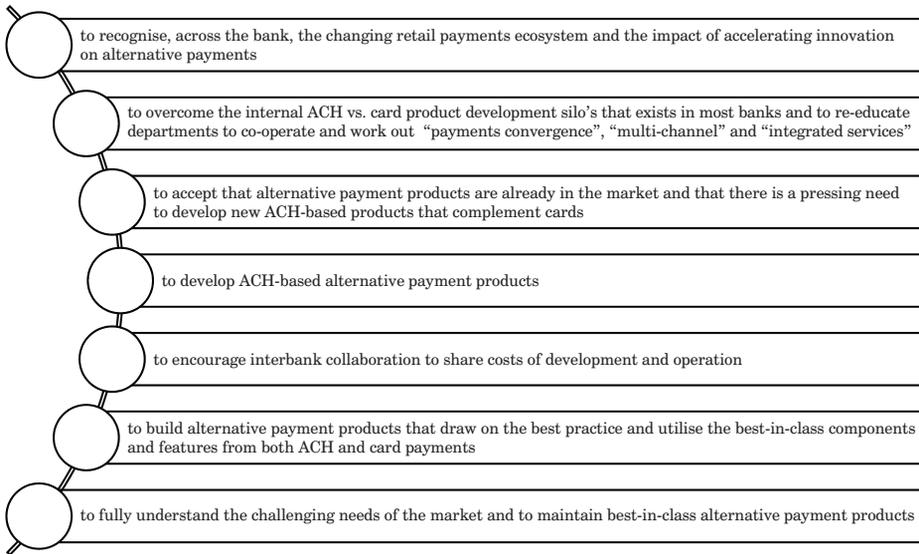
Source: own work based on *Alternative Retail Payments…*, *op. cit.*

Fortunately for banks, the alternative payment sector is still highly fractured among many different providers[29]. Not all new market players will be successful on the market, but banks should be aware of payment trends and make some efforts to match their offer with the customer's needs and expectations.

CONCLUSION

Alternative payment methods are spreading all over the world. This process is supported by the development of the network economy. The most significant driver of all changes in the contemporary economy is the new technology. It has influenced not only the commerce but also social behaviours and consumers'

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[29] M. Evans, *Alternative Payment Providers Disrupting the Payment Landscape*, ATM, Debit & Prepaid Forum 2012, Euromonitor International Market Research Group.

lifestyle. As a result, one of the faster-growing markets is the e-commerce. The companies' interests are focused on the value delivery and enhancing purchase pleasure from the very beginning of transaction util the aftersales service. As a result, new payment methods are developed as a part of the value chain. They are expected to be convenient, fast and cheap. The EBA forecast predicts that they become invisible for customers who expect "one-click" initiation and acceptance of payment. Despite that, they will be still one of the most important pillars of the retail transactions.

Today APMs are at the initial stage of their development. Additionally, the term APM is still not clearly defined. APMs classification uses different criteria: objective, subjective or combined ones. The proposed definition has changed those paradigms and has focused on payments' innovativeness and their ability to fulfil customers' expectations. The lack of homogenous taxonomy makes the assessment of the stage of APMs development difficult.

Even if currently the alternative payments are not competition for cash payments, and they are not used to the same extent in different regions of the world, they will surely be more and more popular in the nearest future. Their reach and usage are supported by opening up the market for new players and entering the market by new generation customers who are active users of the Internet and mobile technology.

Payment service providers have already noticed the increasing market potential. Even traditional ones, such as bank and card issuers have perceived the competition of non-bank players, such as EMIs, PIs and TPPs. Some of them have successfully implemented their solutions. The others must undertake an action aimed at following the market trends and matching customers' needs and expectations.

Undoubtedly, the future of retail payments is connected with the mobile and e-wallet technology, but it is not clear which of the bank and non-bank payment providers will be among the largest market players in the next few decades.

The development of alternative payment methods incorporates a different kind of risk. The successful risk management requires implementing security programs. They should include components focused on access protection, intrusion protection, and hard disk encryption.

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Piotr Mielus[*]

A VICIOUS CIRCLE
OF THE BENCHMARK REFORM

INTRODUCTION

Financial market indices play an important role for the economy. They determine an amount of flows from financial contracts (loans, bonds, derivative transactions) and indicate an objective value of financial instruments. For example, 3M USD LIBOR is the reference for 100 bln USD of derivatives[1]. From the point of view of an impact range, IBOR-type money market indices are of key importance. Those indices reflect the cost of money in the interbank market and constitute the basis for settling financial contracts at a large scale[2].

The proven manipulation of indices in the financial market was an impulse for implementing the index reform[3]. The reform was initiated by Wheatley's Report describing indications of manipulation in the LIBOR market[4]. In consequence, financial market regulators commenced work aimed at developing new principles

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[1]   D. Duffie, J. Stein, *Reforming LIBOR and Other Financial Market Benchmarks*, Journal of Economic Perspectives, Vol. 29, No. 2, Spring 2015, p. 191–212.

[2]   R. Abrantes-Metz, M. Kraten, A. Metz, G. Seow, *Libor manipulation?*, Journal of Banking & Finance 2012, Vol. 36, No. 1, p. 136–150; D. Hou, D. Skeie, *LIBOR: Origins, Economics, Crisis, Scandal and Reform*, Federal Reserve Bank of New York Staff Report No. 667, March 2014; P. Mielus, *Financial Market Index Reform Dilemmas*, Gospodarka Narodowa, 4/2016, p. 91–114.

[3]   P. Gandhi, B. Golez, J.C. Jackwerth, A. Plazzi, *Libor Manipulation: Cui Bono?*, Finance Research Seminar, April 2015.

[4]   The Wheatley Review of LIBOR: final report, HM Treasury, September 2012.

for establishing and using the indices. EBA/ESMA, BIS, IOSCO and FSB prepared a set of recommendations[5], and the European Parliament started work on implementing formal regulations for the market of financial indices. The outcome of the work is the EU Regulation on indices used as benchmarks in financial instruments (hereinafter referred to as the 'BMR'), which was published in June 2016 and was in force as of January 2018[6]. The Regulation is supplemented with technical standards prepared by the ESMA[7].

At the same time, an analysis aimed at indicating an optimal form of the index reform compliant with the Regulation is being conducted. The analysis is being made both by authorities in charge of the stability of the financial market, as well as by index administrators. These are the administrators that are responsible for implementing the Regulation by ensuring a relevant quality of indices to be published. On the one hand, current administrators have time to implement changes that are regulatory compliant in the light of the new BMR. On the other hand, supervisory guidelines published a few years ago have not been fully implemented by administrators. The latter is not a good forecast for a success.

Having that in mind, we face an economic problem of conversion of current benchmarks used in the European Union in order to make them compliant with the EU regulations. The conversion means a legal and economic change that has to be imposed in an orderly manner that is transparent for stakeholders and does not affect the financial stability.

This article describes research problems identified during the reform of money market indices and suggests how the problems can be solved. Particular attention is paid to the achievement of the goals of the reform without prejudice to the legal and economic continuity of the benchmarks. At the same time, the fulfilment of regulatory recommendations and the assurance that there are no disturbances in the financial market is the "vicious circle" title of the reform. For the most suggested conversion paths, the aforementioned goals exclude each other or one of the goals is achieved insufficiently. The author analyses possible solutions and indicates their impact on an index and index stakeholders.

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[5] *ESMA-EBA Principles for Benchmark-Setting Processes in the EU*, ESMA/2013/659, June 6, 2013; *Principles for Financial Benchmarks Final Report*, OICU-IOSCO, FR 07/13, July 2013; *Towards Better Reference Rates Practices: A Central Bank Perspective*, Bank of International Settlements, March 2013; *Reforming Major Interest Rate Benchmarks*, Financial Stability Board report, July 22, 2014; *Market Participants Group on Reforming Interest Rate Benchmarks. Final Report*, March 2014; *Review of the Implementation of IOSCO's Principles for Financial Benchmarks*, International Organization of Securities Commissions report, July 2014.

[6] Regulation of the European Parliament and of the Council on indices used as benchmarks in financial instruments and financial contracts, Brussels, 8.06.2016.

[7] Final Report. Draft technical standards under the Benchmarks Regulation, ESMA 30.03.2017.

MARKET CONDITION

The Benchmark Regulation provides for relationships between an administrator and users of indices and aims mainly at protecting consumers against manipulations that have an adverse impact on the index reliability. The Regulation applies to all indices used in financial instruments or used as benchmarks for the evaluation of results achieved by investment funds. The indices are classified based on their significance into three groups: critical indices which are used to index financial instruments or contracts of a total nominal amount exceeding EUR 500 billion or which are of key importance for the stability of the economy; significant indices that are used to index instruments of a nominal value from EUR 50 billion to EUR 500 billion, and non-significant indices[8]. Depending on the significance of an index, a level of requirements for the administrator changes. Firstly, the administrator must ensure that the index is representative, transparent and resistant to manipulation. A key document that defines the index, which must be prepared, is a Benchmark Statement[9]. The document describes in detail economic values represented by the index and an index measurement methodology. To ensure that the index is adequate to economic values it represents, the market must be followed. For that purpose, the index must be based on actual transactions and not on declarations of the panel's participants. The practice shows, however, that this is not always possible.

IBOR-type indices are based now on declarations made by panelists, i.e. banks acting as data contributors. For example, LIBOR panel counts between 11 and 17 contributors (depending on the currency) and EURIBOR panel consists of 20 banks[10]. The banks send their partial quotations which are used by the administrator to calculate the index. The final figure is usually a trimmed average of single quotes in order to exclude outliers. The quotations are based on a given bank's individual approach to the market and should comply with the applicable definition of an index (Table 1).

The very contribution, unless it results from actual transactions, is based on an expert judgement of a given fixing participant. Given market players' attitudes, the following problems in that market model can be identified:
- ❖ if a transaction does not need to be made, rates quoted may significantly differ from actual rates at which the bank would be eager to or could make a deposit transaction[11];

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[8] Regulation of the European Parliament…, *op. cit.*, Article 13–14.

[9] *Ibidem*, Article 27.

[10] Information based on IBA (www.theice.com/iba/libor) and EMMI (www.emmi-benchmarks.eu) web pages as of September 2017.

[11] Even if there is a formal obligation to make the transaction (like in the case of WIBID/WIBOR), the probability that the transaction is made is small (given credit limits between fixing par-

Table 1. Definitions of selected indices

Index	Administrator	Currency	Definition
EURIBOR	European Money Market Institute (EMMI)	EUR	Euribor is the rate at which Euro interbank term deposits are offered by one prime bank to another prime bank within the EMU zone.
LIBOR	ICE Benchmark Administrator (IBA)	USD, GBP, EUR, JPY, CHF	ICE LIBOR provides an indication of the average rate at which a LIBOR contributor bank can obtain unsecured funding in the London interbank market for a given period, in a given currency.
WIBID/ WIBOR	ACI Polska – the Financial Markets Association[*]	PLN	The rate at which a bank is ready to accept a deposit[**] from another fixing participant (bid rate) and grant it to another fixing participant (offer rate) during the first fifteen minutes upon the publication.

[*]   As communicated on 3.11.2016, ACI Poland will hand over the administration of WIBID/ WIBOR to the Warsaw Stock Exchange.

[**]   A deposit is defined as an unsecured deposit in PLN accepted or granted in the interbank market between a domestic bank, credit institution, a foreign bank branch or a credit institution branch.

Source: EMMI, IBA, ACI Poland.

❖ when rates published are strictly supervised by the regulator (which is the case since the manipulation of LIBOR and EURIBOR in the years 2005–2010 was proved), panelists try to reduce the risk of irregularities by minimising dispersion in relation to rates of other market participants and minimising rate volatility in relation to previous quotations, which distorts a natural variation of deposit rates, petrifies index levels deviating from actual funding costs, and stigmatises those participants that show their actual, although inconsistent with other participants, cost of funds in the money market;

❖ as a result of the change in the manner of financing a bank's balance sheet after the crisis in the years 2007–2009, the liquidity of the interbank money market dropped significantly and permanently, moreover negative interest rates and expansionary policy of central banks (especially visible in Eurozone) crowds out the interbank activity[12] [Rostagno et al. 2016] – in consequence, money

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ticipants and the lack of capital and tax effectiveness of interbank deposits) and a maximum amount of the deposit generates a slight interest rate risk for fixing participants.

[12]   M. Rostagno, U. Bindseil, A. Kamps, W. Lemke, T. Sugo, T. Vlassopoulos, *Breaking through the zero line: The ECB's Negative Interest Rate Policy*, Brookings Institution, Washington DC, June 6, 2016.

market benchmarks describe a market that does not exist (unsecured deposits of maturity exceeding one day are rare and are supplanted by secured deposits and deposits from non-financial institutions).

An example of the phenomenon described above is the maintenance of interest rates for several selected markets. Charts 1–4 (see the appendix) present a change in selected interest rates in Germany and Poland and the volatility of differences between those rates. The exchange of a mutual location of interest rates as a result of the financial disturbances in the years 2007–2009 is essential. Before the crisis, IBOR rates determined a marginal cost for a price of funds acquired by banks and were close to a risk-free rate determined by OIS rates. Deposits from non-financial entities were accepted at lower rates. After the outbreak of the crisis, as a result of the rapid growth of credit and liquidity risks, a distance between IBOR and OIS rates increased. In addition, IBOR was no longer used as a marginal funding cost because banks stopped acquiring funds in the interbank market and started acquiring them from the non-bank market[13]. That structural change in the funding methods applied by banks resulted, among others, from new liquidity regulations, which penalised unsecured deposits in the wholesale market and created preferences for more stable funding from the non-wholesale market. Therefore, as banks were not able to effectively borrow funds in the interbank market, they started paying higher rates for stable funds obtained from corporations and natural persons[14].

As a consequence of the aforementioned phenomena, IBOR-type indices became non-representative and sensitive to external shocks. There are three indications of that sensitivity:

❖ firstly, a level of the index cannot be verified any longer because the underlying market which it came from and referred to has disappeared;

❖ secondly, the index still influences cash flows and an economic value of index-based financial contracts whose nominal value exceeds the underlying market many times;

❖ thirdly, banks are exposed to the basis risk connected with the divergence between IBOR that is quoted and a real funding cost, which makes assets and liabilities management ineffective[15].

Those processes are reflected in the statement of turnovers and volumes recorded in various segments of the money market in the American dollar and the Polish zloty (Table 2).

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[13] V. Brousseau, A. Chailloux, A. Durré, *Interbank Offered Rate: Effects of the financial crisis on the information content of the fixing*, IÉSEG School of Management Working Paper, December 2009.

[14] P. Mielus, T. Mironczuk, *Structure of the cost of deposits in selected EU countries*, Safe Bank 3(60), Warsaw 2015, p. 89–101.

[15] V. Brousseau, A. Chailloux, A. Durré, *Fixing the Fixings: What Road to a More Representative Money Market Benchmark?*, IMF Working Paper No. 13/131, May 29, 2013.

Thus, this is an "upside down pyramid" with a very brittle foundation: a small underlying market influences indexation of a large reference market (see Figures 1–2). Furthermore, the analysis of detailed data indicates that instruments indexed to money market benchmarks are not homogeneous. Apart from derivatives, there are loans and variable coupon bonds indexed to IBOR. Thus, these are not only an off-balance-sheet exposures, but balance-sheet instruments whose share is different in different countries, as well. For details, see Table 3.

Table 2. Turnover and open positions in selected segments of the USD and PLN market

Market segment	USD LIBOR (3M)	WIBOR (1M, 3M, 6M)
Open derivatives indexed to IBOR	USD 100 trillion	PLN 6.5 trillion
Daily turnover from IBOR-indexed derivatives	USD 1.15 trillion	PLN 23.5 billion
Daily turnover from interbank deposits	USD 1 billion	PLN 8.2 million

Source: D. Duffie, J. Stein, *Reforming LIBOR…*, *op. cit.* for USD,"The Volume of Open Positions Indexed to the WIBOR rate", Gdańsk Institute for Market Economics and Money market Institute, IBnGR 2015, www.smrp.pl [7.02.2016] for PLN.

Figure 1. Relation between the underlying market and indexed market for USD LIBOR
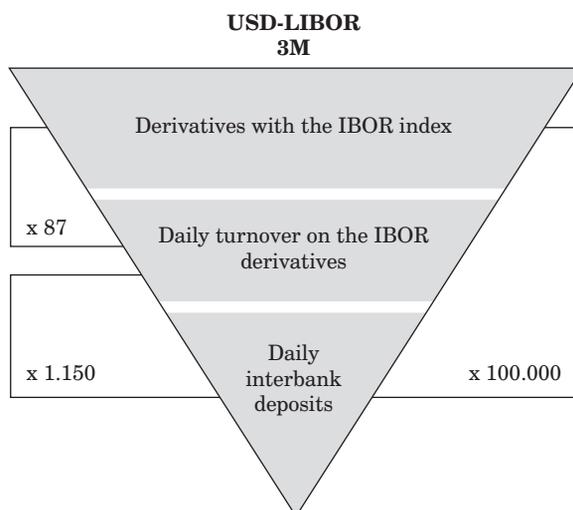
Source: own study based on D. Duffie, J. Stein, *Reforming LIBOR…*, *op. cit.*

Figure 2. Relation between the underlying market and indexed market for WIBOR
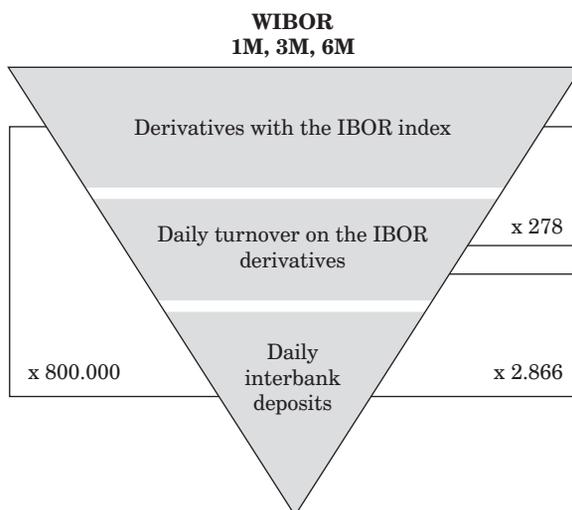
Source: own study based on *The Volume of Open Positions Indexed …, op. cit.*

Table 3. Decomposition of instruments indexed to IBOR-type benchmarks

Instrument	USD (Libor)	EUR (Euribor)	GBP (Libor)	CHF (Libor)	PLN (Wibor)
Off-balance sheet	USD 144 trillion	EUR 147 trillion	GBP 33 trillion	CHF 6.3 trillion	PLN 6.5 trillion
Balance sheet	USD 9 trillion	EUR 8 trillion	GBP 1 trillion	CHF 0.3 trillion	PLN 0.6 trillion
Total	USD 153 trillion	EUR 155 trillion	GBP 34 trillion	CHF 6.6 trillion	PLN 7.2 trillion
Balance-sheet share	5.9%	5.2%	2.9%	4.5%	8.3%

Source: *Reforming Major Interest…, op. cit., The Volume of Open Positions Indexed …, op. cit.*

The divergent impact of off-balance sheet items and balance-sheet items on the macroeconomic stability has to be underlined. Although off-balance sheet instruments are mainly traded in the wholesale market and their net exposure is balanced (i.e. a sum of long and short-term positions in the interbank market is close to zero), balance-sheet instruments generate a risk mainly for the non-

financial sector (and in the case of mortgage loans, for consumers). Therefore, the risk connected with a change in the value of an index is asymmetrical for balance-sheet instruments and may influence income distribution in the economy. This is particularly important in countries where the share of balance-sheet instruments based on a variable interest rate (i.e. indexed to IBOR-type benchmark) is high, like in Poland, where the share of balance-sheet exposures is much higher than in other countries.

The inadequacy of indices that are quoted constitutes a potential source of new disturbances in the financial market in the future. Summing the existing threats connected with the maintenance of non-reformed financial market indices, we have to take into account the following significant risk factors:

❖ in relationships between banks (B2B segment), there is a financial contract continuity risk because the index does not reflect original economic values;
❖ in relationships with customers (B2C segment), we are observing a risk of lawsuits resulting from the inadequacy of an index based on banks' declarations;
❖ in relationships with the regulator (B2R segment), there is a risk of manipulation as the index is not embedded in the transactions made;
❖ in relationships with the market (B2M segment), there is a basis risk, which means a divergence between the index and actual funding costs and a liquidity risk of instruments that are based on the non-representative index.

Thus, the index based on declarations creates not only regulatory risks in the light of the EP Regulation, but it also generates system risks resulting from the post-crisis financial market. The problem results from the fact that the index definition, which was prepared in the past, does not match the new changed market. This implies potential tensions for the economic stability and means that indices must be reformed. The preparation of benchmarks for the reform resulting from the BMR Regulation is a challenge for index administrators. Possible reform models are analysed in the following chapter.

ANALYSIS OF REFORM MODELS

As the practice applied by two main index administrators (IBA for Libor and EMMI for Euribor) shows, index conversion comprises of arrangements with a wide group of stakeholders, because this is a complex process which is likely to influence the macroeconomic stability. The stakeholders are benchmark users (issuers and investors for variable coupon bonds, borrowers and creditors for variable interest rate loans), an administrator as an entity responsible for index reliability, panelists responsible for the quality of data sent during index preparation, and a regulator supervising the administrator and panelists. Special attention should be paid to an interest of consumers that are index users.

The reform of indices is made of several stages:

(i) the identification of a gap between the present market and the BMR requirements;

(ii) a review of index definition and measurement methodology in terms of compliance;

(iii) an analysis aimed at identifying available information necessary to prepare the index reform;

(iv) communication with the stakeholders (panelists, users, regulators) to reach a consensus concerning the target index model and a path along which the model will be reached;

(v) an agreement on the final shape of the index that will both comply with regulations and be feasible;

(vi) tests of measuring the new index value;

(vii) legislation work by the administrator and panelists aimed at implementing the new index measurement methodology (resulting in the publication of the Benchmark Statement).

A key element of that procedure is defining a relevant conversion path which, on the one hand, is feasible and, on the other hand, guarantees the continuity of index publication and does not violate existing contracts. For that purpose, it is necessary to analyse the liquidity and depth of the underlying market, carry out back tests of the reliability and stability of the existing and suggested rate, and check whether the rates are consistent with other financial market benchmarks. Finally, it will be necessary to conduct a legal analysis which will identify whether the suggested conversion path does not violate the existing contracts, which could have a destructive impact on the stability and reliability of the financial market.

Those challenges restrict the room for manoeuvre for the administrator. This results from the unquestionable and irreparable disappearance of the underlying market and a change in banks' financing structure, which contributes to natural divergence between indices and actual funding costs and makes positive verification of the existing indices difficult or sometimes impossible. On the other hand, all attempts of the reform are highly likely to change the economic character of the rate, which generates significant legal and economic risks.

The literature presents two basic solutions taking into account the existing risks and aiming at developing an effective benchmark[16]:

❖ an evolution solution which consists in a moderate transformation of the definition of the index to make it based, to a greater extent, on transactions without prejudice to the legal continuity and economic character of the benchmark;

❖ creating an alternative index which would be quoted simultaneously to the present index.

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[16] D. Duffie, J. Stein, *Reforming LIBOR…*, *op. cit.*

Developing this approach, one can elaborate four models of the reform of the existing benchmarks:

❖ enforcing procedural changes that would prevent manipulations and leaving the definition and methodology of index measuring without modification, i.e. delaying the implementation of the reform (the LEAVE AS IT IS model);

❖ smoothly replacing the index measurement methodology without changing the economic and legal character of the index, but using transaction data to a wider extent (the SEAMLESS TRANSITION model);

❖ implementing the new definition and methodology for index measuring which would be based on prices of transactions made with prejudice to the existing economic character of the index, but without prejudice to legal continuity (the REPLACEMENT method);

❖ creating a parallel index based on transaction data and maintaining the existing index at the same time (the PARALLEL LISTING model).

The implementation of individual models, on the one hand, is dependent on economic and legal conditions that are specific for a given market and, on the other hand, brings about consequences for the future use of converted indices. A detailed analysis of various paths of achieving the models is described in Diagram 1 in the Appendix hereto.

The decision tree is made of 11 paths. 7 paths lead to a positive solution and the remaining ones to a negative solution (see: Table 4). A positive solution means that one of 4 possible models of the reform is used. A negative solution means that the model cannot be used and another path must be chosen. The negative solution can be corrected only if the model of the reform can be changed (which means going back to the prior decision node in order to choose another path of the reform). Finally, if none of the positive solutions is possible, the outcome is negative.

The decision tree is made of 10 nodes where an administrator chooses a further path. Questions that are to support a decision on choosing an optimal path of the reform are analysed in Table 5. Answers to individual questions are dependent on the specificity of a given market: liquidity, competitiveness of panelists, availability of instruments, the regulator's role, etc. The decision tree comprises of the following key research questions:

1. Can the implementation of a full version of the reform consisting in replacing an index based on declarations with an index defined on the basis of actual transactions be delayed?
2. Is it possible that panelists could give up their obligation of contributing input data necessary to measure the index? If yes, when is it possible?
3. Is there a collection of transactions which enable to measure the index in a reliable way? Is it necessary to add new panelists or new instruments in order to obtain that collection of transactions?

Table 4. Decision paths for various reform models

Reform model*		Scenario for a decision path	Number of iterations
Leave AS IT IS	1	The regulator's consent to delay the reform, panelists' positive reaction	2
	2	The regulator's consent to delay the reform and impose a quotation obligation on panelists	3
SEAMLESS transition	3	Sufficient number of adequate transactions to move fluently to a transaction-based index without prejudice to the economic character of that index	2
	4	When the number of panelists is extended, fluent shift to a transaction-based index without prejudice to the economic character of that index is possible	3
	5	When the number of acceptable instruments is extended, fluent shift to a transaction-based index without prejudice to the economic character of that index is possible	5
REPLACEMENT	6	Despite of a change in distribution for the new index upon the implementation of the transaction model, clauses confirming the violation of agreements between contracting parties are not activated	7
PARALLEL listing	7	Implementation of an alternative index because it is impossible to reform the present index without prejudice to agreements between the contracting parties	6
Failure	8	The regulator's opposition to delay the reform	2
	9	The regulator does not intervene when panelists waive their quotation obligation	4
	10	Instruments used to modify the index measurement formula cannot be extended	4
	11	Clauses confirming the violation of agreements between contracting parties are activated	7

* The words written with the capital letter in the path names are consistent with the Diagram 1. The failure model means the lack of a positive solution.

Source: own study.

4. Is the index based on transactions comparable to the index based on panelists' declaration? And does it indicate a comparable variation?
5. Can a change of the index measurement methodology from the declaration-based index to the transaction-based index, which resulted in a shift in the index distribution, activate contractual clauses under which contracting parties must terminate transactions because of a significant change in the characteristics of the index that determined their flows from the financial contract[17]? Is it connected with a litigation risk?

Table 5. Questions based on which a preferred path is selected

Node	Question	Next path
1	Will the index measurement method be changed?	If YES: go to the item 2, if NO: go to the item 8
2	Is a sufficient number of transactions that can be used to determine the benchmark made in the market?	If YES: choose the "seamless transition", if NO: go to the item 3
3	Can the panel be supplemented with additional banks to improve the quality of collected data?	If YES: choose the "seamless transition", if NO: go to the item 4
4	Can instruments that will enable to measure the index be added?	If YES: go to the item 5, if NO: go back to the starting point
5	Has the distribution of the index (level, variation) measured on the basis of new instruments changed?	If YES: to go the item 6, if NO: choose the "seamless transition"
6	Will the index be replaced although its distribution changed?	If YES: to go the item 7, if NO: choose the "parallel listing"
7	Are legal clauses in financial contracts violated?	If YES: go back the starting point, if NO: choose the "replacement".
8	Has the regulator agreed to delay the implementation of the reform?	If YES: go to the item 9, if NO: go back to the starting point
9	Are banks waiving data contribution to the panel?	If YES: go to the item 10, if NO: choose the "leave as it is"
10	Is the regulator intervening and obliging banks to stay in the panel?	If YES: choose the "leave as it is", if NO: go back to the starting point

Source: own study.

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[17] This means, for example, the activation of MAC (a material adverse change) clauses embedded in ISDA MAs (International Swaps and Derivatives Association Master Agreements) providing for rights and obligations of parties to a derivative contract.

An optimal path is determined by a feasibility study for selected paths and a risk analysis connected with a selection of each of the reform models. Advantages and disadvantages of each model (in the form of a SWOT analysis) are described in the Table 6.

Table 6. SWOT analysis of individual reform models

Reform model*	Strengths	Weaknesses	Opportunities	Threats
Leave AS IT IS	The simplest solution, which does not require changes for the administrator	Temporary solution that is contrary to the BMR, protective actions for the regulator must be taken	More time to prepare an optimal solution	Unstable solution, the problem is deferred, possible objection by ESMA, risk of lawsuits from non-resident banks and local consumers, risk that the panelists will leave
SEAMLESS transition	Simple solution consistent with the BMR	Limited implementation feasibility because of the lack of adequate transactions that would constitute the basis for the index measurement	Possible assurance of the index publication continuity	That solution may turn out to be unstable if the economic character of the index changes
REPLACEMENT	Assurance of full compliance with the BMR	Low probability of implementation because of a wide range of risks	Possible full index adjustment to the actual market	Significant risk of the termination of contracts as a result of the activation of clauses confirming that agreements have been violated

Tabela 6 cont.

Reform model*	Strengths	Weaknesses	Opportunities	Threats
PARALLEL listing	Implementation of solutions consistent with the BMR without prejudice to the stability of the existing benchmarks	Introduction of a parallel panel can weaken the liquidity of one of indices	Possible development of an optimal index without prejudice to the continuity of the former, which meets FSB/IOSCO recommendations	Risk that the significance of the former index decreases if it is found that the new index is highly advantageous or a liquidity risk of the new index is low

* The words written with the capital letter in the path names are consistent with the Diagram 1. The failure model means the lack of a positive solution.

Source: own study.

It is difficult to estimate the probability of the models of the reform because the distribution of the probability for individual choices at particular nodes of the decision-making process is not measurable. It is worth pointing out here that the probability of a given scenario is determined by decisions made by entities involved in the reform. Those decisions are influenced by information coming from the process participants, those participants' own interest and an assessment of present and future risks, as well as signals from other process participants (in particular regulators).

Table 7 estimates the total probability for the models of the reform based on various assumptions concerning the probability distribution for each node where the next path is chosen. In one case (50/50 distribution), there is no preference for any path at each node. In turn, for other three cases (67/33, 75/25, 90/10 distribution) a preference for one of the alternatives is taken into account[18]. The preferred alternatives are described in the Table 8.

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[18] For simplicity purposes, the fixed probability distribution in all nodes is assumed. In reality, dis- tributions differ and individual probabilities cannot be estimated. The example reflects the sensitivity of the final probability distribution to changes in the theoretical probability assigned to particular nodes.

Table 7. Probability for the reform models given different assumptions for distribution

Reform model	Probability[*]			
	50/50 distribution	67/33 distribution	75/25 distribution	90/10 distribution
Leave AS IT IS	18.75%	8.48%	5.08%	0.91%
SEAMLESS transition	40.63%	43.57%	40.72%	23.66%
REPLACEMENT	0.78%	1.47%	1.48%	0.59%
PARALLEL listing	1.56%	9.05%	17.80%	53.14%
Failure	38.28%	37.43%	34.92%	21.69%

[*]   The probability of a final result is calculated on the assumption that a preferred variant is chosen at the probability of at least 50% and always equal to the one indicated in the distribution.

Source: own study.

Table 8. Preferred variant for particular decision nodes

Node	Choice	Preferred variant
1	Index change?	YES
2	Are transactions adequate?	NO
3	Can the panel be extended?	NO
4	Can instruments be added?	YES
5	Has the distribution changed?	YES
6	Will the index be replaced?	NO
7	Are contractual clauses violated?	YES
8	Has the regulator given its consent?	NO
9	Are the panelists resigning?	YES
10	Is the regulator intervening?	YES

Source: own study.

In consequence, the seamless transition is the most probable variant, provided that the probability of choosing the preferred path does not exceed 83% at each node of the decision tree. Otherwise, the most probable variant is parallel listing. It is worth noting that the higher probability that a preferred path is chosen, the lower probability that a scenario resulting in the lack of a positive solution will come true. Given the low probability for the preferred path, the seamless

transitionvariant "wins", but the negative scenario, i.e. the lack of a constructive solution of the problem, is still highly probable. The scenario analysis for the administrator should aim at minimising the probability of failure during the index reform. Thus, it is reasonable to draw a conclusion that aiming at the parallel listing variant generates the lowest failure risk[19].

The administrator's function is to minimise the failure risk in the index reform, i.e. aim at excluding scenarios which mean that the quoted index will not meet the requirements of the BMR or related regulations (MAD/MAR) or the index will be no longer published because of the panelists' resignation and, as a consequence, the lack of sufficient data necessary to calculate the benchmark. Thus, the administrator will take up streamlining actions for the purpose of maximising the probability of the successful reform. That streamlining consists in choosing such a path of the reform that ensures the safe process and brings about the greatest benefits for a widely understood market, i.e. mainly to index users. In order to train the reform on a relevant path, the stakeholders should define their preferred manner of proceeding and take up actions aimed at making adequate choices at individual nodes of the process described in the Diagram 1.

CONCLUSION

The reform of money market indices is a phenomenon made of many aspects and determined both by the regulations and by a change in the model of funding of the banking sector and risks that were not identified earlier (the basis risk, legal risk, reputation risk). The consequences of the implementation of the reform will have an impact on the whole financial market (banks, borrowers, investors). Therefore, any incorrect implementation of the reform or any waiver of the key elements of the reform may threaten the macroeconomic stability of countries and markets to which the reformed indices refer.

This article focuses on the detailed analysis of possible scenarios aimed at finalising the reform of indices. Unfortunately, many available paths lead us astray and do not let us find a solution consistent with the EU regulations and safe for the financial market at the same time. As a positive solution cannot be find, the title "vicious circle" materialises. It exists when there is no solution that would enable to comply with the regulations without prejudice to the rights of parties to contracts based on indices, which may threaten the stability of the financial system. Then, one of the following negative scenarios may be possible:

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[19] The table 7 indicates that for 90/10 preference distribution, the probability of failure is only 21.69%, and the probability of parallel listing is 53.14%.

❖ index frustration, which means a significant drop of the benchmark's reliability as a result of the loss of representativeness and/or change of the economic character of the benchmark, which generates a risk that the continuity of financial contracts based on the index will be questioned. In that case, market participants will avoid indexing instruments by the use of the former benchmark and will choose alternative indices (if available);

❖ index discontinuation, which means the administrator not being able to quote the index because of the loss of a sufficient number of panelists or because of the fact that the index does not meet thresholds defined by regulatory authorities; in that case an alternative index must be created.

The administrator faces a stark choice between maintaining the stability of indices he manages and a need to create new indices that will meet the BMR and regulators' recommendations. The administrator must mainly maintain the continuity of index quotations by keeping a relevant group of banks that contribute quotations used to calculate the benchmark. However, quotations based on declarations are dangerous for panelists because of a risk that they will be suspected of manipulation. In turn, the conversion to a transaction-based index (which is safe for panelists because they are no longer responsible for an "expert judgement") is rarely possible without prejudice to the economic character of the quoted index (which may bring about serious legal consequences).

An indication of the change in the economic character is a different distribution of a new index, which is reflected by one of the following phenomena:

1. the new index is quoted at a structurally different level (a parallel shift) because of a different cost of money generated by actual transactions in comparison with non-binding declarations of panelists;

2. the new index shows a different (usually higher) variation because transaction prices respond to changes in liquidity and other market factors, which is in contrast with the inertia of declaration-based quotations.

The literature[20] suggests paths aimed at solving the problem. Firstly, it is possible to maintain the existing index measurement model based not only on dispersed population data, but on individual quotations of panelists as well (subject to cutting marginal findings). In that case, the mix of data used to measure the index (the waterfall feed) made of direct transactions, prices implied by correlated transactions and declarations based on market phenomena that are observed (and evidenced) would be acceptable. Secondly, in order to minimise variations, smoothing techniques could be used. In addition, to increase level convergence in relation to the former benchmark, correction spread could be applied.

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[20] *Evolution of ICE LIBOR Feedback Statement*, IBA, 1.05.2015; *Euribor Transition Policy*, European Money Markets Institute, 14.05.2015.

It is worth noting that technical aspects are crucial for the assessment of a selected path as far as the minimisation of system risks is concerned. Only given the excellent knowledge of processes determining prices in the market segment described by a given index, the impact of changes on the liquidity and volatility of the underlying market and reference markets where the index is used can be adequately estimated.

It seems that to minimise the probability of negative scenarios, a relevant consensus in the group of panelists, users and regulators must be reached. The solutions developed in such a way should provide for fluent transition to the new index measurement model without prejudice to the continuity of contracts and without side effects in the form of reputation or economic risks that have an adverse impact on the performance of the sector and that sector's customers.

Abstract

The Benchmark Regulation (BMR) imposes the necessity of the conversion of the quote-based financial indices to the transactional-based ones. The reform is a challenge for administrators of indices that perform feasibility studies of the conversion process. The article analyses pros and cons of various methods of the index reform indicating the optimal path of such activity as far as money market is concerned. A choice for a "parallel listing" path seems to be the safest one if one takes into account the legal and economic risks embedded in various transition models.

Key words: financial indices, benchmark regulation, money market

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APPENDIX

Chart 1. Interest rates in Germany
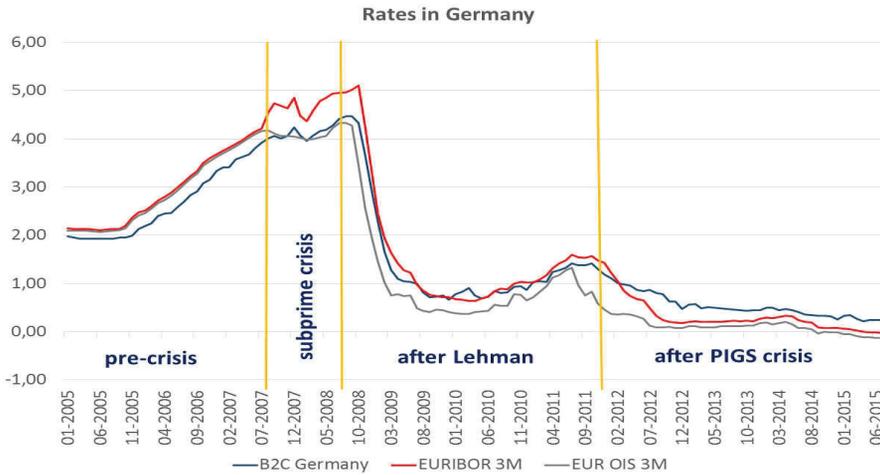
Source: ECB, Thomson Reuters.

Chart 2. Spreads between interest rates in Germany
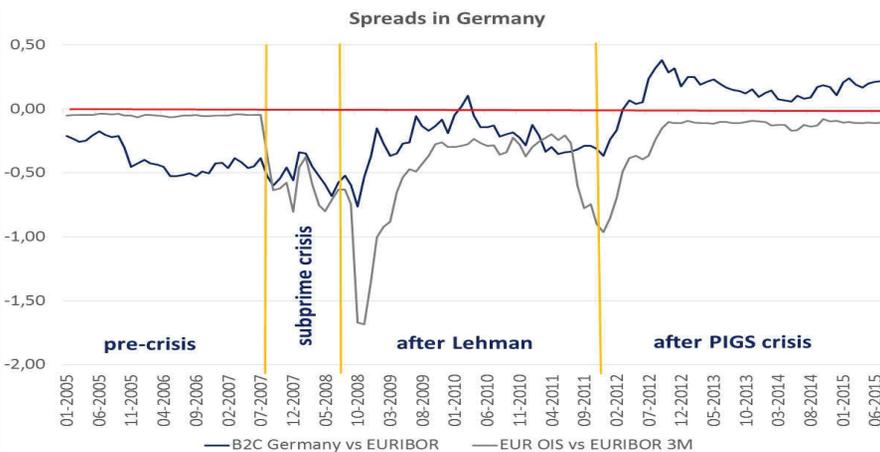
Source: own study based on NBP data, Thomson Reuters.

Chart 3. Interest rates in Poland
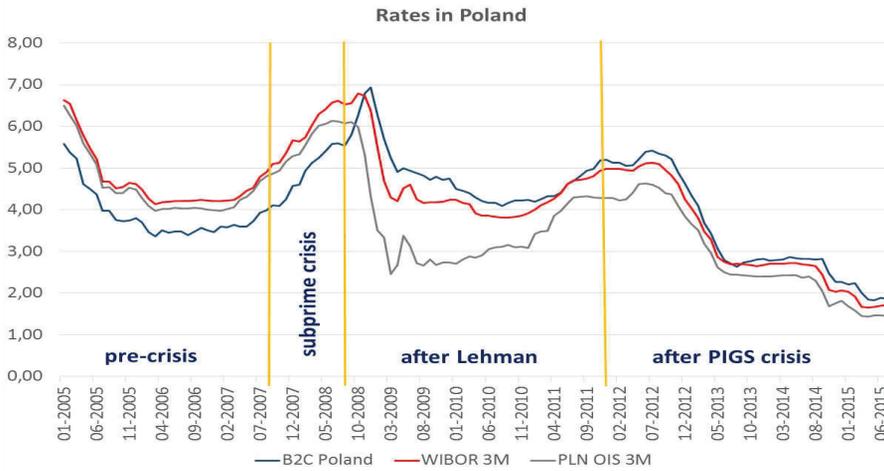
Source: NBP, Thomson Reuters.

Chart 4. Spreads between interest rates in Poland
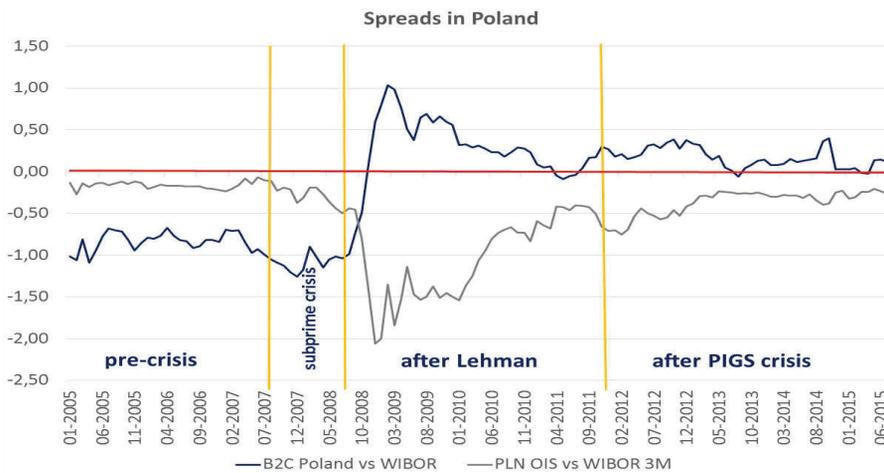
Source: own study based on NBP data, Thomson Reuters.

Diagram 1. Paths for the index administrator
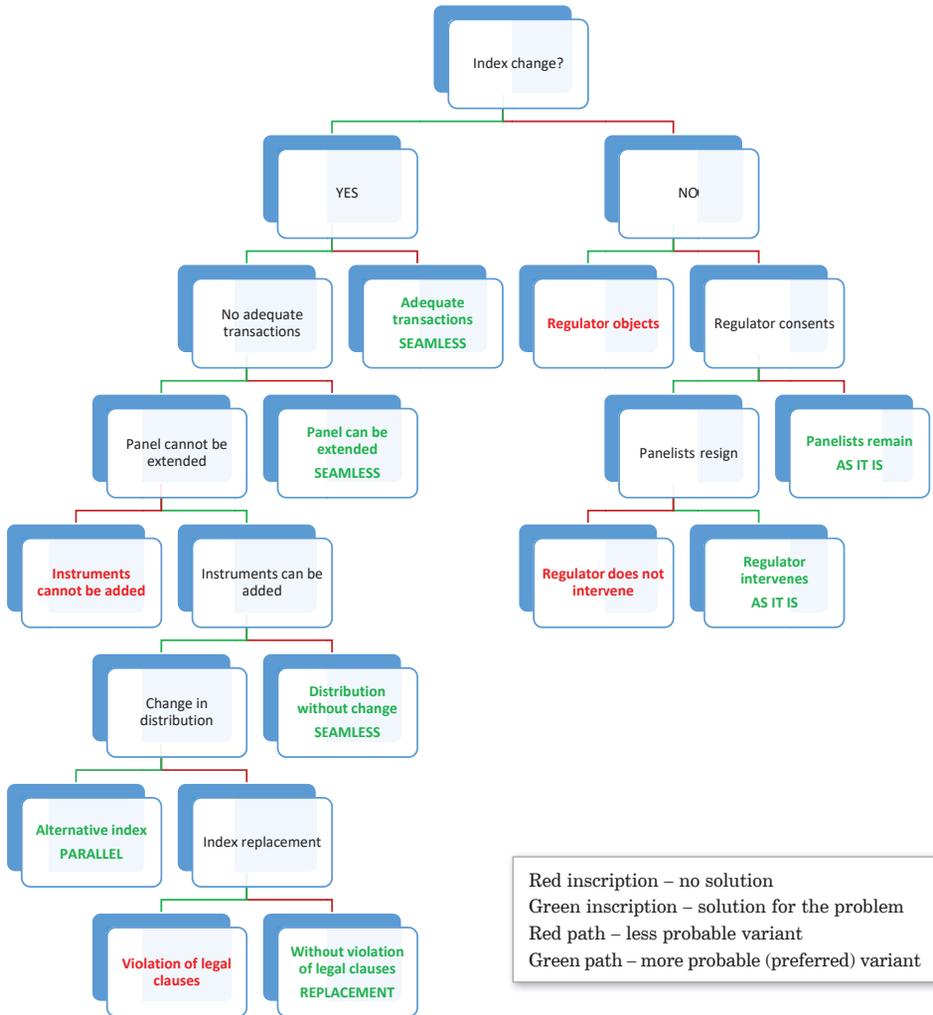
Source: own study.

Marta Penczar[*]

CONSUMER CHARACTERISTICS WITH REGARD TO CHOOSING BETWEEN FIXED AND ADJUSTABLE INTEREST RATES IN MORTGAGE CONTRACTS

INTRODUCTION

The matter of buying a flat is one of the most important decisions made by households. Buying a property on credit means a long-term commitment and a strain on the household budget. Future variability of this burden depends on many factors, including the choice of the interest rate formula used to calculate interest instalments. What is more, the 2008 financial crisis emphasized the impact of the mortgage market situation on the financial system's stability and the economic development.

The literature on the subject analyses, among other things, the determinants of consumer preferences regarding an optimal choice between fixed-rate mortgages (FRMs) and adjustable-rate mortgages (ARMs). It should be noted that the term 'fixed-rate mortgage' refers to a mortgage in which the fixed interest rate is valid for a period of at least 5 years. In the case of a longer loan term, determining the interest rate formula may take place several times over the entire term.

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The article aims to analyse the most important borrower characteristics determining their preferences when choosing the interest rate formula in mortgage contracts. The portfolio of newly-issued mortgages in 2016 was analysed on the basis of the Polish Financial Supervision Authority statistics. It was done in order to identify a group of consumers corresponding to the borrower characteristics who, in the light of European and global research, would be willing or obliged to choose a fixed interest rate.

1. ANALYSIS OF THE SHARE OF FIXED AND ADJUSTABLE INTEREST RATES IN THE PORTFOLIO OF NEWLY-ISSUED MORTGAGES IN THE EUROPEAN UNION IN THE PERIOD FROM 2003 TO 03.2017

The literature on the subject points out that the matter of choosing the optimal mortgage contract is both basic and complex. It is basic because most households deciding to buy a property are forced to get financial support from a bank. On the other hand, the complexity of mortgages is due to the need to include a number of variables that will determine the timely repayment of credit obligations in the future. This includes uncertainty about the monetary policy, level of interest rates, inflation, restrictions on further borrowing, lack of certainty about the income and labour market situation, as well as the need for long-term planning.

One of the aspects that consumers should consider when selecting a mortgage is also the choice of the interest rate formula, either fixed or adjustable, on the basis of which loan instalments are calculated. Given the lack of financial professionalism on the part of consumers and the unpredictability of many economic phenomena, this decision is not easy. Moreover, it can greatly affect the quality of household functioning through household budget constraints[1].

The European Central Bank data indicate a mixed situation in this respect. Fixed interest rates are characteristic and dominant in France, Germany, Czech Republic and Slovakia among others. In general, it should be noted that fixed-rate mortgages prevail in most Eurozone countries. The average share of adjustable interest rates in newly-issued mortgages in the Eurozone is at a very low level of 14.6%. Nevertheless, in Greece, Portugal and Ireland, the share of adjustable rates in the value of newly-issued mortgages is above 50%, indicating a slight advantage of adjustable-rate mortgages.

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[1] J.Y. Campbell, J.F. Cocco, *Household risk management and optimal mortgage choice*, The Quarterly Journal of Economics 2003, Vol. 118.

Graph 1. The share of adjustable interest rates in the value of newly-issued mortgages in the European Union (03.2017)
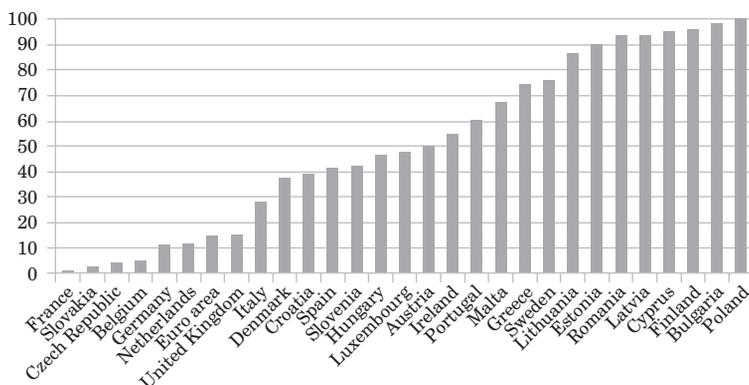
Source: author's own work on the basis of the ECB data.

Countries with a significant share of adjustable interest rates in the portfolio of newly-issued mortgages include: Poland (100%), Bulgaria (98%), Finland (96%), Cyprus (95%), Latvia and Romania (94%). It can, therefore, be pointed out that the banks' offer with regard to the so-called fixed-rate mortgages in these markets is limited or practically non-existent. Choosing the interest rate formula in mortgage contracts may, however, take place only in the markets where there is a real offer of banks with regard to both options. In Poland, at the end of 2016, only 4 banks offered fixed-rate mortgages – BZWBK, PKO BP, BGŻ BNP Paribas, Deutsche Bank.

Table 1. The offer of fixed mortgage rates in Poland

	Fixed interest rate period	**Fixed interest rate**	**Offer after a fixed interest rate**
BZWBK	5 years	from 4,15%	WIBOR 3M + 2,0%
PKO BP	2 years	about 3,5%	WIBOR 3M + 2,0%
Deutsche Bank	1–5 years	3,0–4,0%	WIBOR 3M + 2,0%
BGŻ BNP Paribas	5 years	about 4,0%	WIBOR 3M + 2,0%

Source: A. Pilcicka, *Kredyty hipoteczne o stałej stopie procentowej w polskich realiach*, https://alebank.pl/kredyty-hipoteczne-o-stalej-stopie-procentowej-w-polskich-realiach/ [access: 8.10.2017].

High interest rate fluctuations in mortgage contracts across the European Union are due to cultural and economic factors, as well as the development of the financial market infrastructure. Countries with developed covered bond markets

generally have a higher share of fixed-rate mortgages, as is the case of Germany, the United States or Denmark. By contrast, adjustable rates are dominant in the markets where financing is based on short-term deposits, e.g. in Portugal, Greece or Poland.

It is worth noting the variability of interest rate choices among consumers in individual markets over the years. This is a result of the fluctuations in economic conditions, monetary policy and household preferences and characteristics, which are presented in the next chapter.

Graph 2. The share of adjustable rate mortgages in the portfolio of newly-issued mortgages in France and the Netherlands in the period from 2003 to 03.2017
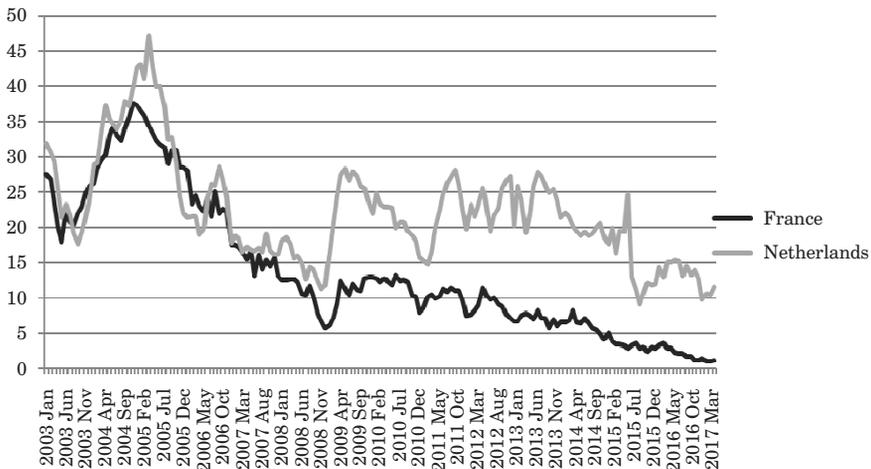
Source: author's own work on the basis of the ECB data.

In the case of France and the Netherlands, a systematic decrease in the share of adjustable rates in the portfolio of newly-issued mortgages can be observed. According to the ECB data, in the period from 01.2005 to 03.2017, the share of such mortgages in the French market decreased from 36% to 1.2%, and in the Dutch market from 43% to 12%.

In many European markets, periods of high variability in the choice of fixed and adjustable rates can be observed. It confirms the existence of certain groups of factors determining the choice of a specific interest rate formula in mortgage contracts.

In Italy, between 01.2005 and 09.2008, i.e. until the outbreak of the financial crisis, there was an increase in the share of fixed rates in the value of newly-issued mortgages – from 13% to 71%. In the next period – until 08.2010, adjustable-rate

mortgages became more attractive to consumers again, with their share amounting to around 88% at the end of August 2010. The negative results of the financial crisis, as well as economic recession in the country, caused consumer interest rate expectations to fall, thus reducing the attractiveness of fixed-rate mortgages. Since March 2014, there was another decline in adjustable-rate mortgages, whose share decreased from 80% to 30% at the end of March 2017.

Graph 3. The share of adjustable-rate mortgages in the portfolio of newly-issued mortgages in the period from 2003 to 03.2017 in selected European markets
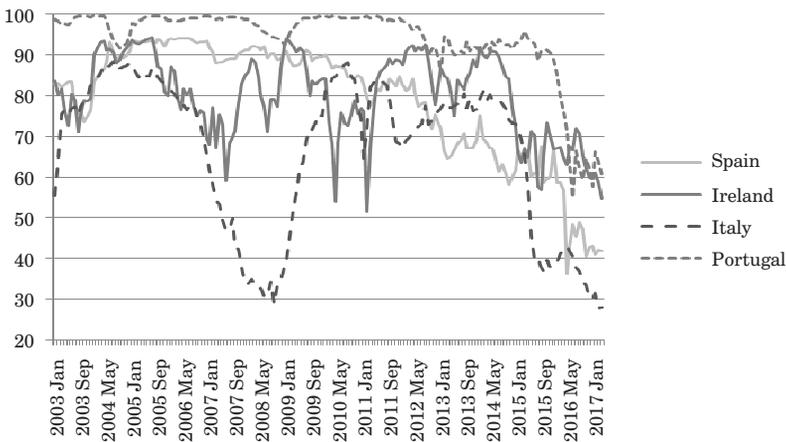
Source: author's own work on the basis of the ECB data.

Another interesting example is the Spanish market. After a long period of adjustable-rate mortgage domination (80–90%), since May 2012 there was an increase in the share of fixed-rate mortgages, amounting to 58% of newly-issued mortgages in March 2017.

A similar situation took place in Ireland, with an increase in the share of fixed-rate mortgages from 10% in April 2014 to 55% in March 2017.

The Portuguese mortgage market was practically dominated by adjustable rates in the period from January 2003 to November 2015 (90–100%), which is similar to the current situation in Poland. Nevertheless, after this period, the development of the fixed-rate mortgage offer could be observed, with their share rising to 40% at the end of March 2017.

The analysis of the European Union mortgage market in terms of fixed and adjustable interest rate choice indicates large diversification in individual markets, as well as a change in interest rate preferences over time. It is, therefore, important to examine the factors that determine the choice of a particular interest rate.

2. DETERMINANTS OF THE CHOICE OF FIXED AND ADJUSTABLE RATES IN MORTGAGE CONTRACTS – A LITERATURE REVIEW

The literature on the subject includes the findings of a number of international studies identifying the determinants that influence the interest rate choice and consumer preferences with regard to interest rate formulas in mortgage contracts – fixed and adjustable. Generally, they can be classified into two factor categories – price-related and non-price related, describing the basic borrower characteristics.

In the case of price-related factors, the choice of the interest rate formula may be determined by the difference between fixed and adjustable interest rates on mortgages. Consumer preferences for adjustable rates can be observed in the situations where the aforementioned difference and the adjustable rate level are high. As implied by Paiella and Pozzolo[2], borrowers expect reference rates to fall in the near future because their current level is high. In general, as Sa-Aadu and Sirmans argue[3], consumers are less likely to opt for a adjustable rate in the face of rising expectations of an increase in interest rates.

The Vickery research[4] confirms high sensitivity of consumers to the mortgage price. A fixed rate increase by 10 base points translates into a 10.4 percentage point decrease in the market share of fixed-rate mortgages.

Price factors also include the relation between the price per square meter and the borrower's income. Paiell and Pozzolo's research shows that the higher the price per square meter in relation to income, the less likely borrowers are to choose a adjustable rate for their mortgage. This is the result of fears that in the event of an interest rate increase, they will not be able to settle their liabilities to the bank in a timely manner.

On the other hand, the most significant determinants of the interest rate formula selection related to the basic borrower characteristics are considered to be the following:
❖ level of the loan-to-value ratio (LTV),
❖ level of the debt-to-income ratio (DTI),
❖ age,
❖ education,
❖ level of income,

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[2]   M. Paiella, A. Pozzolo, *Choosing between Fixed and Adjustable Rate Mortgages*, Universita degli Studi del Molise, Campobasso, Italy, 26 March 2007, https://papers.ssrn.com/sol3/papers. cfm?abstract_id=976346 [access: 22.05.2017].

[3]   J. Sa-Aadu, C.F. Sirmans, *Differentiated Contracts, Heterogeneous Borrowers, and the Mortgage Choice Decision*, Journal of Money, Credit and Banking 1995, 27(2), 498–510.

[4]   J. Vickery, *Interest Rates and Consumer Choice in the Residential Mortgage Market*, Working Paper, Federal Reserve Bank of New York 2007, https://pdfs.semanticscholar.org/5428/7a5f6da a79a15f9b139dd5f1f542841ed96b.pdf [access: 22.05.2017].

❖ risk aversion,
❖ the ability to handle sudden increases in mortgage costs,
❖ financial literacy.

Duffy and Roche studies[5] have shown that households with a high level of LTV ratio tend to choose fixed interest rates (FRMs) more frequently. This is mainly due to the attempts to avoid liquidity problems in the case of an increase in loan burden as a result of the interest rate's changes. Brueckner also exhibited a similar dependence[6]. Namely, consumers making a high down payment, who therefore have a low level of LTV ratio, chose adjustable rates.

Regarding the income level, most studies indicate adjustable rate preferences among high-income households[7]. The close relationship between the choice of a adjustable interest rate and the existence of a co-borrower, e.g. a spouse, is also emphasized. This can be interpreted as increasing financial security and the ability to manage a higher home budget under the conditions of mortgage servicing. In this context, it should be inferred that lower-income households tend to choose fixed rates.

The level of education is also an important factor in choosing mortgage rates, although earlier studies from the 1980s initially did not confirm this thesis[8]. Leece's studies[9] have shown that a higher level of education in a household and the possibility of career advancement reduce the likelihood of choosing a fixed-rate mortgage[10]. The level of education is also clearly linked to higher financial awareness. On the other hand, Bucks and Pence's studies[11] have demonstrated that people with lower education level and a low income, at the time of the interest rate increase, often experienced the biggest changes in mortgage terms. These households also declared that they had no knowledge of the level of reference

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[5] D. Duffy, M.J. Roche, *Heterogeneous homebuyers, mortgage choice and the use of mortgage brokers*, The Economic and Social Research Institute, Dublin 2005.

[6] J.K. Brueckner, *The pricing of interest rate caps and consumer choice in the market for adjustable-rate mortgages*, Housing Finance Review 1986, Vol. 5, No. 2.

[7] E. Fortowsky, M. LaCour-Little, E. Rosenblatt, V. Yao, *Housing tenure and mortgage choice*, Journal of Real Estate Finance & Economics 2011, Vol. 42, No. 2, pp. 162–180, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1336032 [access: 22.05.2017]; J.R. Brueckner, J.R. Follain, *The rise and fall of the ARM: an econometric analysis of mortgage choice*, The Review of Economics and Statistics 1988, Vol. 70, No. 1.

[8] U.S. Dhillon, J.D. Shilling, C.F. Sirmans, *Choosing between fixed and adjustable rate mortgages: a note*, Journal of Money, Credit and Banking 1987, Vol. 19, No. 2.

[9] D. Leece, *Household choice of fixed versus floating rate debt: a binominal probit model with correction for classification error*, Oxford Bulletin of Economics and Statistics 2000, Vol. 62, No. 1, pp. 61–81.

[10] B. Coulibaly, G. Li, *Choice of mortgage contracts: evidence from the survey of consumer finance*, Real Estate Economics 2009, Vol. 37, No. 4.

[11] B. Bucks, K. Pence, *Do borrowers know their mortgage terms*, Journal of Urban Economics 2008, Vol. 64.

rate changes. Campbell[12] has in turn exhibited lower activity in terms of effective mortgage refinancing among people with lower education, including the transition from fixed to adjustable rates or vice versa.

The age is a variable whose influence on the interest rate's choice is not definite and may depend on the region. On the one hand, the research of Sa-Aadu and Megbolugbe[13], as well as Paiella and Pozzolo[14] shows lower propensity to choose adjustable rates among elderlypeople, and on the other hand, Blacklow[15] suggests decreasing likelihood of choosing fixed rates with the age. It is worth quoting Paiella and Pozzolo's study, which showed high correlation between the interest rate choice and the age and number of dependent children. The preference for adjustable rates goes down as the number of children in a household and a borrower's age go up.

Another factor that can determine the interest rate choice is risk sensitivity. Cox[16] researched the impact of risk aversion in relation to the financial education level. The results showed that households with lower willingness to take risks and lower level of financial education prefer less risky alternatives and are less likely to choose adjustable rates. Similar results were obtained by Coulibaly and Li[17]. Households with the lower "risk appetite" were more inclined to choose fixed rates in mortgage contracts.

It should be noted that the borrowers' financial education level is an important determinant of the interest rate choice. Its significance has been demonstrated, inter alia, by Gerardi's research[18], which pointed to the lack of basic financial knowledge among borrowers in the American subprime market. Bergstresser and Beshears[19] found that borrowers who chose an adjustable interest rate in their mortgage contract showed low awareness when asked financial questions. However, Swedish

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[12] J.Y. Campbell, *Household Finance*, The Journal of Finance, Volume 61, Issue 4, August 2006.

[13] J. Sa-Aadu, I.F. Megbolugbe, *Heterogeneous borrowers, mortgage selection, and mortgage pricing*, Journal of Housing Research 1995, Vol. 6, No. 2.

[14] M. Paiella, A. Pozzolo, *Choosing between Fixed…, op. cit.*

[15] P. Blacklow, M. Dungey, G. Wells, *Fixed versus floating rate – borrower characteristics and mortgage choice in Australia*, 2010, http://www.rbnz.govt.nz/-/media/ReserveBank/Files/Publi cations/Seminars%20and%20workshops/AMW2010/3957590.pdf [access: 22.05.2017].

[16] R. Cox, D. Brounen, P. Neuteboom, *Financial literacy, risk aversion and choice of mortgage type by households*, Journal of Real Estate Finance and Economics 2015, Vol. 50, No. 1.

[17] B. Coulibaly, G. Li, *Choice of mortgage contracts…, op. cit.*

[18] K. Gerardi, L. Goette, S. Meier, *Financial literacy and mortgage outcomes"*, 2009, paper presented at ASSA Meetings, San Francisco, 3–5 January, https://www.aeaweb.org/conference/2009/ meetingpapers.php [access: 22.05.2017].

[19] D. Bergstresser, J.L. Beshears, *Who selected adjustable-rate mortgages? Evidence from the 1989–2007 surveys of consumer finances*, Working Paper No. 10-083, Harvard Business School Finance, Boston, 2010, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1573625 [access: 22.05.2017].

research[20] with contradictory findings should also be quoted. In Almenbereg's analyses, people with adjustable-rate mortgages showed a slightly higher level of financial literacy than consumers with fixed-rate mortgages.

On the other hand, Duffy and Roche have shown that consumers receiving mortgage consulting services are less likely to choose adjustable-rate mortgages. Such services were mostly used by first-time flat buyers and households obtaining high loans in relation to the property value, i.e. with a high LTV ratio.

The last feature, describing the preferences for the interest rate's choice in mortgage contracts is the so-called AHSIM (ability to handle sudden increases in mortgage costs). Coulibaly and Li[21] found that financial stress plays an important role in the choice of mortgage interest rates. In this context, it was noted that households with a more limited budget show a tendency to choose fixed rates. A Swedish study conducted by Hullgren and Söderberg[22] has shown that the reduced ability to handle sudden increases in mortgage costs is one of the factors that cause borrowers to choose fixed rates. Different results were presented by Kulander and Lind[23]. They found that, contrary to the expectations, the borrowers with a lower adjustable rate share were statistically more concerned than those with a higher share.

The aggregate results of Swedish research[24] indicate that certain household characteristics, including the low education level, low income, high risk aversion and low financial literacy determine their preference for fixed interest rates in mortgage contracts.

Similar results come from the Campbell and Cocco research[25]. In the model describing optimal consumption and mortgage choices, they showed that borrowers with relatively low mortgages, stable income, low insolvency costs and high probability of relocation should choose an adjustable rate.

Brueckner and Follain[26] point out, however, that a number of children in a household means higher risk aversion, greater demand for housing, and greater concern for future consumption, which translates into lower probability of adjustable rate selection in a mortgage contract.

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[20]   J. Almenberg, *Raknefardighet och finansiell formaga*, Ekonomisk debatt No. 5, 2011 argang 39, 2011, http://nationalekonomi.se/filer/pdf/39-5-ja.pdf [access: 22.05.2017].

[21]   B. Coulibaly, G. Li, *Choice of mortgage contracts…*, op. cit.

[22]   M. Hullgren, I. Soderberg, *The relationship between consumer characteristics and mortgage preferences, A case study from Sweden*, International Journal of Housing Markets and Analysis 2013, Vol. 6, Issue 2, https://www.kth.se/polopoly_fs/1.418655!/Menu/general/column-content/attachment/Paper3_Hullgren_r%C3%A4tta.pdf [access: 22.05.2017].

[23]   M. Kulander, H. Lind, *Loan-to-value ratios – a study of home buyers*, Report No. 49, Royal Institute of Technology, Sweden 2009.

[24]   M. Hullgren, I. Soderberg, *The relationship…*, op. cit.

[25]   J.Y. Campbell, J.F. Cocco, *Household risk management…*, op. cit.

[26]   J.R. Brueckner, J.R. Follain, *The rise and fall of the ARM…*, op. cit.

3. PROFILES OF CLIENTS CHOOSING BETWEEN FIXED OR ADJUSTABLE INTEREST RATES IN A MORTGAGE CONTRACT – CONCLUSIONS FOR THE POLISH MARKET

Based on the literature review on the subject, there is the possibility to build profiles of clients who, on the basis of selected characteristics, may or should (in order to ensure economic security of their household) choose either a fixed or an adjustable interest rate in their mortgage contract.

A detailed overview of borrowers' characteristics is presented in the table below.

Table 2. Profiles of clients choosing between a fixed and an adjustable interest rate in a mortgage contract

Borrower's characteristics	Profile of a borrower preferring an adjustable interest rate	Profile of a borrower preferring a fixed interest rate
LTV	low	high
DTI	low	high
Age	younger	older
Income	high	low
Education	higher level	lower level
Financial education	high level	low level
Willingness to take risks	higher	lower

Source: author's own work.

Subjectively, it can be stated that fixed-rate mortgages should be accessible mainly to the borrowers, belonging to at least one of the specified groups:

❖ that are older – over 50 years old at the time of obtaining a loan, due to the long period of the mortgage loan (over 25 years), the borrowers' income may be reduced when they retire,

❖ with the relatively low education and financial education level,

❖ characterized by a high credit level in relation to the property value – LTV over 80% – according to the PFSA recommendation, borrowers must now hold in cash 20% of the price of an apartment, of which 10% may come from additional insurance,

❖ with low income – the social minimum for a three-person household was 2900 PLN in Poland in 2016 and 3500 PLN for four persons,

❖ whose costs of servicing credit liabilities in relation to income are relatively high – DTI over 50% – this level was indicated by the PFSA in the Recommendation T.

On the basis of borrowers' characteristics, products tailored to consumers' financial capabilities and conditions can be offered. It should be emphasized that the appropriate adjustment of a credit product to clients' needs is one of the key elements of a credit process these days, regulated by the law. The Act of 23 March 2017 on mortgages, supervision of mortgage intermediaries and agents[27] indicates that, prior to the conclusion of a mortgage contract, the lender should, in an unambiguous, understandable and precise manner, provide the consumer with explanations concerning, among others:

❖ the main mortgage terms, including all additional services;
❖ any effects the proposed mortgage may have on the consumer, including the consequences in the event of late payments.

In this context, making clarifications about the applied interest rate, fixed or adjustable, should be a matter of particular priority. When assessing creditworthiness, the bank has information about a consumer's characteristics. It is therefore possible to better adjust mortgage terms to the consumer's financial situation, offering the application of a more suitable interest rate.

As described in the Chapter 1, the use of fixed interest rates in real estate loan agreements in Poland is at a minimum level. At the end of 2016, there were 4240 fixed-rate mortgages worth 724 million PLN in the banks' mortgage portfolio. This represents a 0.2% share in the total mortgage debt in Poland.

Table 3. Fixed-rate mortgages in Polish banks

	Fixed interest rate period						
	1 year	2 years	3 years	4 years	5 years	more than 5 years	total
Number of mortgage contracts	926	180	40	61	1 643	1 389	4 239
Gross carrying amount (PLN million)	300	36	4	2	309	72	724
Share in the mortgage portfolio:							
In the number of mortgages	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,2%
In the value of mortgages	0,1%	0,0%	0,0%	0,0%	0,1%	0,0%	0,2%

Source: *Report on the situation of banks in 2016*, Polish Financial Supervision Authority, Warsaw 2017, p. 81.

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[27] The Act of 23 March 2017 on mortgages, supervision of mortgage intermediaries and agents, Journal of Laws of 2017, item 819, article 18.

Table 4. The scale and structure of mortgage lending in 2016

	Number of mortgages	Value of mortgages (PLN million)	Average mortgage amount (PLN thousand)	Share in the number of mortgages	Share in the value of mortgages
LTV					
up to 80%	119 770	24 063	-	67,7%	62,6%
> 80%–90%	56 485	14 079	-	31,9%	36,6%
> 90%–95%	477	231	-	0,3%	0,6%
> 95%–100%	93	34	-	0,1%	0,1%
> 100%	123	14	-	0,1%	0,0%
Borrowers' age					
up to 25 years old	12 117	2 130	176	6,8%	5,6%
> 25–30	45 365	9 288	205	25,6%	24,3%
> 30–35	46 677	10 692	229	26,4%	27,9%
> 35–40	30 437	7 506	247	17,2%	19,6%
> 40–50	27 491	6 196	225	15,5%	16,2%
> 50 years old	14 862	2 466	166	8,4%	6,4%
Borrowers' education level					
primary	3 284	508	155	1,9%	1,3%
secondary	46 268	7 820	169	26,1%	20,4%
higher	127 397	29 950	235	72,0%	78,2%
Average monthly net income of borrowers (for a mortgage application)					
up to 2 000 PLN	8 380	927	111	4,7%	2,4%
> 2–4	59 798	9 059	151	33,8%	23,7%
> 4–6	48 860	9 998	205	27,6%	26,1%
> 6–8	25 416	6 374	251	14,4%	16,7%
> 8–10	12 609	3 701	293	7,1%	9,7%
> 10 000 PLN	21 886	8 219	376	12,4%	21,5%

Tabela 4 cont.

DTI at the time of issuing a mortgage (%)					
up to 20%	18 132	2 669	147	10,2%	7,0%
> 20%–30%	39 107	6 964	178	22,1%	18,2%
> 30%–40%	49 385	10 538	213	27,9%	27,5%
> 40%–50%	42 459	10 248	241	24,0%	26,8%
> 50%–60%	22 223	6 056	272	12,6%	15,8%
> 60%	5 643	1 804	320	3,2%	4,7%

Source: *Report on the situation of banks in 2016…, op. cit.*

In Poland, there have been no studies on consumer preferences in the choice of interest rates in mortgage loans (fixed or variable). However, the Polish Financial Supervision Authority statistics on the scale and structure of mortgage lending in 2016 identify a group of borrowers whose profile matches the characteristics of households choosing fixed-rate mortgages in other European markets.

Since January 2017, the Polish Financial Supervision Authority recommends making a down payment of at least 20%. With regard to the LTV ratio, a fixed-rate mortgage should be considered in at least 57 178 cases where the LTV level exceeds 80% (32.3% of all mortgage borrowers).

Taking into account the average monthly net income of borrowers, a fixed interest rate could be offered to clients whose income does not exceed 4 000 PLN, i.e. 68 178 people (about 26% of mortgage borrowers in 2016) who took out mortgages with a total value of nearly 10 billion PLN.

With regard to DTI, which shows the ratio of debt obligations to income, the target group of clients with a fixed-rate profile could include 27 866 bank clients (over 20% of the 2016 borrowers) exceeding the 50% level, similarly to the original version of the T Recommendation.

European studies demonstrate the preference for fixed-rate mortgages among the elderly with high risk aversion, who value the predictability of their financial situation. Under the Polish conditions, in 2016, 14 862 clients matching the specified characteristics, over 50 years old (approximately 20% of clients), took out mortgages worth 2.5 billion PLN.

Based on the global research findings, a fixed-rate mortgage could also target 3 284 borrowers with primary education.

In this context, it should be noted that, depending on the determinant, there is a relatively large group of borrowers in Poland who could be under a fixed rate regime and thereby reduce the risk of worsening their household's financial situation.

CONCLUSION

The analysis of the situation in the European Union mortgage market shows great volatility in the choice of the interest rate formula in individual markets. Over the period from 2003 to 2017, there has also been large variability in the relation of fixed-rate to adjustable-rate mortgages. Based on a literature review, borrower characteristics can be identified which determine consumer preferences in the choice of fixed and adjustable interest rates. The main factors are the LTV and DTI levels, income, age, education, financial education level or willingness to take risks. The conducted research shows that in Poland, the scale of the fixed interest rate choice is insignificant and represents only 0.2% of the total mortgage debt.

The analysis of the Polish Financial Supervision Authority statistics points out, however, the existence of a group of Polish consumers who should be given an option to choose a fixed interest rate when signing a mortgage contract. Their characteristics coincide with the consumer characteristics identified as those that shift the choice preferences towards fixed rates.

The size of the target group that should get acquainted with the offer of fixed-rate mortgages varies in Poland, depending on the chosen borrower characteristics. However, it can be incurred from the research that in about 20% of concluded contracts, there should be an option to choose the interest rate formula.

Abstract

The main purpose of the article is to analyse the most important borrower characteristics determining preferences in the choice of the interest rate formula in mortgage contracts. Based on the PFSA statistics, the portfolio of newly-issued mortgages in 2016 was analysed to identify a group of consumers corresponding to the borrower characteristics who, in the light of European and global research, would be willing or obliged to choose a fixed interest rate.

The conducted research shows that in Poland, the scale of the fixed interest rate choice in mortgage contracts is insignificant and represents only 0.2% of total mortgage debt. The analysis allows to identify a group of Polish consumers who should be given an option to choose a fixed rate when signing a mortgage contract. The size of the target group that should get acquainted with the offer of fixed-rate mortgages varies in Poland, depending on the chosen borrower characteristics. On the basis of the research, however, it can be incurred that in about 20% of the concluded contracts, there should be an option to choose the interest rate formula.

Key words: fixed-rate mortgages, FRMs, adjustable-rate mortgages, ARMs, consumer preferences

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Łukasz Cywiński[*]

WILL DIGITAL MONEY CROWD OUT NATIONAL CURRENCIES?

INTRODUCTION

The paper provides a contemporary discussion of functions and dangers related to digital money. And it assesses dangers inherent in the technology based on Bitcoin. The choice is motivated by Bitcoins' popularity in relation to other experimental digital money systems; since other protocols are merely clones of Bitcoins, this analysis also applies to them. Since digital money is a relatively recent phenomenon in economics, and there is no accepted methodology to assess and organize the known information about it, the analysis of DLT applies a universal heuristic approach by analyzing Strengths, Weaknesses, Opportunities and Threats (SWOT) with Bitcoin as a base-model for the global digital currency.

Distributed Ledger Technologies (DLT), or more generally blockchain technologies, allow for fast transfer of detailed records within the global digital nexus in a virtually instantaneous manner. DLT can be configured to create social media, cloud computing, cost-free global communication networks and distributed financial crypto-networks hitherto Bitcoin. In 2016 the World Economic Forum marveled over the potential of DLT to shape the future of innovation-driven economies worldwide. In spite of the fact that there is still a lack of clarity as to what DLT can do, its report envisages that by 2025 around ten percent of GDP will be stored on blockchains or blockchain related technology. Keeping that in mind

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this article concentrates on two scenarios: a) existing prototype digital money i.e. Bitcoin replacing national currencies in order to create a global virtual currency or b) adaptation of DLT by central banks.

DLT allows the elimination of a 'middle man' in a variety of transactions, which might help dramatically reduce red tape and transaction costs. DLT can do it by changing or by taking over three important roles; recording transactions, establishing identity and establishing contracts, which are traditionally carried out by the financial services' sector[1]. DLT allows for transferring and keeping track of all records in the nexus shared by many authorized users. For instance, DLT may help with creating an instant and lightweight global medical database.

The configuration of networks based on the concept of blockchain cryptosystem designed by Nakamoto[2] has been subject to scrutiny. One of its weaknesses is that the system that is both censorship resistant and entirely anonymous also in time becomes murky and dangerous. For example, Bitcoin enables the so called dark web, i.e., the market of illegal goods and services. It is feared that the DLT may turn out to be a Trojan horse designed to undermine the trust bestowed in democratic institutions in the long-run. It remains to be seen whether this would happen. Yet, Bitcoin (the most popular digital money), have been getting traction with its use becoming more widespread. So what makes the system deprived of authority self-sustainable? Digital money is based on trust achieved by the so called "consensus". This consensus is driven by anonymity ensured by cryptographic protocols and self-interest of the so called "nodes" –a creation of a software analyst and probably a hacker *alias* Nakamoto – who experimented with cryptographic protocol called proof-of-work. According to experts, the same could be done by applying other methods, i.e. proof-of-stake or practical Byzantine Fault Tolerance[3]. Bitcoin is a modified version of a protocol created to prevent rejection of service attacks or service abuses such as spam on a system by requiring some work from the service requester, usually by measuring the processing of computation.

Creating money from a system to sort spam is very unusual, therefore this paper assesses the extent to which DLT may lead to the creation of money that might become a full-fledged alternative to national currencies. The candidate for money has to fulfill simultaneously the following functions: it has to be able to serve as a medium of exchange, unit of account, store of value, and a standard of deferred payment. What is the relationship between digital money as represented by Bitcoin

1   B. Marr, *How Blockchain Technology Could Change the World*, 2016, Forbes, http://www. forbes.com/sites/bernardmarr/2016/05/27/how-blockchain-technology-could-change-the-world/#72e19dcb49e0 [accessed: 12.01.2016].

2   S. Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, 2008, Retrieved from https:// bitcoin.org/bitcoin.pdf [accessed 11.08.2016].

3   M. Castro, B. Liskov, *Practical Byzantine Fault Tolerance Proceedings of the Third Symposium on Operating Systems Design and Implementation* 1999 New Orleans, USA.

and national currencies? Which properties make digital money attractive? Are there any potential benefits and threats associated with adopting DLT by central banks?

The remainder of this paper is organized as follows. The first part concentrates on the technology underpinning crypto-currencies and assesses its potential. The second part discusses main properties of bitcoins. The discussion of digital money as a possible substitute for national currencies is in part 3. The last part concludes.

DISTRIBUTED LEDGER TECHNOLOGY: ITS POTENTIAL

The Bitcoin blockchain technology's first application allows an instantaneous transfer of value through the Internet via decentralized online platform[4]. The technology is meticulously designed to provide fast exchange of data. Bitcoin does this very efficiently using the network that has no central server. Generally the information on the Internet is distributed asymmetrically and most of it is stored in the so called "deep web" inaccessible from the position of a standard search engine i.e. Google or Bing. The open-access architecture of the Internet allowed programmers to create private protocols that in number of occasions created new ingenious ways of organizing data by sending and receiving specific types of coded information.

The Blockchain network represents the essence of the Schumpeterian creative destruction to the ways of storing, processing and organizing financial data. It takes advantage of the decentralized network, but at the same time it applies symmetry of information by creating multiple copies of the ledger. The Bitcoin network was the first large-scale experimental application of the Distributed Ledger Technology. And equally to the World Wide Web – that evolved beyond the email and the webpage – the Distributed Ledger Technology, based on various types of blockchains, bears the potential to evolve beyond Bitcoin or currently available digital money.

Private digital money is possibly the most obvious application of DLT. Therefore, it provides the best example for understanding the principles behind the core mechanics of the network. The fundamental property of digital money's blockchain network is anonymity – users are identified through the so called *hash values* (strings of symbols) that replace identities. To process information without central server and to maintain the ledger without error, every user of the blockchain keeps two sets of keys – a public key and a private signature key. The public information is in the essence, an announcement that the connection took place and it was

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[4] B. Marr, *How Blockchain Technology Could Change the World*, 2016, Forbes, http://www. forbes.com/sites/bernardmarr/2016/05/27/how-blockchain-technology-could-change-the-world/#72e19dcb49e0 [accessed: 12.01.2016].

successful. And in the case of digital money that two parties made a transaction. Quintessentially, this is analogical to sending an important letter or a coded note. That note includes a public stamp – recognized by everyone and a secret seal used to decrypt the massage. Both the stamp and a secret seal are coded by a powerful cryptographic protocol.

The fundamental property of the abovementioned cryptographic protocol is to maintain trust and confidentiality. Announcing to the public, that *the note* exists and that it was sent over the Internet is a crucial element of blockchain network infrastructure. The announcement is not only a declaration that the transaction took place. But over time it also becomes – after it has been processed with other similar transactions – a much desired bit of a "golden nugget". This happens because the next owner of the note adds up to the public *hash* that links with first owner's secret public key. In the case of the abovementioned two parties, communication lasts only as long as they send the note to one another. In the environment created by the Internet network this takes only milliseconds. The Bitcoins are sorted and converted, the same way we recycle paper leaflets or notes, but faster – and they are chained with other transactions the same way we blend a papier-mâché. The Blockchain is an anonymous block of linked notes or banknotes.

The abovementioned 'recycling' process is done by volunteering nodes – their task is to process public announcements and provide the so called "solution" – a string of information that represents new efficient block recognized by everyone in the network. This means that whoever makes a new transaction, acknowledges the authenticity of the previous transactions – or in the case of digital money that the note is real.

But, where does the nodes' incentive come from? Nodes perform a process similar to paper recycling factories that add fiber to the papier-mâché. Computer program is designed to do the same thing. And allows nodes to collect the extra part, extra Bitcoin and sometimes even a small commission. The authenticity of digital money is ensured by the existing blockchains of previous transactions. "The first Bitcoins were transacted in January 2009 and by June 2011 there were 6,5 million Bitcoins in circulation among 10,000 users."[5] Since then, nodes and users, proved that establishing trust on cognitive module based on self-interest and anonymous secrecy is possible.

The symmetry of information, the balanced ledger or the public consensus in the case of prototype digital money is maintained automatically without any involvement of third parties. This is possible because the more users make transitions with i.e. Bitcoin the more trustworthy the currency becomes. The

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[5]   F. Reid, M. Harrigan *An Analysis of Anonymity in the Bitcoin System*, 2011, International Conference of Privacy, Security, Risk and Trust and IEEE on Social Computing DOI: 98-0-7695-4578-3/11.

cryptographic algorithm accepts only very specific strings of data – only *hash* values recognized by all nodes in the system holding copies of previous public ledgers. To achieve that recognition – or public consensus, all transactions are time-stamped by the procedure based on the binary tree structure that works by rounds with fixed duration. Registered hash values i.e. $H_{23} = H(y_2 \mid y_3)$ that are needed for verification are continued to be processed as long as the single value is obtained – the so called: round root value[6], hereinafter RH_i, and for previous transaction RH_{i-1}. The timestamp for a completed block of transactions is than $yn = \{(y_{n-1}), (H_{n-1}), (H_n), (RH_{i-1})\}$. Figure 1 demonstrates chaining blocks of transactions with hash.

Figure 1. Linking block-chain with one-way hash function
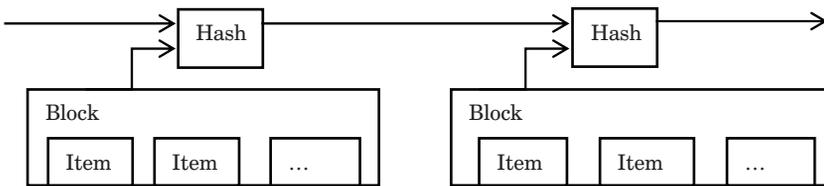
Source: S. Nakamoto, *Bitcoin…*, *op. cit.*.

The described process requires a lot of computing power and very little storage. The value assigned to the public hash is assessed based on the proof-of-work cost-function called Hashcash[7]. The hashcash scans H_n back until it receives a zero-bit value hash. It was precisely this function that was originally created to assess the value of the spam that "throttle systematic abuse of un-metered internet resources such as e-mail"[8]. It is a CPU-cost function that computes a special token used as a proof-of-work. In the case of digital money usually a public announcement is issuing a challenge: C to the nodes using a $chal(s, w)$ function to compute token: τ using a: $mint(C)$ function. When the challenge is completed the server applies the evaluation function: $value(\tau)$ to evaluate the token. The challenge consists of bit-string $s = \{0,1\}^*$, and w that denotes a parameterized amount of work – used to compensate for the Moore's observation about increasing efficiency

[6] See: D. Bayer, S. Haber, W.S. Stornetta, *Improving the efficiency and reliability of digital time-stamping Sequences II: Methods in Communication* 1993 Security and Computer Science, pp. 329–334 and H. Massias, X.S. Avila, J.-J. Quisquater, *Design of a secure timestamping service with minimal trust requirements,* 1999, 20th Symposium on Information Theory in the Benelux, http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.13.6228 [accessed: 11.08.2016].

[7] A. Back, *Hashcash – a denial of service counter-measure*, 2002, http://www.hashcash.org/papers/hashcash.pdf [accessed: 11.08.2016].

[8] A. Back, *Hashcash – a denial of service counter-measure*, 2002, http://www.hashcash.org/papers/hashcash.pdf [accessed: 11.08.2016], p. 1.

of the semiconductor-based computers. *Chal*() function becomes the public announcement, because it contains $H(\cdot)$ with defined size of bits l. The procedure takes the following form:

$$\begin{cases} C \leftarrow chal(s(H\{0,1\}^l), w) \\ \tau \leftarrow mint(C) \\ v \leftarrow mint(\tau) \end{cases}, \quad (1)$$

The computing power of the CPU is therefore a "mining effort" to obtain the hash value for the block of transactions – previously referred to as "the solution". Because parameter w is designed to compensate for the "increasing hardware speed and varying interest in running nodes over time, the proof-of-work difficulty is determined by a moving average targeting an average number of blocks per hour"[9]. According to Nakamoto[10] if a hacker assembles more CPU power than all honest nodes combined, he or she would find it more profitable to use this power to generate new coins rather than to destroy the system. In the case of Bitcoin the level of minting difficulty increased dramatically since the early stage. This happened because the nodes learned new cost effective methods of computation using specially designed circuits.

Bitcoin or other digital money is just one of many applications of the blockchain technology analogically to paper that can be used either to print money or news articles or leaflets. It is discussed that augmented blockchains can be used to hold medical data or store complex information about cross-border value-added transactions. In principle, this would allow for the low-cost, constant flux of information exchanged between multiple clients, multiple institutions or multiple enterprises. In other words, in contrary to the paper note, the main property of distributed digital ledger is constant change and instant self-recyclability. Despite its unquestionable utilities, the blockchain technology might also have yet undiscovered limitations.

THE MAIN PROPERTIES OF BITCOIN

The technology behind Bitcoin – the first experimental application of a distributed ledger based on the blockchain – spawned many replicas, all pulling from the same open source code. Thus, it does not come as a surprise that nowadays the Internet is overcrowded with other versions of private digital money, such as Ethereum or Ripple – all competing to become the global currency. The Bitcoin,

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9   S. Nakamoto, *Bitcoin…*, *op. cit.*

10   *Ibidem*.

however, is the most popular application of DLT so far, and the first that was called 'the money ofthe future'.

The Bitcoin has attracted transactions worth billions of US dollars. However, does it fulfill the three most important functions of money? Can it function as a medium of exchange? Can it function as a unit of account? And as a store of value? To be a medium of exchange, it needs to be an item that purchasers give to suppliers when they want to acquire commodities or services. To be a unit of account, it needs to be a standard people are willing to use to post prices and record debts. Finally, to be a store of value it needs to be a thing that people can use to transfer purchasing power from the present to the future.

According to Krugman[11] "the Bitcoin is evil", and he is not convinced that it can serve as a good store of value. He compares the Bitcoin to gold and concludes that "placing a ceiling on the value of Bitcoins is computer technology and the form of the hash function (…) until the limit of 21 million Bitcoins is reached. Placing a floor on the value of Bitcoins is… what, exactly?" He compares this to the value of gold limited by the mining technology. This is not a well-founded analogy as the Bitcoin is (a) limited by the semiconductor technology, with yet undiscovered nor fully understood limitations; and (b) the decision to limit its supply was made arbitrarily by a team of programmers and not by the technology's limitations.

The technology was designed to render impossible for third parties to manipulate the price. There are, however, organizations striving to take control over the supply of Bitcoins and set new rules on the minting process. Theoretically, minting rules could be amended while still maintaining all blockchain processes. From 2009 to 2011 the Bitcoin development was managed by Nakamoto (according to The Economist's article from May 2nd 2016 this pseudonym belongs to Craig Steven Wright); after Nakamoto's disappearance, the key development work has been done by Gavin Andresen and his team. In 2014 Anderson created the Bitcoin Foundation that manages further software development of the Bitcoin network and that foundation has the necessary resources to control the supply rules.

According to Egorova's and Torzhevskiy's[12] (2016) the supply rules for Bitcoin can be represented by the function: $Q = A[1 - \exp^{-S_i t}]$, where, Q – is a theoretical quantity of the Bitcoin, A – the limit of 21 million bitcoins (imposed by its founders), i denotes the number of nodes in the system, t denotes time, and S is a function parameter which defines growth acceleration or deceleration depending on the so called halving rule. The *modus operandi* of the halving rule creates a discrete reward to the amount of compensation. In the case of Bitcoin this could be represented by:

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[11] P. Krugman, *Bitcoin is Evil*, 2013, Retrieved from https://krugman.blogs.nytimes.com/2013/12/28/bitcoin-is-evil/.

[12] N.E. Egorova, K.A. Torzhevskiy, *Bitcoin: Main Trends and Perspectives*, 2016, British Journal of Economics, Management & Trade, 12(1) pp. 1–11.

$$S_i = \begin{cases} S_0, & t_0 \leq j < t_0 + 1 \\ S_i(j-1)q, & t_0 + j - 1 \leq j \leq t_0 + 1 \end{cases} \quad (2)$$

where $q = 0.5$ – correction coefficient, j – in this case represents a correction number for emission reward and S_0 is a first time reward (50 bitcoins); $t \in [0,T]$. Conditional, yet programmable supply rules combined with unspecified supervision is the reason that makes Bitcoin unable to serve as a tool for the economic policy.

Although the supply of Bitcoins is limited to 21 million bitcoins, the limit of emission embodied in the automated protocol can be amended by anyone who controls the parameter – i.e. a conglomerate of anonymous nodes. The initial idea behind the Bitcoins was that as the limit is reached, the incentive for the nodes would change from the reward to a small commission. In the case of Bitcoin the commission for each node i is:

$$K_i = \begin{cases} 0, & \text{if} \quad S_i > 4 \text{ BTC} \\ 0.0005 \text{ BTC}, & \text{if} \quad S_i \leq 4 \text{ BTC} \end{cases}.$$

In the case of digital money the minting rules are the most important factor of the success. One of the dangers imbedded in the Bitcoin structure is that the rules behind the emission might not create enough incentive for nodes to carry on the work after they reach the limit of 21 million units. Moreover, the efficiency of the blockchain technology, and thus its supply is inseparably linked with computational speed of volunteering nodes. In 2014 the value of Bitcoin was falling because of the introduction of new methods of solving the $chal(s, w)$ function with the Application Specific Integrated Circuit (ASIC) based systems (Figure 2).

Figure 2. Bitcoin to USD exchange rate in 2011–2017
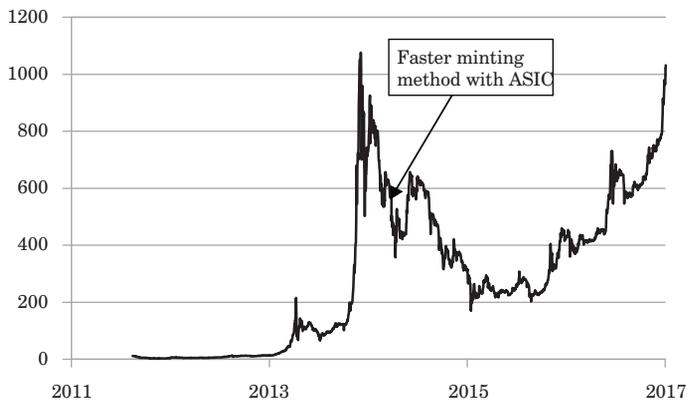
Source: own elaboration based on data retrieved from investing.com.

New methods of calculating complex, brute-force algorithms shortened the time needed for achieving the total number of bitcoins and in consequence, lowered its price (in the period between 2013–2015 the total number of bitcoins increased from 10.6 million to13.7 million units). In the long run this might threaten the network integrity, therefore the minting was deliberately hardened in the halving process. The price of the Bitcoin again skyrocketed to more than USD 1000 per Bitcoin. More people became interested in new, peculiar money and wanted to acquire it. This created a business opportunity for nodes that stored previously minted bitcoins, they founded companies which offered so called BitWallets or Bitcoin Gambling Sites. Popular despite the fact that they offer limited security.

The ability to perform as a store of value and unit of account in the case of the Bitcoin is related to cybersecurity. In the present configuration the Bitcoin is based on the advanced crypto-technology and facilitates an irreversible transfer. It should not come as a surprise that this property of the Bitcoin was exploited by cybercriminals. For instance, in August 2016 Bitfinex – one of the most popular crypto-market in the Internet – was hacked by a black hat hacker. The main aim of a black hat is to gain administrative power over the system. In the case of Bitfinex, the hacker stole 120 thousand bitcoins worth at that time US$65 million[13]. Bitfinex specialized in Exchange Trading, Margin Trading and Funding, Deposits and Bit-Wallets management. And since the transfer is irreversible and censorship-free, it is impossible to recover the stolen property. In the past, the main task of a bank was to provide safety from theft. The digital money market does not guarantee compensation for the cybercrime. The network itself is secure, the hacking takes place mostly in the ecosystem of third-party intermediaries supporting currency conversion that build up around Bitcoin[14].

The cybercrime is not the only argument against bitcoins as the currency. One of the main properties that distinguish the Bitcoin from traditional money is its volatility. The price of the Bitcoin can skyrocket or crash by more than 25 percent in a matter of hours. And this makes it highly questionable in terms of day-to-day purchases. Although, the volatility of Bitcoin, as measured by the ratio of standard deviation of daily transactions and square root of a trading period, has been falling since 2011 (see figure 3), it remains very high. According to Bouoiyour and Selmi[15] "Bitcoin volatility process seems more influenced by negative (bad news) than positive shocks. Not surprisingly, the Bitcoin market is highly driven by self-

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[13] P. Vigna, *People Love Talking About Bitcoin More Than Using It*, 2017, The Wall Street Journal, https://www.wsj.com/articles/people-love-talking-about-bitcoin-more-than-using-it-1491989403 [accessed: 16.04.2017].

[14] T. Moore, N. Christin *Beware the Middleman: Empirical Analysis of Bitcoin-Exchange Risk*, 2013, Financial Cryptography Data Security 7859.

[15] J. Bouoiyour, Selmi R., *Bitcoin Price: Is it really that New Round of Volatility can be on way?*, 2015. Retrieved from: http://mpra.ub.uni-muenchen.de/65580/, p. 10.

fulfilling expectations." The first Bitcoin users consisted of technology enthusiasts and criminals, though slowly the attention to use it shifted towards traders and speculators. And strangely Bitcoin nowadays reminds more of the speculative investment than money.

Figure 3. Bitcoin's decreasing volatility in 2011–2017
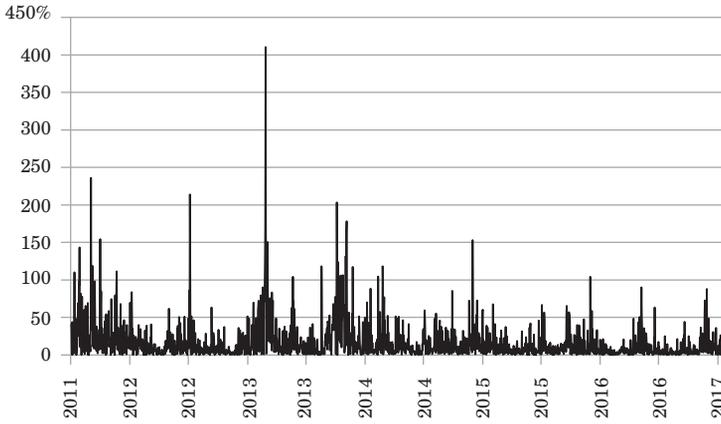
Source: own calculation based on data retrieved from investing.com; the volatility was calculated for a trading period that equals 365 days.

The Bitcoin's current high volatility affects also its ability to serve as a unit of account, because it makes it hard to measure the value of goods and services. Risky changes in the Bitcoin short-run volatility increase costs of doing business in several ways. Businesses need to frequently adjust prices to avoid cuts in returns. This might confuse customers who are unable to spot the true relative price of a particular good or service. In the case of the Bitcoin the ability to serve as a unit of account is also jeopardized by its extremely high divisibility. One Bitcoin is divisible to 10^{-8} so called Satoshi, and this could cause some problems for many people in terms of comprehending and comparing prices of goods and services.

Using Bitcoin requires an initial investment. This includes an intangible investment, such as getting acquainted with the general principles of the software, and tangible investments, such as setting up and installing equipment for the payment system. In some cases the specialized gear can be substituted with the commonly accessible mobile electronic devices. But then again, mobile phones are easily hacked. The level of general computer knowledge in the case of prototype digital money needs to be at least intermediate. And advanced users will be better equipped to deal with many dangers associated with the cybercrime. More

proficient users can even become "the bank", although the code of the Bitcoin is complex and requires both analytical skills and some background in economics.

There are no international laws regulating DLT, and certainly no global agenda nor any agreement that would tackle it from the legal point of view. That is why in reality, the price of the Bitcoin depends on many issues probed and exploited by governments. In November 2013 the Chinese Central Bank (CCB) barred other banks from managing Bitcoin transactions. As a result, the global demand for bitcoins decreased significantly, but it did not stop the trade over the "Chinese Internet". Officially the CCB's decision was motivated by the fact that Bitcoin is not backed-up nor represented by any country, and therefore could not have the same legal status as the yuan. And this argument has a strong merit. Over the last few years the Bitcoin became very popular in China. In 2016 more than 95% of the Bitcoin trade took place in that country alone[16].

The Chinese use of Bitcoin differs from most "shocks" presented later in this paper because demand for Bitcoin in China is propelled primarily by demand created by the institutional regime itself. Investors from China use Bitcoin to buy other currencies discreetly outside the attention of the government. Trading fees in China are high due to the national bank's policy to keep the yuan's exchange rate under the 2 percent daily change. The Bitcoin allows to bypass the fees and maintain the anonymity at the same time. Does the Chinese government see Bitcoin as a Trojan horse designed to leak the capital out of the country? Perhaps it does, because in January 2017 the Bank of China tried to prevent the outflow by devaluing the yuan and requiring Bitcoin exchanges to suspend withdrawals until they updated compliance systems. In theory, this could "kill" the Bitcoin with one swift blow, but investors quickly realized what was happening and the drop in the price was noticeable, but not devastating. The Chinese Internet, despite the general belief, is not entirely censored by the government, its users conduct essential business or surf the web via Virtual Private Networks.

For many people the Bitcoin is 'the alternative money'. Before April 2013 (see the figure 2) the value of Bitcoin was increasing only moderately. That changed when "investors started to pay attention to the crypto-currency; the enthusiasm for Bitcoins even propelled prices to briefly trade higher than gold"[17]. In 2013 the price of the Bitcoin was increasing partially because of the Cypriot banking crisis and the abovementioned Chinese demand. In the case of the former, one of the conditions of the EU and IMF bailout – after the Cyprus' government decided to nationalize its Popular Bank in response to Greek deposits' withdrawal in

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[16] L. Shin, *Bitcoin's Price Was Volatile Last Week, But Not Last Year*, 2017, Forbes, https://www.forbes.com/sites/laurashin/2017/01/09/bitcoins-price-was-volatile-last-week-but-not-last-year/#784fa1e8126f [accessed: 15.03.2017].

[17] See: Kitco News *2013: Year of the Bitcoin*, 2013, Forbes. https://www.forbes.com/sites/kitconews/2013/12/10/2013-year-of-the-bitcoin/#1633fd66303c [accessed: 15.03.2017].

2009–2011 – was to levy a tax on deposits. When Cypriots learned about the deal, they rushed to banks to withdraw the money. The Bitcoin's price surged shortly thereafter because people from Spain and Greece anticipated similar problems and started to reallocate money outside the banking system. The Bitcoin was therefore used to 'hide' the money prior to an anticipated crisis.

Shifting money outside the banking system anonymously and safely requires advanced knowledge. Most of the registered blockchain transactions are not entirely anonymous. The secrecy is only an option reserved for users that are able to set up their own storage and secure network, which is equally hard. The majority of other users make Bitcoin transactions and store Bitcoins on private exchange markets. To set up a fully functional account, these third parties usually require a passport, an ID card, a driving license, a proof of residency, a bank statement or a tax return in order to verify the account.

So what makes prototype digital money so popular if anonymity is only a myth? Most likely, low transaction costs in comparison to traditional money. Not surprisingly, multinational corporations, soon after the Bitcoin became popular, started to accept it as a method of payment. For instance, Microsoft accepts bitcoins for Xbox games, phone apps and software. Spendabit, Overstock, DuoSearch and BazaarBay specialize in the retail shopping and they all accept other digital money as well. Most of the prices are recalculated to USD for convenience, however DuoSearch shows them primarily in Bitcoin.

There is another reason why it is not safe to make the Bitcoin a national currency at least in its current stage of development. At the end of 2016, the Chinese government decided to devalue the yuan which shortly thereafter increased the price of the Bitcoin – the stress on the Chinese financial market shifted investors' attention mainly towards private digital money. The Chinese government wanted to stop its citizens moving money out of the country, and at the beginning of January 2017, set new anti-money laundering rules. Chinese Bitcoin trading sites had been temporarily shut down until they proved to meet the necessary legal requirements. This caused the price of the Bitcoin to plunge over 31% in less than two weeks from US$ 1129.87 to US$ 775.89. Let it be assumed that more countries adopted the Bitcoin currency as their own, for instance on the similar terms as Kosovo and Montenegro adopted the Euro as the national currency. Consequences of the China's anti-money laundering policy – otherwise a good policy – could have catastrophic impact on trade of these hypothetical adopters, and perhaps on others, as well. If the Bitcoin became a global currency adopted by many countries would it become a Trojan horse designed to undermine the trust bestowed in democratic institutions? The Table 1 summarizes the present analysis of the blockchain-based digital money as a model of the global currency.

The Bitcoin is an experimental application of digital money. Is it not safe to treat it as a candidate to become a global currency in its current configuration?

Table 1. Strengths, Weaknesses, Opportunities and Threats associated with digital money

Strengths	Weaknesses
❖ Digital money has a comparative advantage as a medium of exchange over traditional money. The technology provides exchange similar to credit card payments, but it is very fast and significantly cuts transaction costs. ❖ The technology can be adapted to cut the intermediary costs to many ledgers operating simultaneously. ❖ The blockchain technology is very counterfeit resistant and censorship resistant. In case of a fraud the nodes would register that the number of units does not match the total number of units produced. ❖ Trust based on the consensus significantly cuts the number of the red tape. ❖ High transaction speed (especially international transactions). ❖ Multiple copies of the ledger increase stability and safety.	❖ Consumes more computing power than it actually requires – its hashcash function overcompensates for the Moore's law. ❖ Scarce number of units, irreversible transfer and anonymity links its value to the cyber security. These factors make it easier for cyber criminals to avoid consequences of a theft. ❖ Experimental digital money is not a legal tender, and thus it is not linked with the economy of any country. Businesses and individuals accept it voluntarily, which makes its adoption relatively slow. ❖ High volatility might confuse users because they would be unable to spot its true relative price. ❖ In the current stage of development, digital money reminds more of speculative investments than money. ❖ Lack of control over murky or illegal transactions.
Opportunities	**Threats**
❖ Hashcash function has a build-in parameter to compensate for increasing computing speed. The same parameter allows to edit minting speed according to needs of the economy which makes it possible to be used i (after modifications) as a tool for the economic policy. ❖ The system is constructed in such a way that producing counterfeit units it is not impossible, but highly impractical; anyone who possesses a computing power of enough magnitude would find it more profitable to become an honest node. ❖ Other applications: i.e.: for global supply chains, global medical databases or legal actions embedded in the financial system etc.	❖ The prototype digital money was designed to create inflation-free currency by applying artificial limit to the number of total units produced by nodes. If the cost of the electricity and maintenance costs exceed the profits from the commission, the nodes can lose the incentive to carry on the work. ❖ Creating digital money that allows for a reversible transfer is challenging because once nodes are in consensus, any amendment would increase the entropy of the system, and at some point, the system could crash. ❖ The system was designed to undermine the trust bestowed in democratic institutions. It might serve as a Trojan horse.

Source: own elaboration.

For instance, storing digital money today is too risky. The network is based on the open source protocol that can be reviewed by anyone and accessed by everyone. The recent hacking incidents show that anyone with the sufficient knowledge can potentially gain access to third party storage databanks. All you need is to know what you are looking for, and match identities with the *hash*. However, the Bitcoin is just one application of the Distributed Ledger Technology. Can an improved version of digital money based on the blockchain principle become one day a national currency? Exploring this question leads to a deeper discourse about the nature of digital money – its defined strengths and weaknesses, opportunities and associated threats.

DIGITAL MONEY AS A NATIONAL CURRENCY

At the current – experimental stage of development, digital money can create tangible threats to national economies. The Bitcoin for instance, represents the idea of the crypto-anarchy imbedded in the financial system. It introduced a system where "the government is not temporarily destroyed but permanently forbidden and permanently unnecessary"[18]. Perhaps, this is why when adapted on the global scale, it would become a Trojan horse destined to undermine trust bestowed in governmental institutions.

Despite obvious dangers, as a medium of exchange even the experimental or prototype digital money enables transactions that are quicker and less expensive than any former form of a bank transfer. Therefore, a fully developed blockchain network – that applies concepts of the distributed ledger combined with secure and experienced institutions would create abundance of very useful financial applications. For instance, international transactions as easy, and as quick as sending an SMS.

The prototype digital money already functions as a good medium of exchange. In fact, it has a comparative advantage over traditional money in terms of the speed and commission costs. The Bitcoin i.e. provides exchange similar to a credit card payment or a bank transfer for a very little transaction cost. Those costs in the case of standard national currencies are much higher because institutions that provide financial services must cover more intermediary costs. Moreover, in the case of international transfers, traditional money needs to compensate for additional procedures in the clearing system and additional authentication. The average cost of a Bitcoin transfer is less than 1 percent, whereas a traditional online payment charges the fees that are between 2–5%[19]. Notwithstanding that

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[18] W. Dai, *b-money*, 1998 , http://www.weidai.com/bmoney.txt [accessed: 11.08.2016].

[19] P. Cianian, M. Rajcaniova, d'A. Kancs, *The digital agenda of virtual currencies: Can BitCoin become a global currency?*, 2016, Inf Sys E-Bus Manage 14:883-919.

Bitcoin offers almost instantaneous execution of the transfer and in the case of traditional money, the transfer in some cases can take up to several working days.

What costs could be reduced? The shared distributed ledger is decreases the processing costs of operations and hence decreases transaction costs. Moreover, the technology can be adapted to cut the intermediary costs to many ledgers at the same time. "Consider the process of buying a house, a complex transaction involving banks, attorneys, title companies, insurers, regulators, tax agencies and inspectors. They all maintain separate records, and itis costly to verify and record each step. That is why the average closing takes roughly 50 days. The Blockchain offers a solution: a trusted, immutable digital ledger, visible to all participants, that shows every element of the transaction."[20]

A popular difference between prototype digital money and traditional money is that the former uses one integrated protocol that replaces a clearing system formerly managed by hundreds of commercial banks. In this regard, the Bitcoin system serves as a good example – it can instantaneously process thousands of transactions without anyone's supervision. However, it needs to be noted that as the network becomes more entangled it would require faster calculators. So far, digital revolution is able to keep up with growing demand for computing power, but would it be the same if more people used blockchains?

The growing hunger for processing power increases electricity consumption. The nexus of nodes designed to process transitions on the country-level scale would consume monstrous amounts of electricity. The great deal of the value of the Bitcoin is determined precisely by the technology behind the speed of mainframes and the price of electricity. The semiconductor technology plays two roles in the price mechanism of digital money. In the short run, when the computational power increases the value of digital money would fall, but in the long run, faster calculators would increase the efficiency of the network.

In the case of prototype digital money i.e. the Bitcoin, the price of electricity is linked with the nodes' incentive to maintain the network. This might create a serious problem for the Bitcoin in the future. A small commission might not be enough to sustain the network after deducting electricity costs. Will the Bitcoin blockchain collapse before it reaches 21 million Bitcoins? Or perhaps this will be the time when blockchain-based national currencies will take over the space that it is currently occupied by the Bitcoin and alike.

Currently, the incentive to use digital money, such as Bitcoin is related to the number of existing users in the network. If only few businesses accepted Bitcoins as a method of payment, the encouragement to acquire costly equipment or

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[20] G. Rometty, *How Blockchain Will Change Your Life The technology's potential goes way beyond finance*, The Wall Street Journal 2016, http://www.wsj.com/articles/how-blockchain-will-change-your-life-1478564751 [accessed: 29.11.2017].

investment of time to learn the technology would be rather moderate. One of the man challenges in becoming a global currency would be to convince users to conduct daily business using bitcoins[21]. So far, the number of the Bitcoin's users has been increasing, although not as fast as many enthusiasts claim[22].

It is doubtful that current prototypes of digital money can soon replace national currencies as many fervently convince. It is more likely that the national currencies learn to assimilate the DLT. The potential of the blockchain technology can be summarized by the fact that despite no government guarantees and the high volatility, and despite the market being far from mature, in 2016 there were 34 thousand businesses accepting various kinds of experimental digital money payments in 51 countries. Among them there are 16 multinational corporations, 180 financial institutions and 732 operators providing Automated Teller Machines (ATM) that accept and exchange digital money. Bitcoins are accepted by charities, such as Wikipedia, Red Cross and Amnesty International. From takeaways to knowledge-intensive services. In the hands of central banks this technology can be further improved and refined to produce a counterfeit-free and cheap financial system.

According to the European Central Bank[23], digital money or virtual money is a "digital representation of value that is neither issued by the central bank or public authority, nor necessarily attached to a fiat currency, but is accepted by natural or legal persons as a means of payment and can be transferred, stored and traded electronically". However, this definition is precise in the light of further applications of the DLT or perhaps it describes only the private digital money? At the end of 2015, the Danish government proposed to switch entirely to cashless transitions[24] and in Sweden in 2016, more than 50% of bank branches no longer keep cash on hand nor take cash deposits[25]. If the Danish or Swedish central bank decided to switch to blockchain-based systems, would that not make it digital or virtual money?

The Blockchain technology seems to accelerate innovation in the global financial data management, and that is why many governments and central banks are interested in assimilating and perhaps improving this technology in the near

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[21] P. Cianian, M. Rajcaniova, d'A. Kancs *The digital agenda…*, *op. cit.*

[22] See: J. Cobham, *Bitcoin and the Future of Money*, Harvard Political Review 2016, http://harvardpolitics.com/united-states/bitcoin-future-money/ [accessed: 04.04.2017].

[23] European Central Bank *Opinion of the European Central Bank of 12 December 2016 on a proposal for a directive of the European Parliament and of the Council amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing and amending*, 2016, Directive 2009/101/EC. Retrieved from https://www.ecb.europa.eu/ecb/legal/pdf/en_con_2016_49_f_sign.pdf, p. 3.

[24] V. Harrison, *This could be the first country to go cashless*, 2015, http://money.cnn.com/2015/06/02/technology/cashless-society-denmark/ [accessed: 11.05.2017].

[25] J. Henley, *Sweden leads the race to become cashless society*, 2016, https://www.theguardian com/business/2016/jun/04/sweden-cashless-society-cards-phone-apps-leading-europe [accessed: 11.05.2017].

future. The Blockchain is the multipurpose technology, and that is why various institutions and companies think about different applications for it.

In December 2015 the British Government was advised to support the following companies: Digital Catapult, Future Cities Catapult, and Open Data Institute. The UK government also created the Alan Turing Institute – specializing in the data science that will help to create "cryptocurrencies for British institutions". According to Grigg[26] there are several kinds of institutional and business points of interests for the blockchain technology: the cryptography (as a science), software engineering, property rights control, accounting, governance, and finance. Showing a trend, distributed ledgers will be used in the future.

The Bitcoin creates the environment where nodes have enough incentive to willingly give up their processing power, time and electricity consumption to manage working stations constantly calculating extremely difficult mathematical problems by adding transactions to the next blockchain – bit after bit. Perhaps Central Banks can create similar systems of incentives that will honor nodes minting digital money? According to Sir Mark Walport[27] – the UK Government Scientific Adviser – Governmental Institutions need to adapt to the DLT and assimilate this technology into their structures. So far, in 2016 and 2017 only a small number of governments experimented with the DLT treating it seriously – with the British and Estonian governments leading the way in Europe. In the future, adopting blockchains might be not just efficient, but necessary because (despite crypto-anarchic assumptions) increasing difficulty and decreasing profitability of minting will make nodes lose the interest in sustaining the network. At that point, it will be up to the governments to take over.

Can the blockchain become a national currency and replace cash? Probably yes. But only if governments have the control over the code that creates the blockchain and can limit the influence of other governments over the work of nodes. Otherwise, digital money cannot serve as a tool for the economic policy.

The Blockchain technology is expected to transform the banking industry. According to Guo and Liang[28] , the DLT might become a new source of growth that will reverse its current downward trend in innovations. They call the blockchain technology "the greatest disruption of the Internet finance for the traditional banking industry".

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[26] I. Grigg, *Triple Entry Accounting*, 2005, Retrieved from http://iang.org/papers/triple_entry.html.

[27] M. Walport ed., *Distributed Ledger Technology: beyond block chain*, United Kingdom Government Office of Sciences 2015. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf

[28] Y. Guo, C. Liang *Blockchain application and outlook in the banking industry*, 2016, Financial Innovation 2:24 DOI: 10.1186/s40854-016-0034-9.

CONCLUDING COMMENTS

To engage with remote financial transactions people need trust. The Bitcoin – a prototype digital money – provides trust based on the self-interest of the group of anonymous nodes. It does it despite being in the early stage of development. Notwithstanding that its presence created a global economic response of unprecedented power and quality. As the prototype, the Bitcoin provided instant global transactions without trusted third parties or formal political arrangements. It demonstrated that even at the current stage of development the prototype digital money has unique qualities i.e.: extreme resistance to counterfeit, to the point where it would be simply impractical to counterfeit because anyone who have the access to enough computing power, would find it more profitable to create legitimate units instead, and become the "Bank".

At the current stag,e experimental blockchain networks shift the creation of money from the government and banks to distributed nodes based virtually anywhere in the world. Despite the widespread beliefs, the Bitcoin is not free from the influence of third parties. The price of the Bitcoin is influenced by governments that impose taxes on the price of electricity, and the price of a selected basket of other currencies – notably the Chinese yuan. Moreover, the Bitcoin is not free from influence – it is controlled by a narrow group of individuals that can, in theory, manipulate the reward system for the node's minting effort.

Currently, the prototype digital money does not fulfill all criteria of the currency – mainly because of its immense volatility. Therefore, it cannot be used as a national currency, nor the global currency. The Bitcoin cannot serve as a tool for the economic policy. However, its other properties allow it to become very popular. Mainly the instantaneous peer-to-peer transfer of value via Internet-based, decentralized platform which many central banks consider a novelty worth exploring.

The experimental digital money is still 'evolving' – its volatility over time decreases, therefore perhaps in the future it will progress beyond speculative investment. The technology behind digital money is based on a very secure algorithm. It applies a secure and counterfeit resistant *hash* functions that replace users, identities and makes processing transactions very fast.

The Blockchain technology can create positive, as well as negative, externalities. The positive effects are associated with fast transaction speed, low fixed costs and reduction of intermediaries. The negative effects are associated with cryptographic anonymity that draws the attention from e.g. drug or human traffickers or money launderers. The current experience in digital money development shows also that the weakest link in the safety of the system is lined to third party organizations that try to take the role formerly reserved for banks – the so called cryptocurrency markets.

One of the main weaknesses of the prototype digital money is associated with the very limited ability to serve as a tool for the economic policy. Though the inner algorithm is equipped with the parameter that can serve as an instrument changing minting difficulty and thus its supply. Because the prototype digital money is not a legal tender there is no institution that holds the reserve of digital money and hence there is no interest rate nor any bank that lends digital money.

Acknowledgments

Abstract

Despite a relatively short period that elapsed since the development of the blockchain or Distributed Ledger technology (DLT), it has been put to multiple uses by multinational corporations, central banks, governments and individuals. It has been responsible for the emergence of digital money and revolutionary changes in a wide array of financial services. The paper examines opportunities and threats associated with the use of the DLT, with a special emphasis on the first experimental digital money, applying a heuristic SWOT analysis. It includes the analysis of properties of the Bitcoin in comparison to traditional money together with detailed examination of protocols that created it in terms of associated dangers.

Key words: Digital money; Bitcoin, Distributed Ledger Technology, Blockchain technology; SWOT (Strengths, Weaknesses, Opportunities and Threats); financial services

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Ewa Miklaszewska[*]

THE APPLICATION OF THE BAIL-IN TOOL IN THE BANK RESOLUTION FRAMEWORK: THE EVIDENCE FROM THE ITALIAN LOCAL AND REGIONAL BANKS

INTRODUCTION

The 2007–2009 financial crisis revealed many weaknesses of the banking industry and showed the high degree of interconnectedness of markets and existence of banks "too big to fail", whose failure would have dramatic consequences to the economy. Before the crisis, there was a lack of a consistent bank resolution framework, both in the EU and in the Member States. The rescue of failing banks was based on bail-outs of large banks, providing them with guarantees and loans from governments. Post-crisis bank regulations recognised the need for a creation of a formalized resolution framework which would allow for efficient resolution of large banks, with limited use of public funds. Thus, the purpose of this article is to discuss the key elements of bank resolution framework under the Single Resolution Mechanism (SRM) and Bank Recovery and Resolution Directive (BRRD) and to assess its impact, based on the preliminary empirical evidence[1]. The paper attempts to demonstrate that the new European resolution framework contains some serious political and social weaknesses, when it is applied to small

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[1] Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms.

banks or bank networks, such as the cooperative sector, and the Italian banking market is the case in the point.

The paper is organized as follows: the Section 2 provides the overview of the European resolution framework, the Section 3 describes the consequences of the framework for the European cooperative banks, the Section 4 and 5 describe the resolution problems of the Italian cooperative local and regional banks, and the section 6 concludes the paper.

1. THE BANK RESOLUTION FRAMEWORK IN THE EU

Following the financial crisis, the EU has changed the way banks are supervised and resolved in Europe, by creation of the Banking Union, which is currently built on two pillars: the Single Supervisory Mechanism (SSM) and the Single Resolution Mechanism (SRM), with the third pillar in the form of the European Deposit Insurance Scheme (EDIS) to be implemented. The key objectives of the SRM are to ensure continuation of the critical functions of rescued institutions, protection of depositors and to limit the need for public support in the form of a bank bail-out. The SRM is based on the Bank Recovery and Resolution Directive (BRRD, 2014), which provided for a creation of the resolution authority. In the Banking Union, this role was assigned to the Single Resolution Board (SRB), responsible for preparation of resolution plans for the Eurozone's significant and cross-border institutions, which are under supervision of the ECB. The SRB decides also on usage of the Single Resolution Fund (SRF) which is financed by the banking industry. The SRF became operational at the beginning of 2016 and will be gradually built up based on contributions from banks until 2024. The BRRD requires also each Member State to designate the National Resolution Authorities (national central banks or other administrative authorities)[2].

The BRRD describes a set of resolution tools which could be used by the resolution authorities to resolve the troubled banks, such as:

❖ sale of business;
❖ bridge institution – a temporary structure, where the key and critical functions of a failing bank are transferred;
❖ asset separation, in the form of a "good bank" and "bad bank";
❖ bail-in tool which allows the resolution authorities to convert the eligible banks' liabilities into loss-absorbing common equity or even completely write them off[3].

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[2]   World Bank Group (a), *Bank Resolution and Bail-in in the EU: Selected case studies pre and post BRRD*, FinSAC, November 2016.

[3]   T. Philippon, A. Salord, *Bail-ins and Bank Resolution in Europe – A Progress Report, International Center for Monetary and Banking Studies*, Geneva Reports on the World Economy Special Report 4, March 2017.

The new resolution framework does not prohibit the public support. The use of public funds is possible, but only as the last resort measure, when the resolution tools were already used. Moreover, the need to safeguard the financial stability has resulted in the exclusion of some liabilities from the bail-ins, such as:

❖ deposits protected under the deposit guarantee scheme, up to €100,000;
❖ secured liabilities, including covered bonds and other guaranteed instruments;
❖ liabilities resulting from holding of customers' goods, for example the contents of safe deposit boxes or securities held in a special account;
❖ interbank liabilities (except for those within the same banking group) with an original maturity of less than 7 days;
❖ liabilities deriving from participation in payment systems with a residual maturity of less than 7 days;
❖ liabilities to employees, commercial claims and tax liabilities, if these are privileged under the bankruptcy law.

Losses that have not been absorbed by the creditors can be transferred to the resolution fund, which can intervene up to the ceiling of 5% of the total liabilities, provided that a minimum bail-in of 8% of the total liabilities has been applied. The loss bearing should start with the shareholders, then the creditors and finally the uninsured depositors.

2. RESOLUTION CHALLENGES FOR LOCAL AND REGIONAL BANKS

The SSM and SRM regulations gave a strong incentive to centralize the European cooperative banking networks, either by forming the Institutional Protection Schemes (IPS), or by giving new powers to the central institution in the network[4]. From a historical perspective, there were two main types of cooperative network models: the centralised and the decentralised one (the table 1). The basic model, where the cooperation among the members is limited and the cooperative banks jointly own a central institution, which typically ensures the liquidity of the network, cash earning, access to the national central bank and to financial markets, is slowly disappearing. Until recently, it was characteristic mostly for Poland and Spain, but the IPS has recently been instituted also in those countries. In the decentralised models, the post crisis restructuring was based on a reform towards centralizing the network, such as the reform of Italian Banche Popolari (BP) in 2015 and Banche di Credito Cooperativo (BCC) in 2016, or the implementation of the IPS in Spain or in Poland. Today, the majority of cooperative groups in Europe presents an integrated model, with a common brand, advertising and products. Co-

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[4] World Bank Group (b), *Understanding Bank Recovery and Resolution in the EU: A guidebook to the BRRD*, FinSAC, November 2016.

operative groups are generally characterized by an inverted pyramid structure: the local banks own the central institution and its specialized subsidiaries, contrary to the holding company, which owns all local branches and the subsidiaries within the group[5]. Some co-operative networks are organized as a two-tier system, while others as a three-tier ones: local banks-regional banks-central body (table 2).

Table 1. Main European cooperative models

Basic	Decentralized	Consolidated/Integrated
• lack of mutual guarantees or an IPS, • weak competences of the central institution, • local banks supervised by the external regulator.	• IPS, • week competences of the central institution, • local banks supervised by an external regulator.	• mutual guarantees, • supervision by the ECB, • many functions centralized on a group level, • decision of the central institution are binding.

Source: H. Groeneveld, *Governance of European Cooperative Banks: Overview, Issues and Recommendations*, TIAS Working Paper, Sept. 2015.

Table 2. The typical structures of European cooperative networks

Local banks' competences	Network model	Main source of financing
Local banks with a full licence.	1, 2 or 3-level structure.	Reinvested profits.
Local banks represented by a central institution.	Central institution in the form of a joint stock company, cooperative, association.	Local deposits.

Source: H. Groeneveld, *Governance of European Cooperative Bank…*, *op. cit.*

The decentralized structures forms a network with an IPS, where banks entered into a contractual or statutory liability arrangement which protects the local co-operative banks and ensures their liquidity and solvency (which grants a 0% risk weight of intra-group exposures). The IPS must be able to grant support from readily available funds, and be able of monitoring and classification of risks. However, as regards their operational business, the banks in the network remain to a large extent independent. This system is characteristic for BVR Group in Germany, Fachverband der Raiffeisenbanken in Austria and is in the process of establishment in Italy (BBC Group) and by the two cooperative networks in Poland[6]. In an integrated cooperative network, local cooperative banks and the

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[5]   EACB: European Association of Cooperative Banks: *Annual Report 2016*, Brussels, 2017.

[6]   EACB: *The Cooperative Difference: Sustainability, Proximity, Governance*, 2016.

central body are linked by a parent-subsidiary relationship which is characterized by a higher level of control of the central institution (which also allows a 0% risk weight for intra-group exposures) and there is no impediment to the transfer of own funds or repayment of liabilities from the central body to the local banks. This system is characteristic for the cooperative groups in France (Credit Agricole, Credit Mutuel, BPCE). The last stage of centralisation is the consolidated co-operative group, where the central institution and the local banks form one bank and the supervisors focus only on the consolidated level. This model applies to the OP Pohjola Bank in Finland and to the Rabobank in the Netherlands. The concentrated cooperative groups dominate the European cooperative sector in terms of the total assets (the figure 1).

Figure 1. Assets of European cooperative groups, 2015
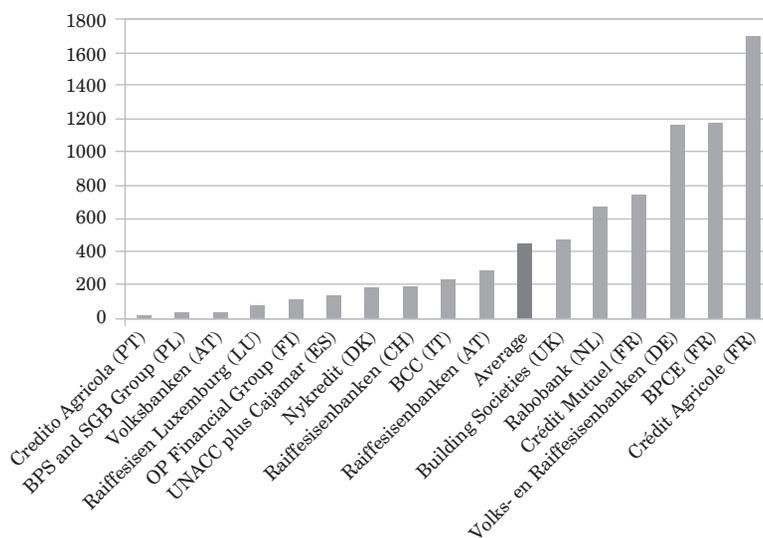
Note: the Italian BPs are excluded from the figure, as they have largely converted to public liability companies, which was required by the Italian law of 2015.
Source: H. Groeneveld, *Snapshot of European Cooperative Banking*, TIAS Working Paper, 2017.

The reforms of the cooperative networks towards centralization were instituted either bottom-up (Germany, the Netherlands, Finland) or they were implemented top-down by the authorities, often because of a poor financial condition of the cooperative groups (Italy, Spain). In the decentralised cooperative systems, the post crisis restructuring was based either on the centralization of the network, or on the implementation of the Institutional Protection Schemes (IPS) (tables 3 and 4).

Table 3. Examples of IPS in the Eurozone, 2015

Country	IPS
Germany	• Sparkassen-Finanzgruppe (DSGV, assets of 2 800 bil.) • Genossenschaftliche FinazGruppe Volsbanken Raiffeisenbanken, (BVR, assets of 1 163 bil.)
Austria	• Erste Group (assets of 200 bn) • RZR Group (Raiffeisen banks) (assets of 138 bn) • Volksbanken (assets of 28 bn)
Spain	• Crupo Cooperativo Cajamar (assets of 40 bn) • Crupo Cooperativo Solventia (assets of 1.6 bn)

Source: C. Choulet, *Institutional Protection Systems: Are They Banking Groups?*, economic-research. bnpparibas.com, January 2017.

Table 4. Polish cooperative banks according to their affiliation, Sept. 2016

Type of affiliation	IPS_1 (BPS Group)	IPS _2 (SGB Group)	Newly created integrated network (basic model)	Undecided banks	Independent cooperative banks	Total
No. of banks	273	197	56	30	3	559

Source: KNF, Warszawa, 12.2016.

3. THE RESOLUTION OF THE ITALIAN LOCAL BANKS IN 2015

In Italy, The Consolidated Law on Banking of 1993 granted the Bank of Italy supervisory powers for banks, banking groups, financial companies, e-money institutions and payment services' providers, currently under the framework of the Single Supervisory Mechanism (SSM), which has been fully operational since November 2014. The Consolidated Law on Finance of 1998 assigned the supervisory tasks to the Bank of Italy for securities investment firms and asset management companies; together with the Companies and Stock Exchange Commission (Consob), which oversees the transparency and fairness of investment practices. The rules for managing bank crises were modified by the Legislative Decree in 2015, transposing the Bank Recovery and Resolution Directive (BRRD) into the Italian law. The Single Resolution Mechanism (SRM) became fully operational on 1 January 2016. The Bank of Italy has been designated the National Resolution Authority. The Bank of Italy voiced its opposition, unsuccessfully, in a consultation

procedure on the bail-in tool, in the form of a paper to the European Council submitted in March 2013, where it called for a 3-year transition period (until 2018) to allow banks to gradually build up the cushion of liabilities (the MREL) needed to absorb the bail-in losses, to be offered to knowledgeable investors.

In Italy, the overall bank performance is poor and the unresolved problem is that of the non-performing loans (NPLs), on average 16% of the loan portfolio, comparing to 5.4% of the EU average in 2016[7]. Also the GDP growth is very low: according to a Moody's forecast, below 1% for the 2016–2018 period. The European Banking Authority's (EBA) Report points to the low growth and the high NPL ratio as the major threats for the European banks, and both problems are significant in Italy[8].

According to the BRRD's rules, the future problems of the Italian banks will have to be solved using the bail-in tool. However, this may be politically difficult, as in Italy bank bonds are largely owned by small investors, and members of cooperatives are not interested in participating in bank governance (the table 5). Consequently, the Italian government has tried to avoid resolution procedures as long as possible, postponing the full entry into force of the bail-in provision to 2016, applying before this date only some burden-sharing systems.

Table 5. Deposits and bonds issued by the Italian banks:
(a) billions of euros, (b) % of household wealth

| | Bank debt instruments | | Subject to bail-in | | | | | | Not subject to bail-in | | | |
| | | | Subordinated bonds | | Senior unsec. bonds | | Deposits above 100 000 EUR | | Deposits below 100 000 EUR | | Senior covered bonds | |
	a	b	a	b	a	b	a	b	a	b	a	b
2008	994	**26.4**	27	**0.7**	330	**8.7**	183	**4.9**	454	**12.0**	0.0	-
2011	1017	**28.6**	25	**1.0**	341	**9.6**	184	**5.2**	457	**12.9**	0.4	-
2015	921	**22.9**	29	**0.7**	173	**4.3**	225	**5.6**	493	**12.3**	0.1	-

Source: Bank of Italy: FSR, 2016/1.

Historically, there were two cooperative networks in Italy: BP and BCC, although the former group had a complex governance structure, allowing BP banks to float

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[7] Businessinsider, www.businessinsider.com/statistics-non-performing-loans-npls-italy-banking-system-2016-11; J. Garrido, *Insolvency and Enforcement Reforms in Italy*, IMF Working Paper WP/16/134, July 2016.

[8] EBA: *Risk Assessment of the European Banking System*, Dec. 2016.

part of their capital on the exchange, directed towards not voting members. Poor economic condition of the Italian cooperative groups, both BP and BCC (table 6), was a central point in the reform program of the Italian banking system instituted by the Italian government in 2015 and 2016[9].

Table 6. Financial characteristics for the Banco Popolare group

	2010	**2011**	**2012**	**2013**	**2014**
loans from clients, mil. Eur	94 462	93 349	91 481	86 149	79 823
deposits, mil. Euro	104 524	100 200	94 506	90 018	86 513
net profit, mil. Euro	308	-2 258	-944	-606	-1 946
ROA (%)	0,24	-1,71	-0,73	-0,49	-1,61
ROE (%)	2,68	-23,96	-10,51	-7,11	-24,10

Source: ECB: Financial Data Warehouse.

In 2015, the reform of the BP group started, aiming at converting the largest BP into joint stock companies. According to the Italian Law N°3/2015, 10 largest Banche Popolari, with assets above 8 bn euro, representing 90% of loans, employment and branches of the group, had to demutualize within 18 months[10] (table 7).

Table 7. Largest BP (assets, bn EUR)

Banco Popolare	126,0
UBI Banca	123,2
Banca Popolare dell'Emilia Romagna	60,9
Banca Popolare di Milano (BPM)	48,8
Banca Popolare di Vicenza (BPVI)	46,1
Veneto Banca	37,9
Banca Popolare di Sondrio	33,0
Credito Valtellinese	26,9
Banca Popolare dell'Etruria e del Lazio	12,5
Banca Popolare di Bari	10,4

Source: Scope ratings, 26.01.2015, www.scoperatings.com.

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9 MEF: *Italian Banking Sector: Recent Developments and Reforms*, http://www.mef.gov.it/focus/sistema_bancario/ITALIAN_BANKING_SECTOR.pdf.

10 https://www.thenews.coop/93102/sector/banking-and-insurance/why-italys-peoples-banks-are-not-co-operatives-anymore [accessed: 25.04.2017].

The reform was partially aborted after the constitutional referendum in December 2016 resulted in a clear "no" vote for the fundamental reforms proposed by the Prime Minister Matteo Renzi, and his subsequent resignation. But most of the largest BP banks had already demutualized, and the group consolidated. The largest BP bank – Banco Popolare Società Cooperativa, merged in 2016 with Banca Popolare di Milano, creating a joint stock company. Ultimately, it would be the third Italian bank with assets above €170 bn, 4 mn clients and 25 ths. of employees[11].

In July 2015, during the liquidation process of Banca Romagna Cooperativa, a small Italian mutual bank, shareholders and junior bondholders were "bailed- in" but did not suffer any loss as the Italian mutual sector's Institutional Guarantee Fund decided to reimburse them to preserve the reputation of the sector. In November 2015, there was a resolution of four small banks: Banca delle Marche, Banca dell'Etruria e del Lazio, Cassa di Risparmio di Chieti, and Cassa di Risparmio di Ferrara. The resolution of those banks aimed at business continuity and financial recovery, in the interests of the local economies. It fully protected the savings of households and local firms in the form of deposits, current accounts and ordinary bonds; it preserved the jobs of banks' employees, and it required no public funds. The banks' cumulative losses were absorbed by the riskiest investment instruments: shares and subordinated bonds. Full bail-in would have required also absorption of losses on the part of senior bondholders and unprotected depositors.

The solution used for those banks consisted of the following elements[12]:

❖ bail-in of equity and subordinated debt: €798 mil. losses were imposed on junior bondholders, of which around half were held by retail investors;

❖ each of the four banks was split into "good or bridge banks" and a single "bad bank" containing toxic assets of all four banks;

❖ the capital of "good banks" was reconstituted by the Resolution Fund in the amount of approximately 9% of total risk-weighted assets. The Resolution Fund is administered by the Bank of Italy's Resolution Unit and is financed with contributions from the entire Italian banking system;

❖ the "bad bank" (not a licensed bank) took possession of all the bad toxic assets remaining after the absorption of the losses. The Resolution Fund also supplied the bad bank with the requisite capital endowment;

❖ the Resolution Fund's financial outlays of €3.6 bn were injected to "good banks" (€1.8 bn.) and €1.7 bn was used to write down banks' bad debt, as well as to set up the bad bank, and the liquidity required for the rescue was advanced by three major banks: Intesa, Unicredit, and UBI;

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[11] http://www.eacb.coop/en/news/members-news/bcc-the-reform-of-the-co-operative-banks-in-italy-is-now-law.html [accessed: 25.04.2017].

[12] http://www.bancaditalia.it/media/approfondimenti/2015/info-soluzione-crisi/index.html [accessed: 25.04.2017].

❖ the good banks kept the original names, adding the suffix "Nuova". The banks will temporarily be administered by BoI, and the bridge banks were to be sold quickly. The proceeds of the sales would be retained by the Resolution Fund;

❖ the rescued banks voluntarily established a fund that will be attached to the national deposit insurance scheme to compensate a large number of retail investors that were bailed-in.

The State sustained no direct cost in the process. The entire cost was borne first by the four banks' shareholders and subordinated bondholders, but ultimately by the Italian banking system as a whole through its contributions to the Resolution Fund.

In 2016, the reform of the second cooperative network BCC has started, aiming at the centralization of the 367 banks and creation of the IPS-type of arrangement[13]. To solve the rescue problems in case it is applicable to larger banks, particularly in relation to the NPLs, in 2016 a special fund was created: *Guarantee on Securitization of Bank Non-Performing Loans* (GACS), with governmental guarantees, supported by a bank-financed fund Atlante (Altante). In 2016, the Atlante fund had to recapitalize two large banks from Popolari group (Banco Popolare di Vicenza and Veneto Banca), which were unable to be recapitalized from private sources. The recapitalization, based on acquiring 90% of the banks' capital by the Fund, depleted it from capital[14]. In result, the Fund has protected some small Italian banks from "resolution" procedures, which was required by the political and social factors, but with side consequences of transmitting the risk to the whole sector.

4. THE RESOLUTION OF THE ITALIAN REGIONAL BANKS – "THE VENETO BANKS" – IN 2017

Banca Popolare di Vicenza and Veneto Banca (often called "the Veneto banks") have been operated in the prosperous Veneto region in north-east Italy. Since 2014, both were directly supervised by the ECB, as at the end of 2016 they were Italy's 10th- and 11th-biggest banks by assets. Due to the law of 2015, the banks demutualized. Veneto Banca S.p.A. changed from a cooperative society to a limited company. Following a failed stock market listing in June 2016, it was taken over by a bail-out fund Atlante, which has prevented its resolution. Both banks became insolvent again in 2017. Banca Popolare di Vicenza (BPVI) was among the four Italian banks (together with Banca Popolare di Milano, Banca Carige and Banca

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[13] Banca d'Italia FSR 2016/1.

[14] S. Merler, *Italian Banks: Not Quiet on the Eastern Front*, http://www.dt.tesoro.it/en/news/ news_gacs.html [accessed: 31.03. 2017].

Monte dei Paschi di Siena) that failed the ECB stress tests in 2014. Both BPVI and Veneto Banca have a very high amount of non-performing loans (37%, compared to the Italian average of 18%) and high operating costs. They have been loss-making for a number of years and between June 2015 and March 2017 the banks lost 44% of their deposit base[15].

On 23 June 2017, the European Central Bank and the Single Resolution Board determined that both BPVI and Veneto Banca were insolvent, but did not fulfilled the criteria to put them in resolution. The SRB explained that it was not in the public interest to put them into resolution, as they did not have a significant impact on the financial stability. Consequently, they have been liquidated under Italian insolvency law, at the estimated cost of €17 billion. Italy determined that the winding up of these banks would have a serious impact on the real economy in their region, hence Italy notified to the EU Commission on its plans to grant State aid to wind-down BPVI and Veneto Banca – to sell parts of the two banks to Intesa, including the transfer of employees. In particular, the Italian State granted the following funds:

❖ cash injections of about €4.8 billion;
❖ state guarantees of a maximum of about €12 billion, notably on Intesa's financing of the liquidation mass.

The European Commission approved the state aid to Intesa and the good assets of the failing banks (performing loans, financial assets, deposits and the senior debt) were sold to Intesa Sanpaolo for one euro, and the rest was put into a "bad bank" with the bail-in of equity and subordinated shareholders, which remained in the entity into liquidation. As part of the "bail-in" rule, the Atlante Fund (with Intesa San Paolo and Unicredit as the two main shareholders), other shareholders, and subordinated bondholders received nothing. Moreover, Intesa announced that together with Unicredit they would establish a fund to repay the bonds that were held by small investors (€200 million in junior bonds)[16].

To conclude, the Italian banking system had spent over €4 billion in mandatory contribution to the resolution of 4 small banks between 2015 to 2017 and made an "investment" of over €4 billion in the Atlante rescue fund dealing with the bad debt of the Veneto Banks. Both cases raised the question of how to deal with retail bondholders. The two Venetian banks were supposed to be healthy after Altante recapitalised them in 2016, but they were not. If the resolution procedures had been applied, it would have required bailing in senior bondholders, which in the Italian case includes a large number of retail clients. Intesa San Paolo solved

[15] The Economist, *The complicated failure of two Italian lenders*, July 1st, 2017, www.economist.com.
[16] European Parliament (IPOL, EGOV), *The Orderly Liquidation of Veneto Banca and BP di Vincenza,* http://www.europarl.europa.eu/ 2017.

the problem by buying the "good" parts of the two Veneto banks for a symbolic sum of 1 euro. All the NPLs, equity and junior debt were bailed in. The equity was mostly held by the Altante fund. Junior bondholders – about 200 million – were bailed-in but will be reimbursed afterwards. This operation was possible because the banks were not resolved but liquidated, thus eligible for an liquidation aid as liquidation is processed under the national insolvency law. In November 2015, when the Bank of Italy imposed losses on bondholders of four small local banks, a customer of Banca Etruria committed suicide after losing his life savings. This was why when MPS, Veneto Banca and Banca Italia di Vicenza entered difficulties, the SRM was not applied. The Italian government has since intervened to bail out MPS and provide guarantees to the two other banks at a cost to the taxpayer of €18 billion.

CONCLUSIONS

The 2007–2009 financial crisis has revealed a number of issues related to failing banks, such as absence of resolution strategies and plans, a lack of designated authorities capable of dealing with failing banks, absence of cross-border coordination. In response to the identified problems and following recommendations from global regulatory bodies, the EU has undertaken number of initiatives aimed at creation of a comprehensive resolution framework. The new laws are aimed at providing the EU with a strong foundation for effective resolution. The framework was built on resolution authorities that received the mandate and tools to execute resolution strategies and plans. The resolution mechanisms allow for proper funding and should in theory result in no or minimum use of taxpayers' funds. However, a number of challenges emerged. Resolution regime is a result of a cost–benefit optimization and the resolution-related decisions must balance interests of various stakeholders[17].

There were not many cases of applying the resolution process to large banks after the BRRD, however, there were some instances of dealing with relatively smaller ones, particularly in Italy. The resolution regulation contains strict limitation on the state aid, which can be used only in exceptional circumstances, and after the bail-in of the junior debt. However, in Italy, about one third of bank bonds are held by households, so even a limited bail-in can have painful political and social consequences[18]. Investors who suffers from bail-in, in the case of Italy to

[17] M. Dewatripont, J. Tirole, J.C. Rochet, *Balancing the banks. Global lessons from the financial crisis*, Princeton University Press, Princeton 2010.

[18] N. Jassaud*, Reforming the Cooperative Governance of Italian Banks*, IMF Working Paper WP/14/181, Sept. 2014.

a large extent households, have a little comfort in the fact that they are protected as taxpayers.

To safeguard the economic and social stability, privately-owned (mostly by banks) funds were created to compensate the bail-ined stakeholders and to protect some small Italian banks from resolution procedures in the future. However, the possible consequence is the creation of the systemic risk to the whole sector. Hence there are voices calling for more flexibility in applying the resolution tools, particularly the bail-in rule[19]. The BRRD scheme was designed for large, systematically important banks and extending all tools and procedures in a rigid manner to the whole banking sector, including cooperative banks and their networks, may create some unresolved political and social problems.

Abstract

Post-crisis bank regulations recognised the need for a creation of a formalized resolution framework which would allow for an efficient resolution of troubled banks, with no or limited use of public funds. However, the resolution schemes are based on complex procedures, which aim at balancing the interests of different stakeholders. The purpose of this paper is to identify and assess the key elements of the resolution framework under the Single Resolution Mechanism (SRM) and the Bank Recovery and Resolution Directive (BRRD), concentrating on the bail-in tool. In particular, the paper attempts to demonstrate that there are some serious economic and social problems, when the resolution procedures are applied to local and regional banks, such as the cooperative sector, illustrating it with the bank resolution experience in Italy.

Key words: resolution, bail-in, cooperative banks

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Book Reviews

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Paul H. Dembinski
Ethics and responsibility in the financial world
Studio Emka, Warsaw 2017, p. 143, ISBN: 978-83-65068-18-7

The rise in interest in ethical issues in the finance sector, concerning in particular the financial market, is definitely connected with the global crisis, which – on a larger scale – was identified by the community of economic researchers and practitioners in 2007. Since then many works have been published which describe sources and consequences of the financial crisis in a quantitative ethical perspective, whereas Paul H. Dembinski belongs undoubtedly to a small circle of economists who have raised ethical issues in business activities, particularly in the financial area since the 1990s. It is also worth noting that apart from his research work in the area of financial ethics, the Author is also engaged in activities of institutional nature in Observatoire de la Finance foundation, which he set up in 1996 in Geneva. The foundation managed by Dembinski is well-known due to the publication in March 2008 of the "Financial activities in the service of the common good" manifesto. Hence, also due to this fact the book entitled "Ethics and responsibility in the financial world" deserves special attention.

The Author defined the purpose of his work as "the incentive for rethinking ethical issues in the financial world after 2007" (p. 11). This reflection is necessary because the structural and legitimising shock experienced by the finance sector does not allow to avoid the necessity to answer the question: "what will happen next in the area of ethics and responsibility in the financial world?" and to neglect ethical issues resulting from occasional (cyclical) or structural (permanent) reasons connected with the nature of finance (p. 12).

The reviewed work comprises six chapters (the Introduction constitutes the chapter 1), each of which discusses ethical issues of individual dimensions of the contemporary practice concerning the functioning of the financial sector and the existing conceptualisation of this practice. The Author draws our attention to

the positivist paradigm, rooted in the finance theory which is deprived of the ethical reflection and highlights only the technical and extremely formalised dimension of the functioning of the financial sector (p. 15 and p. 32). The Author also draws our attention to the euphoric atmosphere of thirty years of the financial world (p. 16) and the connections of this euphoria with the reductionist view on human nature, i.e. the *homo oeconomicus* idea. The reference to the current theoretical paradigm allows undoubtedly to understand better the finance specificity and to reconstruct more completely the uniqueness of the ethical dilemmas in question. However, these analyses and considerations would be incomplete and basically groundless if the Author did not follow the explicitly expressed values he had accepted. The issue is crucial not only from the point of view of the reasoning clarity but also for obtaining validity of conclusions formulated, including the conclusions of the practical nature (e.g. the "Mind the GAP" approach, p. 52 or the "Jubilee 2000" project, p. 96). The Dembinski's axiological foundation for ethical evaluations which, at the same time, are decisive for understanding the role and meaning of the financial sector, are superior values expressed in the form of the following concepts: the community good (p. 24), the common good (p. 44), the social order (p. 120), not the purposes which may be easily operationalised and which assume achieving "fair distribution of risk and profits between different groups of financial relation protagonists" or maintaining "financial stability at the macro level" (p. 24). Adopting the perspective of the superior values is important mainly due to the fact that finance has not become again the source of the social risk.

The obligation of the reviewer is to present the content of the work being evaluated. Basically, it could be said that the Author analyses from the ethical perspective problems concerning globalisation and financialisation of the economy, functioning of equity funds from the point of view of their owners, shareholders, managing persons, savers, and users of the capital (companies, public authorities), etc. However, such an approach would be unfair in the case of this work, as it is an in-depth presentation evaluating possible connections and dependencies between decisions and choices of the financial sector's particular entities, as well as consequences of these decisions for the situation of entities which do not take the relevant decisions and choices. The Author provides similarly careful and ethically balanced reflection while analysing accounting and audit standards, functioning of banking institutions, information asymmetry, understanding asymmetry, as well as the role of information technology and financial innovations, social consequences of cultural superficiality, behaviours of teams managing finances or finally such pathologies as *dark pools*, LIBOR manipulation, *insider trading* and *flash orders*. Nevertheless, on no account is it another simple criticism of "inherent" greediness of entities from the financial sector. Dembinski's work certainly encourages the reflection on ethical dilemmas of the financial world in which we all take part.

Attention should also be paid to considerations concerning categories of sustainable finance, *ex ante* and *ex post* responsibility, the concept of a fulfilled life and fair institutions, as specified by P. Ricoeura, the hypotheses of criticism and the conclusions of financial models constructed exclusively on technical bases. Another indisputable achievement of the P.H. Dembinski's work is methodological reliability expressed in careful definitions of concepts used therein. The Author is aware of multiple meanings of such expressions as "ethics", "morality", "responsibility" and even "finance". In order to avoid possible ambiguities, the Author defines how individual concepts adopted in the text are understood and uses them consequently in further deliberations. The following extracts may serve as an example: "finance should be defined as the creation of promises, obligations and undertakings referring to current and future payments as well as their management and trading" (p. 22) and "finance is a place where private promises or obligations are sold for money, i.e. for public promise" (p. 25). These definitions are further used by the Author for the determination of long-term contracts, e.g. life insurance contracts in categories of accepted (for the insured person's family) level of risk which should be covered by the financial promise of the insurer (p. 64).

The reviewer's obligation is also to indicate gaps or moot points of the P.H. Dembinski's work. An objection that can be formulated concerns too much trust put by the Author in cognitive capabilities of behavioural theories of finance, also in the context of its position in the financial study programmes as a (separate) alternative for dominating technical positivist theory. It may seem that using reasoning of the psychological nature in the conceptualisation of financial market with comprehensive descriptions and explanations in terms of social conditions has not been necessary, as the altruistic and emotional dimension of business entities, including professionals from the financial group, is created and maintained culturally. Another slightly archaic measure used by the Author is using the concept of the coexistence of reasons defined by Aristotle. However, taking into account the content of Dembinski's entire work, this concept is not exposed too much and, in a sense, it supports the cultural presentation of the context in which the existing image of the financial sector is questioned as an area free from and independent of the ethical dilemmas. The logical inconsistency included in the title (responsibility is an ethical category) may be explained by the intention to highlight the meaning of this concept within the concern for the common good. Opinions and evaluations formulated in the review prove that the "Ethics and responsibility in the financial world" is an important book for the entire scientific community of economists. In the first place, the reviewed book should draw interest of financial researchers and practitioners from financial institutions, as well as economic and business ethicists. The cognitive but also educational and practical dimension of the P.H. Dembinski's work also deserves attention of students who may decide about the shape of this world in the future according to the message included in the "Ethics and responsibility in the financial world".