Bank Lending Channel Effectiveness – Potential Lessons For Monetary Policy

Filip Świtała[1]
Faculty of Management, University of Warsaw, Poland
fswitala@wz.uw.edu.pl
https://orcid.org/0000-0002-8046-5240

Iwona Kowalska
Faculty of Management, University of Warsaw, Poland
ikowalska@wz.uw.edu.pl
https://orcid.org/0000-0002-1208-2790

Karolina Malajkat
Collegium of Socio-Economics, Warsaw School of Economics, Poland
https://orcid.org/0009-0004-1637-9323

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ABSTRACT

The article supplements the research on the effectiveness of monetary policy transmission – especially through the bank lending channel. The current study focuses on assessing the transmission of monetary impulses through commercial and cooperative banks as well as through individual loan portfolios, while distinguishing between the fact that they were granted by commercial and cooperative banks. How a change in the central bank's interest rates may determine a change in the volume of loans in the economy remains the core question of the research.

JEL classification: E44, E51, E52, E58, G21

Keywords: loan supply, monetary policy, bank lending channel, impulse response.

1. FOREWORD

The issue of effectiveness of the bank lending channel, the existence of which has been confirmed in numerous scientific publications, has been of interest to many scientists, economists, regulators and banking professionals. What is more, not only does research try to confirm the existence of the bank lending channel itself, but also attempts to assess transmission separately on different types of banks (e.g., commercial banks and cooperative banks) as well as on separate loan portfolios (especially: household lending, corporate loans and mortgage loans) – with the aim to answer the following question: How does the change of central bank's interest rates determine the change of volume and structure of loans in the banking sector?

[1] Corresponding author: Filip Świtała, Adress: Faculty of Management University of Warsaw, 1/3 Szturmowa Street, 02-678 Warsaw, Poland.

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2. LITERATURE REVIEW

In adequate literature, the bank capital channel and its impact on landing and the strength of monetary policy transmission mechanism was discussed by, inter alia, Ramey (1993), Meltzer (1995), Erhmann (et al.) (2001), Gambacorta and Mistrulli (2004), Golodniuk (2006), Markovic (2006) and by Dajcman and Tica (2017).

It is generally argued that following a monetary tightening, smaller banks are less likely to supply loans. Kashyap and Stein (1995) illustrated that when the Fed drains deposits from the system, banks cannot frictionlessly make up the funding shortfall by raising non-deposit external finance. Consequently, their lending behavior is affected, and so in turn is the investment spending of those non-financial firms that rely on banks for funding. In their research, based on disaggregated US data, they constructed bank groups by size and looked at how deposits, securities and loans of the groups responded to monetary policy shocks. Researchers argued that if the abovementioned lending view of monetary policy transmission is correct, one should expect the loan and security portfolios of large and small banks to respond differentially to a contraction in monetary policy. They suggested that if banks are hit by the same deposit and loan demand shocks, than small banks will cut their loan supply more rapidly since they find it costlier to make up for the monetary policy induced shortfall in funds. They also emphasized that liquidity constraints usually become more pronounced for small banks.

Also De Santis and Surico (2013) contribute to the literature by investigating availability of credit depending on the monetary policy with regard to bank characteristics in four largest economies of the euro area. Results indicated that changes in the cost of funding engineered by monetary policy actions exert their maximum impact on cooperative and saving banks in Germany, especially those with lesser liquidity and lower capital, and saving banks in Italy, especially those with smaller size. At the same time large commercial banks appear more capable to isolate their lending activities from changes in monetary policy conditions. Similar results of research confirming that a bank size determines the strength of the bank lending channel, with small banks reacting more actively and therefore enhancing the transmission mechanism of monetary policy, were also obtained by De Haan (2001), Meral (2015), Westerlund (2003), Matousek and Sarantis (2009).

On the other hand, Ananchotikul and Seneviratne (2015) came up with a contradicting conclusion when they examined the effectiveness of monetary policy transmission in selected Asian countries. The authors did not find bank size to be an important factor determining the credit supply response to monetary policy changes as the coefficients on the interaction terms between bank size and monetary policy were not statistically different from the baseline effect. They argued, however, that less liquid banks and/or banks with higher loan-to-deposit ratios are found to respond more strongly to domestic monetary policy shocks. A contradicting result concerning the functioning of the bank lending channel in Poland was also obtained by Havrylchyk and Jurzyk (2005) who investigated the role of banks in the monetary policy transmission in Poland. They argued that, based on the results, after a monetary policy tightening, big banks contract credit more than small banks. Even though the result seemed to be counterintuitive, both authors explained it based on specific situation of the Polish banking sector during the examined period (1997–2002). Big banks were faced with a growing bad loan problem, therefore they contracted their lending to both firms and private customers while investing in Treasury Bonds (which yield higher returns) instead. Small banks (many of which were start-ups) were, on the other hand, free of bad loans problem, had access to better credit rating procedures and expanded lending trying to acquire a market share.

When it comes to conclusions regarding the impact of the bank lending channel on loan structure, Gilchrist and Zakrajsek (1995) have noticed that impact in the case of monetary policy tightening is stronger for SMEs rather than for corporates. The issue of impact of the bank lending

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channel on the structure of granted loans was also investigated by Black and Rosen (2007). They proved that during periods of tight monetary policy, banks adjust their stock of loans by reducing the maturity of loan originations and they reallocate their short-term loan supply from small firms to large firms. The obtained results were stronger for large banks than for small banks. Garretsen and Swank (2003) examined empirical evidence of the existence of a bank lending channel in the Netherlands by analyzing responses of different borrower groups to a contraction of monetary policy. The obtained results confirmed that corporate loans are depressed only after a lapse of over a year, whereas household loans decrease almost instantly due to an interest rate rise.

Some scientist even concentrate their research on impact of the bank lending channel on mortgage loans exclusively. That was the case in the paper prepared by Black, Hancock and Passmore (2010). The scientists differentiate banks into two groups: "traditional banks", which have a large supply of excess core deposits and specialize in information-intensive lending to borrowers and "market-based banks", which are funded with managed liabilities and mainly lend to relatively easy-to-evaluate borrowers. In course of their research, the authors found evidence of a bank lending channel only among transition banks – they significantly reduce mortgage lending in response to monetary contractions. At the same time, the authors did not find any evidence of a bank lending channel among traditional banks with a large core lending capacity and among market-based banks with a large proportion of funding in managed liabilities. This area of research has also been examined by Milcheva (2013) who assessed the responses of US house prices to an exogenous credit supply shock and compared them with the effects from variations in credit supply associated with a bank lending channel. She obtained results which suggest that in the first 3 years credit supply shocks affect house prices exogenously rather than through the bank lending channel. More recently Gyöngyös, Ongena and Schindele (2019) researched impact of monetary conditions on the supply of mortgage credit by banks to households by analyzing data from Hungarian banks. They found that expansionary domestic monetary conditions increase the supply of mortgage credit to all households in the domestic currency and to risky households in the foreign currency.

A thorough analysis of the monetary policy transmission mechanism in Poland was recently presented by Chmielewski (et al.) (2018) and its impact on, inter alia, specific loan portfolios. The authors examined impact of monetary policy on standards and requirements of banks' credit granting policy. They proved that the standards set for SMEs react a little bit stronger than those for corporates. It is especially visible in the case of long-term loans, which is due to asymmetry of information and higher uncertainty to borrower's solvency in long-term rather than in short-term. Therefore, in the case of tightening on monetary policy SMEs are more exposed to stricter credit granting policy – especially long-term loans (investment and real estate loans) than corporates. At the same time scientists proved that when it comes to private investment, crediting standards set by banks are not of greatest importance and the height of interest rates is the deciding factor. Private investment lowered with increase of interest rates set by the national bank.

3. RESEARCH METHODOLOGY

To analyze the operation of the bank lending channel for the transmission of monetary impulses to the Polish economy, a multi-equation error correction model (VECM) was built, and then the results were analyzed and interpreted in terms of verifying the hypothesis about the possibility of stimulating economic growth through the central bank's interest rate policy. The model uses aggregated quarterly data from 2004 to mid-2019 (62 quarters) regarding the Polish banking sector and the macroeconomic environment:

– the NBP reference rate (ir_mp) reflecting monetary policy in Poland (as at the beginning of the quarter);

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- the total interest rate on newly granted PLN loans (ir1_loans), as well as the interest rate on newly granted PLN loans for households (ir1_loans_h), for consumer loans (ir1_loans_h_c) and for housing loans (ir1_loans_h_mortg), the interest rate on newly granted PLN loans for enterprises (ir1_loans_b). In addition, the robustness test included the weighted average interest rate on newly granted PLN and foreign currency loans (ir1_loans_all). The model uses the average interest rate in the quarter. In this respect, it should be emphasized that many studies (including earlier authors' studies) are based, for example, on the WIBOR rate as a rate related to the average market interest rate on loans granted;
- loans to the non-financial sector granted by the sector (loans_all), cooperative banks (loans_s) and commercial banks together with branches of credit institutions (loans_k) broken down into: loans to households (loans_h_s and loans_h_k, respectively), as well as in the case of commercial banks only consumer loans to houeseholds (loans_h_cons_k), mortgage loans to households (loans_hm_k) and also corporate loans (loans_b_s and loans_b_k, respectively for cooperative and commercial banks). The aggregates (as at the end of the quarter) allow an analysis of the impact of interest rates in individual sectors of the economy, taking into account the varied behavior of cooperative and commercial banks;
- own funds of the sector (equity), cooperative banks (equity_s) and commercial banks (equity_k), as they determine the possibility of developing lending by banks (as at the end of the period);
- the share of the five largest banks in the total assets of the sector (asssets_5share), i.e., the basic measure of concentration, to take into account the possible impact of changes in the area of concentration in the banking sector on the efficiency of the monetary policy transmission channel;
- the share of the commercial (assets_share_k) and cooperative (assets_share_s) banks' assets in the total banking sector assets;
- the share of liquid assets in total assets (assets_liq_assets) and in the group of cooperative banks (assets_liq_assets_s) and in the group of commercial banks (assets_liq_assets_k). This variable seems important due to the impact of the subprime financial crisis on the Polish banking sector – significantly lower liquidity was observed during the crisis, which increased the cost of obtaining deposits and could have influenced banks' decisions regarding the development of lending;
- gross domestic product (gdp), which represents in the model the real zone of the economy (reflects the general economic situation determining the demand for loans);
- unemployment rate (unempl), as another dimension of the real zone of the economy (reflects the economic situation of households determining the demand for loans).

The analysis period was a derivative of two factors, firstly, the NBP has been publishing data on the interest rate on newly granted loans since 2004, and secondly, it was assumed to cut off the historical period of high NBP rates. It seems that the transmission of interest rates to the economy may take place differently in the environment of high and low interest rates.

All variables describing the volume of loans, own funds and gross domestic product are logged-in real values – while inflation was used to convert nominal values into real ones. The time series of the endogenous variables used in the VAR model are shown below. Descriptive statistics and correlation tables between the analyzed variables are attached.

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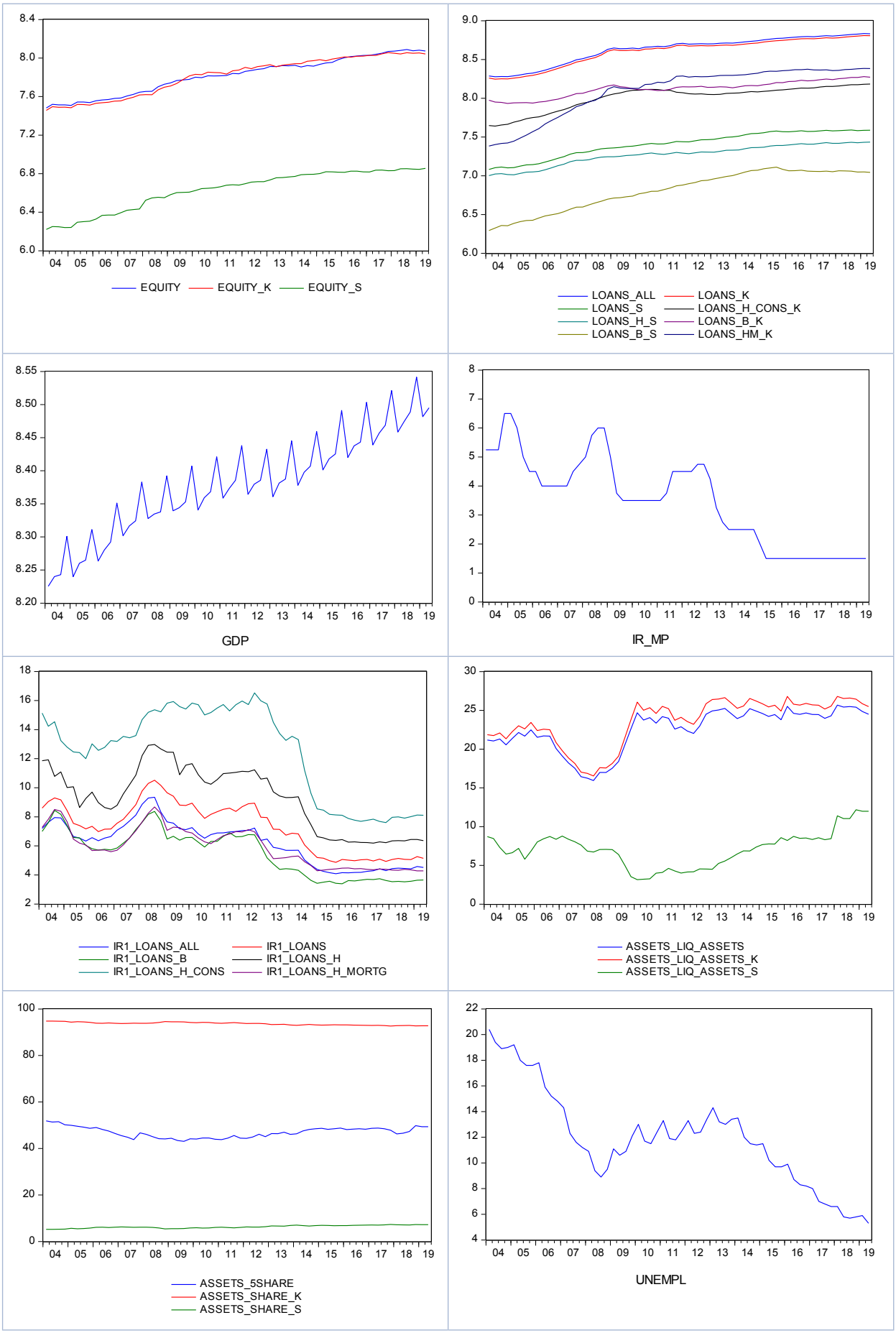
Figure 1
Time series of variables used in the model



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4. RESULTS

The first stage of model construction was the estimation of a stable VAR model based on endogenous (ir_mp, ir1_loans, loans, equity, gdp) and exogenous (q1, q2, q3, zm01, asssets_5share, assets_liq_assets, assets_share, unempl) variables. The legitimacy of treating asssets_5share, assets_liq_assets, assets_share and unempl as exogenous was confirmed using the Granger causality test.

The non-stationarity of the tested series at levels was initially determined on the basis of graphs and confirmed by the ADF statistical test (Augmented Dickey-Fuller) and the KPSS test (Kwiatkowski-Phillips-Schmidt-Shin). The KPSS test will often select fewer differences than the ADF test. A KPSS test has a null hypothesis of stationarity, whereas ADF tests assume that the data has I(1) non-stationarity. Consequently, the KPSS test will only select one or more differences if there is enough evidence to overturn the stationarity assumption, while the other tests will select at least one difference unless there is enough evidence to overturn the non-stationarity assumption.

The results of stationary tests and relevant critical values – attached – indicate the possibility of building the VECM models.

The selection of the optimal number of VAR model delays that would reflect the natural interactions between variables was made based on diagnostic tests – in particular information criteria (Schwarz Criterion, Hannan-Quinn Criterion), the Wald's combined significance test and assessment of stationarity, autocorrelation and normality random components. The information criteria did not give a clear indication of the number of delays, but ultimately it was decided to build the VAR model with two delays, and thus the VECM models contain only the first differences. The stability of the VAR models were confirmed by the assessment of the characteristic elements of the equation that lie inside the unit circle, which is particularly important from the perspective of testing the impulse response functions (all results available on request).

The VAR models used are very general and may not correspond to the specific economic situation. The models are based on the detected dynamics and relationships between the variables used, and do not yet contain restrictions that would indicate relationships between variables resulting from economic theories. At this stage, it is possible to observe the behavior of the system in the face of a monetary shock, i.e., a unit change in the reference rate, but in this study we focused on the construction of the VECM models and analysis of the impulse response function from a models containing both long- and short-term relationships.

The analysis of interaction between variables, which is the basis for the structuring of the VAR model, is also an important aspect of VECM modeling. To this end, causality tests were used to verify the relationships arising from economic theory and as a tool for detecting relationships (not resulting directly from the theory) between variables. The Granger causality test used is to check a one-way relationship whether changes in the value of one variable are reflected in changes in the other variable. The results of the test for variable levels and their first differences are provided on request.

The test for the number of cointegrating elements was carried out using the Johansen method. Although this is the most commonly used method of cointegration testing and consists in estimating the vector autoregression model using the maximum likelihood method, determining the eigenvalues of one of the parameter matrix and checking the number of non-zero eigenvalues, the disadvantage of the test is its dependence on the assumed form of deterministic trends, which means that inference about the number of cointegrating vectors depends on their assumed form. For the order of cointegration, the trace test (Trace Test with null hypothesis that the number of different cointegration vectors is less than or equal to r against the alternative hypothesis that it is greater than r) was used along with the maximum value test (Maximum Eigenvalue with null hypothesis assuming that the number cointegrating vectors is r against the alternative hypothesis that this number equals r + 1). (The results are available on request).

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Because endogenous variables are integrated in the first stage and it was found that there are co-integrating vectors between them, it was possible to transform the model (according to Granger's theorem) into a vector error correction mechanism, which allows to distinguish matrices containing parameters determining long-term relationships between variables and speed of model adjustment in the case of disturbance.

In the next stage of building the VECM model, the estimated matrix containing co-integrating vectors was imposed with restrictions resulting from the theory of economics, other empirical studies showing relationships between variables and conducted causality analyzes. The imposition of an appropriate number of restrictions was necessary to identify the model, and the imposed restrictions were tested by the combined materiality test. In this way, in a sense, the atheoretical VAR model was combined with economic theories. In most presented models two cointegrating vectors were obtained which represent the long-term relationships between variables.

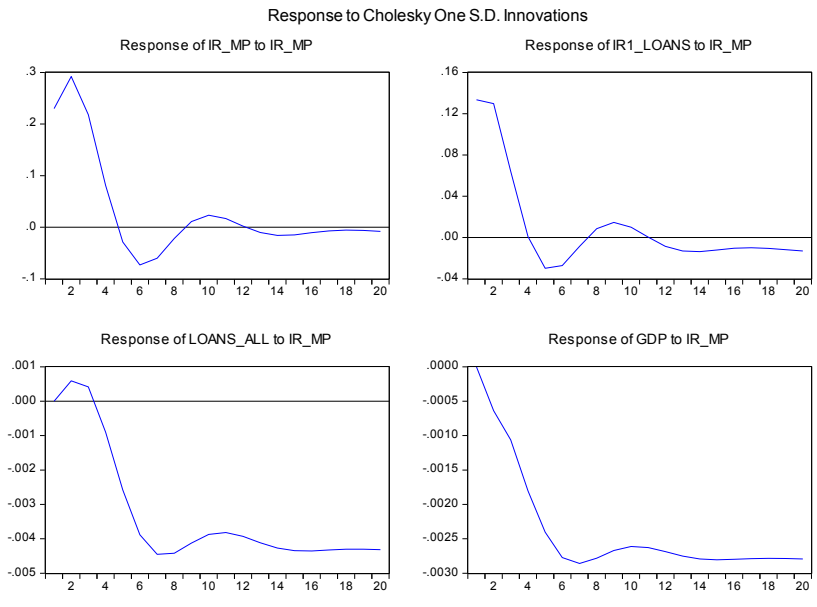
The model reflects the demand and supply side of loans describing, i.a., the fact that the volume of loans increases along with the improvement of the overall economic situation and the credit expansion possibilities of the banking sector increase with the increase in own funds but also that banks are willing to significantly increase the supply of loans if the interest margin increases. Detailed equations of the aforementioned phenomena are presented in the figures below along with the impulse response functions showing that monetary policy impulses are indeed transferred into the real economy independently of the form of bank and either by households or corporates. Thus, changes in central bank's interest rate levels have permanent impact on volume of loans and also on gdp.

The structured VECM model allows to study the response of the presented system to the impulse introduced into it. In particular, this model allows tracking the mechanism of impulse transmission in monetary policy (in the form of a change in the reference rate) to the market interest rate and the volume of loans.

The functions of the reaction of the endogenous variables (ir_mp, ir1_loans, loans and gdp) to the unit impulse of reference rate change are presented below. The adjustment path allows us to determine whether the impulse is only temporary or whether the interference is permanent.

Figure 2

Impulse response of endogenous variables to the interest rate impulse and the long term relations – whole banking sector



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	1.21	0.05
	(0.23)	(0.01)
	[5.22]	[4.42]
IR1_LOANS(-1)	-1.21	0.00
	(0.23)	
	[-5.22]	
LOANS_ALL(-1)	1.00	1.00
GDP(-1)	0.00	-1.74
		(0.64)
		[-2.72]
EQUITY(-1)	-2.75	0.00
	(2.81)	
	[-0.98]	
C	17.50	5.80

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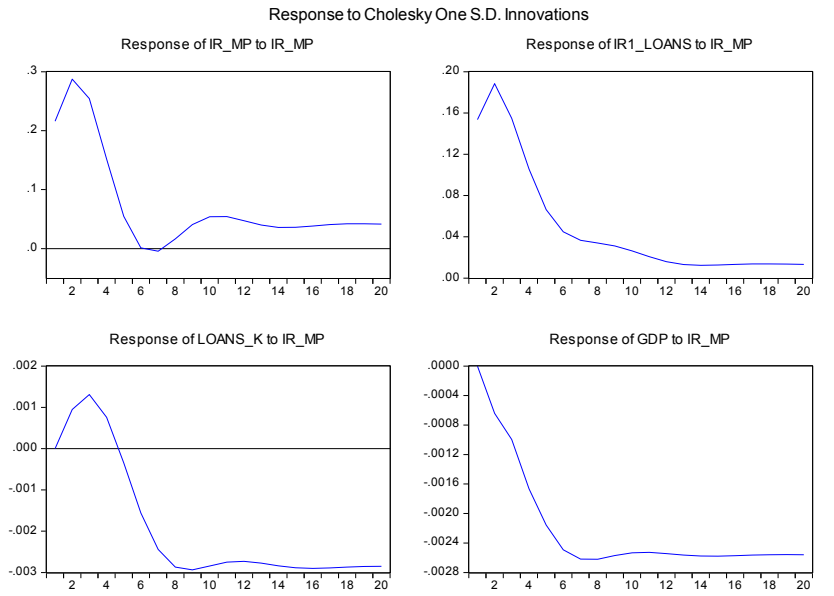
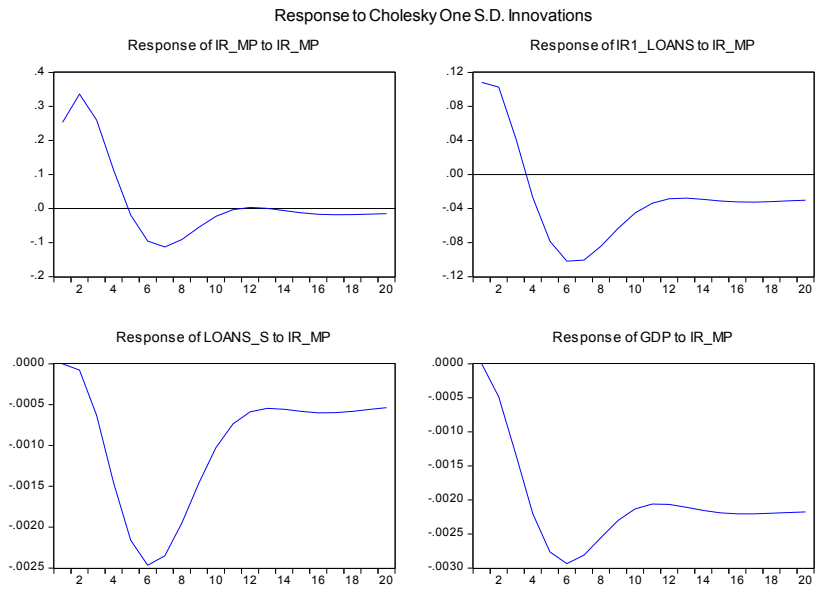
Figure 3
Impulse response of endogenous variables to the interest rate impulse and the long term relations – commercial banks



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.00	0.10
		(0.01)
		[8.71]
IR1_LOANS(-1)	0.14	-0.10
	(0.033)	(0.01)
	[5.65]	[-8.71]
LOANS_K(-1)	1.00	1.00
GDP(-1)	-0.36	0.00
	(0.54)	
	[-0.67]	
EQUITY_K(-1)	0.00	-0.86
		(0.05)
		[-16.44]
C	-6.63	-1.48

Figure 4
Impulse response of endogenous variables to the interest rate impulse and the long term relations – cooperative banks



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.24	0.01
	(0.04)	(0.01)
	[5.65]	[1.38]
IR1_LOANS(-1)	-0.08	0.00
	(0.05)	
	[-1.64]	
LOANS_S(-1)	1.00	1.00
GDP(-1)	-0.77	0.00
	(1.44)	
	[-0.53]	
EQUITY_S(-1)	0.00	-0.56
		(0.09)
		[-6.31]
C	-1.20	-3.76

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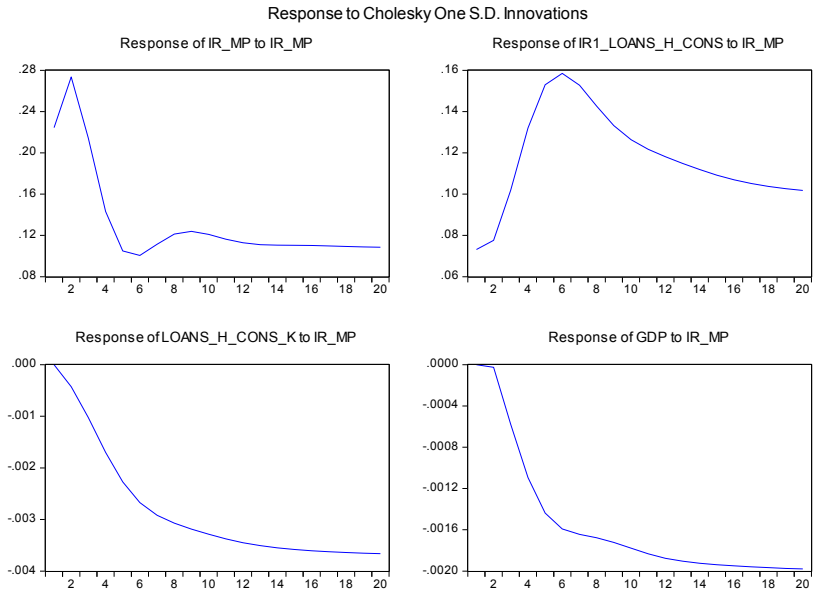
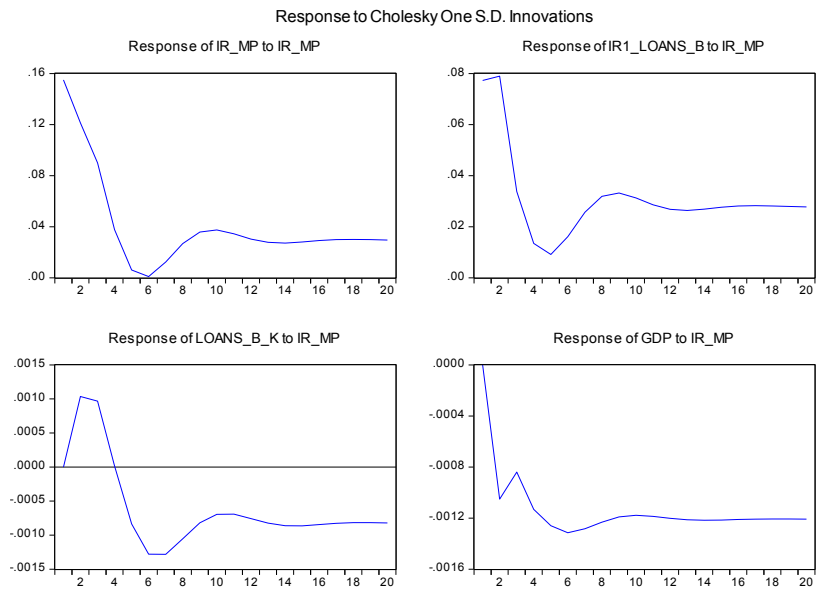
Figure 5
Impulse response of endogenous variables to the interest rate impulse and the long term relations – commercial banks – consumer loans



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.28	-0.03
	(0.06)	(0.01)
	[4.57]	[-2.17]
IR1_LOANS_H_CONS(-1)	-0.28	0.05
	(0.06)	(0.01)
	[-4.57]	[3.40]
LOANS_H_CONS_K(-1)	1.00	0.00
GDP(-1)	0.00	1.00
EQUITY_K(-1)	-0.56	0.00
	(0.22)	
	[-2.60]	
C	-1.08	-8.94

Figure 6
Impulse response of endogenous variables to the interest rate impulse and the long term relations – commercial banks – corporate loans



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.03	1.00
	(0.01)	
	[2.52]	
IR1_LOANS_B(-1)	0.00	-1.06
		(0.07)
		[-15.41]
LOANS_B_K(-1)	1.00	0.00
GDP(-1)	0.00	0.00
EQUITY_K(-1)	-0.08	0.00
	(0.07)	
	[-1.07]	
C	-7.59	2.35

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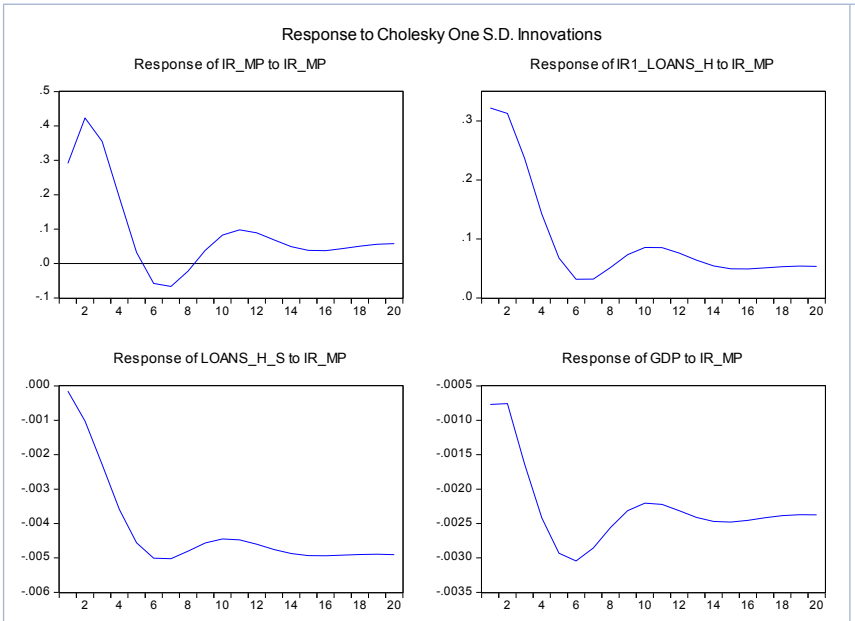
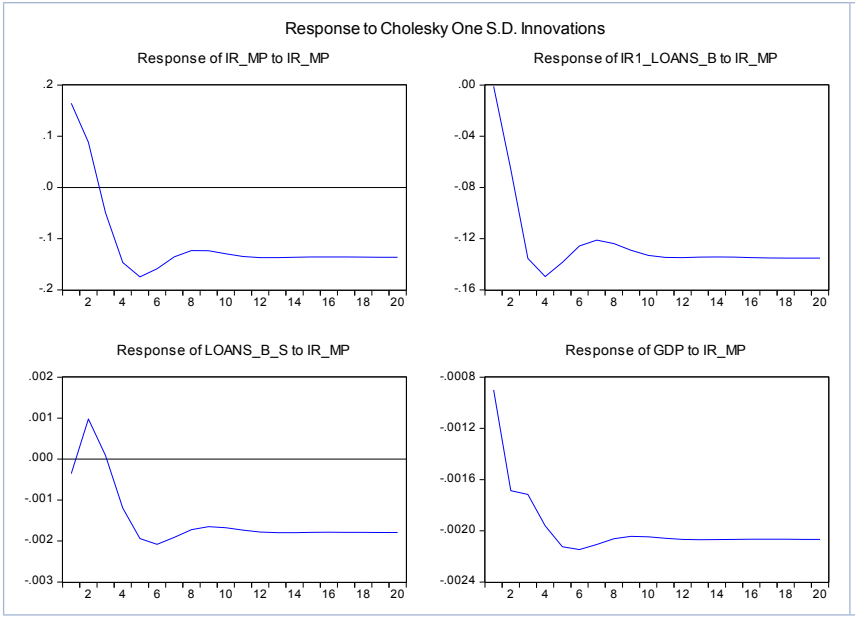
Figure 7
Impulse response of endogenous variables to the interest rate impulse and the long term relations – cooperative banks – consumer loans



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.04	0.13
	(0.02)	(0.08)
	[2.65]	[7.73]
IR1_LOANS_H(-1)	0.00	-0.04
		(0.01)
		[-2.99]
LOANS_H_S(-1)	1.00	1.00
GDP(-1)	-1.20	0.00
	(0.56)	
	[-2.16]	
EQUITY_S(-1)	0.00	0.0
C	2.63	-7.34

Figure 8
Impulse response of endogenous variables to the interest rate impulse and the long term relations – cooperative banks – corporate loans



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	1.000	0.00
IR1_LOANS_B(-1)	-1.03	0.00
	(0.06)	
	[-17.58]	
LOANS_B_S(-1)	0.00	-0.67
		(0.04)
		[-18.37]
GDP(-1)	0.00	0.00
EQUITY_S(-1)	0.000	1.00
C	2.08	-2.08

The figures show the impact of "disruptions" in the period of 20 quarters – the results are presented on a general to detailed basis – i.e., from the results for the banking sector, through the results broken down into commercial and cooperative banks (figures 3 and 4), and then for consumer and corporate loans in the two groups of banks (figures 5–8). Additionally, the enclosed robustness check (in appendix) shows the results for foreign currency loans.

Generally the tightening of the monetary policy results for cooperative banks in decreased volumes of loans, however, there is a slightly delayed response in corporate loans in comparison to consumer loans (figures 7–8). The delay can be explained by a decision-making process in enterprises. So, monetary policy has a constant impact on the volume of loans in the case of cooperative banks (new equilibrium at a lower level is visible after 6 quarters, although full stabilization appears after 12 quarters). It confirms the existing of bank lending channel transmission of monetary policy

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impulses in cooperative banks. Increased interest rates indirectly contribute to the decline in gross domestic product. At the same time, the period of reaching a new level of equilibrium is long. For households, the effect of the influence on the real economy weakens over time.

When we look at the results for commercial banks there is similar delay in corporate reaction in the decline in loans volume (figure 6) while decrease in consumer loans is instant (figure 5). The long-term loan volume reaches new lower equilibrium level after a similar period as in the case of cooperative banks. The impact on gross domestic product also weakens in the longer term, as compared to the first reaction, but remains significant until the end – both for corporates and households. All the results confirm that the bank lending channel operates in commercial banks.

5. CONCLUSIONS

The analysis of the impulse response function of the VAR models carried out in earlier studies of the authors confirmed the existence of the monetary policy transmission mechanism to the real economy. During the research, various response functions were noted for commercial and cooperative banks. Current research shows that different response functions can be observed for separate loan portfolios (for both commercial and cooperative banks). In the case of cooperative banks we considered loans for households and corporate loans and in the case of commercial banks we divided household loans into consumer and housing loans. The obtained results indicate the expected behavior of the impulse response function in all cases except one – in the case of housing loans it was not possible to build a model which, taking into account historical data, would retain prognostic capacity, mainly due to regulatory changes that occurred in the respect and to some extent artificial portfolio division in previous years into individual currencies.

The results obtained, although in general consistent with the theory of economy require further research – especially when dealing with impact of COVID-19 on credit portfolios of banks. It may be presumed that a large part of customers will become insolvent, even despite the fact that authorities around the world are trying to use different sets of countermeasures, what may lead to changes in banks' credit policies due to anticipated problems with liquidity risk management. Further research therefore would have to include those kinds of effects that may have impact on response functions. In this respect it would be desirable to take into account the spread between lending rate and deposit rate to capture the shifts in the supply of bank loans. Having the abovementioned in mind, the results obtained could, and in the authors' opinion should, be taken into account when designing the process of cushioning the pandemic effects especially with the tools of monetary policy. Nevertheless, monetary authorities, having in mind, the possibility of stimulating economic growth through the central bank's interest rate policy via the bank lending channel for the transmission of monetary impulses to the economy should also take into account the "predictive component" – i.e., anticipated market developments and the need to reassess the risk situation. Further research, including COVID-19 developments may give an answer whether those countermeasures affected the shape of impulse response functions and may therefore give an assessment of their individual effectiveness. We should, however note that it will be extremely difficult to distinguish the effects of monetary policy instruments – and as described by Niedźwiedzińska (2020) – the monetary policy reaction to the pandemic across countries was extraordinary as central banks have been ready to reach for instruments regarded as unconventional in the past – from fiscal expansion applied simultaneously.

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References

Ananchotikul, N., Seneviratne, D. (2015). Monetary Policy Transmission in Emerging Asia: The Role of Banks and the Effects of Financial Globalization. IMF Working Paper, WP/15/207. https://doi.org/10.5089/9781513516233.001

Black, L. K., Rosen, R. K. (2007). *How the credit channel works: Differentiating the bank lending channel and the balance sheet channel*. Working Paper, No. 2007-13, Federal Reserve Bank of Chicago, Chicago, IL.

Black, L., Hancock, D., Passmore, W. (2010). *The Bank Lending Channel of Monetary Policy and Its Effect on Mortgage Lending*, Finance and Economics Discussion Series. https://doi.org/10.2139/ssrn.1895500

Chmielewski, T., Kapuściński, M., Kocięcki, A., Łyziak, T., Przystupa, J., Stanisławska, E., Wróbel E. (2018). *Mechanizm transmisji polityki pieniężnej w Polsce. Stan wiedzy w 2017 roku*. Materiały i Studia NBP, nr 330.

Dajcman, S., Tica J. (2017). *The broad credit and bank capital channels of monetary policy transmission in the core and peripheral Euro Area*. Zbornik radova Ekonomskog fakulteta u Rijeci, časopis za ekonomsku teoriju i praksu – Proceedings of Rijeka Faculty of Economics, Journal of Economics and Business, Vol. 35, No. 2, 249–275. https://doi.org/10.18045/zbefri.2017.2.249

De Haan, L. (2001). The credit channel in the Netherlands: evidence from bank balance sheets, European Central Bank Working Paper Series no 98/ December 2001.

De Santis, R. A., Surico P. (2013). Bank lending and monetary transmission in the euro area, European Central Bank Working Paper Series no 1568 / July 2013. https://doi.org/10.2139/ssrn.2294854

Ehrmann, M., Gambacorta, L., Martines-Page, J., Sevestre, P., Worms, A. (2001). *Financial Systems and the Role of Banks in Monetary Transmission in the Euro Area*. ECB Working Paper, No. 105. https://doi.org/10.2139/ssrn.356660

Gambacorta , L., Mistrulli, P. E. (2004). *Does bank capital affect lending behavior?*. Journal of Financial Intermediation, Volume 13, Issue 4, 436–457. https://doi.org/10.1016/j.jfi.2004.06.001

Garretsen, H., Swank, J. (2003). *The Bank Lending Channel in the Netherlands: The Impact of Monetary Policy on Households and Firms*. De Economist volume 151. https://doi.org/10.1023/A:1022984614506

Gilchrist, S.G., Zakrajsek E. (1995). *The importance of credit for macroeconomic activity: identification through heterogenity*. Federal Reserve Bank of Boston Conference Series, No. 39.

Golodniuk, I. (2006). *Evidence on the bank-lending channel in Ukraine*. Research in International Business and Finance 20. https://doi.org/10.1016/j.ribaf.2005.09.007

Gyöngyös, G., Ongena, S., Schindele, I. (2019). *The Impact of Monetary Conditions on Bank Lending to Households*. https://www.researchgate.net/publication/336374849_The_Impact_of_Monetary_Conditions_on_Bank_Lending_to_Households

Havrylchyk, O., Jurzyk, E. (2005). Does the Bank Lending Channel Work in a Transition Economy? A Case of Poland. European University Viadrina, http://www.ceistorvergata.it/conferenze&convegni/banking&finance/XII_conference/9DICEMBRE/HavrylchykJurzyk.pdf

Kashyap, A. K., Stein, J. C. (1995). The impact of monetary policy on bank balance sheets. Carnegie-Rochester Conference Series on Public Policy, 42,151–195. https://doi.org/10.1016/0167-2231(95)00032-U

Kashyap, A.K., Stein, J.C. (2000). *What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?*, The American Economic Review, Vol. 90, No. 3. https://doi.org/10.1257/aer.90.3.407

Markovic, B. (2006). *Bank capital channels in the monetary transmission mechanism*. Bank of England, Working Paper no. 313, 1–52. https://doi.org/10.2139/ssrn.965470

Matousek, R., Sarantis N. (2009). The bank lending channel and monetary transmission in Central and Eastern European countries. Journal of Comparative Economics, 2009, Vol. 37, Issue 2, 321–334. https://doi.org/10.1016/j.jce.2008.09.008

Meltzer, A.H. (1995). Monetary, Credit (and Other) Transmission Processes: A Monetarist Perspective. Journal of Economic Perspectives, No. 9. https://doi.org/10.1257/jep.9.4.49

Meral, G. (2015). The Effect of Bank Size and Bank Capital on the Bank Lending Channel for Turkish Banks, American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS) (2015) Volume 12, No 1, pp 1–28.

Milcheva, S. (2013). *A bank lending channel or a credit supply shock?*. Journal of Macroeconomics, Volume 37. https://doi.org/10.1016/j.jmacro.2013.03.004

Niedźwiedzińska, J. (2020). *Initial Monetary Policy Response to the COVID-19 Pandemic in Inflation Targeting Economies*, NBP Working Paper No. 335, https://www.nbp.pl/publikacje/materialy_i_studia/335_en.pdf

Ramey, V. (1993). *How Important is the Credit Channel for the Transmission of Monetary Policy?*, NBER Working Paper, No. 4285. https://doi.org/10.3386/w4285

Westerlund, J. (2003). *A Panel Data Test of the Bank Lending Channel in Sweden*. Working Papers. Department of Economics, Lund University, No 16.

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APPENDIX

Appendix 1
Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
IR_MP	3.48	3.50	6.50	1.50	1.55	62
IR1_LOANS	7.30	7.47	10.52	4.87	1.72	62
IR1_LOANS_ALL	6.21	6.54	9.35	4.08	1.47	62
IR1_LOANS_B	5.51	5.89	8.44	3.40	1.58	62
IR1_LOANS_H	9.29	9.64	12.97	6.19	2.20	62
IR1_LOANS_H_CONS	12.46	13.29	16.53	7.60	3.15	62
IR1_LOANS_H_MORTG	5.94	5.90	8.68	4.28	1.33	62
LOANS_ALL	8.63	8.70	8.83	8.28	0.18	62
LOANS_K	8.60	8.67	8.81	8.25	0.18	62
LOANS_S	7.41	7.44	7.59	7.08	0.16	62
LOANS_B_K	8.12	8.14	8.28	7.93	0.10	62
LOANS_H_CONS_K	8.01	8.07	8.18	7.64	0.16	62
LOANS_HM_K	8.10	8.27	8.38	7.38	0.38	62
LOANS_B_S	6.81	6.88	7.11	6.29	0.25	62
LOANS_H_S	7.27	7.29	7.43	7.00	0.13	62
GDP	8.38	8.38	8.54	8.23	0.08	62
EQUITY	7.82	7.84	8.09	7.48	0.19	62
EQUITY_K	7.81	7.87	8.06	7.46	0.20	62
EQUITY_S	6.63	6.68	6.86	6.22	0.20	62
ASSETS_LIQ_ASSETS	22.54	23.77	25.68	15.94	2.73	62
ASSETS_LIQ_ASSETS_K	23.59	24.96	26.79	16.53	2.96	62
ASSETS_LIQ_ASSETS_S	7.09	7.13	12.17	3.16	2.26	62
ASSETS_5SHARE	46.95	46.85	51.87	43.07	2.24	62
ASSETS_SHARE_K	93.66	93.79	94.76	92.68	0.62	62
ASSETS_SHARE_S	6.34	6.21	7.32	5.24	0.62	62
UNEMPL	11.90	11.75	20.40	5.30	3.79	62

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Appendix 2
Correlation tables – respectively for the banking sector, commercial banks, cooperative banks, corporate and consumer loans in commercial and cooperative banks

ALL SECTOR	IR_MP	IR1_LOANS	LOANS_ALL	GDP	EQUITY
IR_MP	1	0.89	-0.78	-0.80	-0.85
IR1_LOANS	0.89	1	-0.55	-0.67	-0.69
LOANS_ALL	-0.78	-0.55	1	0.91	0.97
GDP	-0.80	-0.67	0.91	1	0.92
EQUITY	-0.85	-0.69	0.97	0.92	1

COMMERCIAL BANKS	IR_MP	IR1_LOANS	LOANS_K	GDP	EQUITY_K
IR_MP	1	0.89	-0.78	-0.80	-0.84
IR1_LOANS	0.89	1	-0.54	-0.67	-0.67
LOANS_K	-0.78	-0.54	1	0.91	0.97
GDP	-0.80	-0.67	0.91	1	0.91
EQUITY_K	-0.84	-0.67	0.97	0.91	1

COOPERATIVE BANKS	IR_MP	IR1_LOANS	LOANS_S	GDP	EQUITY_S
IR_MP	1	0.89	-0.84	-0.80	-0.81
IR1_LOANS	0.89	1	-0.65	-0.67	-0.61
LOANS_S	-0.84	-0.65	1	0.92	0.99
GDP	-0.80	-0.67	0.92	1	0.90
EQUITY_S	-0.81	-0.61	0.99	0.90	1

COOPERATIVE BANKS CORPORATE LOANS	IR_MP	IR1_LOANS_B	LOANS_B_S	GDP	EQUITY_S
IR_MP	1	0.94	-0.82	-0.80	-0.81
IR1_LOANS_B	0.94	1	-0.79	-0.74	-0.76
LOANS_B_S	-0.82	-0.79	1	0.89	0.99
GDP	-0.80	-0.74	0.89	1	0.90
EQUITY_S	-0.81	-0.76	0.99	0.90	1

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COOPERATIVE BANKS HOUSEHOLD LOANS	IR_MP	IR1_LOANS_H	LOANS_H_S	GDP	EQUITY_S
IR_MP	1	0.85	-0.83	-0.80	-0.81
IR1_LOANS_H	0.85	1	-0.58	-0.64	-0.56
LOANS_H_S	-0.83	-0.58	1	0.92	0.99
GDP	-0.80	-0.64	0.92	1	0.90
EQUITY_S	-0.81	-0.56	0.99	0.90	1

COMMERCIAL BANKS CORPORATE LOANS	IR_MP	IR1_LOANS_B	LOANS_B_K	GDP	EQUITY_K
IR_MP	1	0.94	-0.77	-0.80	-0.84
IR1_LOANS_B	0.94	1	-0.69	-0.74	-0.78
LOANS_B_K	-0.77	-0.69	1	0.91	0.94
GDP	-0.80	-0.74	0.91	1	0.91
EQUITY_K	-0.84	-0.78	0.94	0.91	1

COMMERCIAL BANKS CONSUMER LOANS	IR_MP	IR1_LOANS_H_ CONS	LOANS_H_ CONS_K	GDP	EQUITY_K
IR_MP	1	0.78	-0.72	-0.80	-0.84
IR1_LOANS_H_ CONS	0.78	1	-0.34	-0.61	-0.54
LOANS_H_CONS_K	-0.72	-0.34	1	0.87	0.92
GDP	-0.80	-0.61	0.87	1	0.91
EQUITY_K	-0.84	-0.54	0.92	0.91	1

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Appendix 3
Stationary tests – ADF, KPSS – and relevant critical values

	Null Hypothesis:	ADF test	KPSS test
		... has a unit root	... is stationary
		t-Statistic	LM-Stat.
Exog.: c	EQUITY	-1.573	0.972
Exog.: c, trend	EQUITY	-1.140	0.189
Exog.: c	D(EQUITY)	-4.641	0.262
Exog.: c	EQUITY_S	-3.957	0.933
Exog.: c, trend	EQUITY_S	-1.488	0.246
Exog.: c	D(EQUITY_S)	-1.803	0.717
Exog.: c	EQUITY_K	-2.000	0.949
Exog.: c, trend	EQUITY_K	-0.238	0.217
Exog.: c	D(EQUITY_K)	-1.853	0.512
Exog.: c	LOANS_ALL	-2.820	0.895
Exog.: c, trend	LOANS_ALL	-1.372	0.222
Exog.: c	D(LOANS_ALL)	-4.262	0.388
Exog.: c	LOANS_K	-2.828	0.891
Exog.: c, trend	LOANS_K	-1.414	0.221
Exog.: c	D(LOANS_K)	-4.347	0.372
Exog.: c	LOANS_S	-4.248	0.942
Exog.: c, trend	LOANS_S	-1.249	0.224
Exog.: c	D(LOANS_S)	-2.176	0.694
Exog.: c	LOANS_B_K	-1.371	0.882
Exog.: c, trend	LOANS_B_K	-2.020	0.118
Exog.: c	D(LOANS_B_K)	-5.308	0.066
Exog.: c	LOANS_H_CONS_K	-1.840	0.787
Exog.: c, trend	LOANS_H_CONS_K	-3.760	0.204
Exog.: c	LOANS_H_CONS_K	-1.830	0.398
Exog.: c	LOANS_B_S	-1.774	0.939
Exog.: c, trend	LOANS_B_S	1.340	0.234
Exog.: c	D(LOANS_B_S)	-0.967	0.838
Exog.: c	LOANS_H_S	-3.612	0.927
Exog.: c, trend	LOANS_H_S	-3.765	0.193
Exog.: c	D(LOANS_H_S)	-2.767	0.515

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	Null Hypothesis:	ADF test	KPSS test
		... has a unit root	... is stationary
		t-Statistic	LM-Stat.
Exog.: c	IR_MP	-1.334	0.860
Exog.: c, trend	IR_MP	-3.938	0.081
Exog.: c	D(IR_MP)	-4.877	0.065
Exog.: c	IR1_LOANS	-1.212	0.693
Exog.: c, trend	IR1_LOANS	-2.272	0.161
Exog.: c	D(IR1_LOANS)	-5.186	0.098
Exog.: c	IR1_LOANS_B	-1.736	0.818
Exog.: c, trend	IR1_LOANS_B	-2.872	0.124
Exog.: c	D(IR1_LOANS_B)	-4.881	0.070
Exog.: c	IR1_LOANS_H	-1.035	0.647
Exog.: c, trend	IR1_LOANS_H	-1.548	0.171
Exog.: c	D(IR1_LOANS_H)	-6.736	0.091
Exog.: c	IR1_LOANS_H_CONS	-0.473	0.582
Exog.: c, trend	IR1_LOANS_H_CONS	-1.371	0.204
Exog.: c	D(IR1_LOANS_H_CONS)	-5.791	0.168
Exog.: c	GDP	-0.740	0.968
Exog.: c, trend	GDP	-2.560	0.107
Exog.: c	D(GDP)	-2.967	0.371

		Augmented Dickey–Fuller test statistic	Kwiatkowski–Phillips–Schmidt–Shin test statistic
Test critical values (exog.: c):	1% level	-3.550	0.739
	5% level	-2.914	0.463
	10% level	-2.595	0.347
Test critical values (exog.: c, trend):	1% level	-4.127	0.216
	5% level	-3.491	0.146
	10% level	-3.174	0.119
Test critical values (exog. c – diff):	1% level	-3.550	0.739
	5% level	-2.914	0.463
	10% level	-2.595	0.347

Notes: The values of ADF and KPSS tests do not give consistent and ambiguous results for all variables. In most cases ADF tests (except: LOANS_H_S – test with an exogenous constant and constant and trend, LOANS_S – test with an exogenous constant, EQUITY_S – test with an exogenous constant) don't let us reject the non-stationarity hypothesis for the levels of the variables and allow to reject the null hypothesis at first differences of the variables at the significance level 5%. KPSS tests inform about the necessity to reject the assumption of stationarity at levels for all variables in a test with an exogenous constant at the significance level 5% and at least all variables (except: LOANS_B_K, IR_MP, IR1_LOANS_B, GDP) in a test with an exogenous constant and trend at the significance level 5%. Generally the tests show that variables have a unit root I(1) and should be transformed into a stationary process. Coupled with the theory of economics, the theory suggests the existence of long-run equilibrium relationships among nonstationary at levels time series variables.

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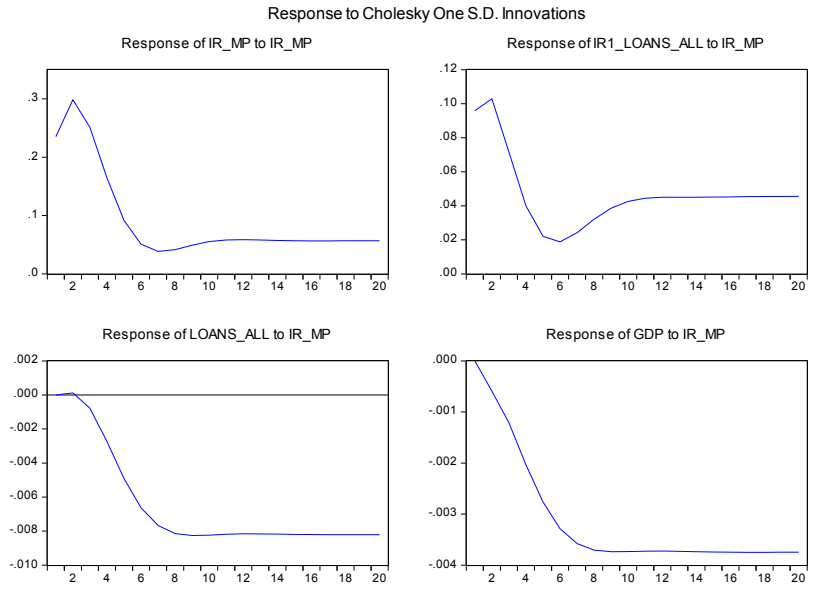
Appendix 4

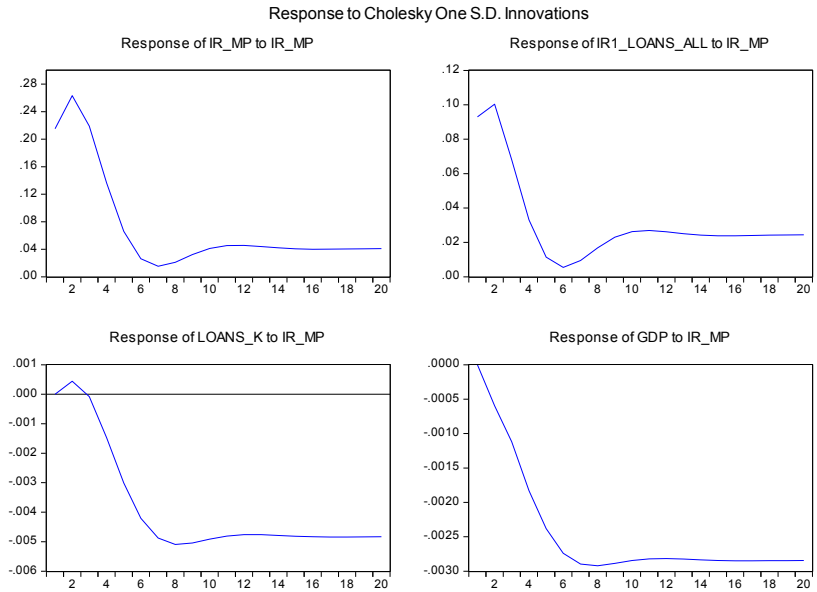
Robustness tests. Models included the weighted average interest rate on newly granted PLN and foreign currency loans (ir1_loans_all).

A. Impulse response of endogenous variables to the interest rate impulse and the long term relations – whole banking sector



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.00	0.75
		(0.14)
		[5.51]
IR1_LOANS_ALL(-1)	0.10	-0.75
	(0.03)	(0.14)
	[3.40]	[-5.51]
LOANS_ALL(-1)	1.00	1.00
GDP(-1)	-0.97	0.00
	(0.39)	
	[-2.49]	
EQUITY(-1)	0.00	0.79
		(0.51)
		[1.55]
C	-1.14	-12.71

B. Impulse response of endogenous variables to the interest rate impulse and the long term relations – commercial banks



Cointegrating Eq:	CointEq1	CointEq2
IR_MP(-1)	0.00	0.26
		(0.04)
		[6.64]
IR1_LOANS_ALL(-1)	0.17	-0.26
	(0.04)	(0.04)
	[4.59]	[-6.64]
LOANS_K(-1)	1.00	1.00
GDP(-1)	-0.29	0.00
	(0.55)	
	[-0.52]	
EQUITY_K(-1)	0.00	-0.45
		(0.143)
		[-3.19]
C	-7.24	-4.34

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