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BANKING SECTOR AND REAL ECONOMY OF POLAND – ANALYSIS WITH A VAR MODEL

Abstract: The chapter introduces a vector autoregressive model to study impacts of the banking sector in Poland on the real macroeconomic processes. The model includes variables that capture capital adequacy and credit risk in the banking sector as well as main macroeconomic indicators. The role of macroprudential policy is also discussed. The impulse responses and variance decomposition make it possible to draw conclusions. The main result is that there are strong interconnections between the banking sector and the real side. An important aspect of the analysis is the observed drop of GDP below a potential due to higher capital requirements but the loss to GDP growth is minor.

Keywords: banking sector, macroeconomy, macroprudential policy, capital requirements, VAR model.

1. Introduction

The economic development is increasingly dependent on the ability to coordinate monetary and fiscal policies. In the new framework the role of macroprudential regulatory policies in the financial sector should also be considered. Macroprudential policy may affect credit lending and processes in the real economy.

There are a lot of regulatory changes in the banking sector. The unique position of banks in the financial system gives an additional possibility for the central bank to influence the real economy through the credit channel.

Central banks and supervisors worldwide are interested in modelling the macro-financial linkages. The focus on credit risk is essential for monitoring capital adequacy and liquidity.

This chapter focuses on the links between macroeconomic factors and credit risk. It is an empirical contribution to the research on the relationship between the situation on the financial market and economic growth. The chapter contributes also to the macroprudential research on integrating macroeconomics and financial supervision. It provides information on financial system vulnerability to exceptional but plausible shocks and combines a forward-looking macroeconomic perspective

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with the financial system as a whole. This practice was introduced and stimulated by the Financial Sector Assessment Program framework of the International Monetary Fund and the World Bank.

The chapter is organized as follows. Section 2 is a brief introduction to macroprudential policy. Section 3 introduces the VAR model, which maps the banking sector linkages to the real economy. Finally, section 4 concludes and sets out a further research agenda.

2. Macroprudential policy

According to many economists one of the shortcomings of financial supervision was too much microprudential focus (Crockett 2000, Borio et al. 2001, Borio 2003, Kashyap and Stein 2004, Kashyap et al. 2008, Bank of England 2009, French et al. 2010). Microprudential approach is expressed in the construction of partial equilibrium models of individual financial institutions. Macroprudential approach can be called a general equilibrium model of the whole financial system. Now the view prevails that the regulatory policy should focus more on macroprudential approach (Bernanke 2008).

Macroprudential policy is important as it affects credit lending via the credit channel. The credit channel reinforces the traditional effects associated with the change in interest rates (Bernanke and Gertler 1995). Reduction in bank lending may be associated with a reduction of credit supply. Under excessive loan demand, due to credit risk factors, there is credit rationing, consistent with the rational behavior of credit institutions (Hodgman 1960, Jaffee and Modigliani 1969, Jaffee 1971).

"Credit rationing" – „credit crunch" or „capital crunch" – can be considered an equilibrium condition, since banks in credit policy take into account not only the interest rate, but also credit risk (Stiglitz and Weiss 1981, Brinkmann and Horvitz 1995). Banks are not willing to lend at a higher rate for risky borrowers. They prefer creating demand from borrowers of acceptable risk level. Credit rationing affects both households and corporations which seek for external funding.

Reducing the capital base because of the deterioration in loan portfolio leads to a reduction of assets to maintain appropriate capital standards, i.e. higher capital requirements may have an impact on reducing the scale of credit financing.

Under financial crisis access to capital is difficult. Particularly damaging for the economy are banking crises. As a result of the banking crisis the level of confidence reduces in the sector, rising risk aversion, reducing the scale of financial intermediation, imbalancing public finance. This is all followed by lower accumulation of human capital.

"Macroprudential policy" is a relatively new discipline. Its origins date back to late seventies of the 20th century (Clement 2010, Sławiński 2013). The objective of macroprudential policy is the stability of the financial system. On the one hand, financial stability can be defined as a condition in which the financial system, including a system for intermediation, the markets and their infrastructure are able to resist the interference and resolve growing financial imbalances (ECB 2010). On the other hand, the financial instability can be defined as any deviation from the optimal savings and investment plan for the economy, which is caused by imperfections of the financial market (Saporta et al. 2004). Strengthening financial stability requires the ability to identify risks at the micro and macro levels.

The concept of macroprudential policy is closely linked to the concept of systemic risk. Perotti and Suarez (2009) defined systemic risk as the propagation risk causing the imbalances to spill over beyond the main areas of impact, contributing to the diffusion of the crisis to the real economy. The risk accumulates during the upturn and then materializes in the form of imbalances during the downturn.

Financial market regulations are present in banking activities due to the risk of bank collapse, the risk of excessive concentration and asymmetry of information. It is well known that problems of one bank can quickly spread to other banks, which may lead to the collapse of the whole system (Aghion, Bolton and Dewatripont 2000).

Modern macroprudential policy tools include: (a) time-varying capital requirements which indicate that banks maintain higher capital adequacy ratio – the ratio of capital to risk-weighted assets – in times of prosperity and lower during recessions; then during the recession they can access additional capital buffers which prevent the reduction of assets, primarily loans to the economy; (b) accumulation of high quality capital; (c) incentives for banks to increase their capital base than operating solely on capital adequacy ratio (Hanson et al. 2011).

The objective of regulatory capital in the banking sector is aimed at putting discipline on banks to internalize the costs of risk in connection with business activity. Consequently, the regulations are aimed to protect depositors and mitigate the effects of "moral hazard" under conditions of asymmetric information.

According to Berger and Udell (1994), raising capital is more expensive than collecting deposits. Hence the requirement for a risk-based capital (RBC) can be regarded as a regulatory tax – increasing returns to scale of risky assets. Review of the literature on empirical research on capital standards may be found in Jackson et al. (1999).

An attempt to unify best practices in the banking sector was proposed in the form of Capital Accords. The main objective of the 1988 Basel I Capital Accord was the introduction of uniform rules and the definition of regulatory capital, minimum 8 percent of risk-weighted assets. New Capital Accord of 2004 (Basel II) was established in response to the deficiencies of Basel I. One of the main features of the Basel II was to increase the sensitivity of capital requirements to assets risk. Basel II provided a flexible structure of risk weights, taking into account operational risk, market risk and credit risk. Basel I was criticized for procyclicality. Similarly, it is believed that Basel II was also procyclical. Lending is procyclical if banks' capital adequacy ratios vary (Goodhart and Segoviano 2004). From this perspective, the development of counter-cyclical policy instruments is reflected in the proposals of Basel III. A detailed review of the assumptions in Basel III is given in BCBS (2010) (see also Angelini et al. 2011, Hanson et al. 2011). An important source of regulations are Directives (requiring transfer to the Polish law) and Regulations (directly applicable to all member states of the EU) of the European Parliament and of the Council of the EU and also local regulations resulting from the freedom of national authorities to decide on certain conditions (CRD IV/CRR).

Regulatory requirements for capital are conservative. They take into account the risk levels of individual banks to a limited extent, as too stringent requirements may reduce the value of the sector and increase the cost of financing (Santomero and Watson 1977). Banks are interested in maintaining higher capital adequacy ratios than regulatory requirements by building capital buffers. They are a kind of buffers against changes in supervisory policy or increased market pressure. Various studies confirm that banks' capital adequacy ratios are influenced by minimum capital requirements (Keeley 1988, Jackson et al. 1999, VanHoose 2008).

Regulatory capital requirements limit the systemic risks arising from externalities caused by bank failures and contagion effects due to the decline in confidence in solvent banks. „Optimal" setting of capital requirements provides a compromise between the benefits of reducing systemic risk and the cost of the reduction of financial intermediation.

Banks have many opportunities to comply with supervisory regulations. In a typical situation, however, they tend to pass through additional regulatory costs on consumers by raising credit margins. This increases credit costs for final consumers. The money market interest rate – as a proxy for marginal cost of capital – becomes crucial in this setting.

The benefits of regulation arise from the greater stability of the financial system, thereby reducing risk and improving the management at micro and macro levels. It should also be noted that banks have ample opportunities to improve its financial results without resorting to an increase in credit spreads, for instance by raising fees and commissions and reducing costs, including operating expenses and interest on deposits.

Simulation studies on the economic impact of higher capital requirements are carried out with structural models, including stochastic general equilibrium models (DSGE) (Catalán and Ganapolski 2005, Goodfriend and McCallum 2007) and VAR models (Alves 2004, Pesaran et al. 2004, Hoggarth et al. 2005). Structural models are a particularly effective tool for forecasting. In a large part of simulation studies the focus is on the assessment of more stringent capital and liquidity requirements.

According to Macroeconomic Assessment Group (MAG 2010), increase of capital adequacy ratio by 1 p.p. could lead to an average decline in GDP of 0.22%. This means reducing annual GDP growth by 0.03 percentage points – see also Wdowiński (2012) in the case of Poland. In addition, the MAG study shows that an increase in the adequacy ratio by 1 p.p. can lead to a decline in effective demand for loans by 1.89%, increase credit spreads by approximately 17 basis points[1].

There are several factors that may weaken the impact of stricter capital standards on economic growth. First, in recent years many banks have strengthened their capital position through new equity issues and retention of profits. Second, banks may shift costs of their operations by lowering interest rates on deposits or increasing revenues from fees and commissions.

In the next section a VAR model is introduced to capture macro-financial linkages.

3. VAR model

A parsimonious number of macroeconomic and financial variables was used. The analysis was restricted to five variables which capture the main factors of the development of the real economy and the banking sector performance.

The aggregated capital adequacy ratio (CAR) in the banking sector shows that there is a mark-up (a buffer) over a minimum capital requirement. This is the main indicator of the capital structure. The ratio of non-performing loans to the non-financial sector (UNPLNF) is a measure of credit risk. This is also a very important indicator of the financial market risk. The remaining two variables – the real effective zloty exchange rate distance to equilibrium (long-run exchange rate) (REER_GAP) and output gap (YR_GAP) – are thought of expressing the cycle of the real economy. The output gap is introduced to capture real side effects. The latter variables are of crucial importance – via income and cost channels accordingly – to changes in demand for credit. The variables in this setting are believed to capture macro-financial linkages. The output gap stands also for the effects that are cumulated over different markets, e.g. labour market. The crucial role of (real) money market interest rate was introduced in previous chapter. The real rate was deflated with CPI. This variable is a bridge between the financial market and real

[1] The results were averaged on the basis of 97 models used by the members of MAG, including 42 models of national economies, 40 models of the IMF and 15 models of the ECB and European Commission. The results should be regarded as a very rough approximation of the analyzed relationships.

economy. It is shaped mainly in a credit channel and has strong effects in real economy.

The dummies on financial crises were not included in the model for the estimates to account for all potential shocks to the economy. The data sample – 2000Q1:2011Q3 – spans over the floating exchange rate regime.

Let $\mathbf{z}_t' = [z_{1t}, z_{2t}, \ldots, z_{nt}]$ be a vector of stochastic endogenous variables for which the data generating process is given by an unrestricted VAR(k) model[2]:

$$\mathbf{z}_t = \mathbf{A}_1\mathbf{z}_{t-1} + \mathbf{A}_2\mathbf{z}_{t-2} + \ldots + \mathbf{A}_k\mathbf{z}_{t-k} + \boldsymbol{\mu}_t + \boldsymbol{\Phi}\mathbf{D}_t + \boldsymbol{\varepsilon}_t,\ \boldsymbol{\varepsilon}_t \sim N(0, \boldsymbol{\Sigma}),\ t = 1, \ldots, T,$$

where: $\mathbf{z}_t$ – $(n \text{x} 1)$ vector of endogenous variables, $\mathbf{A}_i$ – $(n \text{x} n)$ matrix of parameters, $\boldsymbol{\mu}$ – $(n \text{x} 1)$ vector of intercepts, $\mathbf{D}_t$ – $(m \text{x} 1)$ vector of exogenous variables, $\boldsymbol{\Phi}$ – $(n \text{x} m)$ matrix of parameters, $\boldsymbol{\varepsilon}_t$ – $(n \text{x} 1)$ vector of error terms, $\mathbf{z}_0, \ldots, \mathbf{z}_{-k}$ are predetermined. Vector $\mathbf{D}_t$ may include trend, dummies, centred (orthogonal) seasonal dummies, and other I(0) exogenous variables. The model is not subject to a co-integration analysis. As a consequence, no exogeneity tests were performed, nor exogenous I(0) variables were used. All variables in the system are assumed I(0) endogenous.

3.1. Data and preliminary testing

To estimate VAR model parameters, statistical data published by the Polish Financial Supervision Authority (PFSA), National Bank of Poland (NBP) and Eurostat were used. Table 1 presents the names, description and source of variables, Figure 1 graphs of variables (levels), while Tables 2–5 results of testing for unit roots.

Selected variables were transformed. The capital adequacy ratio (CAR) in the period 1995–2005 was interpolated using "cubic spline" (see e.g. Kahaner et al. 1988) (from annual data into quarterly data). The real interest rate (MM3MR) was calculated as a difference between a nominal short-term interest rate WIBOR3M and a realized y/y CPI inflation. The real effective exchange rate (REER_GAP), based on unit labor cost, was calculated as a log-difference from its long-run trend based on Hodrick-Prescott (HP) filter. The output gap was calculated as a log-difference of a real non-seasonal GDP from a potential product based on GDP HP-filtered.

[2] The analysis was carried out in EViews 6.0.

Table 1. Statistical data in the model

Variable name	Description	Source	Transformation
car	capital adequacy ratio, banking sector, total, percent	PFSA	
d4pcpi	CPI inflation, y/y, percent	own calculations	(log(pcpi) – log(pcpi(–4))) * 100
mm3m	interest rate, WIBOR 3M, percent	Eurostat	
mm3mr	interest rate, WIBOR 3M, real, percent	own calculations	mm3mr = mm3m – d4pcpi
nnf	total banking debt of non-financial sector, mln PLN	NBP	
nplnf	non-performing debt of non-financial sector, mln PLN	NBP	
pcpi	CPI index	Eurostat	
py	GDP deflator	Eurostat	
reer	zloty real effective exchange rate, based on ULC	Eurostat	
reer_gap	zloty real effective exchange rate, distance to equilibrium, percent	own calculations	reer_gap = log(reer / reer_hp) * 100
reer_hp	long-run zloty real effective exchange rate	own calculations	reer HP filtered
unplnf	non-performing loans ratio, percent	own calculations	unplnf = (nplnf / nnf) * 100
yp	GDP, current prices, mln PLN	Eurostat	
yr	GDP, real, mln PLN	own calculations	yr = (yp / py) * 100
yr_gap	GDP output gap, percent	own calculations	yr_gap = log(yr_sa / yr_hp) * 100
yr_hp	long-run GDP, real, mln PLN	own calculations	yr HP filtered
yr_sa	GDP, real, mln PLN	own calculations	yr seasonally adjusted

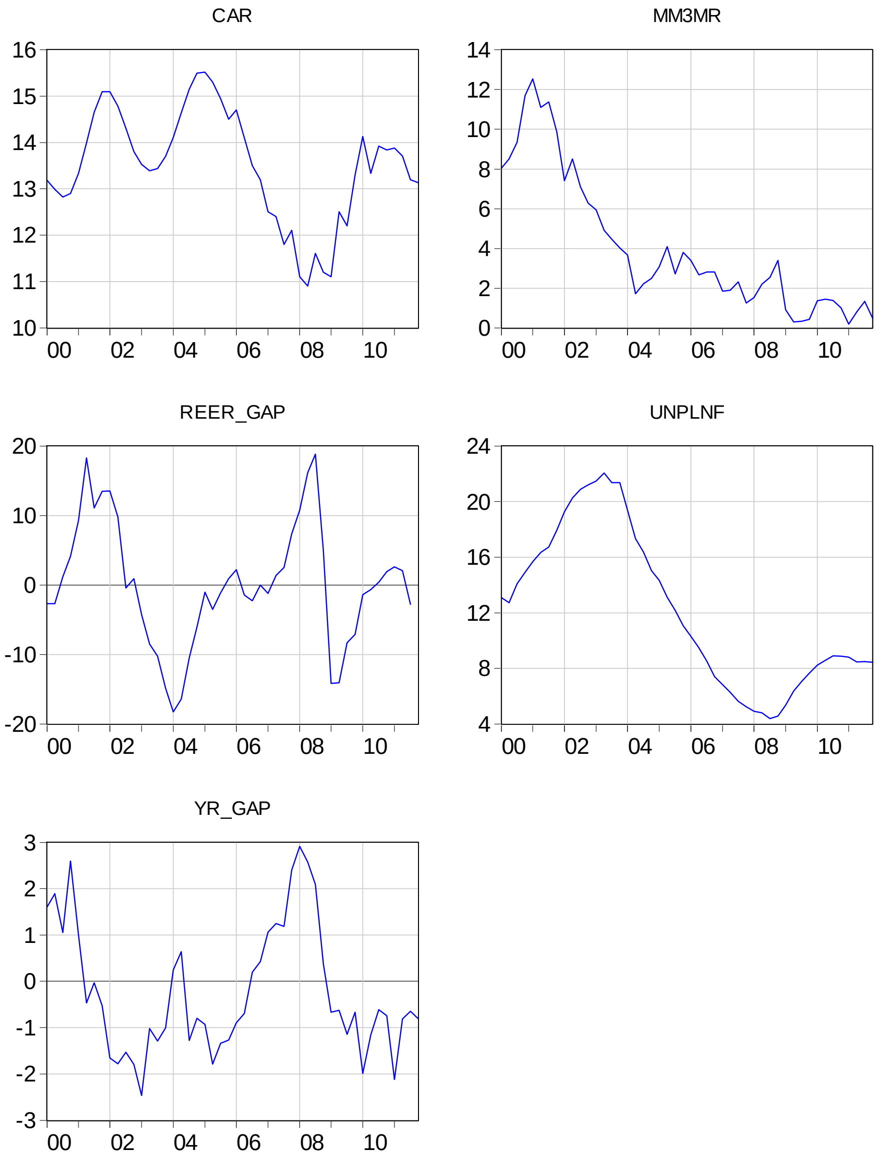

Figure 1. Plots of variables

Testing for unit roots

Table 2. ADF test for unit roots – levels of variables

Variable	Augmented Dickey-Fuller test											
	Akaike						Schwarz					
	no constant		constant		const, trend		no constant		constant		const, trend	
	stat	p-val	stat	p-val	stat	p-val	stat	p-val	stat	p-val	stat	p-val
	levels of variables											
CAR	–0.19	0.61	–2.04	0.27	–2.27	0.44	–0.19	0.61	–2.04	0.27	–2.27	0.44
MM3MR	–1.68	0.09	–1.14	0.69	–1.94	0.62	–1.68	0.09	–1.14	0.69	–1.94	0.62
REER_GAP	–3.25	0.00	–3.21	0.03	–3.23	0.09	–3.25	0.00	–3.21	0.03	–3.23	0.09
UNPLNF	–1.22	0.20	–2.08	0.25	–2.71	0.24	–1.08	0.25	–1.75	0.40	–2.26	0.45
YR_GAP	–3.59	0.00	–3.68	0.01	–3.53	0.05	–2.76	0.01	–2.84	0.06	–2.71	0.24

Table 3. ADF test for unit roots – changes of variables

Variable	Augmented Dickey-Fuller test											
	Akaike						Schwarz					
	no constant		constant		const, trend		no constant		constant		const, trend	
	stat	p-val	stat	p-val	stat	p-val	stat	p-val	stat	p-val	stat	p-val
	change of variables											
CAR	–3.51	0.00	–3.45	0.01	–3.43	0.06	–3.51	0.00	–3.45	0.01	–3.43	0.06
MM3MR	–7.49	0.00	–7.61	0.00	–7.52	0.00	–7.49	0.00	–7.61	0.00	–7.52	0.00
REER_GAP	–5.01	0.00	–4.96	0.00	–4.93	0.00	–5.01	0.00	–4.96	0.00	–4.93	0.00
UNPLNF	–2.09	0.04	–2.12	0.24	–1.99	0.59	–2.86	0.01	–2.88	0.06	–2.78	0.21
YR_GAP	–8.40	0.00	–8.39	0.00	–8.39	0.00	–8.40	0.00	–8.39	0.00	–8.39	0.00

Table 4. KPSS test for unit roots – levels of variables

Variable	KPSS test			
	Newey-West		Andrews	
	const	const, trend	const	const, trend
	statistic			
	level of variables			
CAR	0.25	0.09	0.23	0.13
MM3MR	0.74	0.16	0.38	0.13
REER_GAP	0.09	0.08	0.11	0.10
UNPLNF	0.61	0.12	1.22	0.42
YR_GAP	0.09	0.09	0.09	0.09
significance level	critical value			
1%	0.739	0.216	0.739	0.216
5%	0.463	0.146	0.463	0.146
10%	0.347	0.119	0.347	0.119

Table 5. KPSS test for unit roots – changes of variables

Variable	KPSS test			
	Newey-West		Andrews	
	const	const, trend	const	const, trend
	statistic			
	change of variables			
CAR	0.08	0.07	0.11	0.10
MM3MR	0.08	0.06	0.08	0.06
REER_GAP	0.09	0.08	0.07	0.06
UNPLNF	0.17	0.16	0.13	0.12
YR_GAP	0.16	0.11	0.16	0.10
significance level	critical value			
1%	0.739	0.216	0.739	0.216
5%	0.463	0.146	0.463	0.146
10%	0.347	0.119	0.347	0.119

The results of testing for unit roots (ADF and KPSS tests) are mixed. As all variables are given as ratios, it is assumed they should be stationary in a long-run. Some of them actually exhibit stationarity within the sample – REER_GAP, YR_GAP. To account for potential non-stationarity of remaining variables – a constant and deterministic trend in VAR model were used - as they might exhibit trend-stationarity.

3.2. Estimation results

The use of Schwarz and Akaike information criteria (Table 6) and sequential likelihood ratio test LR (significance level of 5%) led to the formulation of VAR(1) and VAR(4) models. Eventually – by experiment – VAR(1) model was selected on the basis of Schwarz criterion.

VAR(1) model was characterized by correct statistical properties (normality distribution of residuals, no autocorrelation LM(4), a high degree of fit of individual equations) – Tables 7–8. Figure 2 shows a realization of the random component.

Table 6. VAR lag order selection criteria

Lag	sequential modified LR test statistic (each test at 5% level)	Akaike	Schwarz
0	x	21.19	21.59
1	323.69	14.16	15.54
2	36.37	14.19	16.55
3	38.13	13.98	17.33
4	45.10	13.24	17.57

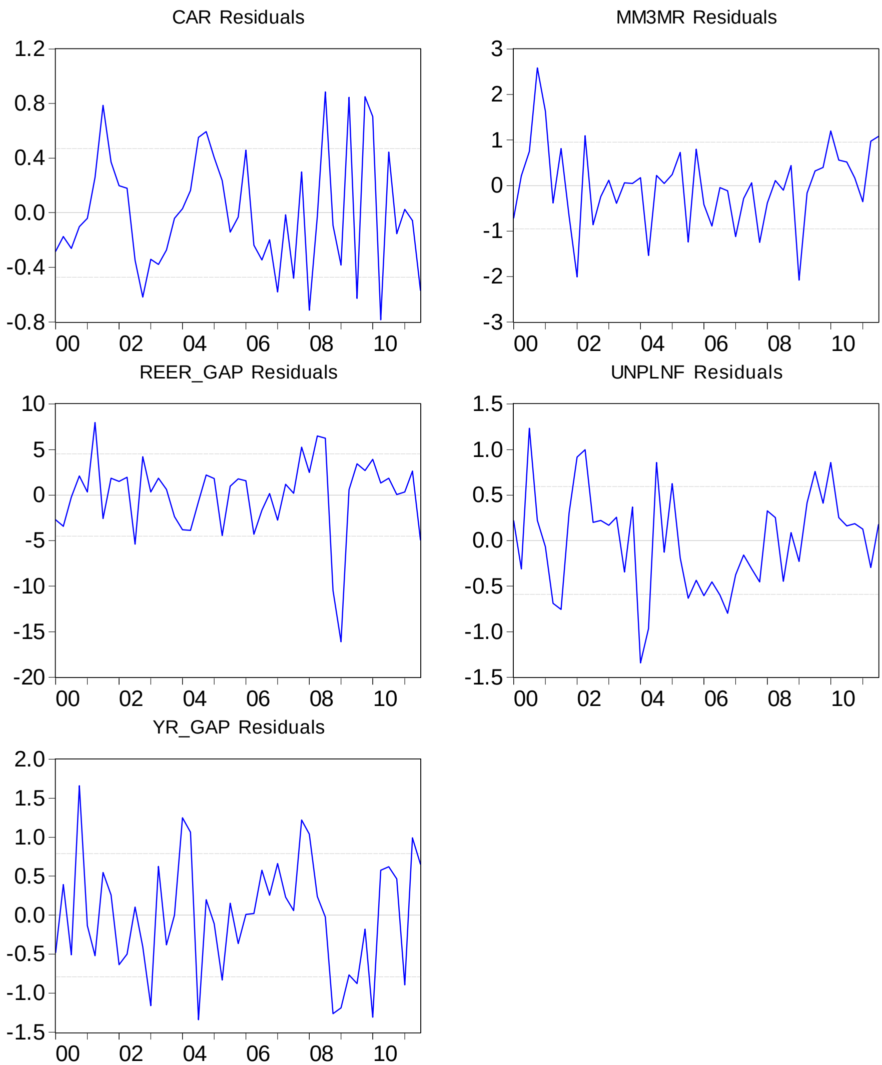

Figure 2. Residuals of the VAR model

Table 7. VAR residual normality test (Cholesky orthogonalization)

Component	Jarque-Bera	df	p-value
1	3.85	2	0.15
2	0.06	2	0.97
3	5.32	2	0.07
4	2.09	2	0.35
5	3.60	2	0.17
Joint	14.92	10	0.14

Table 8. VAR residual serial correlation LM test

Lag	LM-stat	p-value
1	34.10	0.11
2	22.27	0.62
3	35.51	0.08
4	30.57	0.20

3.3. Impulse response functions

An impulse response function is an effect of a shock to one of the errors on current and future values of all endogenous variables. A shock to the i-th variable directly affects the i-th variable and is also transmitted to all other endogenous variables through the dynamic structure of the VAR model.

If the innovations are contemporaneously uncorrelated, the interpretation of the impulse response is straightforward. The *i*-th innovation is simply a shock to the *i*-th endogenous variable. If innovations are correlated, they may be viewed as having a common component which cannot be associated with a specific variable. In order to properly interpret the impulses, it is common to apply a transformation to the innovations so that they become uncorrelated. Cholesky transformation uses the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize the impulses. This imposes an ordering to the variables in the VAR. It attributes all effects of any common component to the variable that comes first in the VAR model. The responses can change if the variables' ordering is changed.

Generalized impulses as proposed by Pesaran and Shin (1998) are constructed with an orthogonal set of innovations that does not depend on the VAR ordering. The generalized impulse responses from a shock to the *i*-th variable are derived by applying a specific Cholesky factor computed with the *i*-th variable at the top of the Cholesky ordering.

By applying Cholesky and generalized innovations, no significant changes to impulse response functions were observed.

As shown in Figures 3–4, the impulse responses (over 4 years) map the relationships between the real variables and the financial sector variables. There are several important outcomes to mention. On the real side:

- a rising real interest rate (MM3MR) is accompanied by a drop in GDP below a potential product;
- the same effect to GDP is given by appreciating real exchange rate with respect to a long-run trend;
- there is a pressure for real exchange rate appreciation under GDP growth, which conforms to the monetary model (Frenkel-Bilson, Dornbusch-Frankel).

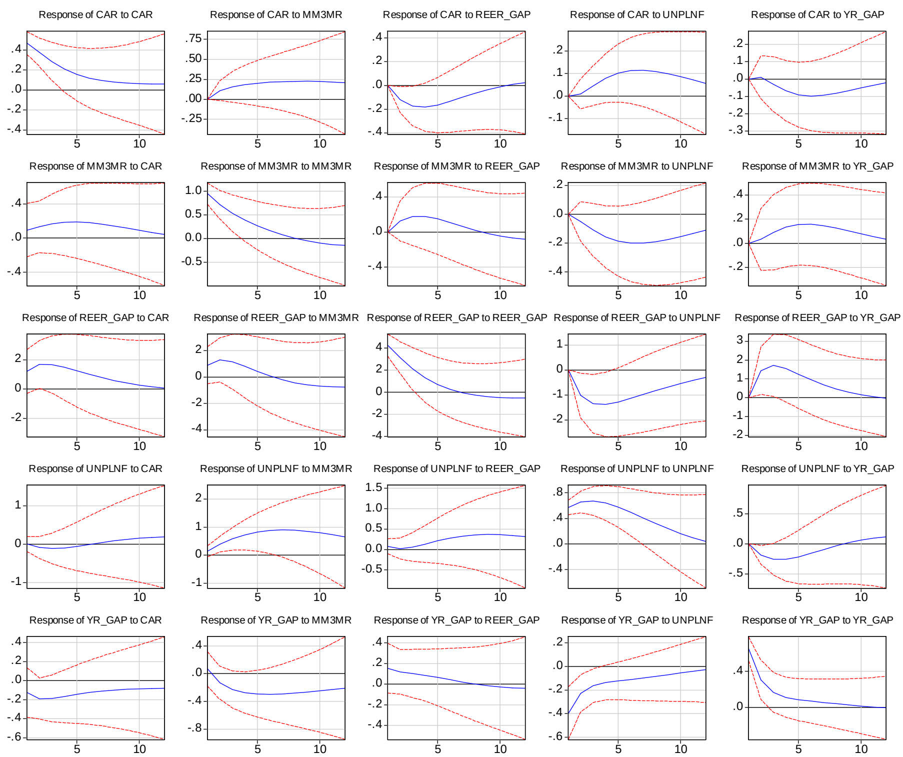

Figure 3. Response to Cholesky one S.D. innovations

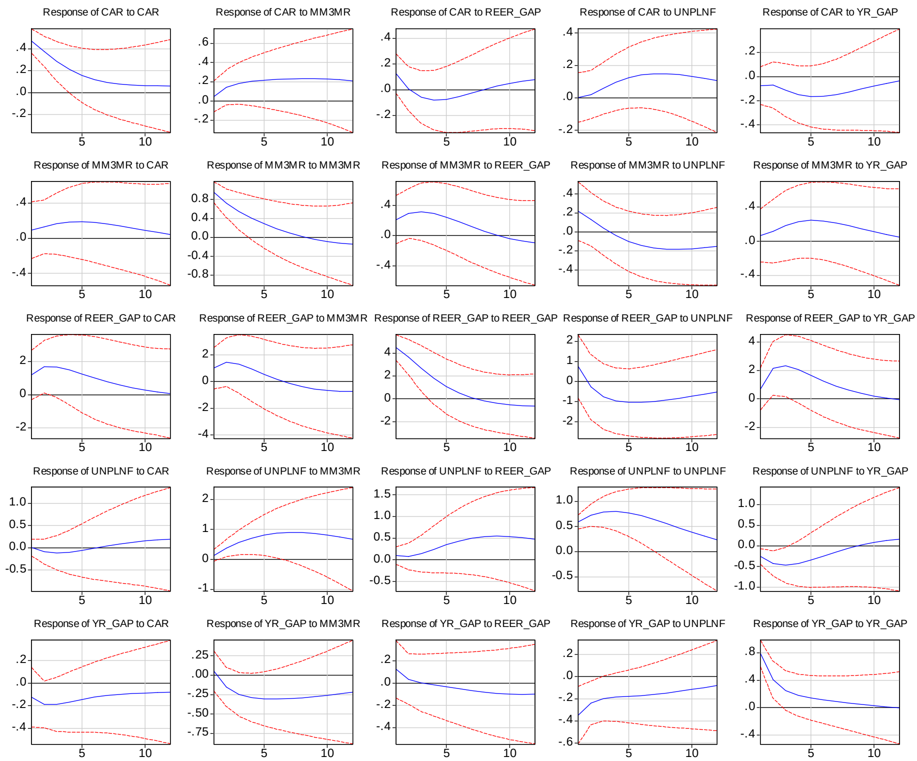

Figure 4. Response to generalized one S.D. innovations

The banking sector is represented by two variables – capital adequacy ratio (CAR) and non-performing loans (UNPLNF). In this respect there are also important outcomes to mention:

- higher capital requirements (CAR) may be associated with an increase of capital base and/or a decrease in risk weighted assets (RWA). In either case it puts additional costs on banking sector under constant return on assets (ROA) and return on equity (ROE). Higher capital requirements raise costs of capital. Lower RWA position reduces yields on assets and drives up interest margins. In turn a rise in interest rate is observed;
- capital requirements respond positively to a real interest rate shock. This is related to a drop in demand for loans and contraction of credit supply (credit rationing) due to higher interest rate risk;
- GDP growth over potential product is accompanied by a lower CAR ratio. This is connected with a procyclical character of banking activity. Banks usually do not build capital buffers during upturns, at the same time loosing their credit policies. This, in turn, leads to a deteriorating capital position;

- Higher real interest rate leads to more defaults – in both corporations and households – and gives rise to non-performing loans;
- During upturns, with higher income, drop in non-performing loans ratio is observed.

Another important aspect of the analysis is the observed drop of GDP below a potential due to higher capital requirements. As this brings costs to the banking sector and raises interest rates, it translates into lower economic activity. What is remarkable, the loss to GDP growth is minor. This outcome is in line with other studies on the banking sector under Basel III capital standards and their growth effects (see e.g. MAG 2010; see also Wdowinski 2012 for Poland).

3.4. Variance decomposition

Impulse response functions give the effects of a shock to one endogenous variable on the other variables in the VAR model. Variance decomposition computes the variation in endogenous variable over the component shocks to the VAR. Hence, variance decomposition provides information about the relative importance of each innovation in affecting the VAR variables.

Figure 5 displays a separate variance decomposition for each endogenous variable. The individual graphs – left to right – give the percentage of the forecast variance due to each innovation which adds up to 100.

The variance decomposition – as with the impulse responses – is based on the Cholesky factor and can change if the ordering of the variables in the VAR is altered. First period decomposition for the first variable in the VAR is completely due to its own innovation. The decomposition maps the importance of real and financial variables in explaining each variable variance. There are several important outcomes to mention.

First, capital adequacy ratio (CAR) forecast error – as expected – was mainly driven by real interest rate (MM3MR) up to 20–40 percent and real exchange rate distance to equilibrium (REER_GAP) at approx. 10 percent. This is related to main costs of credit, i.e. interest rate and exchange rate under large amounts of mortgage outstanding credits indexed to foreign currencies. To a lesser extent CAR error was related to non-performing loans ratio (UNPLNF) and output gap (YR_GAP), approx. 5 percent.

Second, strong inertia was observed in real interest rate (MM3MR), other variables accounted to approx. 30 percent of forecast error.

Third, real exchange rate misalignment (REER_GAP) was driven by CAR, approx. 20 percent and output gap (YR_GAP), approx. 15 percent. It comes out that capital position of the banking sector influenced to a large extent the real exchange rate which is again related to large debt in foreign exchange indexed mortgages. The importance of output gap is straightforward and it shows the relevance of monetary approach to exchange rate determination in Poland.

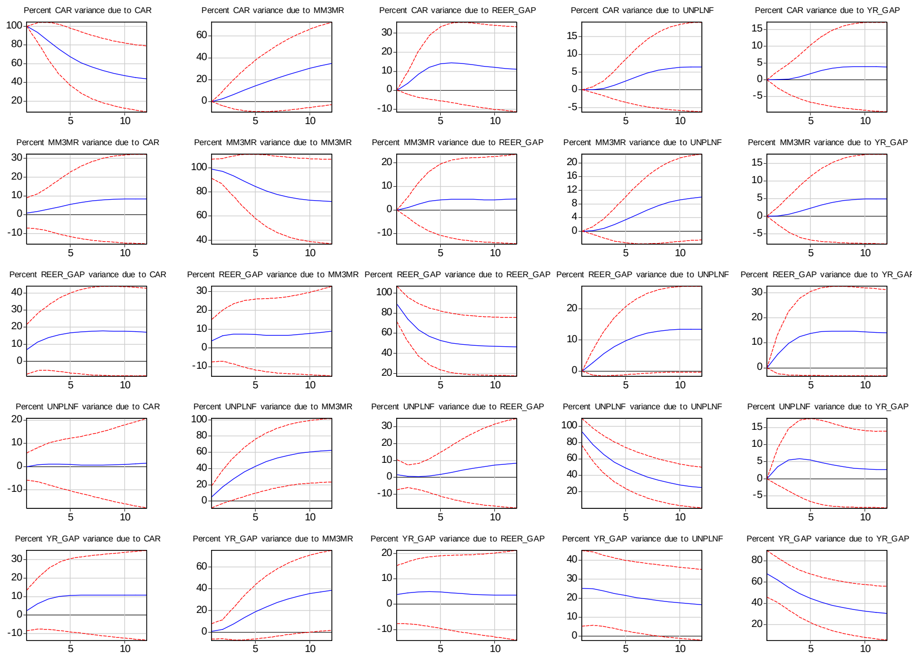

Figure 5. Variance decomposition

Fourth, the forecast error of non-performing loans ratio (UNPLNF) was mainly influenced by a real cost of credit (MM3MR), approx. 60 percent, and another cost factor, i.e. real exchange rate. The balance channel related to output gap was less important.

Finally, there were also output gap main driving forces: CAR (10 percent), MM3MR (40 percent and rapid growth over time), and also – what is particularly important – non-performing loans ratio (approx. 20 percent). This all shows the importance of monetary and macroprudential policies and financial variables for economic growth.

4. Conclusion

The destabilization of the financial system during 2007–2009 due to the loss of financial soundness by some financial institutions has resulted in a significant reduction in global economic growth. Extensive corrective actions on a global scale were designed to protect against the insolvency of financial institutions.

In the chapter it was shown that the economic growth is highly dependent on the ability to coordinate macroprudential regulatory and monetary policies in the financial sector as macroprudential policy may affect lending and processes in the real economy.

Regulatory capital requirements may be associated with an increase of capital base and/or a decrease in risk weighted assets. It was shown that higher capital requirements in either case put additional costs on the banking sector and increased costs of capital. Lower risk weighted assets position reduces yields on assets and drives up interest margins. In turn a rise in interest rate was observed.

Procyclicality of capital requirements was also a concern. It was shown that GDP growth over potential product was accompanied by a lower capital adequacy ratio. This is connected with a procyclical character of banking activity. New capital standards under Basel III framework introduce the counter-cyclical capital buffer. Further research on the topic is necessary as there are different propositions of capital buffer economic drivers.

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SEKTOR BANKOWY I SFERA REALNA GOSPODARKI POLSKI – ANALIZA NA PODSTAWIE MODELU VAR

Streszczenie

Analiza opiera się na modelu wektorowej autoregresji (VAR) do badania wpływu sektora bankowego w Polsce na sferę realną. Model obejmuje podstawowe zmienne dla sektora bankowego – współczynnik wypłacalności oraz wskaźnik kredytów z utratą wartości – oraz główne wskaźniki makroekonomiczne. Podano również kontekst polityki makroostrożnościowej. Analiza funkcji reakcji oraz dekompozycji wariancji pozwoliła na wyciągnięcie wniosków, iż istnieją silne wzajemne powiązania między sektorem bankowym a sferą realną. Zaobserwowano spadek PKB poniżej produktu potencjalnego na skutek wyższych wymogów kapitałowych, jednak ograniczenie wzrostu gospodarczego było nieznaczne.