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Determinants of credit in the Polish banking sector before and after the GFC according to information from the NBP Senior Loan Officer Survey. Does supply or demand matter?[1]

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Irving Fisher Committee Workshop: *Combining micro and macro statistical data for financial stability analysis. Experiences, opportunities and challenges.*

Title:

Determinants of credit in Polish banking sector before and after the Great Financial Crisis according to information from Senior Loan Officer Opinion Survey data. Does supply or demand matter?

Zuzanna Wośko[1]

Abstract

The paper investigates the problem of most important determinants of bank lending in Poland according to qualitative information of banks from the Senior Loan Officer Opinion Survey. The analysis takes into consideration banks' answers on the purpose of the change of their lending before and after the crisis. The research which bases on the panel regressions as well as disequilibrium econometrics models allows to decide, which factors – supply or demand had more important influence on lending growth in particular periods of time. Estimated models use bank-level and aggregated quarterly data concerning three loan segments – corporate, housing and consumer from the half of 2005 to the end of 2014.

Key words: credit growth, senior loan officers opinion survey, demand for loans, supply of loans, credit growth modelling

JEL: E51, G21, G01

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1. Introduction

The sharp decline in world economic activity during the late of the last decade, which is generally considered the largest downturn since the Great Depression also influenced the Polish banking system and its credit dynamics. Following the world financial crisis, banks curbed supply of loans by considerably tightening the standards and terms of granting them.

Before the crisis, the lending growth in Poland was strong, most notably due to housing loans, which was the consequence of both households' rising demand for dwellings, supported by the increasing availability of credit and its relatively low cost, and limited supply on the residential property market which elevated prices. The price rise caused a feedback in the form of growing demand, triggered by, among others, an expected further price rise, which in turn stimulated higher demand for loans.

A significant role in this process was played by strong easing of standards and terms of granting loans by banks and the related low loan spreads observed in the pre-crisis period. This development stemmed from strong competition among banks, leading some institutions to focus on raising a market share at the expense of diligent credit risk assessment (Financial Stability Report. July 2010., p. 35).

The accumulation of imbalances has been disrupted by the last financial crisis. Due to tightening the standards and terms of granting loans. Demand, particularly from enterprises, also fell.

After a period of tightened policy, from 2011 one could observe the start of a gradual process of easing the standards and terms of granting loans by banks.

This paper investigates the problem of most important determinants of bank lending in Poland before and after the crisis. The key issue is the role of demand and supply factors in this process – if the demand or the supply was the main driver of lending growth? Or, maybe, both factors influenced the credit in the same way?

To achieve this research goal two kinds of approach were applied. Both were using the qualitative information of banks from the Senior Loan Officer Opinion Survey. However the first one, on aggregated data, supported with other banking and macro data leads to the conclusions about dominations of regimes in particular periods of time – demand or supply. Here, disequilibrium econometrics methodology was used. The second one bases on the panel regressions. Panel models are estimated on bank-level quarterly data. The conclusions on the

possible impact of different factors are made using significance test of regressors in two subsamples.
Both approaches consider three loan segments – consumer, housing and corporate from the half of 2005 to the end of 2014.

The structure of the paper is as follows: chapter 2 summarizes literature on assessing the impact of demand and supply factors on credit growth, chapter 3 describes econometric methodology applied to the research. Detailed information on empirical part of the paper are included into chapter 4 and 5, where the data and results of the analysis are included. The most important findings are collected in *Conclusions*.

2. Literature

Estimation of credit demand and supply has become a key issue of many economic publications. They present not only very wide range of methodologies but also applications to many countries. But the operational goals of researchers can vary.
Some authors aim at receiving very general information about influence of demand-side and supply-side variables on credit growth. Others want to find exact trajectories of non-observable demand and supply, and finally, there are some trying to receive a zero-one answer about dominating regime for particular time unit.
Vast literature on loan demand-supply decomposition can be classified according to granularity of data and quantitative methodologies which have been applied.
Aggregated data are usually used in disequilibrium econometrics models, which consist of demand and supply linear equations together with optimization function which defines observable volume of credit as minimum of demand and supply. Such approach can be found in Laffont & Garcia (1977), Sealey (1979), Ito & Ueda (1981), Stenius (1983), Artus (1984), Martin (1990), Pazarbasioglu (1997), Ghosh and Ghosh (1999), Hurlin & Kierzenkowski (2002), Burdeau (2014). The aim of mentioned papers were, amongst others, the analysis of credit crunch in particular country (Canada, USA, Japan, Finland, Korea, Indonesia, Thailand) or the investigation of monetary transmission channel (for example, Poland in Hurlin & Kierzenkowski 2002).
Another tool of decomposing the supply and demand for loans in order to investigate monetary channels was also done in the literature by using VECM (Vector of Error

Correction Models) methodology. Imposing appropriate economic restrictions on variables and then finding cointegrating vectors can reveal quantitatively unobservable demand and supply side. Such research were presented by, for example, Kakes (2000), Calza (2006), Mello & Pisu (2009), Łyziak et al. (2014).

There are also relatively new approaches to disentangling supply and demand of loans such as Dynamic Factor Models (DFM). Balke, Zeng (2013) applied such methodology, in which the demand and supply of credit are one of the unobservable common factors in the model using 65 macro and financial variables of quarterly and monthly frequency.

However there is much less research on demand and supply of loans based on panel data. One of most known research is Del Giovane, Eramo, Nobili (2010) who used bank-level data from Eurosystem Bank Lending Survey – the answers of banks on the demand and supply of loans. Asea, Blomberg (1997) estimated two regimes of lending growth - high and low risk in the model, where the margin on loans in a particular bank depends on the real cost of financing of the bank, the share of risky loans in the bank and the set of macroeconomic variables. Brown, Kirschenmann, Ongena (2010) used two logit panel models - firms' decisions to request FX loans and banks' decision to grant FX loans. The first equation can be regarded as the approximation of loan demand and the second as realized demand.

This paper uses two different approaches from the literature to Polish data. On aggregate data the disequilibrium econometrics approach has been used and on disaggregated, bank-level data somewhat similar analysis to Del Giovane, Eramo, Nobili (2010) has been applied.

3. Methodology

As mentioned above, in this paper the econometric framework of modelling credit dynamics includes two approaches. The first one is time series regression on aggregated data with the use of disequilibrium econometric approach (regime-switching model) and the second one is panel regression on disaggregated (bank level) data.

Disequilibrium approach mentioned in previous chapter is usually applied to aggregated data. It bases on the system of separate demand and supply equations together with optimization function which defines observable volume of credit as minimum of demand and supply:

$$Y_t^s = \mathrm{X_t}'\alpha + \xi_{\mathrm{st}}$$
$$Y_t^d = \mathrm{Z_t}'\beta + \xi_{\mathrm{dt}} \quad , \quad (1)$$
$$\mathrm{Q_t}=\mathrm{Min}(Y_t^s, Y_t^d)$$

where Q is observable value of loans (dynamics of the stock of loans), and Y are nonobservable values of supply (s) and demand (d), X is a matrix of supply regressors (determinants) and Z matrix of demand regressors (determinants). It is also assumed, that vector $\xi_t = (\xi_{st}, \xi_{dt})'$ is i.i.d. , $\mathrm{N}(0, \Omega)$ where:

$$\Omega = \mathrm{E}(\xi_{\mathrm{st}}\xi_{\mathrm{dt}}') = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix} \quad (2)$$

In the process of estimation using Maximum Likelihood method (ML), the following vector of structural parameters is estimated: $\theta = (\alpha\ \beta\ \sigma_1\ \sigma_2\ \sigma_{12})'$. In presented research, following the suggestions for example Hurlin & Kierzenkowski (2002), the starting parameters were taken from one step OLS estimations of separate equations of demand and supply, substituting demand and supply values by historical values of loan dynamics.

The probability of being in the demand regime in period t can be formulated using following formula:

$$P(Y_t^{\,d} < Y_t^{\,s}) = P(Z_t'\beta + \xi_{dt} < \mathrm{X_t}'\alpha + \xi_{st})$$

$P(Y_t^{\,d} < Y_t^{\,s}) = P\left(\frac{\xi_{dt}-\xi_{st}}{\sigma} < \frac{\mathrm{X_t}\alpha - Z_t\beta}{\sigma}\right)$ where $\sigma^2 = \sigma_d^2 + \sigma_s^2$ when the random variables are independent. Assuming that $\frac{\xi_{dt}-\xi_{st}}{\sigma} \sim N(0,1)$, then:

$P(Y_t^{\,d} < Y_t^{\,s}) = \Phi\left(\frac{\mathrm{X_t}\alpha - Z_t\beta}{\sigma}\right)$ where $\Phi(.)$ is a CDF of normal distribution.

And probability of demand regime is given by:

$$P(Y_t^{\,s} < Y_t^{\,d}) = 1 - \Phi\left(\frac{\mathrm{X_t}'\alpha - Z_t'\beta}{\sigma}\right)$$

In case of disaggregated approach, equations were estimated with the use of unbalanced data[2] from commercial banks.

Let us assume the model:

$$\mathrm{y_{it}} = \mathbf{x}_{\mathrm{it}}'\,\boldsymbol{\beta} + \alpha_i + \varepsilon_{it} \quad (3)$$

where t=1,2,...,T and i=1,2,...,N, $[\mathbf{x}_{\mathrm{it}}]_{1\mathrm{xK}}$, $[\beta]_{\mathrm{Kx1}}$, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$.

The problem of incompleteness was solved using a Tx1 vector of selection indicators:

[2] The panel is unbalanced due to mergers in the banking sector.

$s_i = (s_{i1}, \ldots, s_{iT})'$, where $s_{it} = 1$ if (x_{it}, y_{it}) is observed and zero otherwise. Such indicators are included into the parameters' estimator.

Equations of lending growth were estimated with the use of the OLS while allowing the standard errors (and variance–covariance matrix of the estimates) to be consistent when the disturbances from each observation are not independent, and specifically, allowing the standard errors to be robust to each bank having a different variance of the disturbances and to each bank's observations being correlated with those of the other banks through time. Nevertheless, some of the equations are dynamic. Dynamic panel regression with AR(m) can be presented as:

$$y_{it} = \delta y_{i,t-m} + x_{it}'\beta + \alpha_i + \varepsilon_{it} \quad (4)$$

where δ is a scalar. The issue of estimator's properties in dynamic unbalanced panel regressions was more developed in Wośko (2015).

4. Data

Almost all the research cited in chapter 2 on demand and supply of loans use change of the stock of loans to approximate flow of new credit. However it should be considered that such measurement is biased, amongst others, by repayments, loan sale transactions and securitization. For example, Giovane et al. (2010) excluded securitization from the dynamics of credit and it improved the significance of the statistical influence of variables from the SLOS.

In order to identify regimes correctly, first of all, one need to exclude the rate of depreciation of loans (amortization). But reporting bank standards in Poland does not allow for accurate separation of repayment of loans. The same problem occurs in case of loan sale transactions. Lending growth can be distorted especially in case of consumer loans. In this segment of loans sale transactions are common in Poland, contrary to corporate loans. Information about loan sale transactions is rather poor.

Therefore we have to use simple measure of new loans using quarterly difference of stock of loans in case of aggregated data and quarterly rate of growth in case of disaggregated data ignoring above mentioned problem. But we are aware of consequences of such simplification.

Main source of data to the research is Senior Loan Officers Opinion Survey (SLOS). SLOS is regularly carried out by Narodowy Bank Polski since 2003 Q4. It is directed at CEOs/executives chairing credit committees at commercial banks and the content is similar to analogous ECB and Fed surveys. Aggregate results are presented in the form of diffusion

indices (net percent of answers) published on NBP website. Depending on supervisory needs, the survey contains additional ”descriptive” questions. Usually such national surveys cover a large part of loan portfolio of the banking system. The Polish survey covers 26-30 commercial and cooperative banks responsible for more than 80% of existing credit portfolio. It covers three market segments: corporate loans (distinction between SMEs and large enterprises with regard to lending standards), housing loans and consumer loans. As the questions in the survey concern changes in the particular bank's policy in a relatively short period of time (from quarter to quarter), it is the obvious that the majority of answers in the sample indicated lack of change (between 50 and 80% depending on the question asked). The largest percent of not-applicable answers was recorded in the case of housing loans, as some banks had not been extending housing loans at all. The most rare answer option among banks was "eased considerably", which means that banks were reluctant to ease drastically their policy from quarter to quarter (see more in Wośko 2015).

The full list of variables (survey, banking and macro indicators) used in the research was included in Table 1.

5. Results

5.1. Aggregate approach

The selection of variables to final specifications in disequilibrium model was made according to following steps. Very broad list of potential regressors (see Table 1) was narrowed using the t-test of Pearson coefficient of correlation. Not only coincident, but also lagged relations were taken into account. The results of selection are presented in Table 3 and the conclusions are as follows:

a) In case of corporate segment the list of significant variables was relatively long comparing to housing and consumer segment.

b) Most significant correlations the corporate credit growth had with such demand-side variables as questions from SLOS concerning current and forecasted demand of SMEs and large companies for long term loans, questions about reasons of demand change like fixed capital needs, inventories, mergers funding, change of loan standards and terms. Other significant demand factors are, amongst others, percentage of requested loans, consumer and production prices, GDP growth, Polish stock market index, return on sales.

c) The strongest supply-side relations in case of corporates had questions about current standards for all types of loans (both short and long-term), questions concerning supply causes such as demand and credit risk reasons (also large exposures) and forecasts of supply for loans for SME. Indicators of capital adequacy, funding abilities and credit risk in banking system also passed the test as expected.

d) Interest rate changes also were significant. Both national loan interest rates: interbank – WIBOR and corporate– RCR had strongest coincident relation and foreign interest rates influenced loans with two-quarter time lag.

e) The strongest determinants of housing loans from the tested list were economic situation, change of standards and terms of loans, wages, consumer confidence indicator, foreign exchange rate, interest rates.

f) Change of consumer loans was significantly correlated with economic situation of households, consumption, GDP, change of terms of loans, change of incomes, employment, capital adequacy ratio, foreign funding, funding gap, provisions to loans to households, competition on the market and interest rates.

Next, the selected variables were divided into two groups – demand and supply side. Simple linear regressions of demand and supply were tested, were demand and supply were represented by observable credit change. Tests of significance, colinearity check enabled to select final set of variables (regressors). These are:

1a. demand for corporate loans - net percent of the answers from the survey about reasons for the change in demand: DEMCAUSECOR_DEBTRESTR(-2), DEMCAUSECOR_MERGERS(-1), DEMCAUSECOR_TERMSCHNG(-2), and consumer prices CPIQ(-1), change of interest rate D(RCR), stock market index WIG(-2), index of consumer sentiment - CSI(-1), government support for SMEs - MINIMIS.

1b. supply of corporate loans – capital adequacy ratio CAR, change of deposit rate for corporates D(DRCORP), foreign funding FLIAB(-2), non-performing loans ratio INPLCORP, provisions to loans ratio PROV, change of loan interest rate for corporates D(RCR), net percent of answers from the survey concerning credit standards for large companies, of short-term loans STANDARDS_LCSHORT(-2), forecast of supply of loans for SMEs SUPPLYF_SMELONG(-2), and government support for SMEs - MINIMIS

2a. demand for housing loans –net percent of answers from the survey concerning forecasts of demand DEMANDF_HOUS, reasons of demand changes DEMCAUSEHOUS_STANDARDSCH, and other variables, such as change of LIBOR or FX

rate D(LIBORCHF3M), CHF(-2), change of loan interest rate D(RH), consumer sentiment indicator CSI(-1).

2b. supply of housing loans – net percent of answers from the survey concerning reasons of change in supply SUPCAUSEHOUS_ECONOMICSIT(-2), CAR, change of deposit rate for households D(DRHOUHLDS), non-performing loan ratio INPLHOUSHLDS, change of interest rate of zloty and CHF housing loans D(RH), D(LIBORCHF3M), and introducing government programme GOVP.

3a. demand for consumer loans – net percent of answers from the survey concerning reasons of change in demand DEMCAUSECONS_ECONOMICSIT(-1), DEMCAUSECONS_TERMSCHNG(-2), change in interest rate of consumer loans D(RC(-1)), change in overall consumption D(CONS) and seasonal factors (Z).

3b. supply of consumer loans – capital adequacy ratio CAR, foreign funding FLIAB(-2), funding gap GAP(-2), ratio of non-performing loans for households INPLHOUSHLDS, provisions to loans PROV(-2), change of interest rate of consumer loans D(RC(-2)), causes of supply according to survey such as collateral SUPCAUSECONS_COLL and demand SUPCAUSECONS_DEMAND(-2), recommendation of Polish FSA (RECT) and seasonal factors (Z).

Final specifications of regressors for each loan segment were put into disequilibrium model in the form (1)[3]. Firstly, initial parameters were obtained using OLS method and then nonlinear optimization of regime-switching model was made with the use of the Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm which is one of the quasi-Newton methods of optimizing. Vectors of initial and optimal parameters are included in Table 4, 5 and 6 together with significance tests. At Figure 5, 6 and 7 quarterly changes of estimated demand and supply are given together with historical values of observable credit changes. Figure 8, 9, 10 includes probabilities of supply and demand regimes estimated for particular periods.

In case of corporate loans, from 2004 to 2008 banks were easing credit policy (see Figure 1). That time banks also declared relatively high demand for loans from enterprises (and Figure 3). The results of estimation suggest that at the beginning of this period demand was slightly higher than supply and just before the Crisis tendency has reversed. It means that at that second period easier credit standards, increasing supply of credit did meet the financial needs

[3] However to simplify the analysis, we assume $\sigma_{12} = 0$.

of corporates. In 2009 banks curbed supply of loans, however the results suggest that such deep drop of credit dynamics to negative values was driven more by decreasing demand. Early after the crisis, in 2011, the demand was increasing faster than supply, as financial needs connected with infrastructure investments of football competition Euro 2012 quickened. Supply did not increase much, and even went down in the second half of 2012 as banks tightened credit policy due to worsening quality of loans of enterprises involved in infrastructure projects connected with Euro 2012. Increasing prices of materials raised the real costs comparing to agreed contracts which led large infrastructure companies to financial problems. From 2014 the supply of credit to corporates increased faster than demand showing rather reluctance of firms towards taking a loan.

In case of housing credit to households, results suggests that until 2007 demand and supply were more or less in equilibrium. However before the lending crisis supply regime started to dominate. The second period of disequilibrium was just after the Crisis, till 2012, where demand was lower than supply (see Figure 6).

Consumer loan segment before the Crisis was more demand-regime dominated and after the Crisis supply regime was more frequent (Figure 7).

5.2.Bank-level approach

Bank-level approach focuses on the analysis of the influence of particular demand and supply variables on the credit dynamics before and after the last financial crisis.

For each segment of loans two specifications were tested in two subsamples. First specification is basing on results included in Wośko (2015), where statistically and predictively best specifications of panel models of credit growth in Poland were found. Equations include both, demand and supply variables. Second specification uses in the role of regressors the data gathered only from SLOS on disaggregated level. These are answers concerning credit policy (credit standards) and demand for loans.

According to Polish characteristics of the consequences of world financial crisis, the timeline was divided into periods “before the Crisis”, it means to the end of 2008, and “after the Crisis”, which starts from 2011. Both panel equations were estimated on these two subsamples. Tables from 7 to 12 include the results of estimations.

According to Wośko (2015), the growth of corporate loans in Poland depends strongly on past developments in this category, banks’ policy expectations from the last quarter, past GDP rate of growth, and from 2014 onwards – the government guarantee programme for SMEs. In case

of corporate segment, as the first specification, similar equation was estimated (see Table 7). The second equation includes only answers from the survey regarding large and SMEs and concerning short and long term loans (Table 8).
Estimations of both specifications in two subsamples suggest the strong rise of significance of supply factors of credit in the period after the Crisis.

In case of segment of housing loans, the conclusions are quite similar to corporate, however the rise in significance of supply factors is smaller. But in fact, in the period after the Crisis, answers on the questions concerning supply had higher values of the test of significance (see Table 9 and 10).

The growth of consumer loans depends on past banks' policy and on the last-quarter change of consumer sentiment indicator (see Table 11). Consumer loans are the short-term financing of consumer goods, these are loans at current accounts, credit card accounts, etc. The higher the optimism concerning the following months, the more prominent the rise of household expenses, as households predict that their credibility will improve.
Estimation of growth of consumer loans in two subsamples of both equations has shown decrease of information value of both demand and supply factors in the second subsample (Table 11 and 12). In other words, significance of demand as well as supply factors decreased after the Crisis.

6. Conclusions

This paper described the influence of demand and supply determinants on the credit growth in the sector of commercial banks in Poland. The main idea of the concept was to use survey information in the form of panel data from Senior Loan Officers Opinion Survey (SLOS). The main objective of included models was answer about possible changes in tendencies of the influence of demand and supply factors as the result of the last financial crisis at the disaggregated (for particular banks, different types of loans) and aggregated (the commercial banks' sector) level.
Two methodological approaches were used. First one, on aggregated data, was time series regression with the use of disequilibrium econometric approach (regime-switching model) and the second one was a panel regression on disaggregated (bank level) data.
The results received on the bank-level data suggest increasing significance of supply factors after the Crisis in case of corporate and housing loans. Results on aggregated data with the

use of regime-switching model confirm these results in case of corporate loan segment. However disequilibrium (aggregated approach) suggest also increase of probability of supply side in consumer loans in the period following GFC.

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Table 1
Variables tested in the models of supply and demand and their transformations (in parentheses).

abbreviation	description	details	supply/ demand side
(D)CSI	consumer sentiment indicator (quarter-to-quarter change)	Source: Polish Central Statistical Office	D
(G)RGDP	gross domestic product (rate of growth, constant prices)	Source: Polish Central Statistical Office	D
(G)WIG	Warsaw Stock Exchange Index (rate of change)	Source: Reuters	D
CHF/PLN, EUR/PLN, USD/PLN	exchange rates	Source: NBP	D,S
(R)CONS	consumption (constant prices)	Source: Polish Central Statistical Office	D
CPI	consumer products inflation (q/q)	Source: Polish Central Statistical Office	D
ECI	business climate indicator	Source: Polish Central Statistical Office	D
SPI	sold production of industry (q/q)	Source: Polish Central Statistical Office	D
PPI	production prices of industry	Source: Polish Central Statistical Office	D
(D)EMPL	number of employed in the corporate sector	Source: Polish Central Statistical Office	D
INC	households' disposable income	Source: Polish Central Statistical Office	D
HHP	Housing prices q/q	Source: NBP	D
ROE,ROA,ROS	profitability ratios of corporates	Source: Polish Central Statistical Office	D
U	unemployment rate	Source: Polish Central Statistical Office	D
WAGE	average wage	Source: Polish Central Statistical Office	D
(D)WIBOR3M, (D)LIBORCHF3M, (D)LIBOREUR3M	interbank interest rates	Source: NBP, Reuters	D,S
(D)DRH	deposit interest rate - households	Source: NBP	S
(D)DRC	deposit interest rate - corporates	Source: NBP	S
(D)FGAP	Funding gap - the difference between the sum of loans to non-financial sector and government and the sum of deposits from these sectors as a percentage of loans.	Source: NBP	S
(D)IBGAP	total interbank loans of the bank minus its total interbank borrowings, as fraction of bank's assets (quarter-to-quarter change)	Source: NBP	S
(G)LOANSC	consumer loans (quarter-to-quarter growth)	Source: NBP	regressand
(G)LOANSCR	corporate loans (quarter-to-quarter growth, constant prices)	Source: NBP	regressand
(G)LOANSH	housing loans (quarter-to-quarter growth, constant prices)	Source: NBP	regressand
CAR	capital adequacy ratio	Source: NBP	S
FLIAB	liabilities from foreign financial institutions to total assets	Source: NBP	S
govp	Binary variable. Government support plan for families buying their first flat (“Rodzina na	Source: own computations	S

	swoim")		
minimis	Binary variable. Government support for SMEs in the form of loans guarantee plan. ("1" from 2013, "0" otherwise)	Source: own computations	S
(D)NPLHoushlds	non-performing loans – loans from households	Source: NBP	S
INPLHoushlds	non-performing loans ratio – loans from households	Source: NBP	S
(D)NPLcons	non-performing loans - consumer loans	Source: NBP	S
(D)NPLcorp	non-performing loans - corporate loans	Source: NBP	S
(D)NPLhousing	non-performing loans - housing loans	Source: NBP	S
INPLcons	non-performing loans ratio - consumer loans	Source: NBP	S
INPLcorp	non-performing loans ratio - corporate loans	Source: NBP	S
INPLhousing	non-performing loans ratio - housing loans	Source: NBP	S
PROV	provisions to loans, annualized data	Source: NBP	S
(D)RC	interest rate – consumer loans	Source: NBP	D,S
(D)RCR	interest rate – corporate loans	Source: NBP	D,S
rect	Binary variable ("1" from second half of 2013, "0" otherwise). Adjustment to Recommendation T of the Polish Financial Authority which eased the standards of consumer loans	Source: own computations	S
(D)RH	interest rate – housing loans	Source: NBP	D,S
req	percentage of enterprises applying for credit - survey data	Source: NBP	D
accept	the share of approved loan applications - survey data	Source: NBP	
Standards_LCShort	current credit policy (credit standards) concerning short-term loans to large companies	Source: NBP	S
Standards_LCLong	current credit policy (credit standards) concerning longterm loans to large companies	Source: NBP	S
Standards_SMEShort	current credit policy (credit standards) concerning short-term loans to SMEs	Source: NBP	S
Standards_SMELong	current credit policy (credit standards) concerning long-term loans to SMEs	Source: NBP	S
SupCauseCor_capital	Reasons for changes in lending policy - current or expected capital position of the bank	Source: NBP	S
SupCauseCor_monetary	Reasons for changes in lending policy – decisions of central bank on monetary policy	Source: NBP	S
SupCauseCor_economicsit	Reasons for changes in lending policy - risk related to the expected economic situation	Source: NBP	S
SupCauseCor_industryrisk	Reasons for changes in lending policy – industry risk	Source: NBP	S
SupCauseCor_largeexp	Reasons for changes in lending policy – risk related to large borrowers	Source: NBP	S
SupCauseCor_npl	Reasons for changes in lending policy – change in the share of non-performing loans	Source: NBP	S
SupCauseCor_competit	Reasons for changes in lending policy – changes in competition pressure	Source: NBP	S
SupCauseCor_demand	Reasons for changes in lending policy – change in demand for corporate loans	Source: NBP	S
SupCauseCor_other	Reasons for changes in lending policy – other reasons	Source: NBP	S
Demand_LCShort	Demand for loans – short term loans for large companies	Source: NBP	D

Demand_LCLong	Demand for loans – long term loans for large companies	Source: NBP	D
Demand_SMEshort	Demand for loans – short term loans for SMEs	Source: NBP	D
Demand_SMElong	Demand for loans – long term loans for SMEs	Source: NBP	D
DemCauseCor_fixedcapital	Reasons for changes in demand for corporate loans - changes in demand for financing fixed assets (investments)	Source: NBP	D
DemCauseCor_inventory	Reasons for changes in demand for corporate loans - changes in financing needs for inventories and working capital	Source: NBP	D
DemCauseCor_mergers	Reasons for changes in demand for corporate loans - changes in demand for financing mergers and acquisitions	Source: NBP	D
DemCauseCor_debtrestr	Reasons for changes in demand for corporate loans - changes in demand for financing debt restructuring	Source: NBP	D
DemCauseCor_othersources	Reasons for changes in demand for corporate loans - the use of alternative sources of financing	Source: NBP	D
DemCauseCor_termschng	Reasons for changes in demand for corporate loans - change of corporate loans terms	Source: NBP	D
DemCauseCor_stndchng	Reasons for changes in demand for corporate loans – change of corporate loans standards	Source: NBP	D
DemCauseCor_other	Reasons for changes in demand for corporate loans – other reasons	Source: NBP	D
SupplyF_LCShort	Foreseen supply of short term loans for large companies	Source: NBP	D
SupplyF_LClong	Foreseen supply of long term loans for large companies	Source: NBP	S
SupplyF_SMEshort	Foreseen supply of short term loans for SMEs	Source: NBP	S
SupplyF_SMElong	Foreseen supply of long term loans for SMEs	Source: NBP	S
DemandF_LCShort	Foreseen demand for loans – short term loans for large companies	Source: NBP	D
DemandF_LCLong	Foreseen demand for loans – long term loans for large companies	Source: NBP	D
DemandF_SMEshort	Foreseen demand for loans – short term loans for SMEs	Source: NBP	D
DemandF_SMElong	Foreseen demand for loans – long term loans for SMEs	Source: NBP	D
Standards_hous	current credit policy (credit standards) concerning housing loans	Source: NBP	S
Standards_cons	current credit policy (credit standards) concerning consumer loans	Source: NBP	S
SupCauseHous_capital	Reasons for changes in lending policy in case of housing loans - current or expected capital position of the bank	Source: NBP	S
SupCauseHous_monetary	Reasons for changes in lending policy in case of housing loans – decisions of central bank on monetary policy	Source: NBP	S
SupCauseHous_economicsit	Reasons for changes in lending policy in case of housing loans - risk related to the expected economic situation	Source: NBP	S
SupCauseHous_marketsit	Reasons for changes in lending policy in case of housing loans – housing market situation	Source: NBP	S
SupCauseHous_npl	Reasons for changes in lending policy in case of housing loans –change in the share of non-performing loans	Source: NBP	S

SupCauseHous_competit	Reasons for changes in lending policy in case of housing loans – changes in competition pressure	Source: NBP	S
SupCauseHous_demand	Reasons for changes in lending policy in case of housing loans – changes in demand	Source: NBP	S
SupCauseHous_other	Reasons for changes in lending policy in case of housing loans – other reasons	Source: NBP	S
SupCauseCons_capital	Reasons for changes in lending policy in case of consumer loans - current or expected capital position of the bank	Source: NBP	S
SupCauseCons_monetary	Reasons for changes in lending policy in case of consumer loans – decisions of central bank on monetary policy	Source: NBP	S
SupCauseCons_economicsit	Reasons for changes in lending policy in case of corporate loans - risk related to the expected economic situation	Source: NBP	S
SupCauseCons_coll	Reasons for changes in lending policy in case of corporate loans – required collateral	Source: NBP	S
SupCauseCons_npl	Reasons for changes in lending policy in case of corporate loans –change in the share of non-performing loans	Source: NBP	S
SupCauseCons_competit	Reasons for changes in lending policy in case of corporate loans – changes in competition pressure	Source: NBP	S
SupCauseCons_demand	Reasons for changes in lending policy in case of corporate loans – changes in demand	Source: NBP	S
SupCauseCons_other	Reasons for changes in lending policy in case of consumer loans – other reasons	Source: NBP	S
Demand_hous	Current demand for housing loans	Source: NBP	D
Demand_cons	Current demand for consumer loans	Source: NBP	D
DemCauseHous_housmarket	Reasons for changes in demand for housing loans - changes in housing market	Source: NBP	D
DemCauseHous_spending	Reasons for changes in demand for housing loans - changes in consumer spending	Source: NBP	D
DemCauseHous_othersources	Reasons for changes in demand for housing loans – the use of alternative sources of financing	Source: NBP	D
DemCauseHous_economicsit	Reasons for changes in demand for housing loans – change in economic situation of households	Source: NBP	D
DemCauseHous_termschng	Reasons for changes in demand for housing loans – changes in terms of loans	Source: NBP	D
DemCauseHous_standardschng	Reasons for changes in demand for housing loans – changes in loan standards	Source: NBP	D
DemCauseHous_other	Reasons for changes in demand for housing loans – other reasons	Source: NBP	D
DemCauseCons_durables	Reasons for changes in demand for consumer loans - changes in demand for financing durable goods	Source: NBP	D
DemCauseCons_securities	Reasons for changes in demand for consumer loans - changes in demand for financing purchases of securities	Source: NBP	D
DemCauseCons_othersources	Reasons for changes in demand for corporate loans – the use of alternative sources of financing	Source: NBP	D
DemCauseCons_economicsit	Reasons for changes in demand for consumer loans – change in economic situation of households	Source: NBP	D
DemCauseCons_termschng	Reasons for changes in demand for consumer	Source: NBP	D

	loans – changes in terms of loans		
DemCauseCons_standardschng	Reasons for changes in demand for consumer loans – changes in loan standards	Source: NBP	D
DemCauseCons_other	Reasons for changes in demand for consumer loans – other reasons	Source: NBP	D
SupplyF_hous	Foreseen supply of housing loans	Source: NBP	S
SupplyF_cons	Foreseen supply of consumer loans	Source: NBP	S
DemandF_hous	Foreseen demand for housing loans	Source: NBP	D
DemandF_cons	Foreseen demand for consumer loans	Source: NBP	D

(G)- growth rate, (D) – first difference, (R)- constant prices, (Z1, Z2,….) – seasonal factors

Table 2

Descriptive statistics of data used in aggregated data model

	Mean	Median	Max	Min	Std.Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.	Obs.
ACCEPT	84.34	85.84	91.70	66.67	5.52	-1.43	5.01	20.78	0.00	41
CAR	13.76	13.95	15.77	10.88	1.37	-0.53	2.31	3.03	0.22	45
CHF	2.93	2.95	3.62	2.09	0.46	-0.18	1.74	3.20	0.20	45
CONS	202413.70	202617.20	268262.00	138134.00	39639.42	-0.01	1.65	3.49	0.17	46
CPI	98.39	98.85	110.71	83.48	9.29	0.00	1.50	4.32	0.12	46
CPIQ	100.61	100.50	102.07	99.46	0.70	0.28	2.15	1.99	0.37	46
DEMAND_CONS	0.13	0.16	0.67	-0.54	0.31	-0.15	2.35	0.97	0.62	46
DEMAND_HOUS	0.13	0.15	0.97	-0.69	0.42	0.13	2.33	0.97	0.61	46
DEMAND_LCLONG	0.23	0.25	0.79	-0.60	0.33	-0.41	2.59	1.59	0.45	46
DEMAND_LCSHORT	0.18	0.19	0.60	-0.46	0.23	-0.30	3.00	0.68	0.71	46
DEMAND_SMELONG	0.19	0.19	0.70	-0.52	0.28	-0.23	2.54	0.81	0.67	46
DEMAND_SMESHORT	0.22	0.21	0.76	-0.29	0.22	0.30	3.02	0.71	0.70	46
DEMANDF_CONS	0.44	0.53	0.87	-0.32	0.30	-0.79	2.87	4.82	0.09	46
DEMANDF_HOUS	0.24	0.30	0.97	-0.83	0.42	-0.57	3.07	2.51	0.29	46
DEMANDF_LCLARGE	0.33	0.38	0.85	-0.31	0.32	-0.22	1.97	2.41	0.30	46
DEMANDF_LCSHORT	0.34	0.32	0.75	-0.20	0.23	-0.20	2.32	1.19	0.55	46
DEMANDF_SMELONG	0.38	0.45	0.93	-0.62	0.38	-0.69	2.89	3.63	0.16	46
DEMANDF_SMESHORT	0.43	0.47	0.91	-0.07	0.25	-0.28	2.29	1.55	0.46	46
DEMCAUSECONS_DURABLES	0.23	0.24	0.96	-0.67	0.43	-0.22	2.28	1.35	0.51	46
DEMCAUSECONS_ECONOMICSIT	0.07	0.03	0.93	-0.71	0.41	0.24	2.62	0.72	0.70	46
DEMCAUSECONS_OTHER	0.09	0.04	0.68	-0.38	0.19	0.61	5.13	11.51	0.00	46
DEMCAUSECONS_OTHERSOURCE	-0.11	-0.09	0.32	-0.57	0.19	-0.16	3.25	0.33	0.85	46
DEMCAUSECONS_SECURITIES	0.01	0.00	0.86	-0.74	0.25	0.44	8.00	49.30	0.00	46
DEMCAUSECONS_STANDARDSCH	0.13	0.11	0.73	-0.74	0.33	-0.30	3.03	0.71	0.70	46
DEMCAUSECONS_TERMSCHNG	0.22	0.16	0.82	-0.31	0.31	0.14	2.15	1.55	0.46	46
DEMCAUSECOR_DEBTRESTR	0.12	0.02	0.71	-0.40	0.22	0.66	3.45	3.68	0.16	46
DEMCAUSECOR_FIXEDCAPITAL	0.31	0.42	0.99	-0.91	0.54	-0.74	2.34	4.97	0.08	46
DEMCAUSECOR_INVENTORY	0.35	0.38	1.00	-0.40	0.36	-0.34	2.43	1.53	0.47	46
DEMCAUSECOR_MERGERS	0.06	0.05	0.55	-0.65	0.26	-0.55	4.20	5.09	0.08	46
DEMCAUSECOR_OTHER	0.07	0.02	0.66	-0.61	0.21	0.13	5.70	14.12	0.00	46
DEMCAUSECOR_OTHERSOURCES	-0.06	-0.06	0.21	-0.26	0.10	0.05	2.82	0.08	0.96	46
DEMCAUSECOR_STNDCHNG	0.03	0.01	0.32	-0.55	0.18	-0.90	4.42	10.09	0.01	46
DEMCAUSECOR_TERMSCHNG	0.07	0.06	0.62	-0.48	0.24	-0.24	2.95	0.44	0.80	46
DEMCAUSEHOUS_ECONOMICSIT	0.04	0.01	0.76	-0.86	0.38	-0.10	2.65	0.31	0.86	46
DEMCAUSEHOUS_HOUSMARKET	0.21	0.35	0.97	-0.88	0.53	-0.50	2.18	3.20	0.20	46
DEMCAUSEHOUS_OTHER	0.09	0.06	0.78	-0.44	0.24	0.33	3.75	1.91	0.39	46
DEMCAUSEHOUS_OTHERSOURCE	-0.04	-0.04	0.59	-0.52	0.22	0.31	4.66	5.99	0.05	46
DEMCAUSEHOUS_SPENDING	0.02	0.00	0.65	-0.54	0.24	0.32	3.30	0.98	0.61	46
DEMCAUSEHOUS_STANDARDSCH	0.01	0.05	0.69	-0.85	0.32	-0.59	4.15	5.22	0.07	46
DEMCAUSEHOUS_TERMSCHNG	0.11	0.08	0.94	-0.83	0.41	-0.09	2.51	0.52	0.77	46
DINC	206843.10	204976.00	283927.00	143316.00	37965.48	0.12	1.84	2.63	0.27	45
DRCORP	0.04	0.04	0.06	0.02	0.01	0.09	2.45	0.63	0.73	45
DRHOUHLDS	0.04	0.04	0.06	0.02	0.01	0.17	2.72	0.37	0.83	45
EMPL	5260.35	5364.00	5549.00	4000.00	322.25	-1.78	6.83	46.85	0.00	41
EUR	4.09	4.11	4.78	3.35	0.31	-0.11	3.31	0.26	0.88	45
FLIAB	0.12	0.14	0.20	0.04	0.05	-0.36	1.56	4.87	0.09	45
GAP	-0.01	0.08	0.14	-0.27	0.15	-0.69	1.75	6.58	0.04	46
GOVP	0.52	1.00	1.00	0.00	0.51	-0.09	1.01	7.67	0.02	46
HHP	136.67	141.86	158.68	90.11	16.74	-1.30	4.09	12.98	0.00	39
INPLCONS	0.13	0.12	0.18	0.07	0.04	0.16	1.59	4.00	0.14	46
INPLCORP	0.12	0.11	0.27	0.06	0.05	1.49	5.01	24.70	0.00	46
INPLHOUSHLDS	0.07	0.07	0.13	0.04	0.02	1.05	5.07	16.75	0.00	46
INPLHOUSING	0.03	0.03	0.05	0.01	0.01	0.51	2.85	2.01	0.37	46
LIBORCHF3M	0.74	0.25	2.96	-0.69	0.99	1.19	3.04	10.82	0.00	46
LIBOREUR3M	1.84	1.53	5.28	0.03	1.55	0.73	2.42	4.73	0.09	46
LOAN_COR	193007.20	206927.00	266684.10	116001.70	52782.87	-0.27	1.55	4.61	0.10	46
LOAN_HOUS	193876.60	210647.90	365036.50	29575.83	118043.40	-0.09	1.43	4.78	0.09	46
LOANS_CONS	103412.20	126887.70	138741.20	41875.23	36646.45	-0.59	1.63	6.27	0.04	46
MINIMIS	0.20	0.00	1.00	0.00	0.40	1.53	3.35	18.29	0.00	46
PPI	387.75	379.98	438.19	326.89	34.97	0.07	1.53	4.17	0.12	46
PPIQ	102.46	102.40	109.57	97.33	3.27	0.37	2.48	1.54	0.46	46
PROV	0.01	0.01	0.02	0.00	0.00	0.34	2.31	1.76	0.41	45
RC	0.15	0.15	0.16	0.09	0.01	-2.01	8.23	81.55	0.00	45
RCONS	199496.20	200569.60	271934.60	137373.60	40576.89	0.03	1.72	3.17	0.21	46
RCR	0.06	0.06	0.08	0.04	0.01	-0.43	2.93	1.40	0.50	45
RECT	0.15	0.00	1.00	0.00	0.36	1.94	4.75	34.63	0.00	46
REQ	24.38	23.89	33.19	16.70	4.63	0.23	1.89	2.46	0.29	41
RGDP	181.03	180.85	240.73	137.66	25.95	0.25	2.51	0.93	0.63	45
RH	0.07	0.07	0.09	0.05	0.01	0.15	2.43	0.77	0.68	45
ROS	5.19	5.23	6.40	4.30	0.60	0.16	2.10	1.74	0.42	46
STANDARDS_CONS	0.00	0.05	0.56	-0.79	0.36	-0.62	2.58	3.25	0.20	46
STANDARDS_HOUS	-0.15	-0.08	0.49	-0.90	0.32	-0.69	2.93	3.69	0.16	46
STANDARDS_LCLONG	-0.06	0.00	0.35	-0.82	0.21	-1.39	5.86	30.45	0.00	46
STANDARDS_LCSHORT	-0.01	0.02	0.26	-0.83	0.19	-2.24	10.01	132.74	0.00	46
STANDARDS_SMELONG	-0.05	-0.02	0.33	-0.89	0.26	-1.02	4.38	11.58	0.00	46
STANDARDS_SMESHORT	0.01	0.04	0.63	-0.90	0.28	-0.81	4.66	10.37	0.01	46
SUPCAUSECONS_CAPITAL	0.01	0.00	0.52	-0.47	0.16	0.81	6.66	30.73	0.00	46
SUPCAUSECONS_COLL	-0.03	0.00	0.17	-0.44	0.11	-2.39	9.22	118.15	0.00	46
SUPCAUSECONS_COMPETIT	0.34	0.26	0.95	-0.08	0.30	0.49	2.02	3.71	0.16	46
SUPCAUSECONS_DEMAND	0.20	0.10	0.73	-0.20	0.23	0.77	2.51	4.99	0.08	46
SUPCAUSECONS_ECONOMICSIT	-0.06	0.00	0.54	-0.90	0.30	-0.83	3.91	6.90	0.03	46
SUPCAUSECONS_MONETARY	-0.04	0.00	0.56	-0.51	0.23	-0.16	3.69	1.12	0.57	46
SUPCAUSECONS_NPL	0.00	0.02	0.55	-0.66	0.26	-0.27	3.12	0.58	0.75	46
SUPCAUSECONS_OTHER	-0.05	0.00	0.69	-0.79	0.26	-0.12	4.53	4.62	0.10	46
SUPCAUSECOR_CAPITAL	-0.05	0.00	0.41	-0.90	0.26	-1.09	4.87	15.91	0.00	46
SUPCAUSECOR_COMPETIT	0.18	0.19	0.49	-0.09	0.13	0.03	2.45	0.58	0.75	46
SUPCAUSECOR_DEMAND	0.08	0.08	0.50	-0.23	0.15	0.52	3.79	3.28	0.19	46
SUPCAUSECOR_ECONOMICSIT	-0.05	0.07	0.79	-0.99	0.45	-0.47	2.39	2.41	0.30	46
SUPCAUSECOR_INDUSTRYRISK	-0.16	-0.08	0.42	-0.75	0.25	-0.56	2.93	2.39	0.30	46

SUPCAUSECOR_LARGEEXP	-0.06	-0.01	0.31	-0.60	0.17	-0.98	5.26	17.10	0.00	46
SUPCAUSECOR_MONETARY	-0.05	0.00	0.15	-0.48	0.11	-1.90	8.07	76.79	0.00	46
SUPCAUSECOR_NPL	-0.07	-0.03	0.31	-0.63	0.19	-0.85	3.88	6.99	0.03	46
SUPCAUSECOR_OTHER	-0.05	-0.02	0.46	-0.36	0.17	0.38	3.88	2.63	0.27	46
SUPCAUSEHOUS_CAPITAL	-0.07	0.00	0.21	-0.67	0.16	-2.16	8.80	100.41	0.00	46
SUPCAUSEHOUS_COMPETIT	0.22	0.23	0.87	-0.25	0.25	0.21	2.81	0.40	0.82	46
SUPCAUSEHOUS_DEMAND	0.14	0.12	0.85	-0.50	0.23	0.36	4.31	4.32	0.12	46
SUPCAUSEHOUS_ECONOMICSIT	-0.10	0.00	0.48	-1.00	0.32	-1.00	3.89	9.15	0.01	46
SUPCAUSEHOUS_MARKETSIT	0.06	0.00	0.84	-0.77	0.34	0.22	3.58	1.01	0.60	46
SUPCAUSEHOUS_MONETARY	-0.03	0.00	0.25	-0.40	0.09	-1.07	8.67	70.53	0.00	46
SUPCAUSEHOUS_NPL	-0.08	-0.03	0.13	-0.52	0.14	-1.82	5.97	42.23	0.00	46
SUPCAUSEHOUS_OTHER	-0.19	-0.12	0.38	-0.95	0.29	-1.04	3.55	8.82	0.01	46
SUPPLYF_CONS	0.05	0.12	0.61	-0.81	0.36	-0.61	2.61	3.11	0.21	46
SUPPLYF_HOUS	-0.07	-0.09	0.74	-0.86	0.36	-0.01	2.93	0.01	0.99	46
SUPPLYF_LCLONG	-0.03	0.01	0.37	-0.69	0.23	-1.04	4.16	10.85	0.00	46
SUPPLYF_LCSHORT	0.05	0.06	0.55	-0.60	0.22	-0.75	4.57	8.99	0.01	46
SUPPLYF_SMELONG	0.05	0.12	0.67	-0.65	0.33	-0.39	2.28	2.19	0.33	46
SUPPLYF_SMESHORT	0.13	0.23	0.75	-0.65	0.33	-0.67	2.71	3.57	0.17	46
U	11.41	9.85	20.70	6.60	3.96	1.04	2.70	8.52	0.01	46
USD	3.09	3.12	3.91	2.12	0.38	-0.25	3.71	1.42	0.49	45
WAGE	102.68	102.80	107.80	99.10	2.05	0.56	2.68	2.53	0.28	45
WIBOR3M	4.52	4.43	6.80	1.85	1.24	-0.10	2.60	0.38	0.83	46
WIG	41391.21	41979.31	61739.93	20333.69	10853.91	-0.24	2.26	1.49	0.48	46
WWUK	-25.46	-26.60	-5.60	-44.90	10.13	0.23	2.35	1.19	0.55	45

Table 3
Results of the selection of most significant correlations with loan dynamics (quarterly change).

significant correlations	lag of significant correlation			correlation coefficients			prob. (t-stat.)		
variable	d(LOAN_COR)	d(LOAN_HOUS)	d(LOANS_CONS)	d(LOAN_COR)	d(LOAN_HOUS)	d(LOANS_CONS)	d(LOAN_COR)	d(LOAN_HOUS)	d(LOANS_CONS)
ACCEPT	1	-	-	0.558	-	-	0.000	-	-
CAR	0	0	0	-0.527	-0.473	-0.680	0.001	0.003	0.000
CHF	2	2	-	-0.458	-0.468	-	0.005	0.004	-
CONS	-	-	0	-	-	-0.573	-	-	0.000
CPIQ	1	-	-	0.329	-	-	0.044	-	-
DEMAND_CONS	-	-	1	-	-	0.392	-	-	0.015
DEMAND_LCLONG	1	-	-	0.571	-	-	0.000	-	-
DEMAND_SMELONG	1	-	-	0.394	-	-	0.014	-	-
DEMANDF_HOUS	-	0	-	-	-0.339	-	-	0.037	-
DEMANDF_LCLARGE	2	-	-	0.449	-	-	0.006	-	-
DEMANDF_SMELONG	2	-	-	0.582	-	-	0.000	-	-
DEMCAUSECONS_ECONOMICSIT	-	-	1	-	-	0.647	-	-	0.000
DEMCAUSECONS_OTHER	-	-	1	-	-	0.437	-	-	0.006
DEMCAUSECONS_TERMSCHNG	-	-	2	-	-	0.394	-	-	0.017
DEMCAUSECOR_DEBTRESTR	2	-	-	-0.498	-	-	0.002	-	-
DEMCAUSECOR_FIXEDCAPITAL	1	-	-	0.564	-	-	0.000	-	-
DEMCAUSECOR_INVENTORY	1	-	-	0.383	-	-	0.018	-	-
DEMCAUSECOR_MERGERS	1	-	-	0.623	-	-	0.000	-	-
DEMCAUSECOR_STNDCHNG	2	-	-	0.446	-	-	0.006	-	-
DEMCAUSECOR_TERMSCHNG	2	-	-	0.517	-	-	0.001	-	-
DEMCAUSEHOUS_ECONOMICSIT	-	2	-	-	0.364	-	-	0.029	-
DEMCAUSEHOUS_SPENDING	-	-	1	-	-	0.372	-	-	0.022
DEMCAUSEHOUS_STANDARDSCH	-	0	-	-	-0.349	-	-	0.032	-
DEMCAUSEHOUS_TERMSCHNG	-	0	-	-	-0.334	-	-	0.040	-
DINC	-	-	2	-	-	-0.640	-	-	0.000
DRCORP	0	-	-	0.496	-	-	0.002	-	-
DRHOUHLDS	-	0	-	-	0.389	-	-	0.016	-
EMPL	-	-	2	-	-	-0.422	-	-	0.010
EUR	-	1	2	-	-0.588	-0.575	-	0.000	0.000
FLIAB	2	-	2	-0.398	-	-0.497	0.016	-	0.002
GAP	2	-	2	-0.347	-	-0.490	0.038	-	0.002
INPLCORP	0	-	-	-0.571	-	-	0.000	-	-
INPLHOUSHLDS	-	0	0	-	-0.362	-0.557	-	0.025	0.000
LIBORCHF3M	2	2	-	0.574	0.436	-	0.000	0.008	-
LIBOREUR3M	1	1	-	0.588	0.397	-	0.000	0.014	-
NPLCORP	0	-	-	-0.443	-	-	0.005	-	-
PPIQ	0	-	-	0.354	-	-	0.029	-	-
PROV	0	-	2	-0.478	-	-0.680	0.002	-	0.000
RC	-	-	2	-	-	-0.453	-	-	0.006
RCONS	-	-	0	-	-	-0.570	-	-	0.000
RCR	0	-	-	0.334	-	-	0.040	-	-
REQ	0	-	-	0.123	-	-	0.463	-	-
RGDP	-	-	1	-	-	-0.594	-	-	0.000
GRGDP	3	-	-	0.587	-	-			
RH	-	0	-	-	0.375	-	-	0.020	-
ROS	2	-	-	0.516	-	-	0.001	-	-
STANDARDS_LCLONG	2	-	-	0.521	-	-	0.001	-	-
STANDARDS_LCSHORT	2	-	-	0.395	-	-	0.017	-	-
STANDARDS_SMELONG	2	-	-	0.552	-	-	0.001	-	-
STANDARDS_SMESHORT	2	-	-	0.430	-	-	0.009	-	-
SUPCAUSECONS_COLL	-	-	0	-	-	-0.348	-	-	0.032
SUPCAUSECONS_COMPETIT	-	-	2	-	-	0.376	-	-	0.024
SUPCAUSECONS_DEMAND	-	-	2	-	-	0.429	-	-	0.009
SUPCAUSECOR_DEMAND	2	-	-	0.364	-	-	0.029	-	-
SUPCAUSECOR_LARGEEXP	2	-	-	0.366	-	-	0.028	-	-
SUPCAUSECOR_NPL	2	-	-	0.475	-	-	0.003	-	-
SUPCAUSEHOUS_CAPITAL	-	0	-	-	-0.443	-	-	0.005	-
SUPCAUSEHOUS_ECONOMICSIT	-	2	-	-	0.349	-	-	0.037	-
SUPPLYF_SMELONG	2	-	-	0.553	-	-	0.001	-	-
SUPPLYF_SMESHORT	2	-	-	0.468	-	-	0.004	-	-
USD	2	2	1	-0.633	-0.596	-0.553	0.000	0.000	0.000
WAGE	1	2	-	0.479	0.348	-	0.002	0.038	-
WIBOR3M	0	0	0	0.462	0.365	0.447	0.004	0.024	0.005
WIG	2	-	-	0.576	-	-	0.000	-	-
WWUK	1	1	-	0.566	0.435	-	0.000	0.006	-

Table 4

Results of optimization of likelihood function for corporate loans segment. Initial parameters, final parameters and value of log likelihood.

equation	variable	coefficient	z-statistics	Prob.
demand for corporate loans	C	-21281.81	-0.417894	0.6760
	DEMCAUSECOR_MERGERS(-1)	8736.259	4.641278	0.0000
	DEMCAUSECOR_TERMSCHNG(-2)	6251.653	3.357885	0.0008
	CPIQ(-1)	220.0528	0.435886	0.6629
	D(RCR)	55358.57	0.943508	0.3454
	D(WIG)	-0.494536	-4.720471	0.0000
	Z1	2071.670	2.861342	0.0042
	sigma	1762.319	5.095865	0.0000
supply of corporate loans	C	48487.32	6.009759	0.0000
	CAR	-3604.720	-4.666727	0.0000
	D(DRCORP)	584789.6	2.244399	0.0248
	FLIAB(-2)	-15930.40	-1.233510	0.2174
	INPLCORP	34085.32	0.814243	0.4155
	D(RCR)	-416004.7	-1.032788	0.3017
	STANDARDS_LCSHORT(-2)	11692.46	3.434518	0.0006
	SUPPLYF_SMELONG(-2)	217.4226	0.094338	0.9248
	MINIMIS	5565.652	3.639962	0.0003
	sigma	3417.71	4.663135	0.0000
min log likelihood				-789.0142
Akaike info criterion				36.68246
Schwarz criterion				37.41236
Hannan-Quinn criter.				36.95314

Table 5

Results of optimization of likelihood function for housing loans segment. Initial parameters, final parameters and value of log likelihood.

equation	variable	coefficient	z-statistics	Prob.
demand for housing loans	C	17874.23	4.800784	0.0000
	CHF(-2)	-2452.712	-1.291575	0.1965
	DEMANDF_HOUS	-2584.934	-1.793909	0.0728
	DEMCAUSEHOUS_STANDARDSCH	-2158.200	-0.816606	0.4142
	D(LIBORCHF3M)	-10953.22	-2.939347	0.0033
	D(RH)	-47490.82	-0.317556	0.7508
	WWUK(-1)	195.2982	2.151385	0.0314
	sigma	1894.496	5.355470	0.0000
supply of housing loans	C	23670.65	2.930178	0.0060
	CAR	-508.6283	-1.206371	0.2360
	D(DRHOUHLDS)	588226.7	0.836535	0.4087
	INPLHOUSHLDS	-150069.8	-1.913552	0.0641
	D(LIBORCHF3M)	-9761.165	-3.234188	0.0027
	D(RH)	-537689.9	-0.875950	0.3872
	SUPCAUSEHOUS_ECONOMICSIT(-2)	9611.780	2.538338	0.0159
	GOVP	2633.097	1.034987	0.3080
	LTV	-2802.511	-0.865009	0.3931
	Z2	3411.483	1.696637	0.0989
	sigma	1347.777	5.974410	0.0000
min log likelihood				-756.4043
Akaike info criterion				36.11183
Schwarz criterion				36.93099
Hannan-Quinn criter.				36.41391

Table 6

Results of optimization of likelihood function for consumer loans segment. Initial parameters, final parameters and value of log likelihood.

equation	variable	coefficient	z-statistics	Prob.
demand for consumer loans	C	1233.377	3.017181	0.0026
	DEMCAUSECONS_ECONOMICSIT(-1)	3348.003	3.231196	0.0012
	DEMCAUSECONS_TERMSCHNG(-2)	1009.439	1.389395	0.1647
	D(RC(-1))	-1531.403	-0.032531	0.9740
	D(CONS)	0.031155	0.741954	0.4581
	Z1	-2032.031	-1.941255	0.0522
	Z2	1007.659	1.598990	0.1098
	C	1233.377	3.017181	0.0026
	sigma	922.1606	4.361497	0.0000
supply of consumer loans	C	3961.788	0.881497	0.3780
	CAR	-244.0535	-1.126053	0.2601
	FLIAB(-2)	13763.18	0.696223	0.4863
	GAP(-2)	-5619.373	-0.967252	0.3334
	INPLHOUSHLDS	5648.826	0.374139	0.7083
	PROV(-2)	-251822.6	-2.212459	0.0269
	D(RC(-2))	-6962.054	-0.184980	0.8532
	SUPCAUSECONS_COLL	-4577.608	-2.513269	0.0120
	SUPCAUSECONS_DEMAND(-2)	3044.757	3.187189	0.0014
	RECT	210.8637	0.175602	0.8606
	Z1	-1643.450	-3.091594	0.0020
	Z3	1110.004	2.164574	0.0304
	sigma	742.8768	6.193842	0.0000
min log likelihood				-699.8304
Akaike info criterion				33.52700
Schwarz criterion				34.38712
Hannan-Quinn criter				33.84418

Table 7

Results of estimation of the equation of corporate loans growth

	Before the Crisis						After the Crisis					
	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]		Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
GLOANSCR(-4)	0.082	0.072	1.140	0.254	-0.059	0.223	0.041	0.216	0.190	0.848	-0.381	0.464
SUPPLYF_ SMESHORT(-1)	1.482	1.102	1.340	0.179	-0.679	3.642	5.330	2.634	2.020	0.043	0.167	10.494
SUPPLYF_ SMESHORT(-3).	-0.190	1.073	-0.180	0.860	-2.293	1.913	3.611	1.454	2.480	0.013	0.760	6.461
GRGDP(-2).	1.047	0.718	1.460	0.145	-0.359	2.454	-2.760	1.615	-1.710	0.088	-5.926	0.406
minimis	(omitted)						2.234	4.657	0.480	0.631	-6.893	11.361
dummies (mergers)												
_cons	-4.849	7.351	-0.660	0.509	-19.256	9.559	-13.169	8.325	-1.580	0.114	-29.486	3.148

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Table 8

Results of estimation of the equation of corporate loans growth. Survey data as regressors.

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
STANDARDS_LCSHORT	1.238	1.914	0.650	0.518	-2.512	4.989	14.825	5.701	2.600	0.009	3.651	25.998
STANDARDS_LCLONG	-0.298	1.756	-0.170	0.865	-3.739	3.143	7.489	4.743	1.580	0.114	-1.806	16.784
STANDARDS_SMESHORT	1.270	1.170	1.090	0.278	-1.023	3.563	-14.643	4.070	-3.600	0.000	-22.620	-6.665
STANDARDS_SMELONG	-0.723	0.975	-0.740	0.459	-2.634	1.189	-13.754	4.391	-3.130	0.002	-22.360	-5.148
DEMAND_LCSHORT	-1.165	1.330	-0.880	0.381	-3.772	1.442	-0.018	3.913	0.000	0.996	-7.688	7.652
DEMAND_LCLONG	2.011	1.402	1.430	0.151	-0.736	4.758	5.968	5.244	1.140	0.255	-4.309	16.246
DEMAND_SMESHORT	0.328	1.362	0.240	0.809	-2.342	2.998	-4.675	3.326	-1.410	0.160	-11.194	1.843
DEMAND_SMELONG	-1.639	1.553	-1.060	0.291	-4.684	1.406	-8.569	3.941	-2.170	0.030	-16.293	-0.844
SUPPLYF_LCSHORT(-1)	-1.422	2.158	-0.660	0.510	-5.651	2.807	-5.987	6.578	-0.910	0.363	-18.879	6.905
SUPPLYF_LCLONG(-1)	-1.276	1.738	-0.730	0.463	-4.682	2.130	-1.459	4.950	-0.290	0.768	-11.161	8.244
SUPPLYF_SMELONG(-1)	0.459	1.861	0.250	0.805	-3.189	4.107	3.723	5.274	0.710	0.480	-6.613	14.060
SUPPLYF_SMESHORT(-1)	1.659	1.732	0.960	0.338	-1.736	5.055	8.075	5.281	1.530	0.126	-2.275	18.426
DEMANDF_LCSHORT	1.490	1.469	1.010	0.310	-1.389	4.370	-4.172	7.159	-0.580	0.560	-18.203	9.860
DEMANDF_LCLONG	-1.325	1.609	-0.820	0.410	-4.479	1.829	-5.066	6.343	-0.800	0.424	-17.498	7.365
DEMANDF_SMESHORT	-1.479	1.470	-1.010	0.314	-4.361	1.403	4.188	6.261	0.670	0.504	-8.083	16.459
DEMANDF_SMELONG	-0.792	1.257	-0.630	0.529	-3.256	1.672	6.171	7.337	0.840	0.400	-8.209	20.550
dummies												
_cons	10.825	6.655	1.630	0.104	-2.218	23.868	22.392	9.864	2.270	0.023	3.059	41.726

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Table 9

Results of estimation of the equation of housing loans growth

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interv.]		Coef.	Std.	z	P>z	[95% Conf. Interv.]	
GLOANSH(-1)	0.287	0.200	1.430	0.152	-0.106	0.679	0.258	0.166	1.550	0.120	-0.067	0.583
SUPPLYF_HOUS(-2)	2.914	4.643	0.630	0.530	-6.186	12.015	-1.464	1.030	-1.420	0.155	-3.483	0.556
RH(-1)	-936.294	459.497	-2.040	0.042	-1836.890	-35.697	181.297	120.588	1.500	0.133	-55.051	417.644
dummies (mergers)												
_cons	70.820	41.954	1.690	0.091	-11.409	153.049	-1.647	9.198	-0.180	0.858	-19.676	16.381

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Table 10

Results of estimation of the equation of housing loans growth. Survey data as regressors.

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
SUPPLY_HOUS	-0.039	2.035	-0.020	0.985	-4.028	3.950	-0.612	1.390	-0.440	0.660	-3.336	2.113
DEMAND_HOUS	2.270	1.054	2.150	0.031	0.204	4.335	2.154	1.037	2.080	0.038	0.121	4.186
SUPPLYF_HOUS(-1)	-0.118	2.055	-0.060	0.954	-4.146	3.909	2.003	1.129	1.770	0.076	-0.211	4.216
DEMANDF_HOUS	2.564	1.811	1.420	0.157	-0.985	6.113	-2.058	1.163	-1.770	0.077	-4.338	0.222
dummies (mergers)												
_cons	-6.019	11.751	-0.510	0.608	-29.050	17.012	2.842	5.940	0.480	0.632	-8.801	14.485

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Table 11

Results of estimation of the equation of consumer loans growth

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf.Interval]		Coef.	Std.	z	P>z	[95% Conf.Interval]	
SUPPLY_CONS(-5)	4.243	1.886	2.250	0.025	0.545	7.940	3.993	2.000	2.000	0.046	0.073	7.913
DCSI	-0.746	0.331	-2.250	0.024	-1.395	-0.096	0.664	0.831	0.800	0.424	-0.964	2.292
rect	(omitted)						-23.764	17.590	-1.350	0.177	-58.240	10.711
dummies (mergers)												
_cons	-20.107	8.898	-2.260	0.024	-37.547	-2.667	16.815	14.384	1.170	0.242	-11.376	45.007

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Table 12

Results of estimation of the equation of consumer loans growth. Survey data as regressors.

	before the Crisis						after the Crisis					
	Coef.	Std.	z	P>z	[95% Conf.Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
SUPPLY_CONS	-0.885	0.746	-1.190	0.235	-2.347	0.577	0.426	1.949	0.220	0.827	-3.395	4.247
DEMAND_CONS	2.191	0.652	3.360	0.001	0.914	3.468	0.586	2.371	0.250	0.805	-4.061	5.234
SUPPLYF_CONS(-1)	1.909	0.920	2.070	0.038	0.105	3.714	0.501	1.545	0.320	0.746	-2.527	3.529
DEMANDF_CONS(-1)	3.825	1.222	3.130	0.002	1.431	6.219	-0.203	1.592	-0.130	0.899	-3.323	2.917
dummies (mergers)												
_cons	-23.975	7.466	-3.210	0.001	-38.608	-9.342	-0.830	11.880	-0.070	0.944	-24.115	22.454

The Prais-Winsten estimator. The Huber/White/sandwich estimator of the covariance matrix of parameter estimates was used.

Figure 1

Banks' lending policy (credit standards) – corporate loans. Aggregated data from SLOS (net percent).

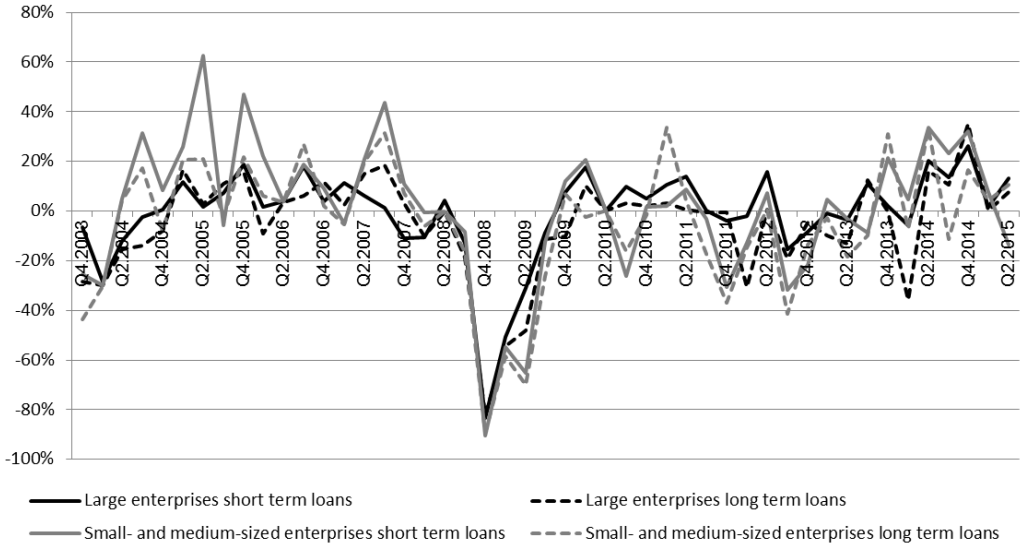


Figure 2

Banks' lending policy (credit standards) – loans for households. Aggregated data from SLOS (net percent).

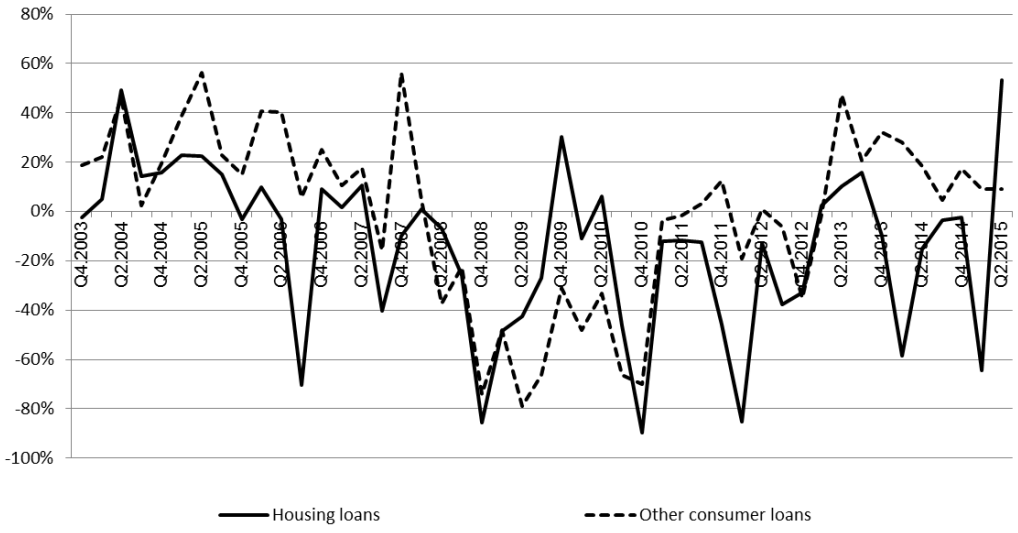


Figure 3

Banks' declared demand for corporate loans. Aggregated data from SLOS (net percent).

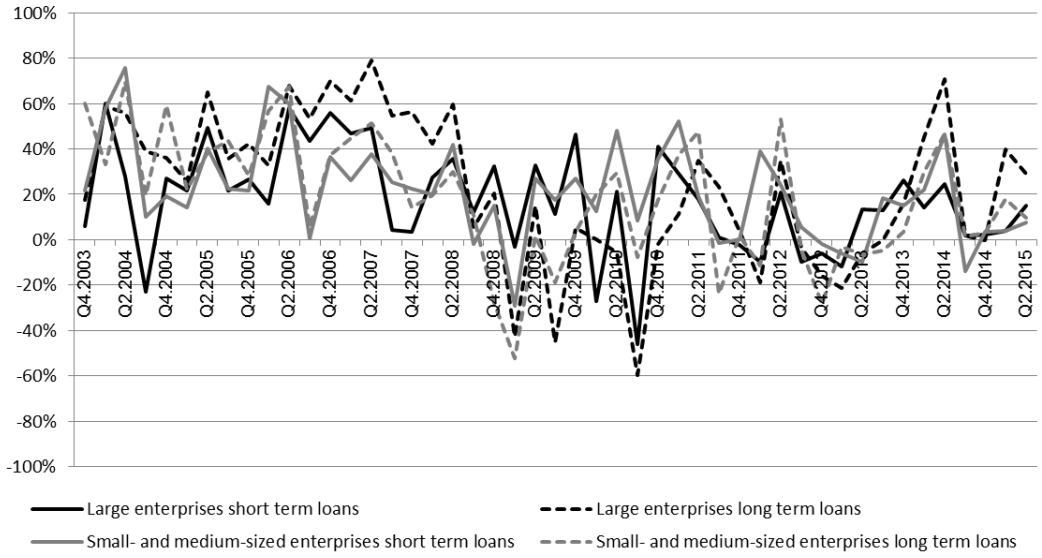


Figure 4

Banks' declared demand for loans for households. Aggregated data from SLOS (net percent).

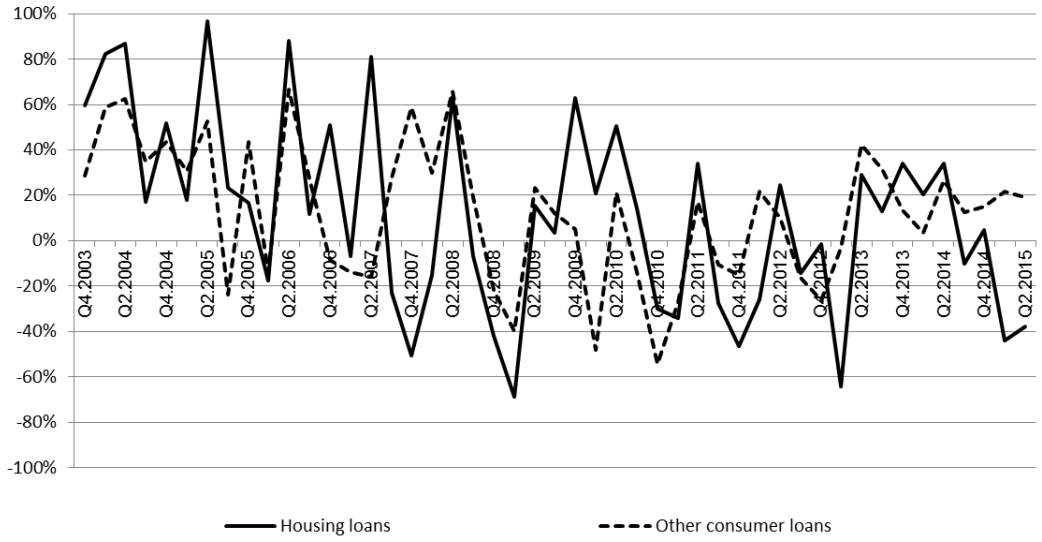


Figure 5

Estimated demand and supply of corporate loans versus historical corporate lending. Quarterly changes in zloty bln (left panel), yearly changes in zloty bln (right panel).

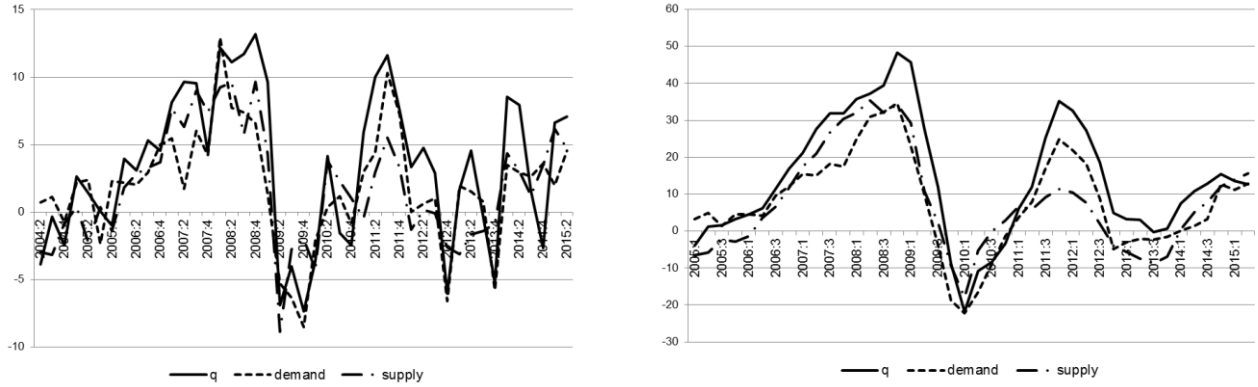


Figure 6

Estimated demand and supply of housing loans versus historical housing loans. Quarterly changes in zloty bln (left panel), yearly changes in zloty bln (right panel).

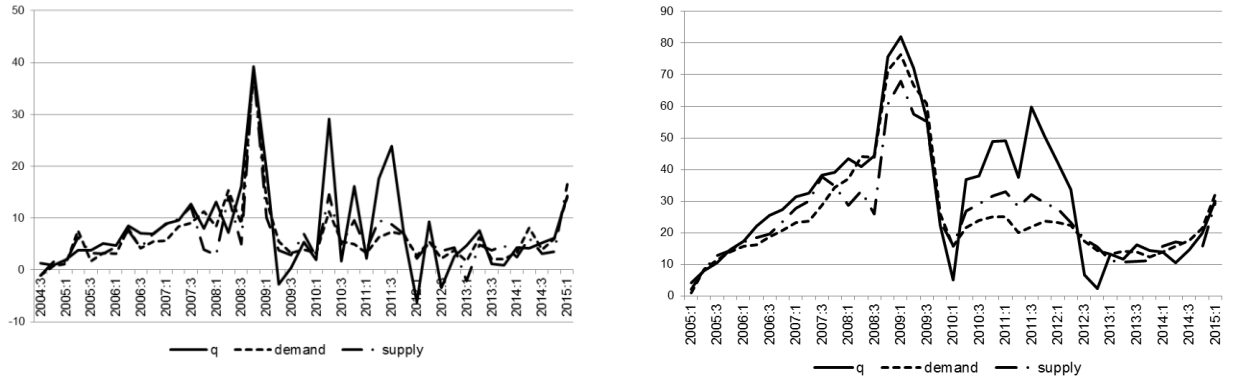


Figure 7

Estimated demand and supply of consumer loans versus historical consumer loans. Quarterly changes in zloty bln (left panel), yearly changes in zloty bln (right panel).

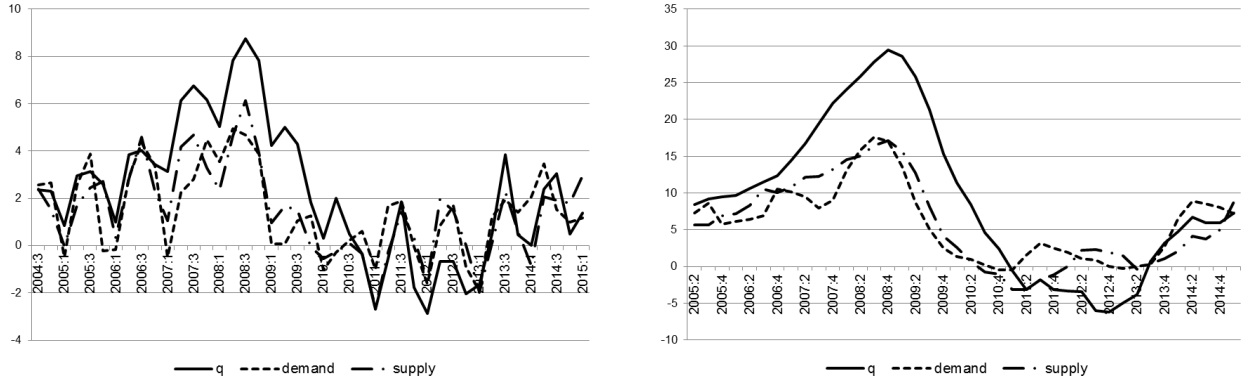


Figure 6

Estimated probability of demand and supply regimes – corporate loans.

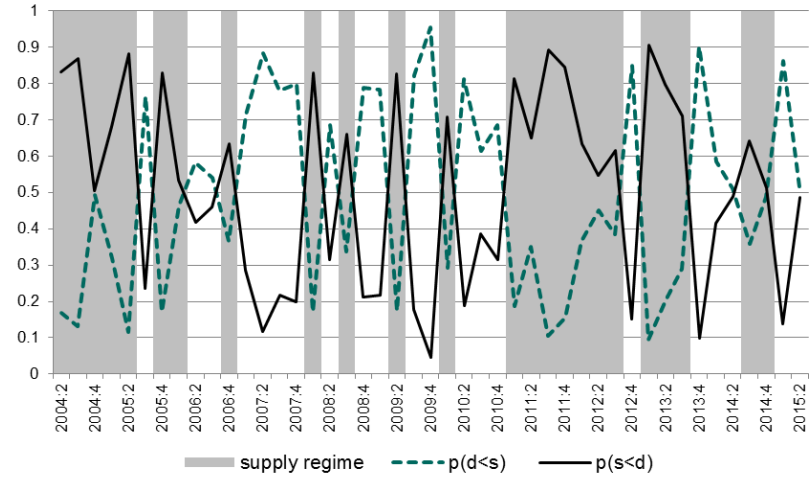


Figure 7

Estimated probability of demand and supply regimes – housing loans.

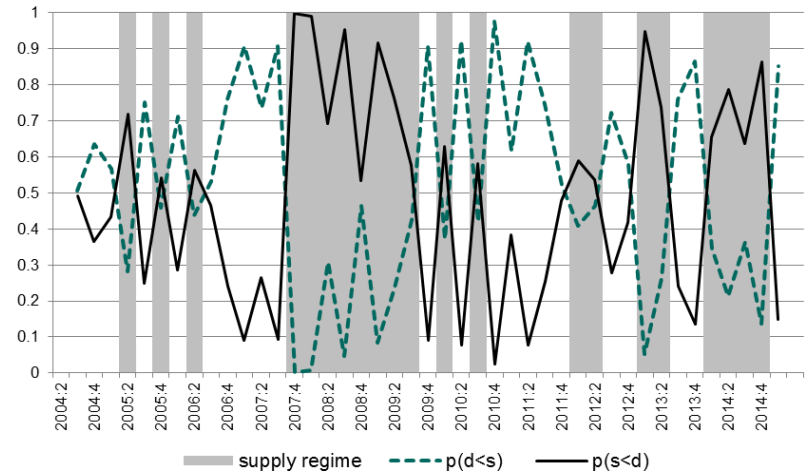
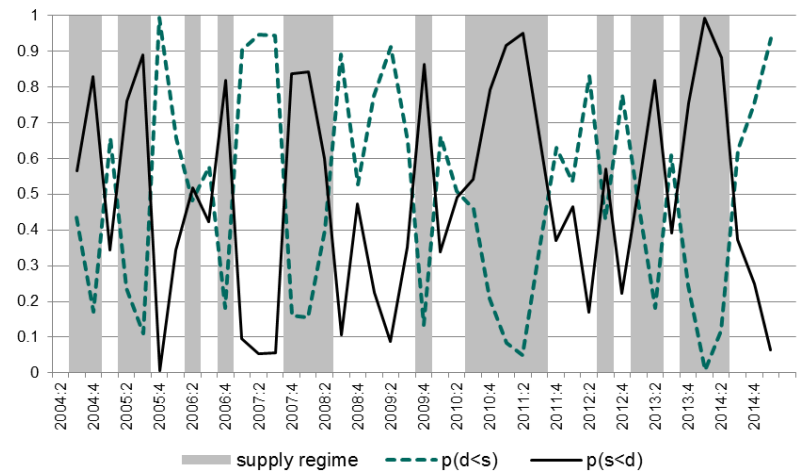


Figure 8

Estimated probability of demand and supply regimes – consumer loans.



Irving Fisher Committee on
Central Bank Statistics

BANK FOR INTERNATIONAL SETTLEMENTS

IFC workshop on *"Combining micro and macro statistical data for financial stability analysis. Experiences, opportunities and challenges"*

Warsaw, Poland, 14-15 December 2015

Determinants of credit in the Polish banking sector before and after the GFC according to information from the NBP Senior Loan Officer Survey. Does supply or demand matter?[1]

Zuzanna Wośko,
Narodowy Bank Polski (Poland)

[1] This presentation was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS or the central banks and other institutions represented at the meeting.

NBP Narodowy Bank Polski

Zuzanna Wośko / Financial Stability Department

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Table of contents

1.

Introduction

- Before the crisis – strong lending growth in Poland (housing loans, consequence of rising demand and increasing availability of credit at low cost and limited supply on the residential property market which elevated prices).
- Strong easing of standards and terms of granting loans by banks and the related low loan spreads in the pre-crisis period (strong competition among banks, leading some institutions to focus on raising a market share at the expense of diligent credit risk assessment)
- Following the world financial crisis - curbed supply of loans by considerably tightening the standards and terms of granting them. Demand, particularly from enterprises, also fell.
- After a period of tightened policy, from 2011 - the start of a gradual process of easing the standards and terms of granting loans by banks.

Aim of the research

This research investigates the problem of most important determinants of bank lending in Poland before and after the crisis.

The key issue is the role of demand and supply factors in this process:

- Demand or the supply was the main driver of lending growth?
- Or, maybe, both factors influenced the credit in the same way?

Disclaimer:
The views expressed herein are those of the author and not necessarily those of the Narodowy Bank Polski

2.

Literature

The summary of the literature

data	method	authors	specifics of the analysis	country
aggregated	Disequilibrium econometrics (demand and supply equation and historical credit dynamics as minimum of demand and supply)	Laffont & Garcia (1977)	credit crunch analysis	Canada
		Sealey (1979)	credit crunch analysis	USA
		Ito & Ueda (1981)	credit crunch analysis	Japan, USA
		Stenius (1983)	Bond market	Finland
		Artus (1984)	2 approaches– standard + approach which aggregates submarkets with exogenous information about market disequilibrium	France
		Martin (1990)	+ spillovers (the effect of one market of rationing encountered on other markets)	UK
		Pazarbasioglu (1997)	credit crunch analysis after the crisis in 1991-92	Finland
		Ghosh and Ghosh (1999)	credit crunch analysis	Korea, Indonesia, Thailand
		Hurlin & Kierzenkowski (2002)	MTM analysis	Poland
		Burdeau (2014)	Among regressors survey data from SLOS (net percent)	France
	VECM, cointegrating vectors	Kakes (2000)	Analysis of banking monetary transmission channel. 2 cointegrating relations – demand and supply.	Holland
		Calza (2006)	MTM analysis. One cointegrating vector (demand)	Euro zone
		Mello, Pisu (2009)	MTM analysis. 2 cointegrating vectors	Brazil
		Łyziak et al. (2014)	MTM analysis, 2 cointegrating vectors (demand and supply)	Poland
	DFM (Dynamic Factor Model)	Balke, Zeng (2013)	Demand and supply as one of common factors (nonobservable) in the model with 65 macro and financial variables of qurterly and monthly frequency.	USA

The summary of the literature (cont.)

data	method	authors	specifics of the analysis	country
panel	Panel model – significance of regressors analysis	Del Giovane, Eramo, Nobili (2010)	Answers from survey as regressors, how demand and supply factors are important for the loan variability.	Euro zone (Eurosystem Bank Lending Survey)
	Markov switching panel model	Asea, Blomberg (1997)	2 regimes of lending estimated – of high and low risk for the model of credit margin in particular bank depends on real financing cost of particular bank, share of risky loans, macrovariables.	USA (from Fed Survey of terms of bank lending, quarterly, 1977-1993)
	Logit model - 2 equations: firms' decisions to request FX loans, banks' decision to grant FX loans	Brown, Kirschenmann, Ongena (2010)	Result: FX lending more supply than demand driven	Bulgaria, data from 1 commercial bank , firm level data (SME)

3.

Methodology

Econometric methodology

2 approaches:

- time series regression on aggregated data with the use of disequilibrium econometric approach (regime-switching model)
- panel regression on disaggregated (bank level) data.

Disequilibrium econometrics (regime-switching regressions)

System of separate demand and supply equations together with optimization function (observable volume of credit as minimum of demand and supply):

$$Y_t^s = \mathrm{X}_t'\alpha + \xi_{st}$$
$$Y_t^d = \mathrm{Z}_t'\beta + \xi_{dt}$$
$$\mathrm{Q}_t = \mathrm{Min}(Y_t^s, Y_t^d)$$

Q - observable value of loans (dynamics of the stock of loans),

Y - nonobservable values of supply (s) and demand (d),

X - matrix of supply regressors (determinants)

Z - matrix of demand regressors (determinants).

It is also assumed, that vector $\xi_t = (\xi_{st}, \xi_{dt})'$ is i.i.d. , $\mathrm{N}(0, \Omega)$ where:

$$\Omega = \mathrm{E}(\xi_{st}\xi_{dt}') = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{pmatrix}$$

In the process of estimation using Maximum Likelihood method (ML), the vector of structural parameters is estimated: $\theta = (\alpha\ \beta\ \sigma_1\ \sigma_2\ \sigma_{12})'$.

Starting parameters - from one step OLS estimations of separate equations of demand and supply, substituting demand and supply values by historical values of loan dynamics

Unbalanced panel model

Let us assume the model:

$$y_{it} = \mathbf{x}_{it}{}' \boldsymbol{\beta} + \alpha_i + \varepsilon_{it}$$

where t=1,2,...,T and i=1,2,...,N, $[\mathbf{x}_{it}]_{1xK}$, $[\beta]_{Kx1}$, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$.

The problem of incompleteness was solved using a Tx1 vector of selection indicators:

- $s_i = (s_{i1}, \dots, s_{iT})'$, where $s_{it} = 1$ if (x_{it}, y_{it}) is observed and zero otherwise. Such indicators are included into the parameters' estimator.

Equations of lending growth were estimated with the use of the OLS while allowing the standard errors (and variance–covariance matrix of the estimates) to be consistent when the disturbances from each observation are not independent, and specifically, allowing the standard errors to be robust to each bank having a different variance of the disturbances and to each bank's observations being correlated with those of the other banks through time.

Some equations are dynamic. Dynamic panel regression with AR(m) can be presented as:

$$y_{it} = \delta y_{i,t-m} + x_{it}{}' \beta + \alpha_i + \varepsilon_{it}$$

where δ is a scalar.

5.

Data

Aggregated:

- survey (net percent)
- banking sector data
- macro data

Disaggregated (bank-level):

- survey (answers coded from 1 to 5)
- banking sector data
- macro data

Aggregated survey data

Figure 1
Banks' lending policy (credit standards) – corporate loans. Aggregated data from SLOS (net percent).

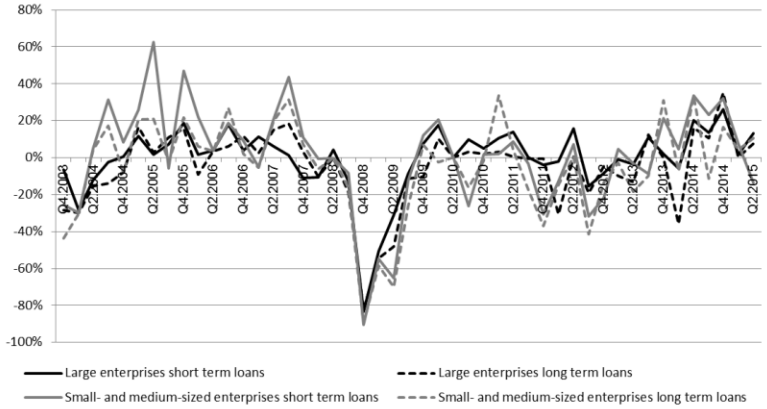
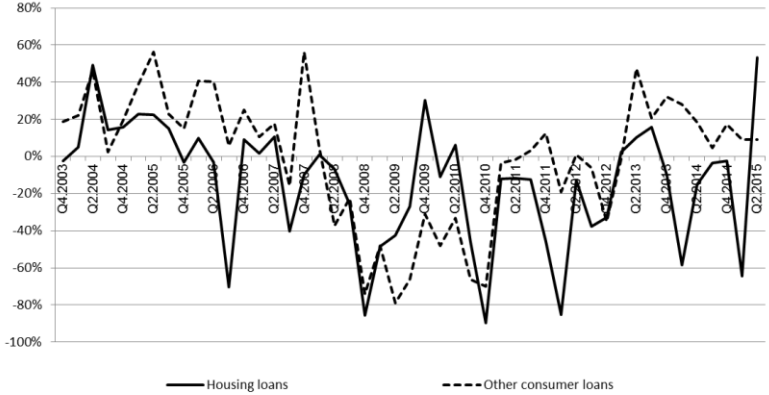


Figure 2
Banks' lending policy (credit standards) – loans for households. Aggregated data from SLOS (net percent).



Disaggregated survey data

Sample question from the survey:

*Over the last three months, how have your bank's **credit standards** for approving applications for loans or credit lines to large enterprises and SME changed? If your bank's policies have not changed over the last three months, please report them as unchanged even if they are restrictive or accommodative relative to longer-term norms. If a type of loan is not offered by your bank, please use the answer "not applicable".*

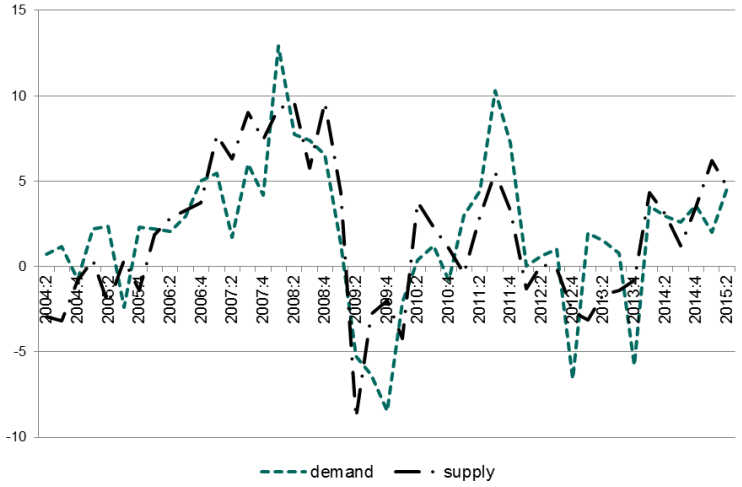
Corporate credit standards	Large enterprises		Small & medium-sized enterprises	
	Short-term loans	Long-term loans	Short-term loans	Long-term loans
Tightened considerably				
Tightened somewhat				
Remained basically unchanged				
Eased somewhat				
Eased considerably				

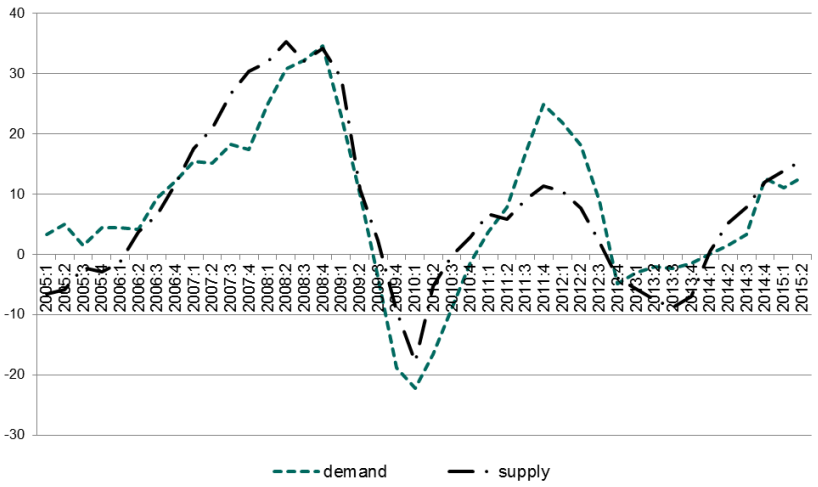
6.

Results

Regime-switching model - results

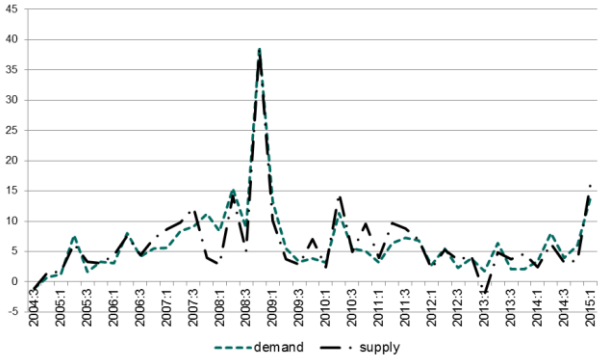
Estimated demand and supply of corporate loans
Quarterly changes in zloty bln (left panel), yearly changes in zloty bln (right panel).

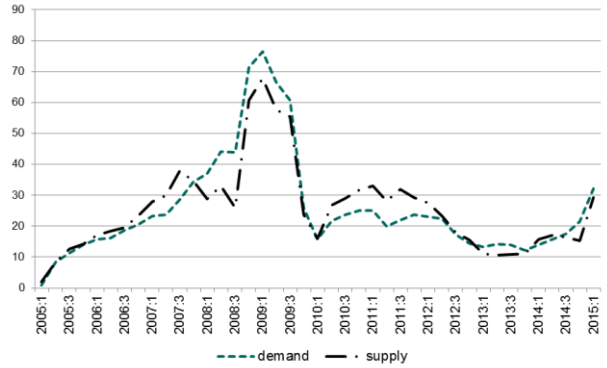




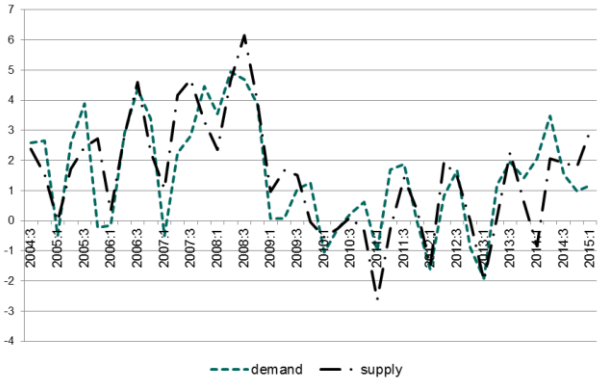
Estimated demand and supply of loans to housholds

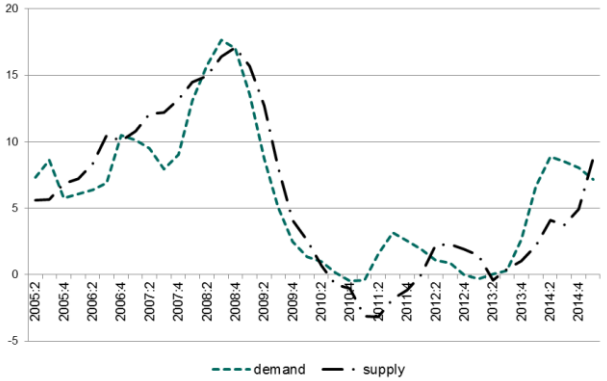
Quarterly changes in zloty bln (left panel), yearly changes in zloty bln (right panel).





housing loans

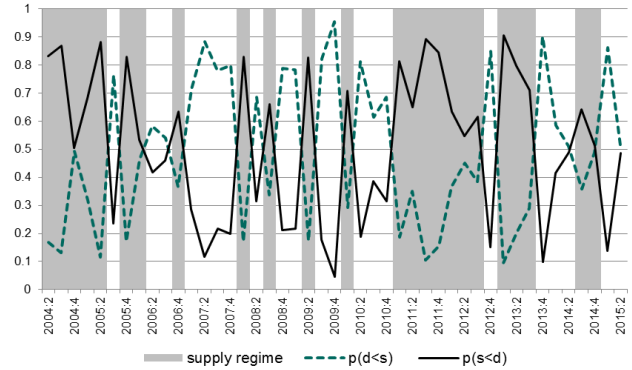




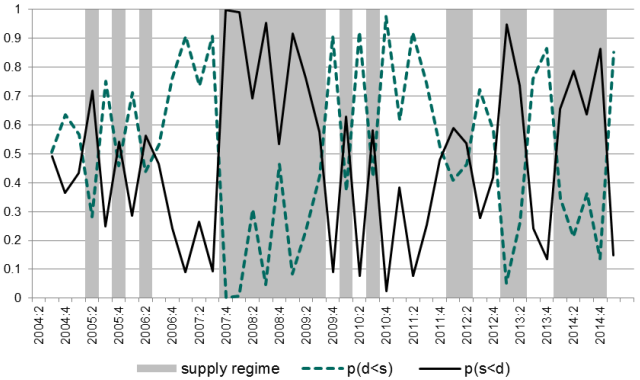
consumer loans

Regime-switching model - results

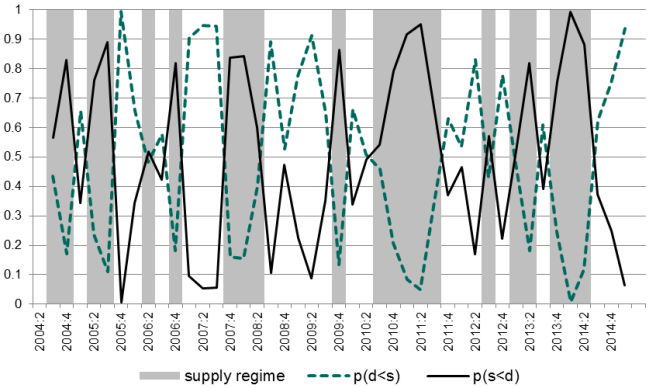
Estimated probability of demand and supply regimes – corporate loans.



Estimated probability of demand and supply regimes – housing loans.



Estimated probability of demand and supply regimes – consumer loans.



Panel regressions - results

Results of estimation of the equation of **corporate** loans growth

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
STANDARDS_LCSHORT	1.238	1.914	0.650	0.518	-2.512	4.989	14.825	5.701	2.600	0.009	3.651	25.998
STANDARDS_LCLONG	-0.298	1.756	-0.170	0.865	-3.739	3.143	7.489	4.743	1.580	0.114	-1.806	16.784
STANDARDS_SMESHORT	1.270	1.170	1.090	0.278	-1.023	3.563	-14.643	4.070	-3.600	0.000	-22.620	-6.665
STANDARDS_SMELONG	-0.723	0.975	-0.740	0.459	-2.634	1.189	-13.754	4.391	-3.130	0.002	-22.360	-5.148
DEMAND_LCSHORT	-1.165	1.330	-0.880	0.381	-3.772	1.442	-0.018	3.913	0.000	0.996	-7.688	7.652
DEMAND_LCLONG	2.011	1.402	1.430	0.151	-0.736	4.758	5.968	5.244	1.140	0.255	-4.309	16.246
DEMAND_SMESHORT	0.328	1.362	0.240	0.809	-2.342	2.998	-4.675	3.326	-1.410	0.160	-11.194	1.843
DEMAND_SMELONG	-1.639	1.553	-1.060	0.291	-4.684	1.406	-8.569	3.941	-2.170	0.030	-16.293	-0.844
SUPPLYF_LCSHORT(-1)	-1.422	2.158	-0.660	0.510	-5.651	2.807	-5.987	6.578	-0.910	0.363	-18.879	6.905
SUPPLYF_LCLONG(-1)	-1.276	1.738	-0.730	0.463	-4.682	2.130	-1.459	4.950	-0.290	0.768	-11.161	8.244
SUPPLYF_SMELONG(-1)	0.459	1.861	0.250	0.805	-3.189	4.107	3.723	5.274	0.710	0.480	-6.613	14.060
SUPPLYF_SMESHORT(-1)	1.659	1.732	0.960	0.338	-1.736	5.055	8.075	5.281	1.530	0.126	-2.275	18.426
DEMANDF_LCSHORT	1.490	1.469	1.010	0.310	-1.389	4.370	-4.172	7.159	-0.580	0.560	-18.203	9.860
DEMANDF_LCLONG	-1.325	1.609	-0.820	0.410	-4.479	1.829	-5.066	6.343	-0.800	0.424	-17.498	7.365
DEMANDF_SMESHORT	-1.479	1.470	-1.010	0.314	-4.361	1.403	4.188	6.261	0.670	0.504	-8.083	16.459
DEMANDF_SMELONG	-0.792	1.257	-0.630	0.529	-3.256	1.672	6.171	7.337	0.840	0.400	-8.209	20.550
dummies												
cons	10.825	6.655	1.630	0.104	-2.218	23.868	22.392	9.864	2.270	0.023	3.059	41.726

Only survey data as regressors

	Before the Crisis						After the Crisis					
	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]		Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
GLOANSCR(-4)	0.082	0.072	1.140	0.254	-0.059	0.223	0.041	0.216	0.190	0.848	-0.381	0.464
SUPPLYF_ SMESHORT(-1)	1.482	1.102	1.340	0.179	-0.679	3.642	5.330	2.634	2.020	0.043	0.167	10.494
SUPPLYF_ SMESHORT(-3)	-0.190	1.073	-0.180	0.860	-2.293	1.913	3.611	1.454	2.480	0.013	0.760	6.461
GRGDP(-2)	1.047	0.718	1.460	0.145	-0.359	2.454	-2.760	1.615	-1.710	0.088	-5.926	0.406
minimis	(omitted)						2.234	4.657	0.480	0.631	-6.893	11.361
dummies (mergers)												
_cons	-4.849	7.351	-0.660	0.509	-19.256	9.559	-13.169	8.325	-1.580	0.114	-29.486	3.148

Selected equation from equations with survey, banking and macro data as regressors

Panel regressions - results

Results of estimation of the equation of **housing** loans growth

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
SUPPLY_HOUS	-0.039	2.035	-0.020	0.985	-4.028	3.950	-0.612	1.390	-0.440	0.660	-3.336	2.113
DEMAND_HOUS	2.270	1.054	2.150	0.031	0.204	4.335	2.154	1.037	2.080	0.038	0.121	4.186
SUPPLYF_HOUS(-1)	-0.118	2.055	-0.060	0.954	-4.146	3.909	2.003	1.129	1.770	0.076	-0.211	4.216
DEMANDF_HOUS	2.564	1.811	1.420	0.157	-0.985	6.113	-2.058	1.163	-1.770	0.077	-4.338	0.222
dummies (mergers)												
_cons	-6.019	11.751	-0.510	0.608	-29.050	17.012	2.842	5.940	0.480	0.632	-8.801	14.485

Only survey data as regressors

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf. Interv.]		Coef.	Std.	z	P>z	[95% Conf. Interv.]	
GLOANSH (-1)	0.287	0.200	1.430	0.152	-0.106	0.679	0.258	0.166	1.550	0.120	-0.067	0.583
SUPPLYF_HOUS(-2)	2.914	4.643	0.630	0.530	-6.186	12.015	-1.464	1.030	-1.420	0.155	-3.483	0.556
RH(-1)	-936.294	459.497	-2.040	0.042	-1836.890	-35.697	181.297	120.588	1.500	0.133	-55.051	417.644
dummies (mergers)												
_cons	70.820	41.954	1.690	0.091	-11.409	153.049	-1.647	9.198	-0.180	0.858	-19.676	16.381

Selected equation from equations with survey, banking and macro data as regressors

Panel regressions - results

Results of estimation of the equation of **consumer** loans growth

	before the Crisis						after the Crisis					
	Coef.	Std.	z	P>z	[95% Conf.Interval]		Coef.	Std.	z	P>z	[95% Conf. Interval]	
SUPPLY_CONS	-0.885	0.746	-1.190	0.235	-2.347	0.577	0.426	1.949	0.220	0.827	-3.395	4.247
DEMAND_CONS	2.191	0.652	3.360	0.001	0.914	3.468	0.586	2.371	0.250	0.805	-4.061	5.234
SUPPLYF_CONS(-1)	1.909	0.920	2.070	0.038	0.105	3.714	0.501	1.545	0.320	0.746	-2.527	3.529
DEMANDF_CONS(-1)	3.825	1.222	3.130	0.002	1.431	6.219	-0.203	1.592	-0.130	0.899	-3.323	2.917
dummies (mergers)												
_cons	-23.975	7.466	-3.210	0.001	-38.608	-9.342	-0.830	11.880	-0.070	0.944	-24.115	22.454

Only survey data as regressors

	Before the Crisis						After the Crisis					
	Coef.	Std.	z	P>z	[95% Conf.Interval]		Coef.	Std.	z	P>z	[95% Conf.Interval]	
SUPPLY_CONS(-5)	4.243	1.886	2.250	0.025	0.545	7.940	3.993	2.000	2.000	0.046	0.073	7.913
DCSI	-0.746	0.331	-2.250	0.024	-1.395	-0.096	0.664	0.831	0.800	0.424	-0.964	2.292
rect	(omitted)						-23.764	17.590	-1.350	0.177	-58.240	10.711
dummies (mergers)												
_cons	-20.107	8.898	-2.260	0.024	-37.547	-2.667	16.815	14.384	1.170	0.242	-11.376	45.007

Selected equation from equations with survey, banking and macro data as regressors

Panel regressions - results

- **corporate loans**

Estimations of both specifications in two subsamples suggest the strong rise of significance of supply factors of credit in the period after the Crisis.

- **housing loans**

In case of segment of housing loans, the conclusions are quite similar to corporate, however the rise in significance of supply factors is smaller. But in fact, in the period after the Crisis, answers on the questions concerning supply had higher values of the test of significance

- **consumer loans**

Estimation of growth of consumer loans in two subsamples of both equations has shown decrease of information value of both demand and supply factors in the second subsample (significance of demand and supply factors decreased after the Crisis).

7.

Conclusions

The results received on the bank-level data:

- increasing significance of supply factors after the Crisis in case of corporate and housing loans.

Results on aggregated data with the use of regime-switching model

- higher importance of supply side in determining the credit growth in case of corporate loans and consumer loan segment after the Crisis.

We protect the value of money