

NBP Working Paper No. 317

How to measure lending policy stance of commercial banks?

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I have received helpful comments and suggestions from Ryszard Kokoszczyński, Tomasz Łyziak, participants of the 23rd ICMAIF Conference (Rethymno), and an anonymous referee. Any remaining errors are mine own. The views expressed in the paper do not necessarily represent the views of the Narodowy Bank Polski.

Published by:
Narodowy Bank Polski
Education & Publishing Department
ul. Świętokrzyska 11/21
00-919 Warszawa, Poland
www.nbp.pl

ISSN 2084-624X

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Abstract

Basing on the notion that “true” changes in credit standards set by commercial banks are these which do *not* result from a variation in the Net Present Value (NPV) of a loan, we suggest a method to verify whether the currently observed lending standards are too tight (soft). In this aim we use (S)VAR models which employ macroeconomic data and information contained in the Senior Loan Officer Opinion Survey. We argue that forecasts of credit standards obtained from these models may be identified with the level of standards congruent with the NPV. If actual credit standards systematically differ from forecasts, they provide a signal of a potential development of a credit cycle.

Key words: lending standards, Net Present Value, (S)VAR models

JEL: E5, G21

1 Introduction

Since the global financial crisis (GFC henceforth) 2008-09, when according to bank lending surveys, banks tightened credit standards, terms and conditions to unprecedented levels, economists are conscious that shocks to credit provision as well as the extended periods of too abundant or too scarce credit supply (credit cycles) may exacerbate output fluctuations. Thus, the issue of credit availability and analyses of banks' lending policy stance are of concern of central banks, especially in countries such as Poland, where capital markets are weak and banking sector provides a dominant part of external funding to the corporates. Analyses of banks' lending stance are also central for verification of the risk-taking by banks. Bearing in mind that since the GFC many economies have been operating under low interest rates¹, and that *too low for too long* may induce banks to take on more risk, it seems of importance to assess how banks perceive and price risk.

This paper suggests a simple method which can be used to analyse the actual stance of banks' lending policy on the aggregate level and spot a build-up of credit cycles. Usually, to assess the stance of banks' lending policy central banks refer directly to raw data from Senior Loan Officer Opinion Surveys (SLOOS) or Bank Lending Surveys (BLS). For example, Monetary Policy Account of the ECB as of May 2019 states: *"According to the bank lending survey results for the first quarter of 2019, both credit standards for loans to enterprises and demand for loans to enterprises had remained broadly unchanged. Overall, bank lending conditions remained favourable and continued to support credit provision"* (<https://www.ecb.europa.eu/press/accounts/2019/html/ecb.mg190523~3e19e27fb7.en.html>).

Indeed, at first glance, for this purpose, raw data might be used, since lending standards are internal guidelines related to approving loan application, such as minimal income per person in a household after adjustment for loan repayment costs or minimal expected rate of return on a business project. Besides, in the surveys, banks declare whether they have changed lending policy comparing to the previous period (usually a quarter). The surveys ask about banks' policy with respect to large (LEs) and medium-sized enterprises (SMEs) and about various types of loans, i.e. for corporates and households, on long-and short-term. Basing on these declarations and considering each bank's share in the total market, central banks which usually conduct the survey, calculate a net weighted per cent of banks which have changed

¹ Polish economy, somewhat less affected by the financial crisis, has begun operating under low interest rates since 2015, much later than EU countries.

lending standards. Narodowy Bank Polski, which data are used in the paper, has been conducting such a survey since the late 2003.

Alternatively, to analyse banking sector loans and to spot credit cycles, a statistical approach is applied. It is based on the magnitude of deviation of currently observed credit-to-GDP ratio from its long-term trend (i.e. credit-to-GDP gap²). The method, recommended by the Basel Committee for Banking Supervision (BCBS, 2010), serves macroprudential policy to decide on setting a countercyclical buffer.

In this paper, we suggest a method which has more structure than credit-to-GDP gap and which points directly at loan supply. We exploit information from the SLOOS and build a suite of structural vector autoregression models to approximate lending standards congruent with the Net Present Value of loans. We argue that using raw data on lending standards to analyse the stance of banks' lending policy can be misleading, since credit officers may not properly assess if a change in standards matches the change of the Net Present Value of credits. Naturally, the process of assessment of banks' credit policy stance by the monetary authorities contains more information than just this from lending surveys.

We depart from the assumption that a "true" change in bank credit standards should be considered solely as an alteration in bank's loan-granting decisions other than a change in the NPV of a loan, as suggested in Berlin (2009). Though, one may suspect that at least in some periods or circumstances, banks' decisions on changes in lending policy do not match relevant shifts in the NPV of projects which are financed with credit. They can be either smaller or larger than a change in the NPV, depending on changes in banks' appetite for risk. In other words, it is possible that not all variations in standards declared by banks should be identified with "true" changes. Those which can be dubbed as "true" are related to shifts in the banks' appetite for risk. Banks which change the appetite for risk, set too loose or too tight standards as compared with the assessment of the Net Present Value. If so, they extend loans to projects which in fact do not satisfy creditworthiness conditions or may reject credit applications which comply with the appropriate level of creditworthiness of the borrower.

There exists a plethora of reasons for which banks may want to adjust lending standards: changes in macroeconomic or microeconomic conditions, changes in monetary policy, pressures from competitors, changes in the supervisory or macroprudential policies or changes in the financial standing of banks. Some of them can be interrelated, as for example,

² The trend is obtained from the Hodrick-Prescott filter.

changes in monetary policy and in economic and financial conditions. Furthermore, some of them have an impact on the Net Present Value of investment projects. Indeed, changes in the expected NPV of the investment project can result from variations in the economic conditions and monetary policy. Besides, they can simply reflect the arrival of information allowing a better assessment of investment prospects.

To illustrate the problem of interrelations and of the proper identification of “true” changes in standards, Berlin (2009) evokes an example of a downturn when default risk increases. Because firms’ defaults are correlated, banks will increase spreads or tighten non-price lending conditions to compensate for the higher probability that many loans will go bad at the same time. This does not necessarily mean that banks have tightened their lending policy, but rather that they have adjusted lending standards to reflect a negative shift in the NPV. Likewise, a tightening of the monetary policy leads to a general fall in the Net Present Value of investment projects. A following hardening of lending policy by banks, if it is in line with the shift in the NPV, does not mean that banks have tightened their policy. But if a change in lending standards exceeds the shift in the NPV, it means that, for some reason, banks reduce their appetite for risk and that in fact their lending standards become more stringent. To sum up, solely if banks tighten lending policies more (less) than it results from the increased (lower) risk, that change can be considered as a tightening (softening) of credit standards. However, at the aggregate level, the NPV is not observable.

Thus, a proper identification of the “true” changes in credit standards is non-trivial. Firstly, it is necessary to determine factors which in fact drive credit standards, or, in other words, to verify if banks say the truth in lending surveys, when they report on reasons underlying their decisions on standards. Secondly, standards corresponding to the unobserved Net Present Value need to be estimated. To solve both problems we use (S)VAR models. Not only do they allow identification of exogenous shocks, which transform the reduced form models into structural ones, but they make it possible to obtain a dynamic forecast. Thus, within this framework we check reactions of lending standards to exogenous shocks to factors indicated by banks as those which impact their lending decisions. If a shock to a potential driver of credit standards does not affect them in a statistically significant way, such factor is discarded from further analysis. Then, we forecast lending standards using these factors which besides driving them, may also impact the Net Present Value of loans. Such a model-based forecast is interpreted as a value of lending standards which conforms to the unobservable NPV of loans. Put it another way, we conclude about banks’ lending policy stance basing on a

comparison of actual and forecasted standards. A *prolonged* period of too lax (i.e. if actual values are persistently lower than forecasted) or too stringent standards (i.e. if actual values are persistently higher than forecasted) is considered as an indication of a developing credit cycle.

This paper follows and develops the works of Maddaloni et al. (2008), Maddaloni and Peydró (2010) and De Bondt et al. (2010), who use either (S)VAR or single equation models to examine *inter alia* how monetary policy affects banks' appetite for risk. Changes in the appetite for risk are also crucial for our analysis, because they are the underlying reason of changes in the stance of banks' lending policy. However, our aim exceeds the usual analysis of credit channels of monetary transmission, as it is to build a measure of risk-taking behaviour on the aggregate level.

We develop a method applicable on the aggregate data which can be used to check whether the banking sector changes its appetite for risk and tends to set either too lax or too stringent lending standards. In the models we use data containing such macroeconomic variables as investment, credit extended to the corporate sector, short-term interest rate, credit standards and specific factors driving credit standards, like risk related to macroeconomic conditions, risks of default of the largest borrowers and industry-specific risk. We believe that this set of variables can properly describe the behaviour of lending standards on loans for the corporate sector and, besides, has some bearing on the NPV of loans.

Applying this method to the Polish data, we provide the robust evidence that before the GFC banks tended to conduct too lax credit policy. During the crisis standards were too stringent. Then they exhibited rather episodes than systematic periods of laxity or stringency.

The rest of the paper is organized as follows: the next section briefly presents related literature. The third one characterizes data and estimation method, while the fourth section brings a few stylized facts. The estimation results are presented in the fifth part, while the last one summarizes and concludes.

2 Related literature

Empirical evidence dating from the 90's demonstrates that lending standards fluctuate over business cycle, e.g. Weinberg (1995), or Asea, Blomberg (1997). The outburst of the GFC brought about a new wave of studies on credit standards, aimed not only on analyses of their behaviour over the business cycle, but on reasons underlying their laxity or tightness. Dewatripont and Freixas (2012) point at four culprits of the excessively soft banks' policy before the crisis: (i) corporate governance – as banks' decisions are the responsibility of managers; (ii) the quality of supervising activity of financial authorities, (iii) implicit guarantees of a bailout, and (iv) underestimate of the business cycle risk of downturn.

Jimenez et al. (2018) provide evidence that during booms or in periods of loose monetary policy, banks soften their lending standards in terms of ex-ante credit risk, while the opposite is true during busts, or when monetary policy is tightened. Furthermore, during crisis, to deleverage and improve balance sheets, banks tend to reject some loan applications with a positive NPV and extend new loans of above average quality, Behr et al. (2014), which means that they tighten standards with the rising share of NPLs. In a more detailed analysis of banks' credit policy toolkit used in various phases of the business cycle, Rodano et.al. (2018) show that in booms banks tend to extend loans to risky borrowers, e.g. relax standards by narrowing the interest rate spreads between substandard and performing firms, whereas during busts banks resort to cuts in the size of loans for the substandard enterprises.

Besides, several studies analysed the role of monetary policy as a factor which added to a build-up of financial imbalances through its impact on lending standards. In this vein, Maddaloni et al. (2008) find that a lower level of the short-term interest rate led to more lax credit standards. Lower EONIA softened standards for both, average and more risky borrowers. The authors conclude that the softening was over and above an improvement in borrower's industry and collateral. Similarly, Altunbas et al. (2010) show that overly low short-term interest rate over an extended period contributed to an increase in bank risk. This has recently been supported by Paligorova and Santos (2017) who show that banks' risk-taking incentives change with the interest rate policy stance. Using individual data from SLOOS, they unveil evidence that the interest rate discount for riskier borrowers in periods of easy monetary policy is prevalent in banks with greater risk appetite. This confirms that the observed loan pricing discount is driven by the bank risk channel of monetary policy.

Another strain in the literature focuses on detecting credit booms and busts with indicators basing on a statistical approach, such as a country's credit-to-GDP ratio or per capita real

credit to its (nonlinear) trend, e.g. Arena et al. (2015). Empirical analysis suggests that the credit-to-GDP gap is the best single indicator for the European Union for signalling the build-up of risks associated with the type of crisis that the countercyclical capital buffer is designed to mitigate. The credit-to-GDP gap has been shown to give a robust signal across a range of specifications of the gap. There are a few methods for calculating the gap that show better signalling qualities than the calculation method suggested in the BCBS's guidance, but these tend to be based on narrower credit aggregates and may thus be less robust in the face of financial innovation, (ESRB, 2014).

However, while such methodologies, may indicate periods of credit booms and busts, it does not disentangle demand and supply; our aim is to analyse the supply of credit, and to provide more structural analysis which supplemented by the analysis of shocks driving standards may show how banks set lending standards. Besides, our method may pre-emptively signal either too lax lending standards which may sow the seeds of financial distress or too stringent which deny financing creditworthy borrowers and hamper investment.

3 Data and methodology

3.1 The Senior Loan Officer Opinion Survey

In Poland, the Survey³ was launched in 2003. It is conducted by the central bank on the quarterly basis. Loan officers answer a set of questions related to loan supply and demand to the non-financial corporations and households. Banks declare whether credit standards (terms and conditions) have been (i) tightened considerably, (ii) tightened somewhat, (iii) remained basically the same, (iv) eased somewhat, (v) eased considerably. Throughout the paper, a positive value of lending standards is understood as a “tightening”, however, as we have argued, not all shifts in lending standards will be considered as “true” changes.

Besides, loan officers are requested to rate factors which potentially drive lending standards. They comprise:

1. risk related to the borrowers (macroeconomic risk, industry-specific risk, risk related to the default of the largest borrowers of a bank),
2. risk related to the lenders (capital position and the share of non-performing loans in total loans),
3. structural factors (competition from other banks and non-bank financial institutions, as well as from market financing (debt/equity issues),
4. developments in demand for credit and
5. central bank’s monetary policy.

In this paper, to check which risk factors could shift lending standards, we shall be using all of them but the last two. We skip survey data on demand for credit for two reasons. Firstly, to extract structural shocks, we impose a set of restrictions which *inter alia* are supposed to identify demand for credit. Secondly, if we used data on credit demand, we would have to eliminate credit data from the model since they would be redundant. Thus, we would end up with a model which would make the necessary non-recursive factorization impossible (the Cholesky decomposition in this case would be flawed, because it would require unrealistic time sequencing of demand and supply of credit). Finally, the reason for not using survey data on monetary policy is that we simply employ a short-term money market rate instead.

³ <http://www.nbp.pl/homen.aspx?f=/en/systemfinansowy/kredytowy.html>

To obtain forecasts of standards which will be considered as those corresponding to the NPV, we shall employ only these risk factors which are related to the borrowers, i.e. the first three of the mentioned above.

In the survey, the possible array of answers ranks from (i) have contributed to tightening considerably, (ii) have contributed to tightening somewhat, (iii) have basically not contributed to any changes, (iv) have contributed somewhat to softening to (v) have considerably contributed to softening.

27 banks, which currently respond to the survey, possess about 90 per cent of total loans to the non-financial sector (extended in the domestic currency and in foreign currencies to both corporates and households). The number of banks involved was changing over the period covered by the survey mostly due to mergers and acquisitions.

The aggregation of data behind the survey results consists in the calculation of weighted percentages of responses and the net percentage, i.e. the difference between the structures presenting opposite trends, i.e. have contributed slightly and have contributed considerably to tightening vs. have contributed slightly and have contributed considerably to softening. The importance of banks in a given market segment is represented by the share of loans outstanding of this bank in the loan portfolio of all banks that respond to the survey, broken down by types of loans. Thus, a weight, corresponding to a given bank's share in a given market segment is assigned to particular responses.

3.2 Other data

Besides data from the survey – lending standards on long- and short-term loans for small and medium sized enterprises and for the large ones, and their potential drivers, we exploit a set of “hard” macroeconomic variables: investment (gross fixed capital formation) in real terms, two types of credit in the domestic currency to the corporate sector: (i) for investment and (ii) for financing working capital and on current account, both deflated with investment prices, a short-term money market interest rate, WIBOR 3M, which is to approximate the central bank's policy rate. Because Poland is a small open economy, we add two exogenous variables: investment in the euro area (12 countries) and a 3-month Euribor to pin down close trade and financial interrelationships. Additionally, we use a dummy variable to capture an abrupt rise in investment prices by 6.2% in 2006Q1 and its drop by 6.2% in 2006Q2.

Table A1 in the Statistical Annex provides all details concerning data and their sources.

3.3 Methodology

Our analysis departs from the observation that a profit maximizing bank should make any loan with a positive Net Present Value. The NPV of a loan depends on a discount rate and risks related to the financial stance of a borrower over the whole period of the covenant. The former is affected by the interest rate policy of the central bank, the latter by a set of various factors, such as business cycle, inflation or changes in competition.

To explain the relation between the NPV and lending standards, let us first assume a situation of monetary policy easing owing to e.g. the expected fall in the inflation rate or because monetary authorities do not expect any significant inflationary pressures. Lower interest rate leads to a general increase in the Net Present Value of investment projects. A following softening of lending policy by banks can be in line with the shift in the NPV, but it can also exceed it if banks change their appetite for risk, for example because they find the interest rate too low or if they misperceive macro or microeconomic risks.

By the same token, if the interest rate increases and leads to a downturn, the number of investment projects with a positive Net Present Value falls, while the probability of a borrower's default increases. As pointed out by Berlin (2009), if in such conditions banks require a larger collateral, increase spread or reject a loan application, this should not be understood as a tightening of lending standards, terms and conditions, but rather as an adjustment of banks' policy caused by reduction of the NPV of loans. However, if banks find that their loans portfolio has worsened or if they are overly pessimistic, they may change standards by more than a shift in the NPV. Thus, solely, if banks change lending policies more (less) than it results from the increased (lower) risk, such change of standards can be considered as a tightening (softening), otherwise, banks simply adjust their policy to the prevailing risks and economic conditions.

Bearing all this in mind and following Berlin (2009), we adopt a definition that a "true" change in bank credit standards is a shift in bank's loan granting decisions which is due to some other reason than a change in the NPV of a loan. The reasons comprise not only risks related to the real sector and borrowers, but also those connected to the banking sector, like competition or quality of banks' balance sheets and capital position. Using the same framework, credit cycles are defined as a systematic tendency to fund negative NPV loans during an expansion and a systematic decision to reject positive NPV loans during a contraction. Because lending decisions comprise pricing and design of the covenant, the credit

cycle can be also defined as a systematic tendency to relax (tighten) loan terms by more than changes in the borrower risk.

The actual change in credit standards comprises therefore two parts: one reflects the ongoing changes in the NPV, the second one is that which is either more or less than a shift in the NPV. In other words, a change in standards by, say, 20% can be due to a part equal to 15% resulting from a change in the NPV and to a part equal to 5% which represents a change in the risk appetite of banks. Since it is in excess with respect to the NPV, it means that banks have tightened their lending policy. The same 20% change can be due to a part of 25% resulting from a change in the NPV and to a part equal to (-5%) which is lacking to fully reflect the shift in the NPV, and therefore means that banks have softened their lending policy.

The difficulty which is involved in disentangling movements of standards which correspond to the NPV from those which are in excess or are lacking, lies in the unobservability of the NPV. Thus, to separate the ‘true changes’ of credit standards from other movements, we build a variable which is a function of factors directly affecting the NPV. In particular, we argue that a hypothetical level of standards consistent with the (unobservable) NPV can be obtained as a forecast from the model which relates standards to: (i) developments in the real sector, such as investment, cyclical component of which coincides with the cyclical component of GDP⁴, (ii) risk factors related to the borrowers and (iii) the interest rate policy of the central bank, which, in turn, impacts interest rates in the money market, lending rates in the banking sector and which also affects yields on treasuries. Such forecasts encompass the main factors which affect the NPV. As a matter of fact, a part of these variables may also affect the actual (or raw) lending standards. However, the raw standards are supposed to be additionally affected by factors which are related to risk-taking, such as quality of banks’ balance sheets (the share of non-performing loans), capital position or competition. Thus, a difference between raw data and the forecast obtained solely from models containing risk factors related to the NPV should indicate the stance of banks’ credit policy.

In the paper we use (S)VAR models. They capture dynamic interdependencies present in the data using a minimal set of restrictions. The identified exogenous shocks to standards satisfy the requirement of the “true” changes, but they cannot provide an answer to the question whether a specific shift in standards is the “true” change. Impulse responses to other structural

⁴ Over a sample 1996.1–2018.1 cyclical components of GDP and investment (gross fixed capital formation) obtained from the Hodrick-Prescott filter are correlated: at lag (-1) $R^2=0.46$, at lead (1) $R^2=0.51$, if they coincide the correlation coefficient $R^2=0.61$.

shocks, including shocks to the interest rate, serve us to validate the models and to preselect risk factors which drive lending standards. We expect a hump-shaped negative reaction of investment and credits to shocks to monetary tightening, positive and hump-shaped responses of credits to a positive shock to investment. Besides, we expect negative responses of credit to the tightening of credit standards. To limit the space of graphs, we demonstrate only impulse response functions to shocks to lending standards⁵.

The survey provides data on three factors related to the enterprise sector which may affect the NPV, namely the macroeconomic risk, the industry-specific risk and the risk of default of the largest borrowers. We plug them into the models one by one to preserve the necessary parsimony. If these factors affect standards in a statistically significant way, then they are used to obtain in-sample dynamic forecasts. Thus, at the maximum, we may have three forecasts, i.e. three somewhat different levels of standards corresponding to the NPV. Because this is not much and owing to model uncertainty, we show the actual standards and the bands of ± 0.5 S.E around the respective forecasts.

To identify structural shocks, we use a non-recursive factorization as in Wróbel (2018), which allows a simultaneous reaction of lending standards and short-term interest rate, approximating the central bank policy rate.

If the underlying structural model is as in (1)

$$(1) AY_t = C(L)Y_{t-1} + Bv_t,$$

where Y_t is a vector of endogenous variables, A is a vector of contemporaneous relations among the variables, $C(L)$ is a matrix of a finite order lag polynomial, and v_t is a vector of structural disturbances, we can estimate a VAR model as the reduced form of the underlying model:

$$(2) Y_t = A^{-1}C(L)Y_{t-1} + u_t,$$

where Y_t is a vector of endogenous variables, u_t is a vector of VAR residuals, normally independently distributed with full variance-covariance matrix Σ . The relation between the residuals and structural innovations is:

$$(3) Au_t = Bv_t \text{ and}$$

⁵ Graphs containing other impulse response functions can be obtain on request.

$$(4) B^{-1}Au_t = v_t$$

In the baseline setting we have the following endogenous variables: investment, credit volume in the domestic currency either for investment or for financing current account and working capital. They are referred to as l_t^{inv} and l_t^{wcca} respectively⁶. WC&CA loans are treated as short-term and therefore used in models with standards on short-term credits. In turn, credits for investment correspond to standards on long-term loans⁷. Loans are in the real terms. They are calculated using investment price deflator (2010=100). Next, the models contain a risk factor which may drive lending standards and affects the NPV. Thus, we plug into our models one by one: risk related to the general economic situation ($macro_t$), industry-specific risk ($industry_t$), risk related to the financial standing of bank's largest borrowers ($default_t^{largest}$). Besides, to verify whether lending standards move if banks' appetite for risk changes we build models with risks related to banks' balance sheets (the quality of credit portfolio or npl_t) and banks' capital position ($capital_t$) and pressures from the competition from other banks or other sources of external financing ($competition_t$). Next, we use a short-term interest rate, i.e. 3-month money market rate ($WIBOR_t$), and finally, we plug in credit standards applied to large and small and medium sized enterprises ($i=1$ or $i=2$) on short-term loans or long-term loans ($j=1$ or $j=2$), referred to as $std_t^{i,j}$. This set of variables in the VAR model makes it possible to control for macroeconomic and industry-specific risks, business cycle and monetary policy. If the models are correct, then the obtained forecasts of credit standards can be considered as their value reflecting the prevailing risks related to the developments in the real sector and a difference between the actual and forecasted value of lending standards can be used as an approximation of the stance of the lending policy.

To identify structural innovations, it is necessary to impose restrictions on matrices A and B in (4). Owing to real and nominal rigidities we assume that investment reacts to developments in monetary policy and credit standards with a lag. Demand for loans is assumed to depend on the scale variable, i.e. investment, and the interest rate. Factors which are supposed to

⁶ Although banks' credit policy concerns both loans in the domestic and in the foreign currencies, we leave aside the latter category. It blurs reactions of loans to the domestic interest rate since it depends rather on a spread between domestic and foreign interest rate and because to make the model well-specified, we would have had to introduce the exchange rate. Bearing on mind data shortness, we cannot expand our model by two variables more.

⁷ We do not analyze credits dubbed as 'other' since it would be impossible to ascribe them the proper maturity.

cause changes in credit standards are assumed to depend contemporaneously on investment and developments in loans. They may simultaneously impact both the interest rate and lending standards. Monetary policy rate responds contemporaneously to developments in investment and may affect lending standards. Credit standards are contemporaneously impacted by investment, factors which banks point at as their drivers and the interest rate. Thus, the set of restrictions in matrices A and B is as in (5). The model is overidentified by one restriction. Each time we perform a test for overidentification to verify whether our assumptions hold. We obtain 5 shocks: a shock to investment (or aggregate demand shock), a shock to credit demand, a shock to risk factors, a monetary policy shock and a shock to credit supply (a shock to standards).

$$(5) \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha_{21} & 1 & 0 & \alpha_{24} & 0 \\ \alpha_{31} & \alpha_{32} & 1 & 0 & 0 \\ \alpha_{41} & 0 & 0 & 1 & \alpha_{45} \\ \alpha_{51} & 0 & \alpha_{53} & \alpha_{54} & 1 \end{bmatrix} \begin{bmatrix} u_t^{inv} \\ u_t^{inv,wcca} \\ u_t^{risk} \\ u_t^{WIBOR3M} \\ u_t^{std^{i,j}} \end{bmatrix} = \begin{bmatrix} v_t^{inv} \\ v_t^{inv,wcca} \\ v_t^{risk} \\ v_t^{WIBOR3M} \\ v_t^{std^{i,j}} \end{bmatrix},$$

We estimate two groups of models. The first one contains investment loans and long-term standards for either large or small and medium-sized enterprises and one by one a possible cause of changes in standards. The second one - short-term loans (for working capital and in current account) and short-term standards, as before for LEs and SMEs.

Next, as a robustness check, we verify whether the suggested measure of “true” changes in lending standards has some bearing on credit extended to the corporate sector. In this aim we do a series of Granger causality tests. Besides, in Wróbel (2018) we have checked whether impulse responses change if we replace WIBOR 3M by POLONIA, the overnight transaction rate. Although WIBOR 3M is considered as a proper approximation of the central bank policy rate, POLONIA may better reflect monetary policy shocks during the financial crisis. Our results turned out to be robust across these two settings.

4 Stylized facts

In Poland, the banking sector is by far the most important provider of external financing to the corporate sector: loans to non-financial enterprises amount to 16% in relation to GDP, while corporate bonds stand at 5%. Firms have loans both in domestic and foreign currencies. Over 2003-16, loans in foreign currencies accounted on average for about 25% of the total amount of loans to the enterprise sector. Loans in foreign currencies are dominated by long-term ones, i.e. loans extended for investment and real property purchase. The latter were growing rapidly before the financial crisis. Loans in PLN are dominated by loans for financing working capital and loans on current account.

A breakdown of the banking sector claims on the corporate sector according to the size of the borrower, i.e. to LEs and SMEs has been available only since 2010. It shows that SMEs account for about 54-59% of the total amount of bank claims.⁸

Since 2013, SMEs have been eligible for the *de minimis* credit guarantee programme by Bank Guarantee Fund (BGK). In practice, the guarantees act as an additional collateral and make it possible for SMEs to obtain bank credit which would otherwise be refused or extended on more costly conditions. Up to 2017, the additional credits extended to SMEs were in general aimed on financing working capital (92.8%).⁹ Most SMEs operate in three sectors: services (51.7%), trade (24.9%) and construction (13.1%). Industry accounts for only 10.3%, PARP (2018).

We conduct our analysis on a sample from 2004 to 2016, which was a period full of turmoil, including the pre-crisis credit boom, the financial crisis and the Europe's sovereign debt crisis. The end of the sample covers a period of the post-crisis slow recovery. Such a diversified sample, with a boom and bust, makes the analysis particularly interesting.

Before the global financial crisis, banks signalled "soft" lending standards. This concerned standards on short-term loans for SMEs and coexisted with relatively high rates of lending growth (Figure 1 and 2). The global financial crisis and the related uncertainty, together with rocketing standards and an abrupt fall in investment, led to a sharp drop in credit to the enterprise sector. Investment loans were hit much more than the short-term credits, indispensable for financing current activity. In 2011-2012, lending transitorily recovered with

⁸ For a broader description see Wróbel (2018).

⁹ <https://media.bgk.pl/43470-efekty-programu-gwarancji-de-minimis>

growing economy. The recovery was short-lived, and since 2013 credit to the non-financial sector has remained subdued.

Obviously, in such a sample, growth rates of loans for investment and short-term loans for financing working capital and on current account are highly volatile. Their cyclical behaviour is shown in Figure 3. Correlation coefficients of the yearly rates of growth of credits and output gap¹⁰ (current and lagged by one quarter) equal to 0.55-0.58 and 0.63-0.64 respectively.

On the conventional level of statistical significance, solely standards on long-term loans for LEs Granger cause the output gap (at one lag). There is some ambiguity in the relationship between standards and credits. Namely, there is a two-way Granger causality between standards on long-term loans for both LEs and SMEs and the rate of growth of investment loans. A similar phenomenon is observed in the case of lending standards on short-term loans for LEs. Thus, it may suggest that indeed, raw standards, used as a measure of the stance of banks' lending policy, may not properly explain changes in credit.

Over the sample, factors which are considered as potential drivers of the NPV (macroeconomic risks, industry-specific risks and risks related to the financial standing of the largest borrowers) were moderately correlated¹¹. Thus, there is some probability that when used in the models, they will bring different information.

Table 1 Correlation coefficients between potential drivers of lending standards related to the NPV, t-statistic in parentheses, sample 2003Q4-2016Q3

| Correlation (t-stat) | $industry_t$ | $default_t^{largest}$ | $macro_t$ |
|-------------------------|--------------|-----------------------|-----------|
| $industry_t$ | 1.0 | | |
| $default_t^{largest}$ | 0.51 (4.2) | 1.0 | |
| $macro_t$ | 0.72 (7.2) | 0.59 (5.2) | 1.0 |

¹⁰ Output gap was obtained using HP filter with $\lambda=1600$, usual for quarterly observations.

¹¹ Correlation coefficients whose magnitude are between 0.5 and 0.7 indicate variables which can be considered moderately correlated.

5 Estimation results

In general, our models show that adverse monetary policy shocks (monetary tightening) tend to gradually lower investment, increase risks related to the NPV and, with a certain delay, lead to a fall in short-term loans. In some models they also affect long-term loans, but this result is less robust. Shocks to lending standards have some bearing on loans, observed rather instantaneously than with a delay¹². Positive shocks to investment increase lending because demand for credit rises with the number of investment projects. Moreover, shocks to investment reduce risks related to the largest borrowers, to the capital position of banks and those related to the competition, whereas other risks seem not to react. These responses, being broadly in line with what one could expect in terms of direction of reactions and their shape, are considered as validating the models.

5.1 Impulse responses of lending standards on long-term and short-term loans for LEs and SMEs to the structural shocks

This chapter describes impulse response functions of credit standards to shocks identified within our (S)VAR setup: to investment, demand for credit (either for investment or for financing working capital and on current account), to the monetary policy and to the risk factors (macroeconomic conditions, industry-specific risks, default risk to the largest borrowers, to banks' balance sheets, capital and competition). However, as aforementioned, even statistically significant responses are not interpreted as "true" changes in standards. Statistically significant response is a necessary but not sufficient condition for a shock to be considered as a "true" driver of lending standards. The impact of shocks to investment, demand for credit and to the monetary policy can be analysed in more than one setting. Figures from 4 through 15 show responses to standards on long-term loans, while these from 16 through 27 on short-term loans. Tables A2 and A3 in the Statistical Annex briefly show the summary of responses.

5.1.1 Impulse responses of lending standards on long-term for LEs and SMEs to the structural shocks

Both, standards on loans for LEs and SMEs react to 4 out of 9 obtained shocks: (i) to the monetary policy, (ii) to risks related to the largest borrowers, although this result for SMEs is at odds with our expectations, as we supposed that these shocks would affect solely LEs, (iii) to risks related to the strength of banks' balance sheets (non-performing loans), (iv) to

¹² For a broader analysis of the impact of lending standards on loans see Wróbel (2018).

risks related to the capital position of banks. Besides, standards for LEs react to two shocks, i.e. to investment and to industry-specific risks. There is some uncertainty concerning the response of standards to LEs after a shock to the macroeconomic conditions: the response is just transitorily significant in the first and third quarter after the shock. We shall tentatively consider macroeconomic risk as a potential driver of credit standards for LEs and leave the final decision on its role to the Granger causality test.

Adverse shocks to risks rise lending standards, whereas positive shocks to investment decrease them. This means that indeed banks may tighten standards after adverse shocks to those types of risks and relax them for LEs if positive outcomes in the business cycle prevail.

In contrast to standards for LEs, there is no doubt that standards for SMEs react to shocks to macroeconomic conditions. However, they do not respond to industry-specific risks. This is seemingly because for SMEs domestic demand is a key market driver. Moreover, information asymmetry and difficulties for lenders to monitor smaller entities may induce banks to use information on general macroeconomic conditions to evaluate long-term creditworthiness of this group of borrowers. Importantly, neither standards for LEs nor for SMEs on long-term loans react to shocks to demand for credit and to competition from other banks or non-bank institutions.

5.1.2 Impulse responses of lending standards on short-term loans for LEs and SMEs to the structural shocks

There are 5 out of 9 structural shocks to which standards on short-term loans for LEs and SMEs react in the same way. These comprise: (i) a shock to the macroeconomic risks, (ii) a shock to industry-specific risks¹³, (iii) a shock to risks related to the largest borrowers; this result for SMEs raises the same doubts as it was the case of reaction of long-term standards for this group of borrowers, (iv) a shock to banks' balance sheets (non-performing loans), and a shock to the capital position of banks. Besides, as in the case of long-term standards, standards on short-term loans for LEs depend on shocks to investment. The impact of shocks to investment on standards for short-term loans looks robust: it is observed in all 6 models for LEs and in none for SMEs. Interestingly, while standards on loans for SMEs react to the

¹³ This contrasts with standards on long-term loans for SMEs which do not react to industry-specific risk shocks. We suspect that in the case of short-term loans, banks can more easily assess industry-specific risks than for long-term loans. Moreover, within the framework of *de minimis* programme, which is *de facto* a collateral, firms take rather short-term loans for financing working capital than long-term for investment. The *de minimis* programme reduces information asymmetry with respect to SMEs and risks with respect to the short-term loans.

monetary policy shocks, the respective reaction of standards on loans for LEs is visible in 3 out of 6 models. Likewise, shocks to competition seem to affect standards for SMEs, but not for LEs. Shocks to demand for credit do not affect standards, neither for LEs, nor for SMEs.

To sum up, if there exists a cyclical behaviour of standards, it concerns banks' lending policy with respect to the large entities, but not to the small and medium-sized ones. Monetary policy seems to be a more important driving factor for standards for SMEs than for LEs, especially for lending standards on short-term loans. Furthermore, the preselection of factors which are considered as potential drivers of standards leads us to accept tentatively macroeconomic risks and eliminate competition for all standards for LEs. As far as lending standards for SMEs are considered, we eliminate industry-specific risks and competition in case of long-term loans and retain full list of potential drivers in case of short-term loans. Shocks to demand for loans and competition seem not to play any important role, but all other factors, i.e. risk to macroeconomic conditions, industry-specific risks, risks to the biggest borrowers, risks related to banks' balance sheets and capital can be considered as factors which might move standards on loans for LEs and SMEs.

Thus, we conclude that lending standards are driven by a whole set of factors, including these connected to the NPV of loans, but also those related to the banks' appetite for risk, e.g. quality of loan portfolio and capital, as well as those related to both – NPV and the appetite for risk, such as the interest rate. Thus, a difference between actual standards and forecasts obtained from models containing solely risk factors of the first group, can be considered as a measure of the stance of lending policy of the banking sector.

5.2 Forecasts of standards and Granger causality tests

This section presents forecasts of standards for LEs and SMEs obtained from preselected models. For standards on long-term loans there are 3 models for LEs and 2 for SMEs. For standards on short-term loans there are 3 models for both LEs and SMEs. In figures from 28 through 35, we show actual data on standards (survey data), and their forecasts from the respective models. To make the graphs more readable, raw standards and bands of ± 0.5 S.E. around the forecasts are presented on separate graphs.

The figures show that starting from about 4th quarter of 2006 to the Lehman Brothers failure, banks conducted soft credit policy, especially with respect to long-term lending for both LEs and SMEs. Considering model uncertainty reflected by the bands of ± 0.5 S.E. around the forecasts, we cannot conclude that this laxity was similar for the two groups of enterprises.

Laxity of standards on short-term loans was smaller, and in the case of SMEs it was rather transitory than long-lived.

During the GFC, banks in fact tightened lending standards: their actual change was greater than forecasted, representing standards congruent with the current level of the NPV. Our estimates suggest that the difference between the actual and forecasted standards was greater in case of SMEs than LEs, reflecting banks' flight to quality. The years 2010-2011 for LEs seem to be a period of standards congruent with the NPV on both, the long-, and short-term loans. In case of SMEs, lending policy was volatile. We observe a short period of neutral standards on long-term loans in 2010 and soft in 2011, whereas credit policy with respect to short-term loans did not display the period of neutrality and turned at once to a short-lived laxity in 2010 and then tightness in 2011. Next, over 2012-2013, banks set too stringent standards on long-term loans for both LEs and SMEs, and over 2011-2012 for SMEs. The tightening was due to concerns about macroeconomic conditions and to the macroprudential policy of the Polish Financial Supervision Authority. Namely, facing growing problems with loans denominated in foreign currencies, the FSA imposed stricter regulations with respect to the collateral and limited a possibility of extending such new loans to units which did not have revenues in foreign currencies. The last subperiod, starting for SMEs from about the 2nd quarter of 2014 (and for LEs slightly earlier), brought about a softer policy, but visibly conducted in the form of a "stop-and-go" strategy, presumably because of uncertainty surrounding macroeconomic policies of the new government and macroeconomic developments, both domestic and foreign.

Finally, to check whether the suggested measure of lending stance can explain behaviour of loans, we use Granger causality tests (Table 1 and 2)¹⁴. In contrast to tests conducted on raw standards, our "true" measure of banks' lending stance does not display a two-way causality. For LEs, the results of all tests reveal that there is Granger causality from our measure of the "true" policy stance to the yearly rate of growth of credits. This is also true for the measure obtained from the model with macroeconomic risks and standards on long-term loans, which at the stage of the impulse response analysis was only tentatively accepted as statistically significant. For SMEs, tests reject the causality of our measure of lending stance for models with risks of default of the largest borrowers (it concerns both lending standards on long-term

¹⁴ Besides, we have tested whether the suggested measure of landing stance Granger causes credit gap, understood as a deviation of currently observed credit to the corporates-to-GDP ratio from its long-term trend. The tests show that all measures but this for short-term loans for SMEs Granger cause (on 1 or in some cases also on 2 lags) such a credit gap.

and short-term loans), but not rejected for industry-specific risk factors. Nonetheless, even if we eliminated these forecasts from the analysis of credit cycles, our conclusions on periodicity of lax and stringent policy would remain unchanged.

Table 2 Granger causality tests for variables defined as a difference between the actual value of a respective standard and its forecast and yearly rates of growth of investment loans and loans for WC&CA in real terms, models for LEs (number of lags: 1)

| H ₀ : variable “x” does not Granger cause $(l_t^{inv} - l_{t-4}^{inv}) - (p_t - p_{t-4})$ | | | H ₀ : variable “x” does not Granger cause $(l_t^{wcca} - l_{t-4}^{wcca}) - (p_t - p_{t-4})$ | | |
|---|--------|----------|---|--------|----------|
| Model with: | F-stat | p. value | Model with: | F-stat | p. value |
| $default_t^{largest}$ | 6.39 | 0.015 | $default_t^{largest}$ | 6.95 | 0.01 |
| $industry_t$ | 6.22 | 0.017 | $industry_t$ | 14.68 | 0.000 |
| $macro_t$ | 7.64 | 0.008 | $macro_t$ | 16.5 | 0.000 |

Note: p_t stands for investment price deflator in quarter t .

Table 3 Granger causality tests for variables defined as a difference between the actual value of a respective standard and its forecast and yearly rates of growth of investment loans and loans for WC&CA in real terms, models for SMEs (number of lags: 1)

| H ₀ : variable “x” does not Granger cause $(l_t^{inv} - l_{t-4}^{inv}) - (p_t - p_{t-4})$ | | | H ₀ : variable “x” does not Granger cause $(l_t^{wcca} - l_{t-4}^{wcca}) - (p_t - p_{t-4})$ | | |
|---|----------------|----------|---|--------|----------|
| Model with: | F-stat | p. value | Model with: | F-stat | p. value |
| $default_t^{largest}$ | 3.85 | 0.056 | $default_t^{largest}$ | 2.51 | 0.12 |
| $industry_t$ | Not considered | | $industry_t$ | 5.09 | 0.029 |
| $macro_t$ | 4.35 | 0.043 | $macro_t$ | 5.89 | 0.019 |

Note: p_t stands for investment price deflator in quarter t .

6 Conclusions

In the paper, we suggest a simple method to analyse whether commercial banks apply too lax (or too stringent) lending standards on loans to the corporate sector. This is an important issue for central banks, since prolonged periods of laxity or stringency (credit cycles) may exacerbate output fluctuations.

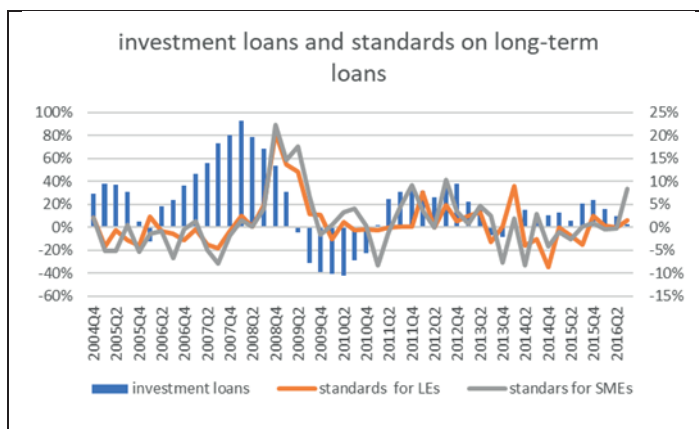
In their analyses of banks' lending policy stance, monetary authorities usually consider a broad set of information contained in the Bank Lending Survey. However, we argue that using raw data on lending standards can be misleading, because credit officers may not properly assess if a change in standards matches this of the NPV of credits. Solely changes in standards which result from other reasons than a change in the NPV, can be considered as "true". Because the NPV is unobservable, we estimate hypothetical standards, corresponding to the NPV. These hypothetical standards are the forecasted standards from (S)VAR models.

In particular, to disentangle "true" changes in standards from their simple adjustments to the shifts in the NPV, we build a series of (S)VAR models containing such macroeconomic variables as investment, loans for investment and for financing working capital and on current account, short-term interest rate, lending standards and risk factors related to the real sector, i.e. macroeconomic risk, industry-specific risk and risk of default of largest borrowers. These risk factors, as well as the interest rate, are assumed to affect the unobservable NPV. We examine impulse response functions of lending standards to the structural shocks, in particular to the interest rate and risk factors. These risk factors which indeed affect standards (have a statistically significant impact) are kept for the further analysis. They are used to forecast lending standards and to approximate this way standards reflecting the unobserved NPV of loans. Comparing the actual value of standards and the hypothetical, we conclude whether banks conduct loose or stringent policy and whether such policy is conducted systematically, leading to credit cycles.

Importantly, a difference between the actual standards and the approximation of standards corresponding to the NPV obtained from most of our models Granger causes rates of growth of credit for investment and loans for financing working capital and on current account. Using Polish data, we show that before the financial crisis, banks conducted systematically soft lending policy. During the financial crisis lending standards got tightened more than it would result from changes in the NPV. Then, after a period of neutral or slightly too tight stance, banks turned to laxity, but this was realized rather as a "stop-and-go" strategy.

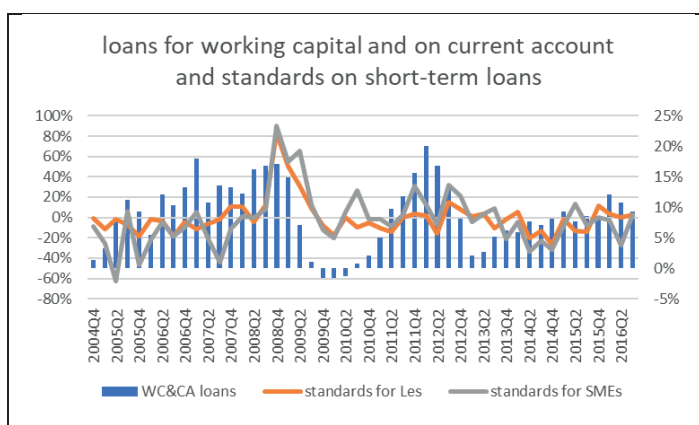
Figures

Figure 1: Investment loans (annual rate of growth in per cent, real terms, right-hand scale) and changes of standards on long-term loans (left-hand scale), in per cent



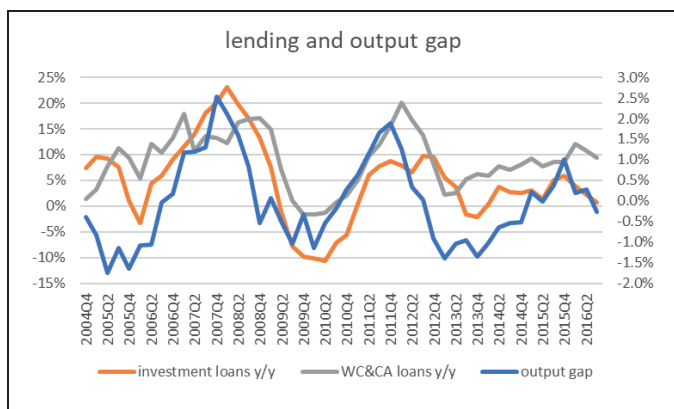
Note: standards ↓ means that banks declare “softening” of credit policy. Source: NBP

Figure 2: Loans for working capital and on current account (annual rate of growth in per cent, real terms, right-hand scale) and changes of standards on short-term loans (left-hand scale), in per cent



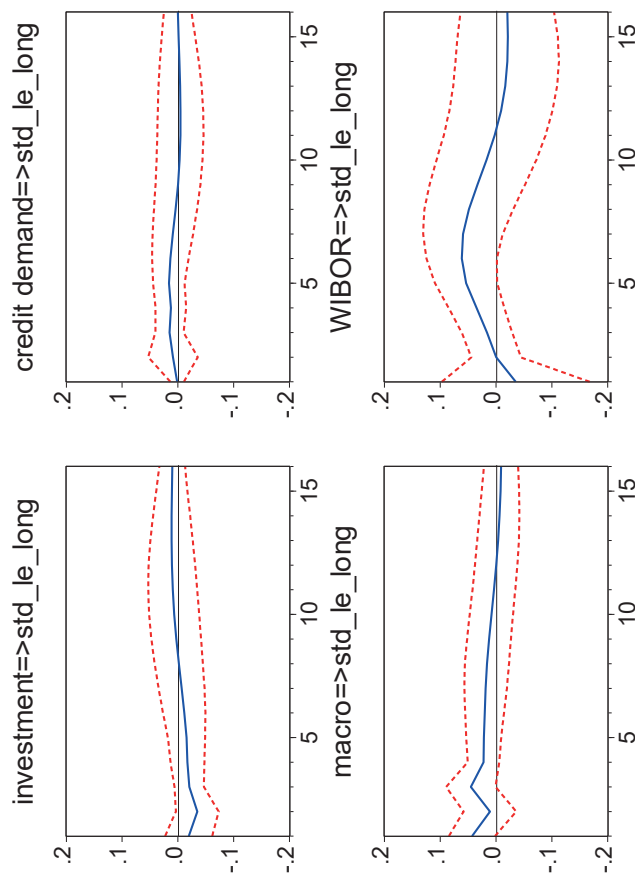
Note: standards ↓ means that banks declare “softening” of credit policy. Source: NBP

Figure 3: Annual rates of growth of loans for investment and for financing working capital and on current account (left-hand scale), in per cent, and output gap (right-hand scale), in per cent.



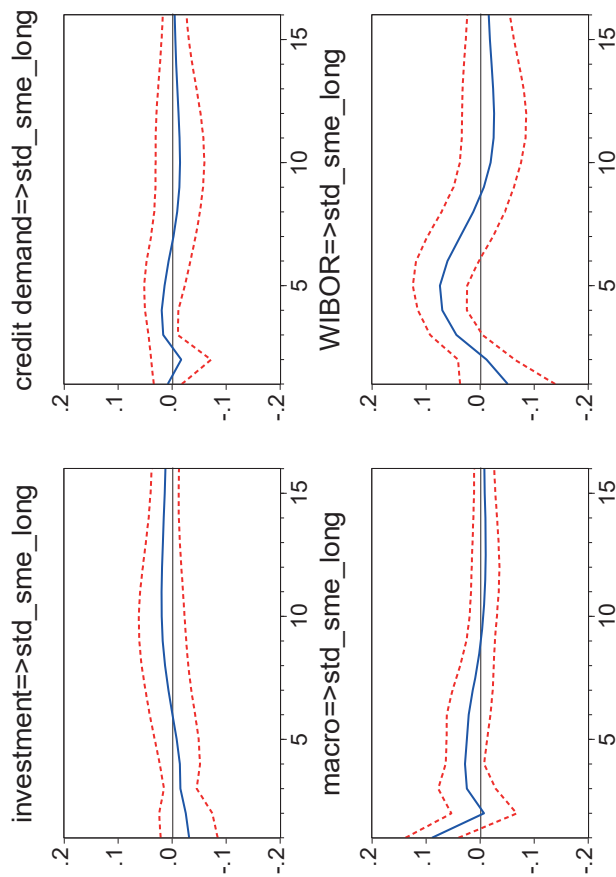
Source: NBP, Eurostat, own estimations

Figure 4 Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with macroeconomic risks



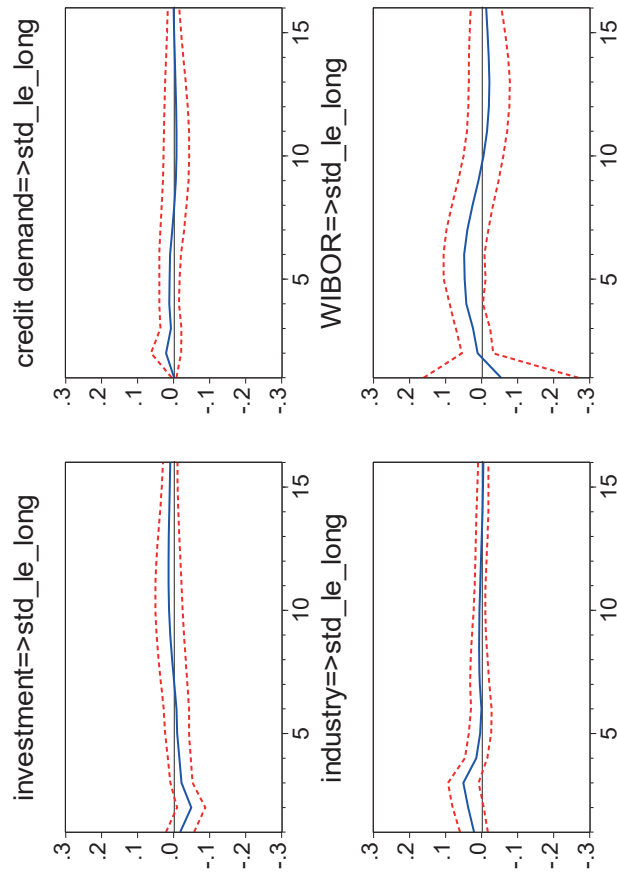
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_long =standards on long-term loans for LEs, $investment$ =aggregate demand shock, $macro$ =risk related to macroeconomic conditions, $WIBOR$ =3-month money market rate.

Figure 5 Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with macroeconomic risks



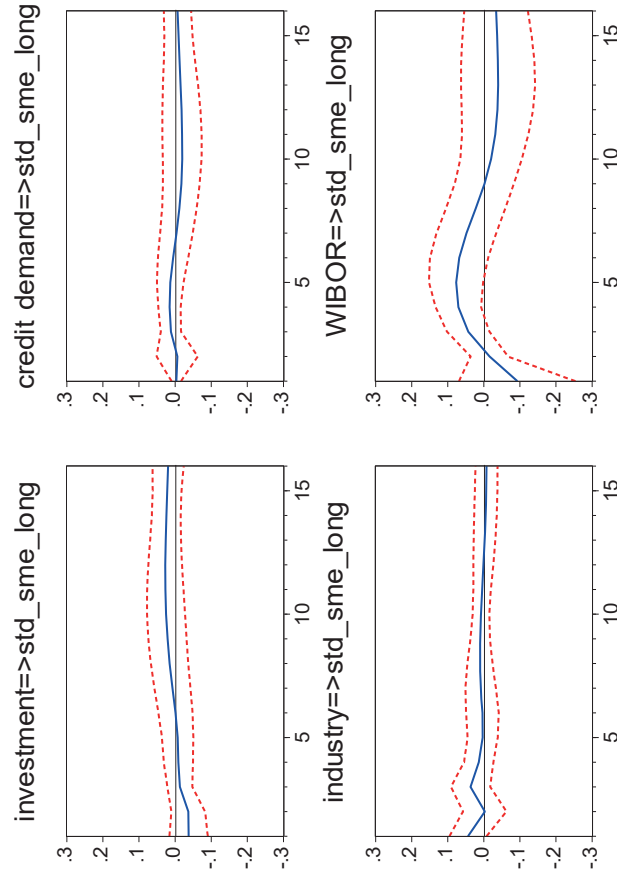
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_long =standards on long-term loans for SMEs, $investment$ =aggregate demand shock, $macro$ =risk related to macroeconomic conditions, $WIBOR$ =3-month money market rate.

Figure 6: Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with industry-specific risks



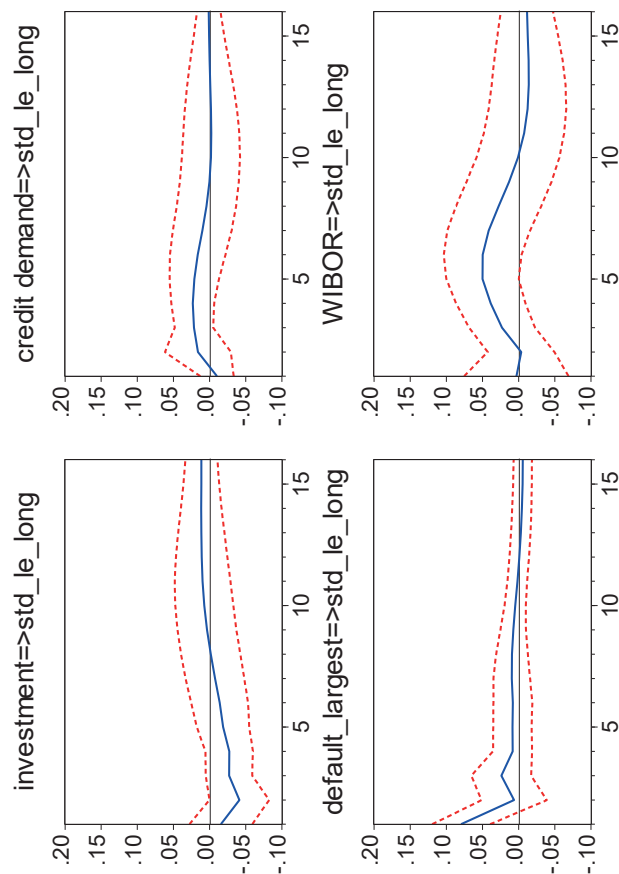
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_le_long*=standards on long-term loans for LEs, *investment*=aggregate demand shock, *industry*= industry-specific risks, *WIBOR*=3-month money market rate.

Figure 7: Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with industry-specific risks



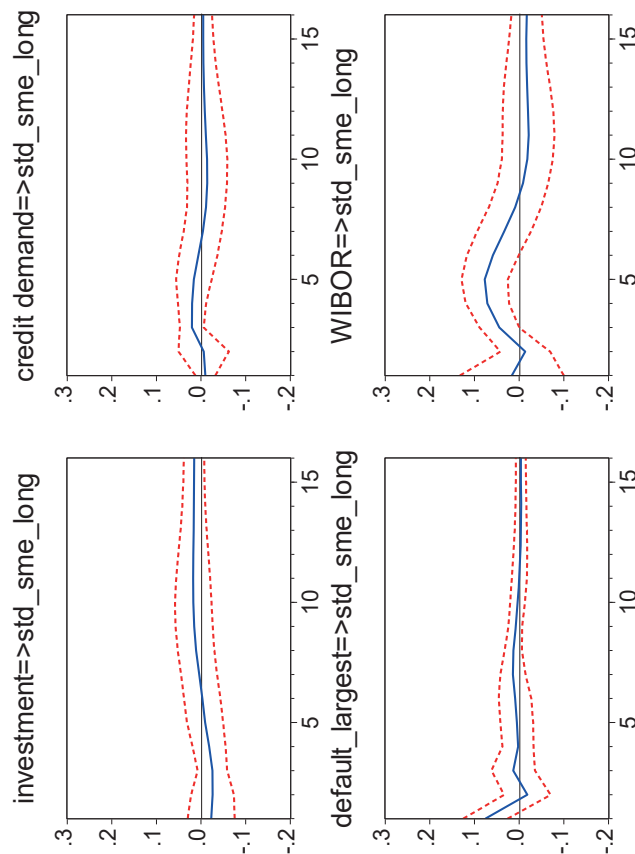
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_sme_long*=standards on long-term loans for SMEs, *investment*=aggregate demand shock, *industry*=industry-specific risks, *WIBOR*=3-month money market rate.

Figure 8 Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to default of the largest borrowers



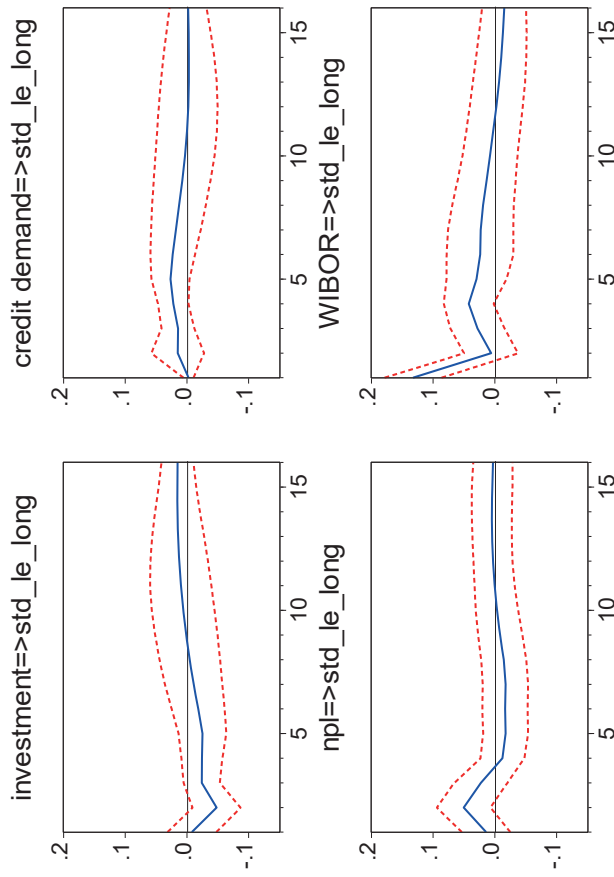
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_long =standards on long-term loans for LEs, $investment$ =aggregate demand shock, $default_largest$ =risk related to default of the largest borrowers, $WIBOR$ =3-month money market rate.

Figure 9 Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with related to default of the largest borrowers



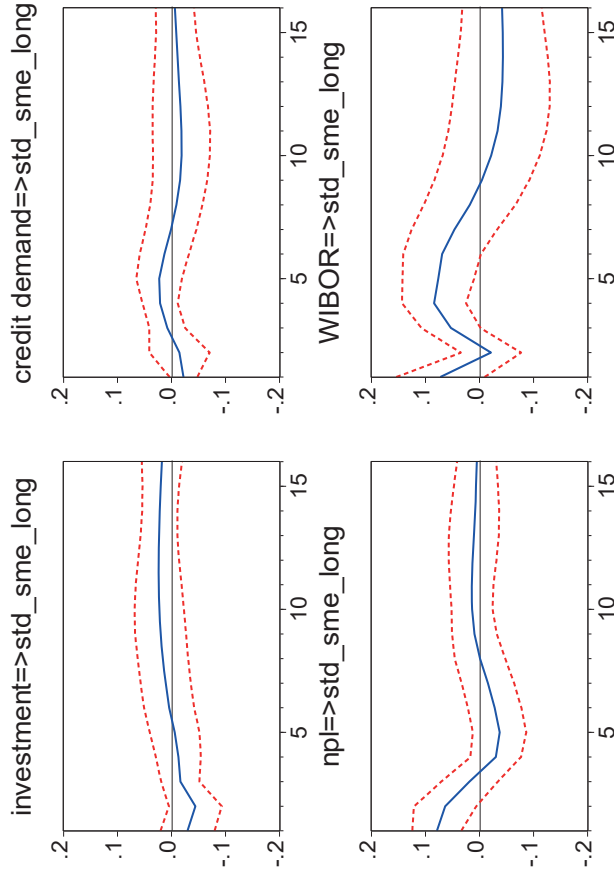
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_long =standards on long-term loans for SMEs, $investment$ =aggregate demand shock, $default_largest$ =risk related to default of the largest borrowers, $WIBOR$ =3-month money market rate.

Figure 10 Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' balance sheets



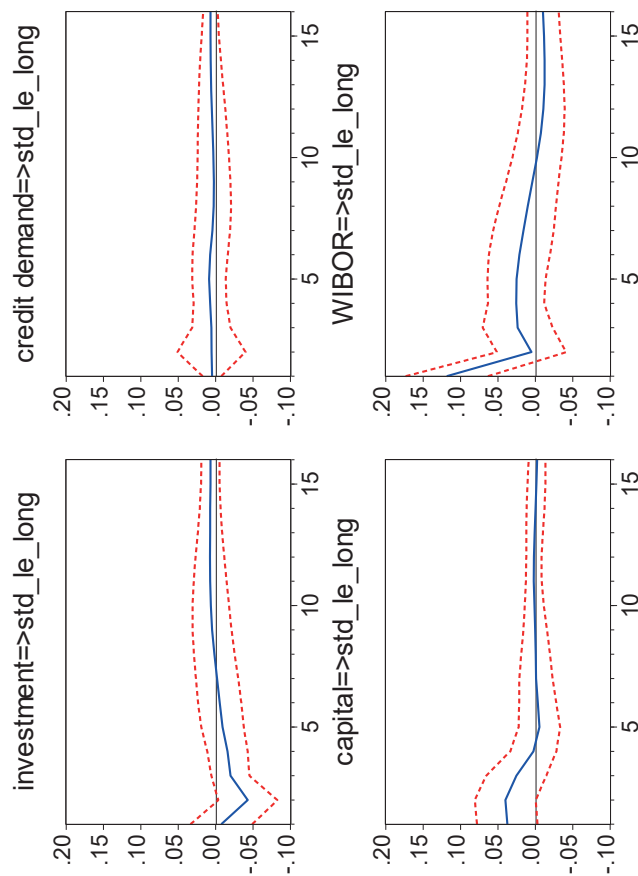
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_long=standards on long-term loans for LEs, investment=aggregate demand shock, npl=risk related to banks' balance sheets (non-performing loans), WIBOR=3-month money market rate.

Figure 11 Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' balance sheets



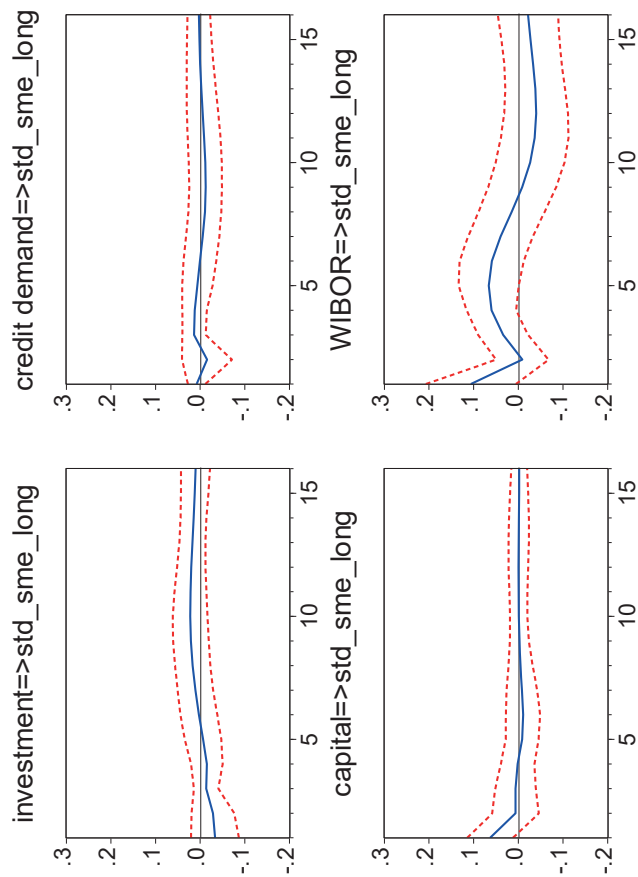
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_long=standards on long-term loans for SMEs, investment=aggregate demand shock, npl=risk related to banks' balance sheets (non-performing loans), WIBOR=3-month money market rate.

Figure 12 Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' capital



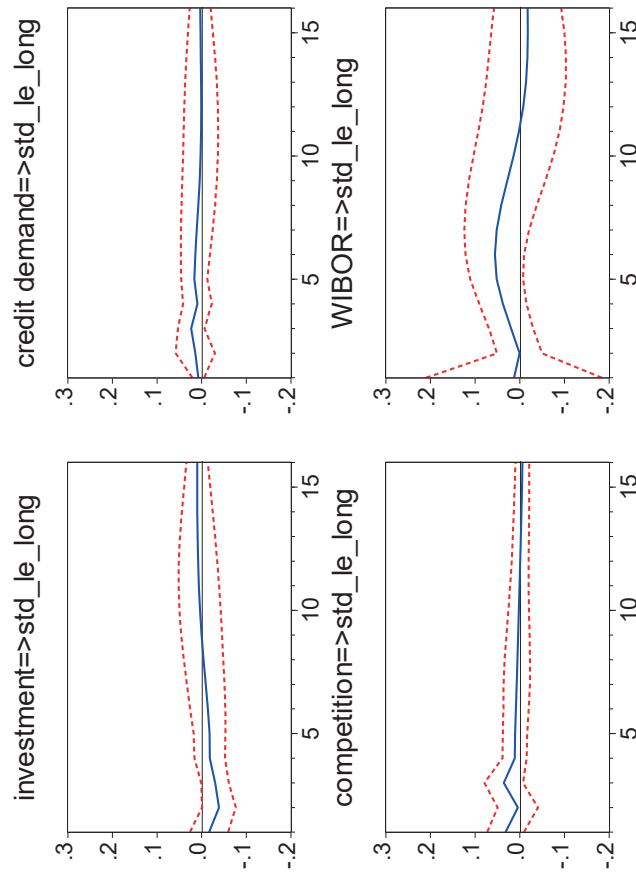
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_long=standards on long-term loans for LEs, investment=aggregate demand shock, capital=risk related to banks' capital, WIBOR=3-month money market rate.

Figure 13 Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' capital



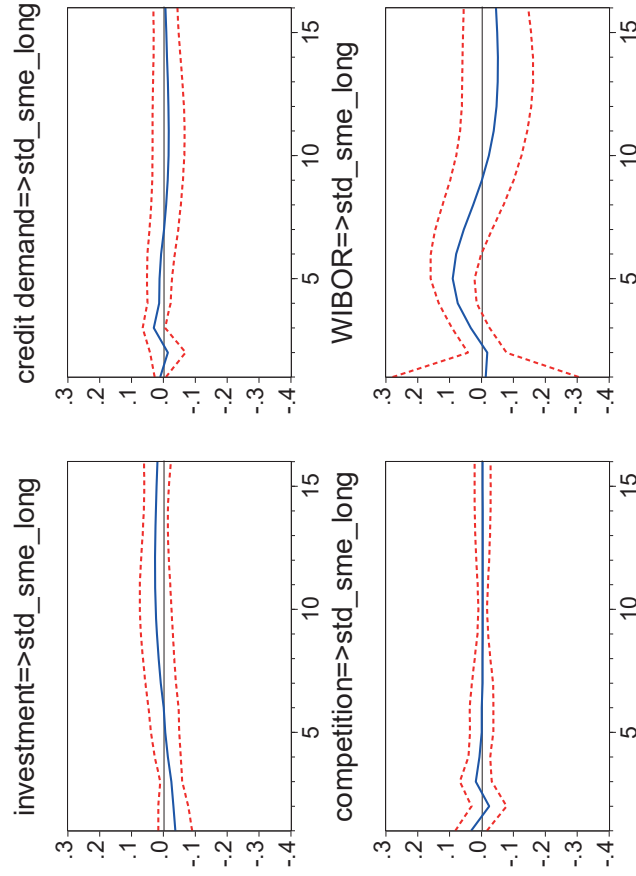
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_long=standards on long-term loans for SMEs, investment=aggregate demand shock, capital=risk related to banks' capital, WIBOR=3-month money market rate.

Figure 14 Response of standards on long-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to competition



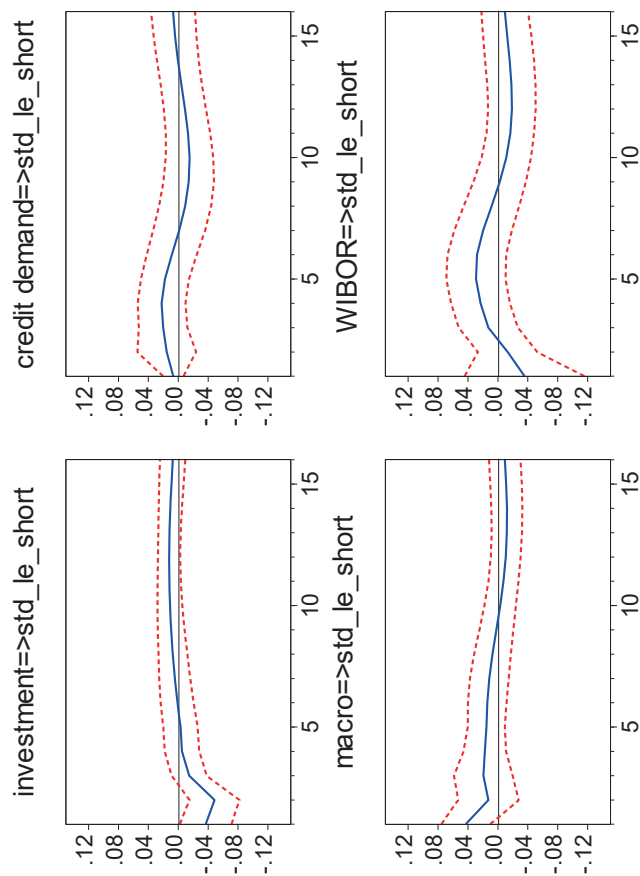
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_long =standards on long-term loans for LEs, $investment$ =aggregate demand shock, $competition$ =risk related to competition from other banks and sources of external financing, $WIBOR$ =3-month money market rate.

Figure 15 Response of standards on long-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to competition



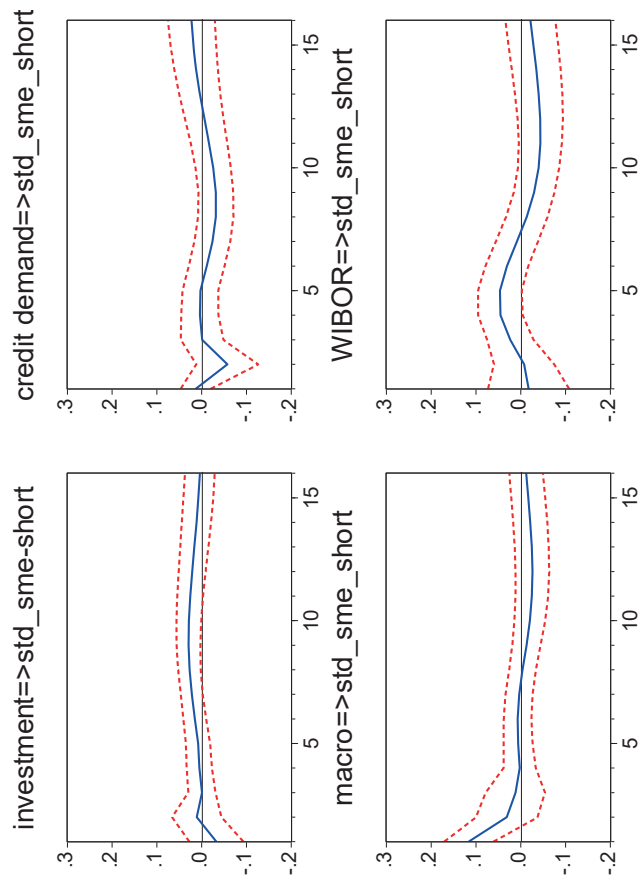
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_long =standards on long-term loans for SMEs, $investment$ =aggregate demand shock, $competition$ =risk related to competition from other banks and sources of external financing, $WIBOR$ =3-month money market rate.

Figure 16 Response of standards on short-term loans for LEs to one S.D. Innovations ± 2 S.E., model with macroeconomic risks



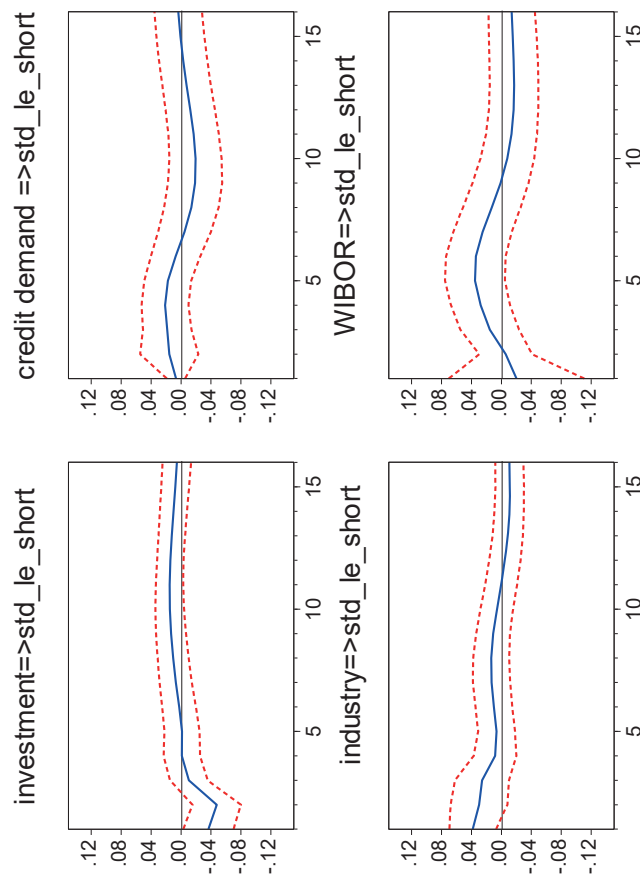
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_le_short*=standards on short-term loans for LEs, *investment*=aggregate demand shock, *macro*=risk related to macroeconomic conditions, *WIBOR*=3-month money market rate.

Figure 17 Response of standards on short-term loans for SMEs to one S.D. Innovations ± 2 S.E., model with macroeconomic risks



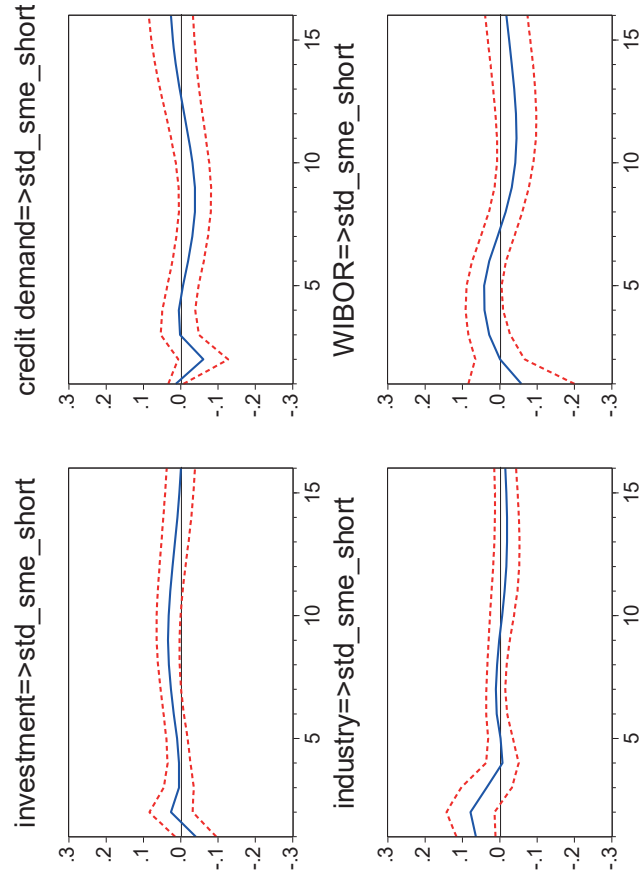
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_sme_short*=standards on short-term loans for SMEs, *investment*=aggregate demand shock, *macro*=risk related to macroeconomic conditions, *WIBOR*=3-month money market rate.

Figure 18 Response of standards on short-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with industry-specific risks



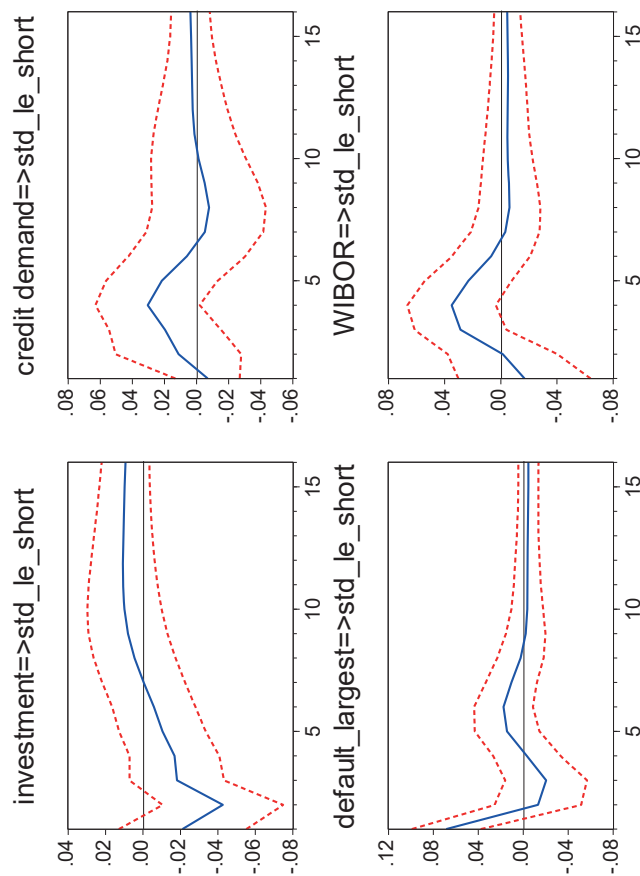
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_short=standards on short-term loans for LEs, investment=aggregate demand shock, industry= industry-specific risks, WIBOR=3-month money market rate.

Figure 19 Response of standards on short-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with industry-specific risks



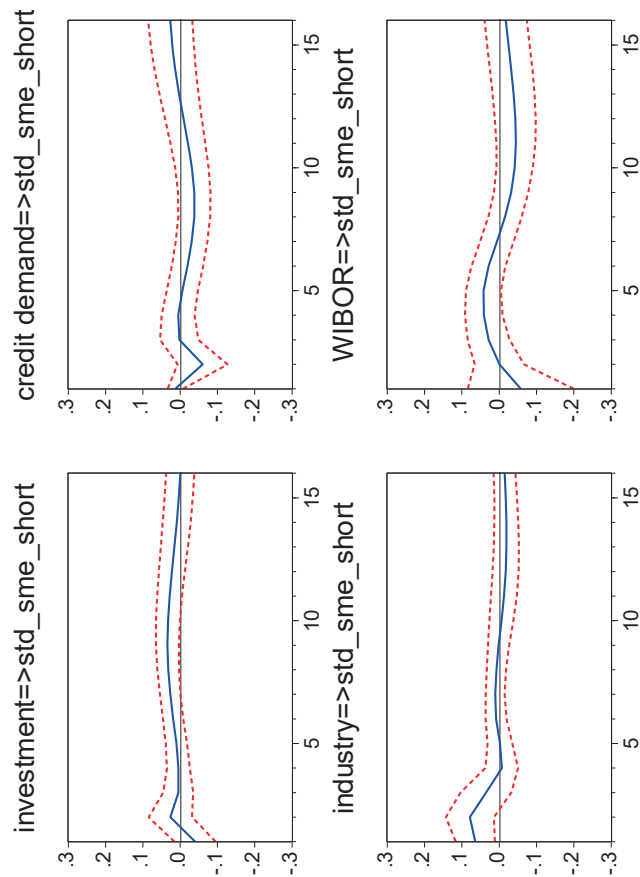
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_short=standards on short-term loans for SMEs, investment=aggregate demand shock, industry= industry-specific risks, WIBOR=3-month money market rate

Figure 20 Response of standards on short-term loans for LEs to one S.D. Innovations ± 2 S.E., model with risks related to default of the largest borrowers



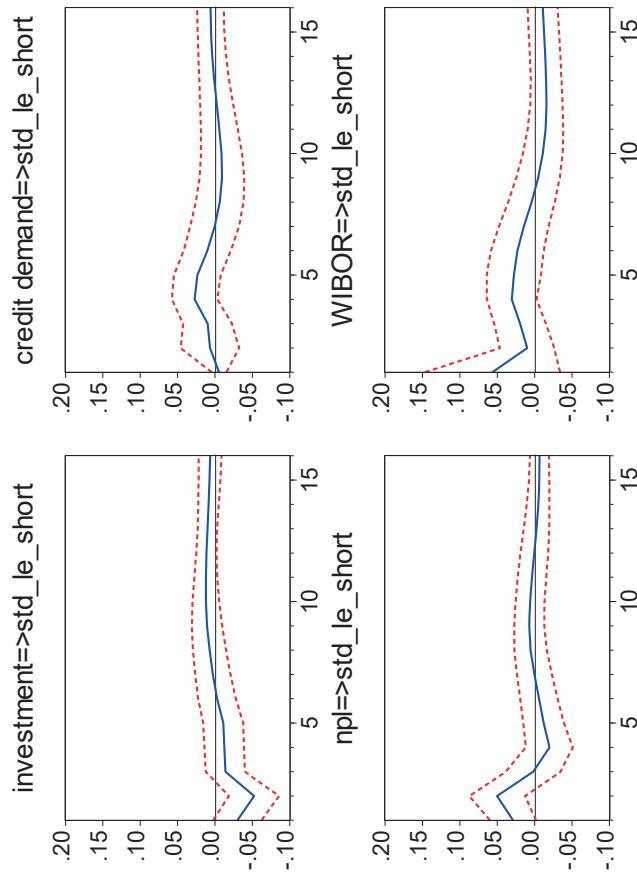
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_short =standards on short-term loans for LEs, $investment$ =aggregate demand shock, $default_largest$ =risk related to default of the largest borrowers, $WIBOR$ =3-month money market rate.

Figure 21 Response of standards on short-term loans for SMEs to one S.D. Innovations ± 2 S.E., model with risks related to default of the largest borrowers



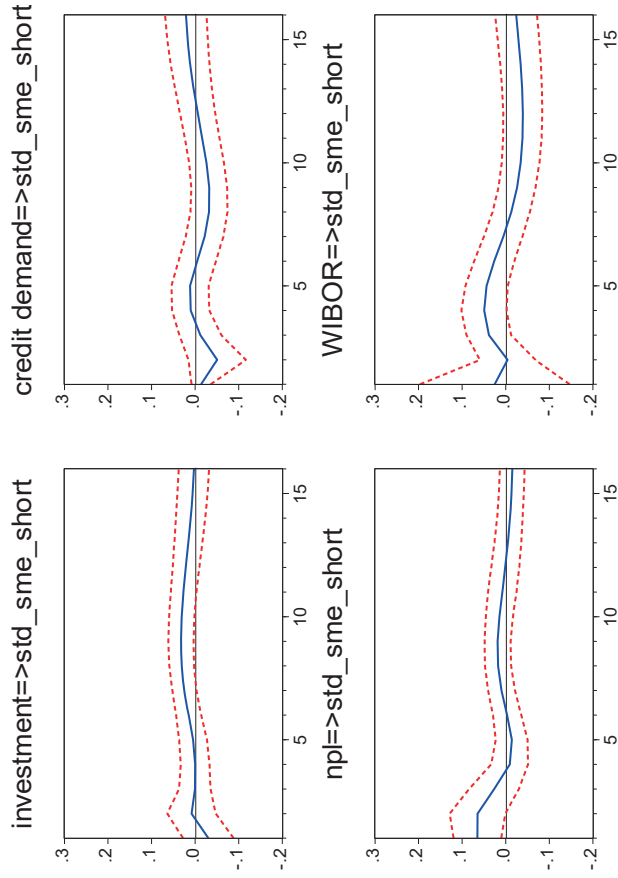
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_short =standards on short-term loans for Es, $investment$ =aggregate demand shock, $default_largest$ =risk related to default of the largest borrowers, $WIBOR$ =3-month money market rate.

Figure 22 Response of standards on short-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' balance sheets



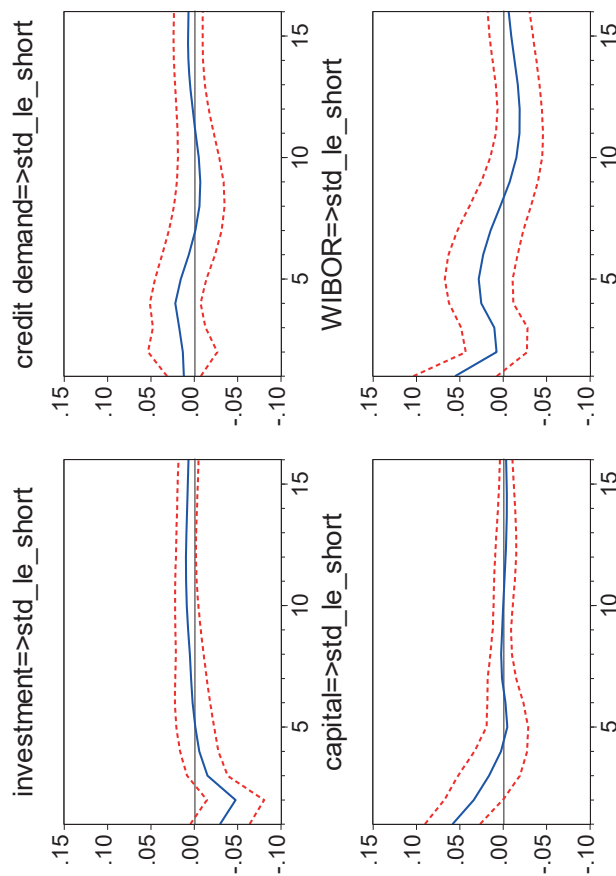
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_le_short*=standards on short-term loans for LEs, *investment*=aggregate demand shock, *npl*=risk related to banks' balance sheets (non-performing loans), *WIBOR*=3-month money market rate.

Figure 23 Response of standards on short-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' balance sheets



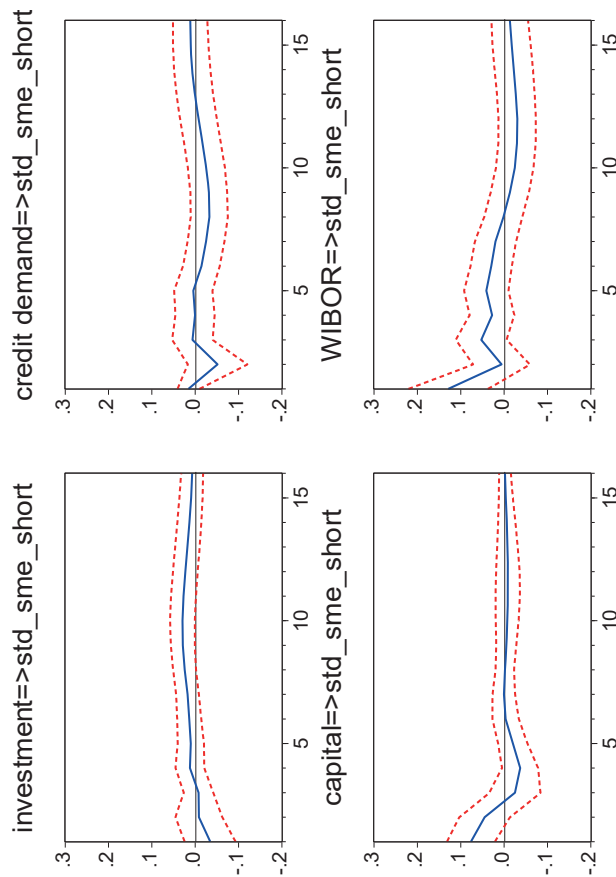
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_sme_short*=standards on short-term loans for SMEs, *investment*=aggregate demand shock, *npl*=risk related to banks' balance sheets (non-performing loans), *WIBOR*=3-month money market rate.

Figure 24 Response of standards on short-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' capital



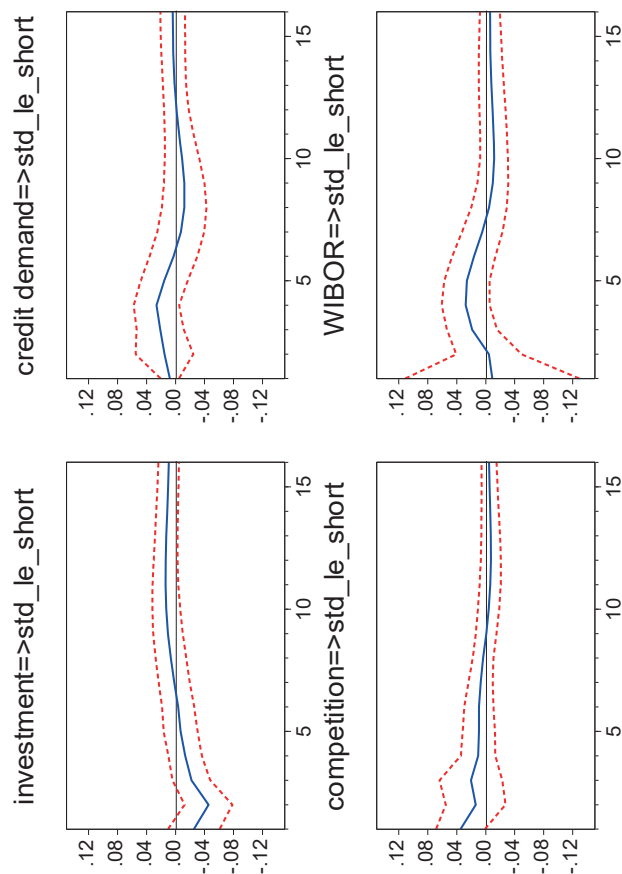
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_le_short=standards on short-term loans for LEs, investment=aggregate demand shock, capital=risk related to banks' capital, WIBOR=3-month money market rate.

Figure 25 Response of standards on short-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to banks' capital



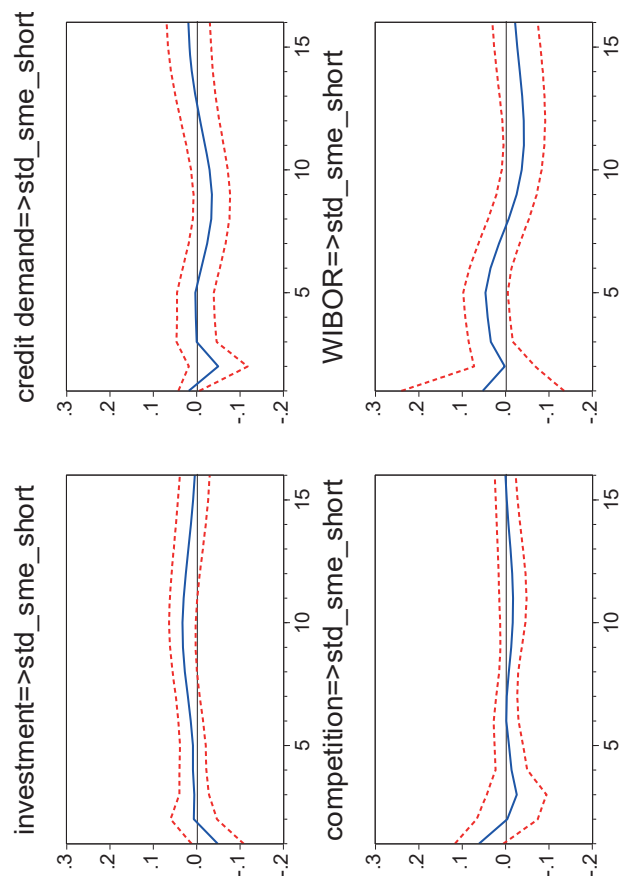
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; std_sme_short=standards on short-term loans for SMEs, investment=aggregate demand shock, capital=risk related to banks' capital, WIBOR=3-month money market rate.

Figure 26: Response of standards on short-term loans for LEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to competition



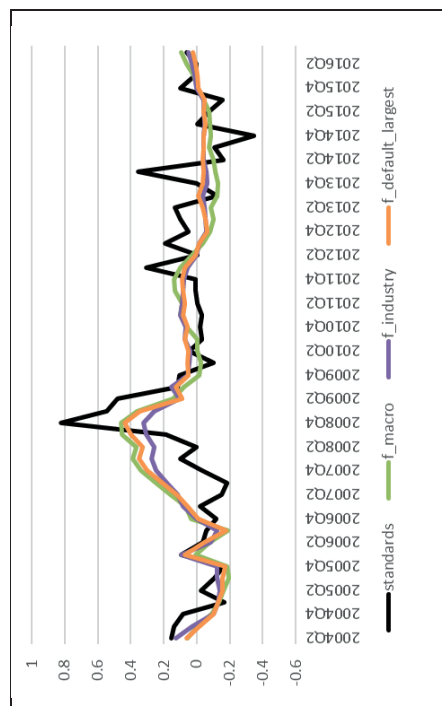
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_le_short*=standards on short-term loans for LEs, *investment*=aggregate demand shock, *competition*=risk related to competition from other banks and sources of external financing, *WIBOR*=3-month money market rate.

Figure 27: Response of standards on short-term loans for SMEs to one S.D. Innovations $\pm 2S.E.$, model with risks related to competition



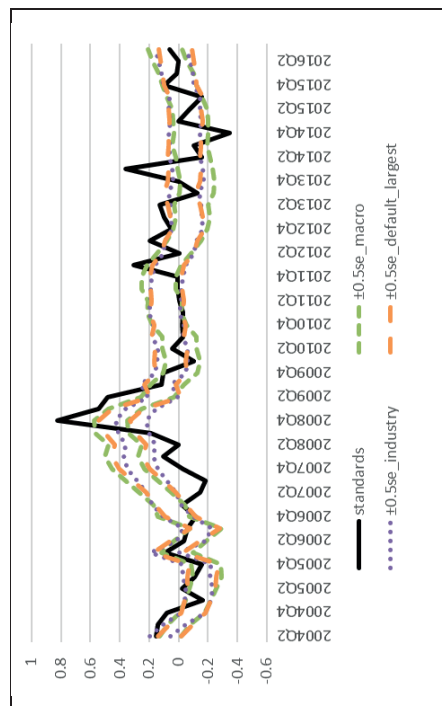
Note: Horizontal axis represents quarters. On the vertical axis units are in decimals, thus to obtain percentage points they need to be multiplied by 100; *std_sme_short*=standards on short-term loans for SMEs, *investment*=aggregate demand shock, *competition*=risk related to competition from other banks and sources of external financing, *WIBOR*=3-month money market rate.

Figure 28: Standards on long-term loans for LEs (black line) and their forecast (coloured lines)



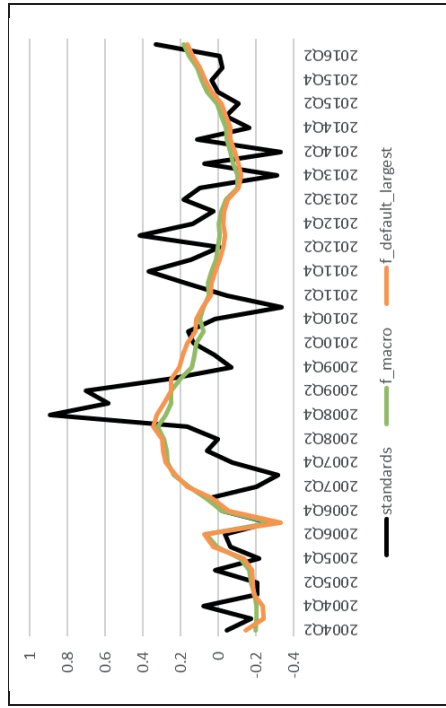
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent.
f_macro=forecast of standards from the model with macroeconomic risks,
f_industry= forecast of standards from the model with industry-specific risks,
f_default_largest= forecast of standards from the model with risks of default of the largest borrowers.

Figure 29: Standards on long-term loans for LEs (solid line) and the band of ± 0.5 S.E. around their forecasts (dotted lines)



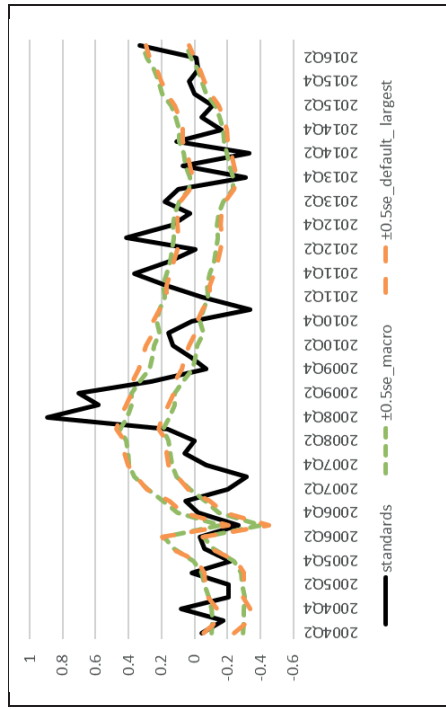
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent, dotted lines represent ± 0.5 S.E. bands around forecasts obtained from models with macroeconomic risks (macro), industry-specific risks (industry) and risks of default of the largest borrowers (default_largest)

Figure 30: Standards on long-term loans for SMEs (black line) and their forecasts (coloured lines)



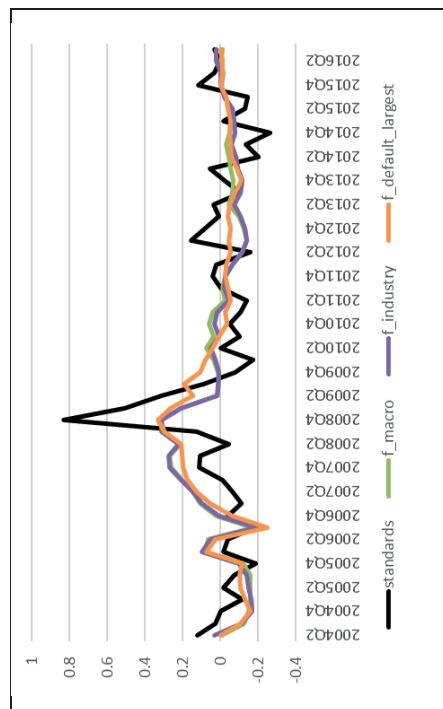
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent, f_macro =forecast of standards from the model with macroeconomic risks, $f_default_largest$ = forecast of standards from the model with risks of default of the largest borrowers.

Figure 31: Standards on long-term loans for SMEs (solid line) and the band of ± 0.5 S.E. around their forecasts (dotted lines)



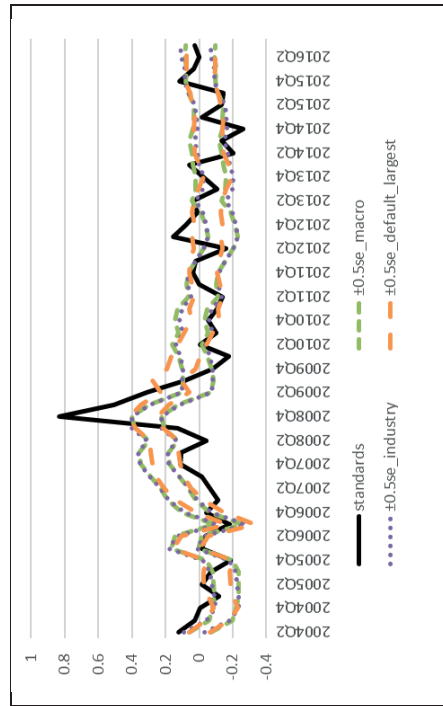
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent, dotted lines represent ± 0.5 S.E. bands around forecasts obtained from models with macroeconomic risks (macro) and risks of default of the largest borrowers ($default_largest$)

Figure 32: Standards on short-term loans for LEs (black line) and their forecasts (coloured lines)



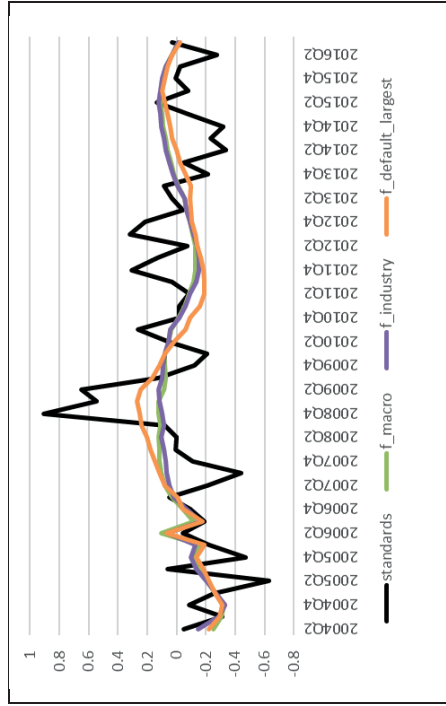
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent.
f_macro = forecast of standards from the model with macroeconomic risks,
f_industry = forecast of standards from the model with industry-specific risks,
f_default_largest = forecast of standards from the model with risks of default of the largest borrowers.

Figure 33: Standards on short-term loans for LEs (solid line) and the band of ± 0.5 S.E. around their forecasts (dotted lines)



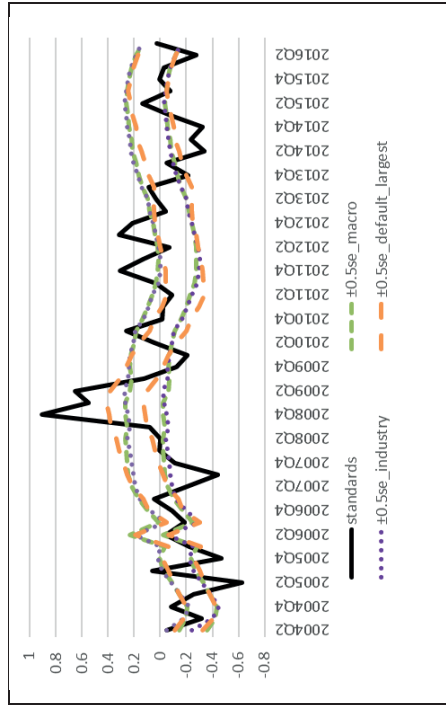
Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent, dotted lines represent ± 0.5 S.E. bands around forecasts obtained from models with macroeconomic risks (macro), industry-specific risks (industry) and risks of default of the largest borrowers (default_largest)

Figure 34: Standards on short-term loans for SMEs (black line) and their forecasts (coloured lines)



Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent.
 f_macro =forecast of standards from the model with macroeconomic risks,
 $f_industry$ = forecast of standards from the model with industry-specific risks,
 $f_default_largest$ = forecast of standards from the model with risks of default of the largest borrowers.

Figure 35: Standards on short-term loans for SMEs (solid line) and the band of ± 0.5 S.E. around their forecasts (dotted lines)



Note: Units are in decimals, thus e.g. 0.1 is equivalent to 10 per cent, dotted lines represent ± 0.5 S.E. bands around forecasts obtained from models with macroeconomic risks (macro), industry-specific risks (industry) and risks of default of the largest borrowers (default_largest)

Statistical Annex

Table A1. Data used in the estimations

| Variable | Transformation | Source |
|---|--|-------------|
| Loans to the corporate sector in the domestic currency (for investment and WC&CA) | The log of, s.a | NBP |
| Investment, Poland, chain linked, 2010 | The log of, s.a., corrected for working days | Eurostat |
| Investment, euro area, chain linked, 2010 | The log of, s.a., corrected for working days | Eurostat |
| WIBOR3M, percent per annum | Quarterly average of the 3-month daily rate | Reuters |
| EURIBOR3M, percent per annum | Quarterly average of the 3-month daily rate | ECB (SDW) |
| Investment deflator, 2010 =100 | The log of, s.a. | Eurostat |
| Lending standards (on long term and short-term credits to: (i) LEs, and (ii) SMEs) | Multiplied by -1 | NBP (SLOOS) |
| Lending standards' driving factors: industry-specific risk, risk related to the financial standing of the largest borrowers, risk related to macroeconomic conditions | Multiplied by -1 | NBP (SLOOS) |

Table A2: IRFs to shocks to the potential drivers of standards on long-term loans

| Shock to risk factor | IRFs: standards for LEs | IRFs: standards for SMEs |
|----------------------------------|-------------------------|--------------------------|
| <i>macro</i> | yes | yes |
| <i>industry-specific</i> | yes | no |
| <i>default largest borrowers</i> | yes | yes |
| <i>npl</i> | yes | yes |
| <i>capital</i> | yes | yes |
| <i>competition</i> | no | no |

Note: "yes" =statistically significant, "no" =statistically insignificant. Confidence intervals: ± 2 S.E. Factors written using bold letters are those which affect the NPV.

Table A3: IRFs to shocks to the potential drivers of standards on short-term loans

| Shock to risk factor | IRFs: standards for LEs | IRFs: standards for SMEs |
|----------------------------------|-------------------------|--------------------------|
| <i>macro</i> | yes | yes |
| <i>industry-specific</i> | yes | no |
| <i>default largest borrowers</i> | yes | yes |
| <i>npl</i> | yes | yes |
| <i>capital</i> | yes | yes |
| <i>competition</i> | no | yes |

Note: “yes” =statistically significant, “no” =statistically insignificant. Confidence intervals: ± 2 S.E. Factors written using bold letters are those which affect the NPV.

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