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Identifying supply and demand in the Hungarian corporate loan market

MAGYAR NEMZETI BANK

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Contents

Abstract

During the recent crisis bank lending to the non-financial corporate sector declined substantially in Hungary and this slump proceeds in the aftermath of the recession as well. However it is not evident whether it is a result of the slow recovery of the real economy (the lack of credit demand), or it is caused by the balance sheet adjustment of financial intermediaries, that is tight credit supply is prevalent. In this paper we identify supply and demand in the corporate loan market in Hungary and decompose the developments of lending to supply and demand factors. Doing this a simultaneous econometric model is estimated on a panel dataset, which covers the major banks in the industry. The model takes into account the results of the Bank Lending Survey of MNB, which provides some information about lending standards and banks' willingness to lend. Our results suggest that tight supply conditions have played an important role in the decline of lending, especially after the outbreak of the crisis. At the same time, demand has been contracted as well during the recession, although it has started to recover in 2010. At the end of 2010 we may conclude that the decline in supply and demand accounted for the drop in corporate lending in a ratio of around 2/3–1/3, respectively.

JEL: E44.
Keywords: corporate lending, credit supply, bank lending survey.

Összefoglaló

A válság során a nem pénzügyi vállalatok banki hitelállománya jelentősen csökkent Magyarországon, és ez a visszaesés a recesszió elmúltával is folytatódott. Nem egyértelmű azonban, hogy ez a jelenség a reálgazdaság lassú kilábalásának, azaz a hitelkereslet hiányának, vagy a pénzügyi közvetítőrendszer mérlegalkalmazkodásának, vagyis a szigorú hitelkínálatnak az eredménye. A cikkben hitelkeresletet és hitelkínálatot identifikálunk, és a vállalati hitelezés alakulását keresleti és kínálati tényezőkre bontjuk fel. Mindez egy szimultán ökonometriai modell becslésének a segítségével történik a bankrendszer legfontosabb szereplőit tartalmazó panel adatbázison. A modell figyelembe veszi az MNB hitelezési felmérésének az eredményeit, amely felmérés a bankok hitelezési feltételeiről, illetve hitelezési hajlandóságáról nyújt információt. Eredményeink szerint a válság kitörése után a szigorú hitelkínálati korlátok játszottak fontosabb szerepet a hitelezés visszaesésében. Ugyanakkor a válság során a hitelkereslet is jelentősen mérséklődött, 2010 elejétől azonban már élénkülésnek indult. 2010 végén azt mondhatjuk, hogy a vállalati hitelezés visszaeséséért a kereslet, illetve a kínálat csökkenése körülbelül 1/3-2/3 arányban felelős.

1 Introduction

Hungary experienced a very severe recession in 2009 and the slump of the GDP has coupled with the contraction of corporate lending. This drop in corporate lending was significant and long-drawn-out in a Central and Eastern European comparison as well (Fábián et al., 2010). The fall of the outstanding amount of loans can be considered as a natural consequence of recessions, it can be explained from both supply- and demand-side. Due to the depressed demand, firms' production volumes are decreasing and they tend to cut back their inventories, which moderate their need for short-term loans. At the same time spare capacities and uncertain economic outlook force them to postpone investments, which reduce demand for long-term loans. Moderate supply also can be justified, especially in the case of the recent crisis, since it was originated from the financial intermediary system. Due to bad portfolio quality and weak capital or liquidity positions, banks adjust their balance sheets, thus tighten credit supply.

The aim of this study is to disentangle supply and demand in the corporate loan market in Hungary. The focus of the analysis is on the period between the fourth quarter of 2008 and fourth quarter of 2010 that is on the crisis and on its aftermath. We are interested in whether the weakness of corporate lending during this period can be attributed rather to demand or to supply. The developments of 2010 make this question more pronounced, since contrary to the pick-up of GDP and the slow recovery, corporate lending was still falling in that year. The role of supply and demand in the decline of lending is important from a policy point of view as well, since depressed lending cannot enhance recovery or at some point it can be an obstacle of economic growth. However the means of economic policy that can boost credit growth depend on the causes of weak lending; whether it is attributable to demand or to supply constraints.

The identification of supply and demand is performed in a simultaneous equation framework, which is estimated on a panel of six banks between 2003 Q1 and 2010 Q4. It is an equilibrium approach since it is assumed that lending rates are market clearing. Credit market imperfections (i.e. asymmetric information) are taken into account through two channels. First, in the supply equation the results of Bank Lending Survey are incorporated, which reflect the non-price conditions of credit supply. Second, a proxy for the creditworthiness of borrowers is also included in the supply. Thus supply may contract either due to the increased risk aversion of lenders, which is reflected in tighter credit conditions, or due to the deteriorated creditworthiness of borrowers, which is captured by higher corporate bankruptcy rates.

The aim is to estimate the slope parameters of demand and supply, since the slopes and the observed price – quantity combinations uniquely define the demand and supply curves. This enables us to detect the movements of these curves between two given dates, therefore to decompose the changes of our quantity type variable into demand and supply components.

Our results suggest that the contraction of supply had started in the second quarter of 2008, before the outbreak of the crisis. The decrease of supply was very severe after the outbreak of the crisis (in 2008 Q4), which ended in the third quarter of 2009. This slump was mainly attributable to the weak liquidity positions of banks; furthermore poor economic outlooks and low risk tolerance also played an important role. Moderate supply was reflected in tight lending conditions and in the decreased willingness of banks to grant loans. According to our results, credit supply improved in the last quarter of 2009 and in the first quarter of 2010, which was the result of the improved liquidity and capital position of banks. However this turnaround in supply did not last long and credit supply dropped in the middle of 2010. This can be attributed to the deteriorated creditworthiness of potential borrowers, the corporate bankruptcy rate (our proxy for clients' creditworthiness) peaked in that time.

The path of credit demand was less variable than supply in the examined period. After a pick up in the last quarter of 2008 it declined during 2009 and bottomed out in the first quarter of 2010. As growth accelerated, demand for credit improved as well, however demand for credit is still weak as opposed to the pre-crisis period. Compared to the pre-crisis period (2008 Q3), at the end of 2010 the fall in supply and demand accounted for the drop in corporate lending in a ratio of around 2/3–1/3, respectively.

The paper is organized as follows. Section 2 highlights the stylized facts of corporate lending, Section 3 presents the methodology, describes the data, the model specification and discusses identification issues. Section 4 presents the results and finally Section 5 concludes.

2 Stylized facts

In this section some stylized facts of Hungarian corporate loan sector are discussed. Since the estimation sample covers the period between 2003 Q1 and 2010 Q4, the graphs also show this time interval, although the focus of the analysis is on the 2008 – 2010 period. In this paper we only examine loans extended by the banking sector, although other sources of credit, such as foreign loans, or loans from other financial intermediaries are also available for non-financial firms.

Hungary experienced a relatively rapid credit growth between the 2003 and 2008 Q3. During this period, the loans outstanding to non-financial enterprises grew at an annualized rate of 12.5 per cent on average; the stock of loans has doubled by end of the period (Chart 1). The recent financial crisis has made an end of this credit expansion, since the last quarter of 2008 loans outstanding keeps on declining. In nominal terms, the most severe drop was in 2008 Q4 and in 2009 Q1, in these quarters the loans outstanding contracted by 200–200 billion forints. The annual growth rate bottomed out in the third quarter of 2009, since then the dynamics of the decline has been moderated somewhat. The seriousness of this contraction can be illustrated by the fact that the loans outstanding at the end of 2010 corresponds to the level of the first quarter of 2007. This downturn is very severe and long drawn-out in a regional comparison; in magnitude it is similar to the slump experienced by the Baltic countries (MNB, 2011b).

One of the most important motivations of this paper is the controversial developments of the loans outstanding and of the GDP. Contrary to moderate recovery of the GDP in 2010, lending was still weak, and the outstanding amount of loans

Chart 1
The dynamics of the loans outstanding to the non-financial corporate sector between 2003 Q1 and 2010 Q4

Net credit flow (right-hand scale)
Annualized quarterly growth rate
Annual growth rate
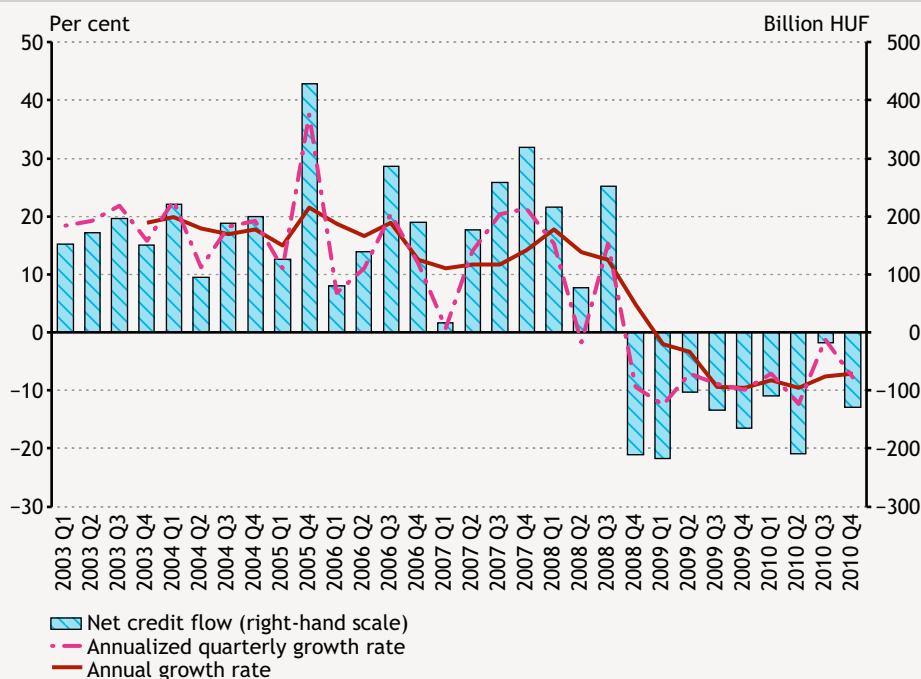
Note: Annual growth rates and annualized quarterly growth rates are adjusted for exchange rate effects, these rates are evaluated at December 31, 2010. The net credit flow is the quarterly difference of the outstanding amount of loans. It is also adjusted for exchange rate effects however each point is evaluated at the end of the actual quarter. This difference in exchange rate adjustment explains why the net credit flow and annualized quarterly growth rate had different signs in 2008 Q2.
Source: MNB.

Chart 2
Cyclical decomposition of the corporate credit/GDP ratio
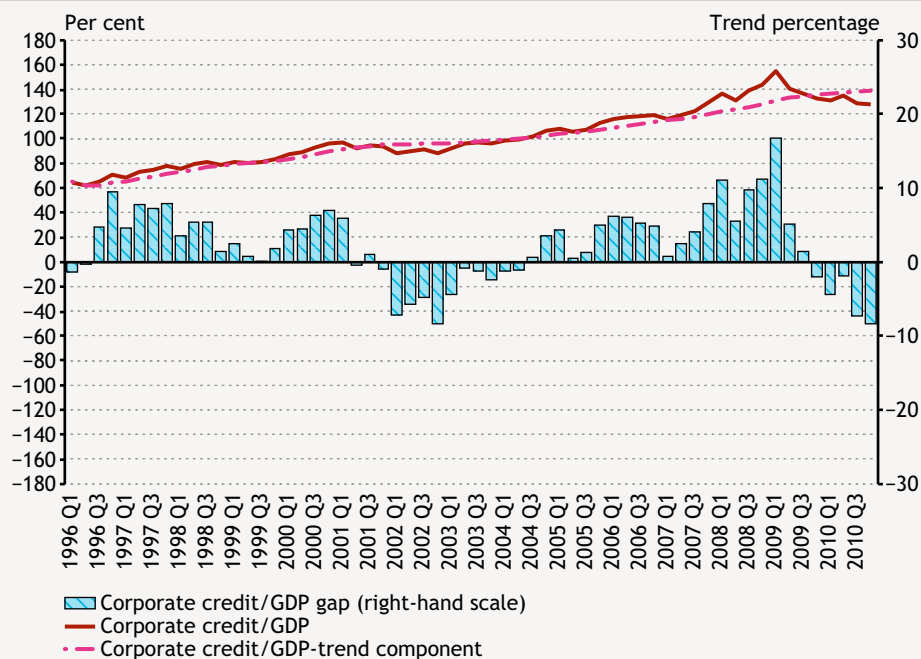
Note: The numerator of the credit/GDP ratio is the outstanding amount of other corporate loans extended by other monetary institutions and to other financial intermediaries, which is not adjusted for exchange rate effects. A denominator is the quarterly nominal GDP. The trend is calculated recursively by the Hodrick-Prescott filter (lambda = 400 000).
Source: MNB, author's calculation.

declined significantly. A possible explanation of this phenomenon might be an excess credit growth before the outbreak of the crisis, which has been corrected during and after the recession.

A commonly used measure to detect financial imbalances, and examine whether a country has experienced an excess credit growth is the credit/GDP ratio. In Hungary the corporate credit/GDP ratio had been increasing since the beginning of 2003, and it peaked in the first quarter of 2009.[1] The trend – gap decomposition suggests that corporate credit/GDP grew above its trend before the crisis, but the gap was below 6 per cent up to beginning of 2008. During 2009 the cyclical position changed substantially, the gap became negative by the end of 2009. However, the negative gap has widened further to 8 per cent by the end of 2010, meanwhile the cyclical position of the economy – measured by the output gap – has improved (MNB, 2011a). This suggests that the contraction of credit during 2009 was a simple cyclical correction, but the widening of this (negative) gap during 2010 cannot be explained from the demand-side. However, it is important to keep in mind that this trend – gap decomposition is based on a very simple statistical method and the trend component cannot be seen as an equilibrium credit/GDP path induced by the fundamentals.[2]

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[1] Since the numerator of the corporate credit/GDP ratio is not adjusted for exchange rate effects, the steep climb in the ratio in 2009 Q1 can be partly attributed to the significant depreciation of forint, which caused the increase of the corporate loans outstanding. This suggests that the credit expansion has continued in this period, although the net credit flow was negative. The main argument for adjusting for exchange rate effects is that the increase of loans outstanding due to the depreciation of forint may be misleading and suggest that corporations were able to get funds from banks. However, in reality it is not true, since they redeemed their debt, i.e. net credit flow was negative. On the other hand, the depreciation of the exchange rate increases firms indebtedness, which should be once redeemed, that is the leverage of non-financial enterprises grows. Additionally, exchange rate movements are also reflected in the nominal GDP, hence the adjustment of the numerator would be misleading. That's why we decided not to adjust for exchange rate effects.

[2] The choice of this method can be justified by the fact that this approach is expected to be the basis of the calculation of the countercyclical capital buffer under Basel III (BIS, 2010).

3 The model

3.1 THE MODEL FRAMEWORK

In this paper we estimate a classical demand – supply system that is it is an equilibrium approach. It is assumed that the observed lending rate is a market clearing one, hence demand equals to supply at each period. Consequently a simultaneous econometric model is estimated, which consists of two behavioral equations (i.e. demand and supply) and an identity (market clearing condition). Since prices and quantities are determined simultaneously, these variables are treated as endogenous in the model. This approach is similar to Calani et al. (2010), which is basically an equilibrium model that employs the results of the Bank Lending Survey for identification.

The dataset is a panel that consists of 6 banks' data that are active in the Hungarian corporate loan market, and the time dimension of the panel covers the period between 2003 Q1 and 2010 Q4 on a quarterly frequency. The size of the sample is mainly determined by the *Senior Loan Officer Survey on Bank Lending Practices (Bank Lending Survey* hereafter). The 6 banks of the sample have covered almost 70 per cent of the corporate loan portfolio at the end of 2010.

The dependent variable of the estimation is the annual growth rate of corporate loans outstanding, which is adjusted for exchange rate effects, while the price type variable is the real lending rate on new loans, which is the weighted average of Forint and Euro lending rates.

In the literature several dependent variables are considered, which approximate lending, such as the outstanding amount of loans, the net credit flow or the gross credit flow. We prefer the annual growth rate of loans outstanding to these indicators since on the one hand it is a normalized measure and it is on the same scale across banks. On the other hand it is considered to be more sensitive to the lending rates compared to the outstanding amount of loans, which reacts sluggishly to lending rate movements due to longer maturities.

Banks included in the sample are active in the same industry, therefore to capture the developments of the broader economy, several macro variables, such as gross fixed capital formation, new-export orders of selected branches of the manufacturing industry and corporate bankruptcy rate, are included in the dataset. These variables have no cross-sectional variance.

The Hungarian banking sector heavily relies on foreign funds, which is provided mainly by their parent banks. To approximate banks' lending ability or capacity, the annual growth rate of the foreign liabilities is also included in the panel.

Magyar Nemzeti Bank launched its Bank Lending Survey first in 2003 to enhance the understanding of bank lending behavior. The aim of this survey is to complement the available information set – which mainly consists of outstanding loans and prices – with qualitative information related to supply and demand. Banks with notable market shares fill in the questionnaires on a quarterly frequency since 2009 (on a biannual frequency before). Questions refer to the developments of supply and demand, to the lending standards and to the indicators describing portfolio quality in the main segments of the credit market (retail, corporate, municipality). Loans officers answer the questions on an ordinal scale, which is published on an aggregate level, weighted with market shares.

During the analysis of bank lending, central banks heavily rely on the qualitative results of the Survey. This can be explained by the fact that the Bank Lending Survey comprises information about several indicators and processes that are not observable for analysts (such as non-price lending standards, parameters describing credit risk). Additionally, banks' expectations about future developments of credit markets are also included in the Survey, which can improve central bank's forecasts. The lessons of the Survey however should be very carefully, since it highlights credit market developments only from one point of view, namely form banks' perspective.

Longer samples of lending surveys enable researchers to empirically test the information content of these surveys. Articles utilize time-series of the survey to investigate the relationship between credit cycles and real business cycles, and to analyze the supply and the demand side of the credit market. Using the results of the US Senior Loan Officer Survey Lown–Morgan (2006) analyzes the relationship between lending standards, credit- and business cycles in a VAR framework. They observe that the tightening of lending standards was always followed by the slowdown of corporate lending and all recessions, but one were preceded by the tightening of credit conditions. According to their results, changes in lending standards explain significantly the changes in lending and the variance of output and inventories. They have found that lending standards had been more important in lending than interest rates, which confirms the presence of credit market frictions. Bondt et al. (2010) examines the information content of lending standards in the eurozone. The authors, using a country panel have found that lending standards explain significantly GDP (and its components) and credit growth. With the means of the Bank Lending Survey's variables they identify transmission channels of monetary policy and they conclude that the bank lending channel and the balance sheet channel of corporations are active in the euro area.

Our panel contains three variables of the Bank Lending Survey, those that are related to banks' willingness to grant loans (1/A), to changes in the credit standards (3/A) and to the changes in demand for loans (5/A).[3] The answers of the Bank Lending Survey are included in the dataset on an individual level. Loan officers have 5 possible answers (ranked on an ordinal scale) for each questions, these answers are transformed to two dummy variables. Hence the model (just as the reported net percentage of respondents in the Lending Survey) takes only the direction of the answers into account.

It is important to note that MNB conducts the Bank Lending Survey on a quarterly frequency since 2009, contrary to the biannual practice before. This change in the frequency of the Survey requires assumptions about the frequency of the sample. Since all the above described variables are available in each quarter, we have opted for the quarterly frequency. Thus we assume that whenever a bank reported the tightening of lending standards in a half year, this meant that this bank tightened its lending standards in both quarters of this half. Since the focus of this paper is on the 2009–2010 period it is worth utilizing a more detailed dataset, which also favors the quarterly frequency.

3.2 SPECIFICATION

In the related literature several demand and supply specifications are considered. It is common that these specifications are not derived from theoretically founded, structural models, but they are rather motivated by pragmatic considerations that are related to country-, or market-specific motives. In this paper we follow the latter approach, and we argue why a given variable is in the set of explanatory variables and not why a given variable should be included in the specification.

The specification of the demand function is the following:

$$L_{it}^D = \beta_0^D + \beta_1^D \cdot r_{it} + \beta_2^D \cdot expord_{t-4} + \beta_3^D \cdot inv_{t-1} + \beta_4^D \cdot inv_{t-2} + \beta_5^D \cdot dem_{it-1}^- + \beta_6^D \cdot dem_{it-1}^+ + \varepsilon_{it}^D,$$

where[4]

L_{it}^D: demand for corporate loans,
r_{it}: real lending rate of new loans,

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[3] The exact questions are available in Appendix 1.
[4] A more detailed description of the variables can be found in the Appendix 2.

expord$_t$: new export-orders of selected branches of the manufacturing sector,
inv$_t$: gross fixed capital formation,
dem$_{it}^+$, dem$_{it}^-$: demand perceived by loan officers.

The pro-cyclicality of lending is partly attributed to the demand-side hence it is common to explain credit demand by variables measuring real economic activity. In booms the demand for the products and services of corporate increases, which boosts production. The working capital necessary to keep this production level is often financed by external funds, e.g. by bank loans. Whenever existing capacities are exploited, firms invest, which increases credit demand as well.

Hungary is a small and open economy, economic performance is jointly determined by internal and external factors therefore it is worth taking these effects into account, when we examine credit demand. Besides, the maturity of the loans is related to different types of economic activities, that is inventories and investments are financed by different maturities. In the model demand for longer term loans are captured by gross fixed capital formation. This variable is rather related to internal demand, although the matching is not perfect. External demand and demand for short-term loans is approximated by the annual growth rate of new-export orders of selected branches of the manufacturing industry (new export orders hereafter). The Bank Lending Survey explicitly asks loan officers how they had perceived credit demand as opposed to the previous period. This variable (two dummy variables) is also included in the specification of demand.

Credit supply is jointly determined by the price and non-price conditions of lending. The price variable in the supply equation – similarly to the demand – is the real lending rate, with an expected positive coefficient. Non-price terms of lending affect credit supply through two channels in the specification of supply.

The first one is closely related to banks, they can moderate supply by tightening their lending standards. This can mean that banks strengthen the maximal maturity or amount of granted loans, demand more collateral or tighten their credit scoring system. We approximate the changes in these standards with the results of the Bank Lending Survey (Question 3/A), we expect a negative (positive) coefficient whenever banks tighten (ease) their lending standards.

Second, non-price terms affect credit supply through the creditworthiness of borrowers. Whenever the macroeconomic conditions and the balance-sheet of firms deteriorate, the pool of potential borrowers narrow; that's why credit supply can decrease by unchanged credit conditions. Due to the heterogeneity of corporate, the creditworthiness of borrowers can be described by their distribution according to their probability of default. The deterioration of creditworthiness is then a change in the shape of this distribution, specifically the shift of the distribution. The expected value of this distribution is approximated by the corporate bankruptcy rate. Hence the decline of the bankruptcy rate corresponds to the improvement of creditworthiness that is to the rise of credit supply.

It is difficult to capture banks' lending ability or capacity, since it depends on banks' capital, liquidity positions and on their access to funding. In the specification of supply lending capacity is approximated by the annual growth rate of banks' foreign liabilities. Since the majority of the Hungarian banking sector has a foreign parent bank, the foreign liabilities of banks provided by their parent banks determine significantly their ability to extend loans.[5]

Banks' willingness to lend is a subjective factor, which is difficult to measure. The Bank Lending Survey asks whether banks' willingness to grant loans or credit lines improved as opposed to the last period. In the equation of supply we include this variable – which is simply referred as banks' willingness to lend later – and the expected sign of the coefficient is positive (negative) whenever banks reported an increase (decline) in their willingness to extend loans.

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[5] From this point of view OTP is an exception in the sample, since it has no foreign parent bank. Foreign liabilities are prevalent in OTP's balance sheet, although their importance is relatively small as opposed to other banks in the sample.

The specification of supply is the following:

$$L_{it}^S = \beta_0^S + \beta_1^S \cdot r_{it} + \beta_2^S \cdot stand_{it-2}^- + \beta_3^S \cdot stand_{it-2}^+ + \beta_4^S \cdot sup_{it}^- + \beta_5^S \cdot sup_{it}^+ + \beta_6^S \cdot bankruptcy_t + \beta_7^S \cdot for_{it} + \varepsilon_{it}^S,$$

where

r_{it}: real lending rate of new loans,
$stand_{it}^+$, $stand_{it}^-$: changes in banks' lending standards,
sup_{it}^+, sup_{it}^-: changes in banks' willingness to lend,
$bankruptcy_t$: corporate bankruptcy rate,
for_{it}: annual growth rate of banks' foreign liabilities.

3.3 IDENTIFICATION

In a simultaneous econometric model that has two structural equations, the necessary and sufficient condition for identification is to include a variable in each equation that is excluded from the other equations.[6] Putting it in another way, we need a variable that explains only the demand (supply) and does not explain the supply (demand). Each equation is estimated by two stage least squares (TSLS).

Supply is identified by the 4 quarter lag of new export orders and first and second lags of gross fixed capital formation. That is it assumed that the change of these variables (holding other variables constant) shifts only the demand curve, and not the supply. These variables identify supply since past movements in external demand or in investments do not affect contemporaneous credit supply. In addition to the timing of these variables, in the case of new export orders a geographic difference matters as well, since we expect that changes in external demand do not affect the credit supply of the banks operating in Hungary.

The relevance of the instruments – i.e. whether an instrument is correlated with the endogenous variable – is supported by the test proposed by Bound et al. (1995), which examines the joint significance of the excluded instruments in the first stage of the TSLS estimation. Since the supply equation is over-identified, the joint validity of the instruments can be tested with the Sargan test. The results of the Sargan test confirm that the over-identifying restrictions hold (Table 2).

Before discussing the identification of demand, it is worth highlighting some articles of the literature that employs Bank Lending Surveys for identification, since lending standards play an important role in our setting. The broad credit channel of monetary policy is analyzed by Ciccarelli et al. (2010) in a panel VAR framework using ECB's Bank Lending Survey. According to their definition the broad credit channel has three sub-channels, namely the bank lending channel, corporation's balance sheet channel and the credit demand channel. These channels are identified by the information of the Bank Lending Survey, they interpret shocks to the demand perceived by loan officers as credit demand shocks, and innovations to the banks' lending standards as credit supply shocks (shock to credit availability). The article finds that the broad credit channel is active in the eurozone and the impact of the bank lending channel on corporate lending is significant. Examining the recent crisis the authors have concluded that credit supply constraints contributed significantly to the downturn in the euro area.

Hempell and Sorensen (2010) investigates the role of credit supply factors in the contraction of corporate lending during the recent crisis in the eurozone. The authors demonstrate the importance of credit supply constraints in the downturn of corporate lending in a panel framework. They examine what were the most important factors that contributed to the tight credit constraints as well. They find that the decline in corporate lending originated in banks' liquidity and funding problems.

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[6] In general such exclusion restrictions are only necessary for identification (order condition), but in a two-equation system they are also sufficient (rank condition); see, e.g., Wooldridge (2002), Greene (2003).

Based on banks' individual answers, Calani et al. (2010) identifies credit demand and supply in Chile. They show that loan officers' answers related to supply and demand are independent of each other hence demand and supply curves can be identified in the different segments of the credit market (corporate loans, mortgage loans, personal loans). They argue that independence should be tested, since loan officers' demand perception might affect their answers related to lending standards. To test independence, they regress the lending standards on bank-specific variables, macro variables and on the demand perception variable. They find that bank-specific variables are significant, meanwhile demand perception variables are not, which supports the hypothesis of independence and enables them to use the results of the Bank Lending Survey to identify supply and demand. Their results are in line with the conclusions of the euro area: the downturn of corporate lending was caused by the moderation of credit supply. However they find that the contraction of lending was mitigated by the rise in the demand.

In our model the demand equation is also identified by two variables, namely by the lags of the lending standards and by the corporate bankruptcy rate. Lending standards are related to banks individual characteristics as pointed out by Calani et al. (2010). The changes in these standards are mainly ascribed to changes in banks' capital or liquidity position, altered risk tolerance or changes in market competition that are related to credit supply (Ciccarelli et al. 2010; Hempell and Sorensen, 2010). The corporate bankruptcy rate approximates the creditworthiness or credit risk of potential borrowers. Hence corporate bankruptcy rate explains supply, since banks try to exclude risky clients from their portfolio. At the same time it is assumed that corporate bankruptcy rate does not shift demand, because credit risk does not affect firms' demand for loans.[7]

Similar to the supply, statistical tests cement our assumptions necessary to identification, instruments are correlated with the endogenous variable and not correlated with the error term. The difference – in – Sargan test confirms the exogeneity of the corporate bankruptcy rate (Table 3).

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[7] One can argue that there is underlying factor behind credit demand and corporate bankruptcy rate, namely the business cycle. In booms as macroeconomic conditions improves corporate bankruptcy rates fall and credit demand improves simultaneously. That is supply and demand are shifted at the same time and the bankruptcy rate does not identify them. However, it is important to note that this argument is misleading since we control for the real side of the economy in the demand equation with the new-export orders and gross fixed capital formation. Since we hold these variables constant, corporate bankruptcy rate cannot move supply and demand simultaneously.

4 Results

Before the discussion of the results, it is worth emphasizing some limitations of the model. It is assumed that credit supply and demand are equilibrated through the adjustment of the real lending rate. At the same time asymmetric information between lenders and borrowers may cause the imperfect adjustment of the lending rate, which has two important implications. First, banks try to screen risky clients through non-price terms, second credit rationing may occur. The specification of the supply equation take the first imperfection into account, since lending standards and a proxy variable for the creditworthiness of borrowers are included as explanatory variables. But this model framework fails to handle the second problem, namely credit rationing. Thus results should be considered with this limitation of the model in mind.

The estimates of the demand equation are shown in Table 4, results of the pooled OLS, the pooled TSLS and the fixed effect estimations are tabulated respectively. The difference between the slope coefficients of pooled OLS and pooled TSLS illustrates that it is worth taking the simultaneity of prices and quantities into account. In the demand equation except for the perceived demand variable the estimates are significant and their signs' correspond to our expectations. The estimated coefficients of the pooled IV and fixed effect IV are similar in magnitude, due to the low variance of the bank-specific error term the results of model (2) are discussed in the rest of the paper.
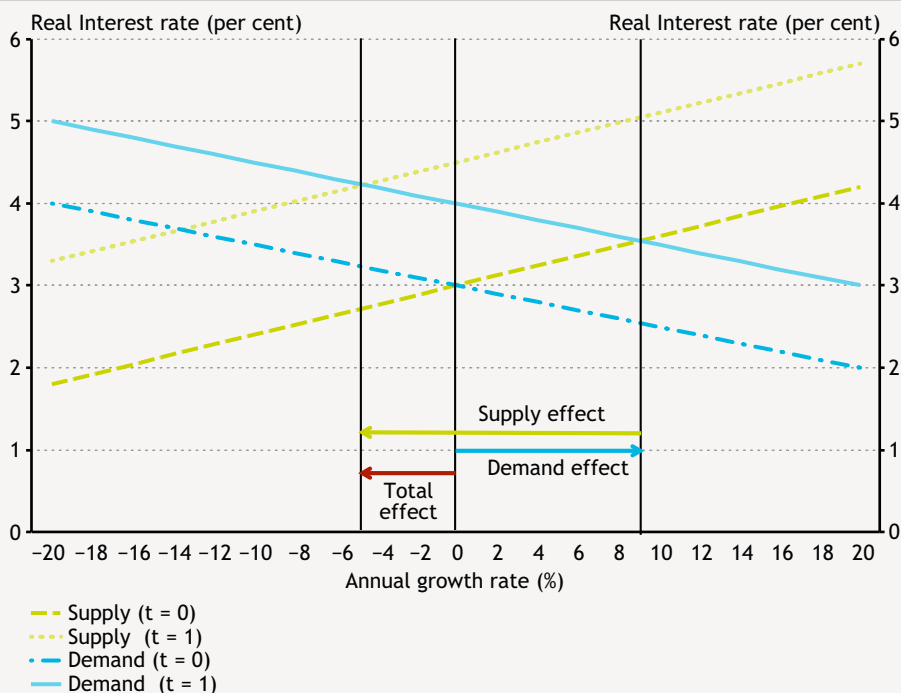
The estimates of the supply equation are shown in Table 5, the content of the columns are the same as in the case of the demand. The slope coefficient of the supply is positive (and significant) as expected, its magnitude is smaller than demand's slope, which suggests that demand is more sensitive to price changes. The coefficient of the corporate bankruptcy rate is negative and significant, which stress the importance of firms' creditworthiness in lending. Similarly, the tightening of lending standards leads to the contraction of credit supply, which suggests that lending standards also play an important role. However, the coefficient of the eased lending standards does not differ significantly from zero, which can be explained by the fact that this kind of event is very rare in the sample. Similar to the case of demand, the results of model (2) will be discussed later.

We are only interested in the slope coefficients of the demand and supply equations, because demand and supply curves are uniquely determined by the observed price – quantity combinations and by these slopes. Therefore changes in the quantity variable (annual growth rate) can be decomposed into a demand and a supply factor. The method is illustrated in Chart 3, in this example demand increased, meanwhile supply contracted and as a result the annual growth rate of loans outstanding declined. Using the hypothetical intercept of demand and supply, this change can be uniquely decomposed into two additive components (see Appendix 5).

Following this method with the parameters of model (2), the changes in corporate lending have been decomposed between 2008 Q1 and 2010 Q4. Total effect can be translated into the difference of the annual growth rates meanwhile the demand and the supply effects show its components (Chart 4).

During 2008 demand for corporate loans has been improving, which was a result of the acceleration of the economy after a slowdown of growth in 2007. Interestingly, demand increased significantly after the outbreak of the crisis, in the fourth quarter of 2008. In that times uncertainty had increased dramatically, and as consequence of the sharp disappearance of liquidity, firms attempted to call down all available credit lines, which boosted demand. Parallel to the downturn of the real economy, demand for credit declined during 2009 and it bottomed out in the first quarter of 2010. This setback was relatively long-drawn-out, and credit demand started to recover in the middle of 2010. However this upsurge is very fragile, as our results suggest, demand has declined somewhat in the last quarter of 2010.

Chart 3
Illustration for decomposition of supply and demand

Real Interest rate (per cent)   Real Interest rate (per cent)

Supply effect

Demand effect

Total
effect

Annual growth rate (%)

- - - Supply (t = 0)
······ Supply (t = 1)
-·-· Demand (t = 0)
—— Demand (t = 1)

Source: MNB.

Chart 4
Changes in the annual growth rate of the non-financial corporations' credit from quarter to quarter, and its decomposition to supply and demand factors

Percentage point   Percentage point

2008 Q1 2008 Q2 2008 Q3 2008 Q4 2009 Q1 2009 Q2 2009 Q3 2009 Q4 2010 Q1 2010 Q2 2010 Q3 2010 Q4

▨ Demand effect
▨ Supply effect
—— Total effect
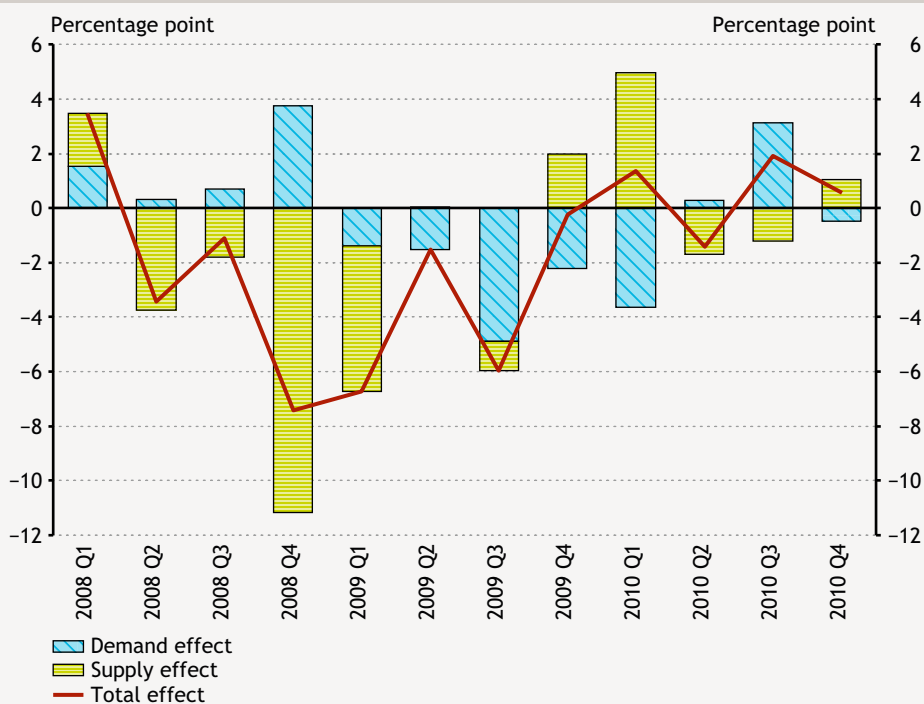
*Note: The red line shows the change of the annual growth rate between time T and T+1 in percentage point. This change is decomposed into supply and demand components. The interpretation of the demand (supply) component is the following: it shows the effect of the change of demand (supply) on the annual growth rate of loans outstanding holding supply (demand) constant.*
Source: MNB, author's calculations.

The developments of credit supply were more variable than demand. Banks had already started to moderate their credit supply in the middle of 2008, however the sharpest decline happened in the last quarter of 2008 and in the first quarter of 2009. In this phase of the crisis, the main driver of this downturn might have been the weak liquidity and capital position of banks, although risk considerations and uncertainty should have also played an important role. The contraction of credit supply came to an end in the third quarter of 2009. The moderation of credit supply – according to the Bank Lending Survey – banks tightened their lending conditions significantly and their willingness to grant loans decreased as well. Between the last quarter of 2009 and the first quarter of 2010 credit supply improved, which might be the result of better liquidity and capital position of banks. Although lending standards tightened further at this period, banks reported that their willingness to extend loans had increased, which was the sign of higher supply. This turnaround however did not last long, since credit supply declined again in the middle of 2010. Although the economy recovered, growth was very weak in Hungary, and economic outlooks remained uncertain as well. The corporate bankruptcy rate peaked in these quarters, which is a proxy for the creditworthiness of corporations in the model. That is without the further tightening of lending standards, the pool of potential borrowers shrank, which means the decrease of supply. Additionally, the evolving sovereign crisis of the eurozone, which affected the parent banks of the euro area, and the bank levy also contributed to the contraction of supply.

Since the focus of the analysis is on the crisis and post-crisis period (2008 Q4–2010 Q4), it is worth examining the cumulative impact of credit supply and demand on lending. Chart 5 decomposes the change of the annual growth rate relative to 2008 Q3 to supply and demand components. Our results suggest that after the outbreak of the crisis supply constraints were mainly responsible for weak lending activity. Credit demand declined relatively slowly, in the first quarter of 2010, the effect of demand and supply on lending was similar in magnitude. Due to the turnaround of supply and to the strengthening of demand, by the end of 2010 supply constraints has become more pronounced and the relative weight of demand and supply factors was 1/3–2/3.

Chart 5
Change in annual growth of non-financial corporations' credit since September 2008, and its decomposition to demand and supply
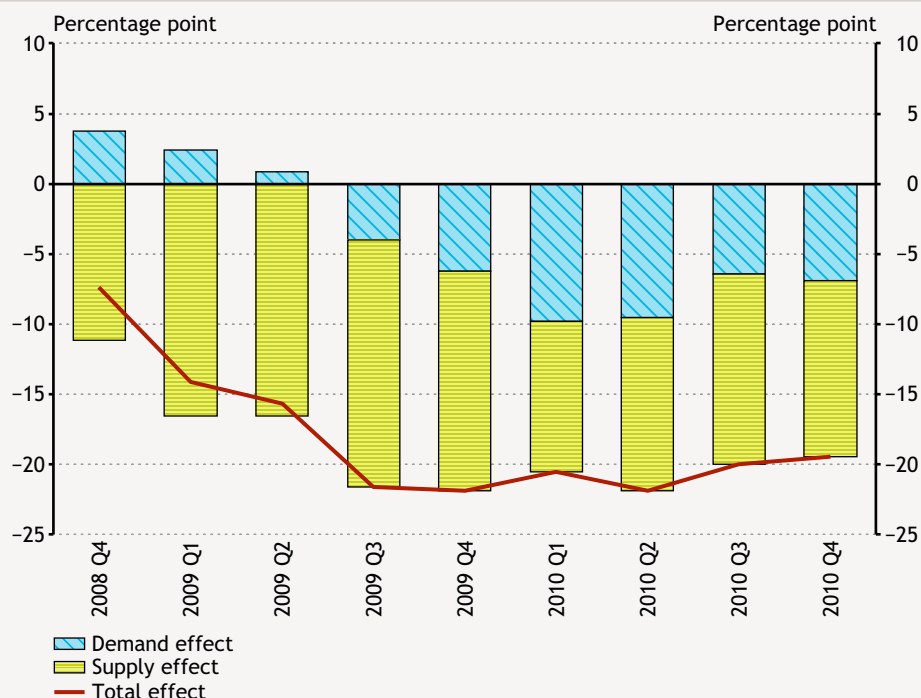
Source: MNB, author's calculations.

5 Conclusion

In this paper we examined the corporate loan market in Hungary. To understand more deeply the developments of corporate lending between 2008 and 2010 we identified supply and demand in an equilibrium framework on a panel dataset. In the demand equation apart from the real lending rate, the lagged indicators of the real economy (such as new export orders, gross fixed capital formation) are included, these variables identify the supply curve. Additionally, the demand perceived by loan officers is also in the demand equation as an explanatory variable. In the supply equation variables of the Bank Lending Survey (lending standards and banks' willingness to lend) are included and the growth rate of banks' foreign liabilities approximates banks' ability to lend. Apart from these variables, the corporate bankruptcy rate also explains credit supply, this variable measures the creditworthiness of borrowers. The demand curve is identified by banks' lending standards and by the corporate bankruptcy rate, by those variables that are related to the risk tolerance of banks.

Based on our slope estimates and on the observed price-quantity combinations, we decomposed the changes of the annual growth rate of loans outstanding into demand and supply factors. Our results suggest that both credit demand and supply decreased substantially during the crisis, hence they were both responsible for the decline in corporate lending. It worth highlighting two periods in the developments of the supply: credit supply contracted significantly after the outbreak of the crisis, which was first attributable to liquidity constraints, later risk considerations and the depressed economic outlook become more important. The moderate supply was reflected in tight lending conditions and the decreased willingness of banks to lend. In the turn of 2009 and 2010 we experienced the increased of supply, however this turnaround did not last long and credit supply contracted in the middle of 2010 again. The path of the demand was relatively simpler, demand declined during 2009 and it bottomed out in the first quarter of 2010. As the economy started to recover, demand increased as well. At the end of 2010 we may conclude that the decline in supply and demand accounted for the drop in corporate lending in a ratio of around 2/3–1/3, respectively. The importance of the role of tight supply in the contraction of lending is similar to the findings of the eurozone, which is not surprising since the parent banks of Hungarian banks are active there.

One of the most important limitations of this paper is that it employs an equilibrium approach, consequently credit rationing is excluded by construction. At the same time, a very popular approach in the literature is a disequilibrium framework that assumes that the observed quantity in the market is determined by a short-side rule, i.e. by the minimum of supply and demand. The interpretation of the model is the following: lending rates do not necessarily clear credit markets since banks do not raise lending rates above a certain level due to risk considerations. That is with higher lending rates banks would either finance more risky clients (adverse selection) or motivate firms to take more risk (moral hazard). As a result credit rationing may occur that is a certain group of applicants, with a given supply of credit, are unable to obtain credit at any interest rate, although they would with higher supply of credit (Stiglitz and Weiss, 1981). This disequilibrium method goes back to the 70s (Fair and Jaffee, 1972; Maddala and Nelson, 1974), and it has become a very common approach to examine credit market developments (Laffont and Garcia, 1977; Sealey, 1979; Ito and Ueda, 1981; Bauwens and Lubrano, 2007). One of the most popular applications of this method is to examine whether weak bank lending was a result of a credit crunch in the aftermath of financial crises (Ikhide, 2003; Allain and Oulidi, 2009). To understand more deeply the developments of corporate lending in Hungary, the disequilibrium framework should be the direction of further research.

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Appendix

A.1 SENIOR LOAN OFFICER SURVEY ON BANK LENDING PRACTICES

The dataset contains variables that are constructed based on the following questions of the Bank Lending Survey:

Question 1/A: Please indicate your bank's willingness to grant loans or credit lines to enterprises now as opposed to the last period. (Non-financial corporations [total])

Possible answers: decreased considerably – decreased somewhat – remained basically unchanged – increased somewhat – increased considerably

Question 3/A: Over the past period, how have your bank's credit standards for approving applications for loans or credit lines to enterprises changed? (Non-financial corporations [total])

Possible answers: tightened considerably – tightened somewhat – remained basically unchanged – eased somewhat – eased considerably

Question 5/A: Apart from normal seasonal variation, how has demand for loans or credit lines to enterprises changed over the past period? (Non-financial corporations [total])

Possible answers: decreased considerably – decreased somewhat – remained basically unchanged – increased somewhat – increased considerably

A.2 DESCRIPTION OF THE DATASET

Table 1
Description of the dataset

L_{it}	Annual growth rate of loans outstanding to the non-financial corporate sector, adjusted for exchange rate effects
r_{it}	Weighted average of forint and euro denominated real lending rates, nominal lending rates are deflated with the contemporaneous inflation rate
$expord_t$	New export-orders of the selected branches of the manufacturing sector, annual growth rate
inv_t	Gross fixed capital formation, annual growth rate
dem_{it}^+	Demand perceived by loan officers, dummy variable, 1 if loan officers reported that the demand for loans increased somewhat or increased considerably, 0 otherwise (Source: Bank Lending Survey – 5/A)
dem_{it}^-	Demand perceived by loan officers, dummy variable, 1 if loan officers reported that the demand for loans decreased somewhat or decreased considerably, 0 otherwise (Source: Bank Lending Survey – 5/A)
$stand_{it}^+$	Lending standards, dummy variable, 1 if loan officers reported that the bank's credit standards eased somewhat or eased considerably, 0 otherwise (Source: Bank Lending Survey – 3/A)
$stand_{it}^-$	Lending standards, dummy variable, 1 if loan officers reported that the bank's credit standards tightened somewhat or tightened considerably, 0 otherwise (Source: Bank Lending Survey – 3/A)
sup_{it}^+	Willingness to lend, dummy variable, 1 if loan officers reported that the bank's willingness to grant loans or credit lines increased somewhat or increased considerably (Source: Bank Lending Survey – 1/A)
sup_{it}^-	Willingness to lend, dummy variable, 1 if loan officers reported that the bank's willingness to grant loans or credit lines decreased somewhat or decreased considerably (Source: Bank Lending Survey – 1/A)
for_{it}	Annual growth rate of bank's foreign liabilities
$bankruptcy_t$	Corporate bankruptcy rate

A.3 TESTS RELATED TO IDENTIFICATION

Table 2
Tests related to the identification of the supply equation

	Test statistic	p-value
Model 2 (Pooled TSLS)		
Joint test of the excluded instruments in the first stage regression (4th lags of new-export orders, 1st and 2nd lags of gross fixed capital formation)	19.39	0.0000
Sargan test (4th lag of new-export orders, 1st and 2nd lags of gross fixed capital formation)	2.211	0.3310
Underidentification test (Kleibergen–Paap)	41.331	0.0000
Difference – in – Sargan test (1st lag of gross fixed capital formation)	0.385	0.5350
Difference – in – Sargan test (2nd lag of gross fixed capital formation)	1.815	0.1779
Difference – in – Sargan test (4th lag of new export orders)	1.758	0.1849
Model 2 (Pooled TSLS)		
Joint test of the excluded instruments in the first stage regression (4th lag of new-export orders, 1st and 2nd lags of gross fixed capital formation, 1st lag of perceived demand)	11.57	0.0000
Sargan test (4th lag of new-export orders, 1st and 2nd lags of gross fixed capital formation, 1st lag of perceived demand)	5.057	0.2815
Underidentification test (Kleibergen–Paap)	41.516	0.0000

Table 3
Tests related to the identification of the demand equation

	Test statistic	p-value
Model 2 (Pooled TSLS)		
Joint test of the excluded instruments in the first stage regression (Lending standards [2nd lag], corporate bankruptcy rate)	9.60	0.0000
Sargan test (Lending standards [2nd lag], corporate bankrupcty rate)	1.380	0.5015
Underidentification test (Kleibergen–Paap)	21.810	0.0001
Difference – in – Sargan test (Corporate bankrupcty rate)	1.318	0.2509
Difference – in – Sargan test (2nd Lending standards [–])	1.349	0.2455
Difference – in – Sargan test (2nd Lending standards [+])	0.000	0.9995
Model 2 (Pooled TSLS)		
Joint test of the excluded instruments in the first stage regression (Lending standards [2nd lag], corporate bankrupcty rate, willingness to lend)	5.73	0.0001
Sargan test (Lending standards [2nd lag], corporate bankrupty rate, willingness to lend)	4.782	0.3105
Underidentification test (Kleibergen–Paap)	21.895	0.0005

A.4 ESTIMATION RESULTS

Table 4
Estimation results – Demand

	(1)	(2)	(3)
Real lending rate	−0.008 (0.0055)	−0.050 (0.0193)***	−0.053 (0.0128)***
Gross fixed capital formation (1st lag)	0.003 (0.0016)**	0.004 (0.0020)*	0.004 (0.0017)**
Gross fixed capital formation (2nd lag)	0.005 (0.0016)***	0.010 (0.0026)***	0.011 (0.0022)***
New-export orders (4th lag)	0.004 (0.0006)***	0.004 (0.0010)***	0.004 (0.0007)***
Perceived demand (+) (1st lag)	−0.006 (0.0170)	−0.001 (0.0251)	−0.000 (0.0181)
Perceived demand (−) (1st lag)	−0.093 (0.0272)***	−0.087 (0.0419)**	−0.066 (0.0288)**
Constant	0.080 (0.0161)***	0.166 (0.0428)***	0.169 (0.0292)***
F-test	27.27***	7.32***	10.50***
Sample period	2003 Q1–2010 Q4	2003 Q1–2010 Q4	2003 Q1–2010 Q4
Estimation method	Pooled OLS	Pooled TSLS	Fixed effect TSLS

Note: Standard errors are reported in parentheses, *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

Table 5
Estimation results – Supply

	(1)	(2)	(3)
Real lending rate	0.008 (0.0049)*	0.023 (0.0110)**	0.022 (0.0081)***
Lending standards (+) (2nd lag)	−0.038 (0.0279)	−0.045 (0.0362)	−0.042 (0.0275)
Lending standards (−) (2nd lag)	−0.036 (0.0209)*	−0.050 (0.0290)*	−0.053 (0.0214)**
Willingness to lend (+)	−0.014 (0.0164)	−0.014 (0.0213)	0.019 (0.0167)
Willingness to lend (−)	−0.079 (0.0292)***	−0.086 (0.0404)**	−0.043 (0.0277)
Corporate bankrupcty rate	−0.094 (0.0104)***	−0.091 (0.0151)***	−0.088 (0.0098)***
Foreign liabilities	0.122 (0.0269)***	0.102 (0.0417)**	0.109 (0.0287)***
Constant	0.372 (0.0398)***	0.340 (0.0585)***	0.316 (0.0392)***
F-test	32.51***	12.57***	9.42***
Sample period	2003 Q1–2010 Q4	2003 Q1–2010 Q4	2003 Q1–2010 Q4
Estimation method	Pooled OLS	Pooled TSLS	Fixed effect TSLS

Note: Standard errors are reported in parentheses, *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

A.5 DECOMPOSITION OF SUPPLY AND DEMAND

In this subsection we present the methodology of the decomposition of supply and demand.

We are interested in the decomposition of the change of the quantity type variable between time T and time T+i. That is we decompose $L_{T+i} - L_T$ to a demand component $(L - L_T)$ and to a supply component $(L_{T+i} - L)$, which are additive.

$$L_T = \alpha_T^D + \beta^D \cdot P_T$$

$$L_T = \alpha_T^S + \beta^S \cdot P_T$$

In the model a linear specification is considered, hence from equations above β^D and β^S are estimated. At time T, based on these estimates and on the realized price-quantity combinations the intercepts can be calculated (a linear curve is uniquely determined by a point and its slope). It is important to note that these intercepts are time-varying.

With the method described above, the equation of the supply and demand curve can be obtained at each period. Using the equation of supply at time T and the equation of demand at time T+i, the hypothetical intercept of the curves can be calculated (L). Then $L - L_T$ is the demand component, since that would be the change of the annual growth rate if the supply curve remained unchanged. Similarly, $L_{T+i} - L$ is the supply component, since this amount would be the change of the annual growth rate, if the demand curve did not shift. Of course, the sum of these components is $L_{T+i} - L_T$, which is the total effect.

Chart 4 is the case when i = 1, that is the demand and supply components are calculated from quarter to quarter. These components are cumulated in Chart 5, that is the first bar is the change of the annual growth rate between 2008 Q4 and 2008 Q3, the second bar is the change between 2009 Q1 and 2008 Q3, etc.