

# Factors Affecting the Supply of Loans to Businesses in the Czech Republic

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## **Abstract**

*The aim of this paper is to identify which banking factors and macroeconomic affecting the supply and availability of loans for Czech corporate sector in the period 2000 – 2014. There was tested the effect of variables such as the return on assets, return on equity, capital adequacy, interest margin, liquidity measured by the share of liquid assets to assets, share of provisions for loans, share of impaired loans to total loans, indicator of interbank position, inflation rate, unemployment, producer price index, exchange rate, repo rate, discount rate, interest rate of banking loans provided to non-financial companies, gross domestic product at constant prices and gross domestic product at current prices. Using panel regression analysis there was recorded a positive influence of the return on assets, return on equity and interest rate of banking loans at supply of loans to non-financial companies. There was recorded a negative influence of the provisions for provided loans and net interest margin at supply of loans to non-financial companies.*

*Keywords: interest rate, net interest margin, return on assets, return on equity, supply of loans*

*JEL codes: E51, G21, G23*

## **1. Introduction**

The aim of this paper is to determine which banking factors and macroeconomic factors influenced the supply of loans and credit availability for the Czech corporate sector from 2000 to 2014. Each company needs to finance its activities sufficient funds. They can come either from own sources or from foreign sources. These external sources of funding include in particular commercial and bank loans, funds raised by issuing bonds, financial or operational leasing, factoring, forfeiting, various grants, franchising and venture capital. A very important source of funding are bank loans which can be short-term and long-term. The results of this paper should provide a basis on which it will be possible to find out which bank factors had an impact on the volume of loans provided by banks to non-financial corporations and to what extent these loans available to businesses. The first chapter includes an introduction. The second chapter includes a literature review. The third part includes a methodology, using date and purpose of the panel regression analysis. This chapter includes an overview of variables and characteristics of the data used. The fourth part of the paper is focused on the results of estimating panel regression analysis and their comments. This chapter is focused on the banking factors and macroeconomic factors influenced the supply of loans and credit availability for the Czech corporate sector from 2000 to 2014. Attention will be given to selected banking and macroeconomic indicators: variables such as the return on assets, return on equity, capital adequacy, interest margin, liquidity measured by the share of liquid assets in assets, share of provisions for loan losses to total loans, the share of loss receivables to total loans, the share of watched loans and impaired loans to total loans, indicator of interbank positions, inflation rate, unemployment, producer price index, exchange rate, repo rate, discount rate, interest rate of banking loans provided to non-financial companies, gross domestic product at constant prices and gross domestic product at current prices.

## **2. Literature Review**

Undoubted benefit of this contribution will be to find the factors that affect the total volume of loans provided by banks to non-financial companies. The vector of explanatory variables will includes

banking and macroeconomic variables such as the return on assets, return on equity, capital adequacy, interest margin, liquidity measured by the share of liquid assets to assets, share of provisions for loans, share of impaired loans to total loans, indicator of interbank position, inflation rate, unemployment, producer price index, exchange rate, repo rate, discount rate, interest rate of banking loans provided to non-financial companies, gross domestic product at constant prices and gross domestic product at current prices. The outcome will be determined which variables affect the overall volume of loans provided by banks to non-financial corporations and which variables the volume of loans had no effect. It is quite evident that a very important task is mainly to fill a vector of explanatory variables and so that we can tap into as many factors that could affect the development of the volume of loans to non-financial companies. For this purpose will be needed to process a detailed literature review. For empirical analysis of credit market is highly advisable to use non-equilibrium model to estimate demand and supply on the condition that the actual volume of loans is determined by the smaller of the two values - the demand for loans and offering loans. For this reason, in this section we focus on study in which this approach was utilized. The contribution focuses mainly on the supply of credit. In the following text we will also pay attention to studies that determining factors affecting the supply of credit used the (panel) regression analysis and cointegration analysis.

The starting point may be a study Melitz and Pardue (1973), who in their study identified equation of supply and demand for loans using regression analysis on quarterly data for the period 1951-1969. Authors characterize a supply of loans as the current value of loans provided by banks. The authors considered the interest rate of bank loans, specifically interest rate of short-term business loans, the interest rate of three-year and five-year government bonds, weighted assets and interest rate deposits for the determinants of credit supply. The authors concluded that there was recorded a positive relation between the weighted assets, the interest rate of short-term business loans, the interest rate of deposits and offering loans. Conversely, there was recorded a negative relation between the rate of three-year and five-year government bonds and supply of loans.

Laffont and Garcia (1977) estimated model of supply and demand for commercial loans in the Canadian market on monthly data for the period 1965 to 1975. Using the method of least squares was their aim to find out which determinants affecting supply and demand for loans. To estimate the supply of credit used the following variables: interest rate on deposits of the bank as the price difference between the interest rate of government bonds and interest rate long-term loans, the requirements for minimum reserve requirements. The authors found that these variables are statistically significant and the supply of credit has a positive impact basic interest rate from loans, term deposits, deposits at sight and the index of industrial production. Conversely, there was recorded a negative impact between the supply of credit and the difference between the interest rate of government bonds, interest rate long-term loans, the difference between the deposit rate and the basic rate of interest on loans.

Martin (1990) have tried to estimate demand and supply of credit using non-equilibrium model of corporate loans in the United Kingdom and to identify the determinants affecting supply and demand for loans. The data that was used for this study has been on a quarterly basis from 1964 to 1984. The author used real interest rate, inflation, the previous level of borrowing and money supply for determinants influencing the supply of credit. Author concludes that the supply of credit positive affects the real interest rate and inflation. Negative impact on the supply of credit has previous levels of borrowing and money supply.

Agung et al. (2001) using a panel regression analysis for the period 1994 to 2000 examined the determinants of supply and demand for loans. Supply of credit is determined according to the authors of the lending capacity of banks which includes total liabilities humiliated by the required capital reserves of banks and cash and cash on hand. Supply of loans is designated interest rate on loans granted actual output measured by real gross domestic product (GDP) ratio of bank capital to assets and outstanding loans. The results suggest that the supply of credit has a positive influence lending capacity, the interest rate on loans and the ratio of capital to assets. Outstanding loans have a negative effect.

Baek (2005) estimated an equation of supply and demand for loans using non-equilibrium model. Time series cover the period from January 1992 to June 2005. The supply of loans is described as the actual volume of loans provided by commercial banks. Over the determinants of credit supply considered the difference between the interest rate on loans and yield corporate bonds. Total deposits, minimum reserve requirements and the industrial production index. The study results show that the difference between the interest rate on loans and yield corporate bonds, total deposits, minimum reserve

requirements and the index of industrial production have a positive impact on the supply of credit. The greatest explanatory power was seen in the difference between the interest rate on loans and yield corporate bonds.

Erdogan and Senftleben (2009) examined the lack of available credit resources in Germany using non-equilibrium model and method of maximum likelihood estimated supply and demand for loans. Time series data formed based on a quarterly basis, specifically from 2000 to 2010. According to the authors, supply of credit is determined the credit capacity of the banks, the interest rate on loans granted, expected inflation and corporate deposits. The lending capacity of banks was specified as the sum of demand deposits, time deposits and total capital. The authors concluded that banking institutions increase the supply of credit in the event of higher lending capacity. In the case of inflation, which leads to higher economic risks, banks offer fewer loans. In the event of rising interest rates of loans is increasing the profitability of banks, which are then willing to provide a larger volume of loans.

Stavárek and Vodová (2010) analyzed the determinants that affect the amount of loans granted in the Czech Republic. Using cointegration analysis estimated demand and supply equilibrium relationship using quarterly data from 1994 to 2007. Among the determinants that affect the supply of loans to banks considered the available resources, specifically lending capacity, which includes deposits, funds obtained from the interbank market or issue debt securities. Another factor that affects the supply of credit, the authors mention the interest margin and the interest rate on deposits. Furthermore, the authors chose as another variable return on average assets. The dependent variable then formed the total volume of loans provided to residents and non-residents. The authors demonstrated the positive impact of lending capacity and interest margins on lending volume. In profitability ratios on average assets was a negative impact on the volume of loans, which is not in line with general expectations. There was recorded a positive impact of return on equity. So, in general, the more resources are available to banks and the more profitable their lending activity, thus providing more loans.

Stavárek and Vodová (2010) using non-equilibrium model examined the changes in demand for loans and loan supply in the Czech Republic on quarterly data from 1994 to 2007. Among the determinants affecting the supply of credit inflation included, the total volume of deposits of residents and non-residents, the gross domestic product at current prices, bank capital calculated as share capital, retained earnings or loss and gain or loss in the current period also was included in the share of classified loans to total loans, capital adequacy, sales from industrial activity, the interest rate on loans, credit capacity, calculated as total liabilities of banks humiliated balances on bank accounts mandatory minimum reserves, cash and capital. Furthermore, the authors included the return on average assets calculated by dividing the net profit on average assets and return on average equity calculated as the ratio of net income to average equity. The dependent variable was defined as the total volume of loans granted to residents and non-residents. For deposits, capital and lending capacity has been shown that the growth of resources available for lending will cause growth of supply of loans. For variables such as gross domestic product and industrial production index was recorded positive influence. There was recorded a negative influence between inflation rate and supply of loans. It is also an important variable interest rate on loans. The growth of profitability of lending will cause to growth of supply of loans. The high proportion of non-performing loans on the contrary, reduces the supply of credit. In the case of interest margin was found to be negative influence. Finally, there was found that the supply of credit in the Czech Republic is a function of deposits, industrial production, interest rates of loans and classified loans. Non-equilibrium model has been proven to offer loans in the Czech Republic is growing in the growth of deposits, industrial production and interest rates and a decline in non-performing loans.

Jimenez et al. (2012) searched answers to questions about how monetary and economic conditions affecting the supply of credit by using the least squares method for the period February 2002 to June 2010. The supply of loans authors characterize as lending volume. Supply of credit is determined by macroeconomic factors, factors of banking and corporate factors. Among the factors the bank authors included short-term interest rate, the annual inflation rate and annual change in gross domestic product (GDP). Banking factors included capital calculated as the ratio of capital to total assets of banks, liquidity calculated as the ratio of liquid assets to total bank assets and return on assets and annual change of assets. The study results suggest that the supply of credit has a positive influence return on assets of the banking sector, the annual change in the total assets of the banking sector, the ratio of own funds to total assets. Negative impact on the supply of credit has short-term interest rate, the ratio of capital to total assets of banks and the ratio of liquid assets to total assets of banks.

### 3. Methodology and Data

Supply of loans and the availability of credit to non-financial companies will be estimated using a panel regression analysis through the following equation:

$$L_{it} = \alpha_0 + \sum_{i=1}^n \alpha_i X_i^L + u_t^L \quad (1)$$

Where  $L_{it}$  is the actual volume of loans provided to non-financial companies by the bank  $i$  at time  $t$ , next  $\alpha_0, \alpha_i$  show the regression coefficients for supply of loans,  $X_i^L$  is a vector of explanatory variables for the supply of loans,  $u_t^L$  represents an error component. Panel data are cross-section data that are collected at various points of time, but the data concern the same panel of subjects or objects in every period. In most studies, large cross-sections are found collected for only a few points of time. In an economic model there is one variable on the left-hand side of the equation, called the dependent variable. Variables on the right-hand side of the equation are the explanatory variables. The nature of economic variables can be endogenous, exogenous or lagged dependent. A variable is an endogenous variable if the variable is determined in the model in question. Therefore the dependent variable is always an endogenous variable. The exogenous variables are determined outside the model. Lagged dependent (or lagged endogenous) variables are 'predetermined' in the model. In fact they are endogenous, but their values have already been realised. Knowledge about the nature of the variables, especially of the explanatory variables, is of importance for the choice of an estimator for the unknown parameters and for knowing the properties of the estimator (Vogelvang, 2005).

The data necessary for the fulfillment of these goals was taken from BankScope database, an annual reports of banking institutions operating in the Czech Republic from 2000 to 2014 and ARAD banking statistic. The sample surveyed banking institutions included the following banks: Komerční banka, Česká spořitelna, Československá obchodní banka, UniCredit Bank, Raiffeisen bank, Equa bank, ERB banka, Fio bank, GE money bank, JT bank, LBBW, PPF bank, Sberbank. Vector of explanatory variables will includes variables such as the return on assets, return on equity, capital adequacy, interest margin, liquidity measured by the share of liquid assets in assets, share of provisions for loans, the share of impaired loans to total loans, indicator of interbank position, inflation rate, unemployment, producer price index, exchange rate, repo rate, discount rate, interest rate of banking loans provided to non-financial companies, gross domestic product at constant prices and gross domestic product at current prices (see Appendix). The all bank data was examined on an annual basis from 2000 to 2014.

### 3. Results and Discussion

This part of the paper focuses on the estimation results of panel regression analysis including their comments. Using panel regression analysis we determined which bank variables affect the supply of credit, and which do not. To estimate the supply of credit was used the equation (1). First, we conducted a test of stationarity or the unit root test. The conducted tests stacionarity showed that we accept the null hypothesis when the time series contains a unit root and is not stationary. Then we tested all considered banking variables. We used the results of diagnostic tests determining redundancy of parameters to reduce the number of explanatory variables. It was taken on information criteria including the Akaike criterion, Schwarz criterion and Hannan-Quinn criterion. We also watched the values of the degree of correlation and statistical significance of individual variables. The aim of this paper was to find a model with a high value of the adjusted coefficient of determination where all the variables model will be statistically significant. For estimating the linkages between supply of loans and banking factors (explanatory variables) was detected resulting equation estimating the supply of loans to non-financial companies in the Czech Republic from 2000 – 2014. The resulting equation is following:

$$L_{it} = 14.47 + 0.40 ROA - 0.68 PL - 1.10 NIM + 2.84 IR + 0.84 ROE \quad (2)$$

Table 1: Relation between the Supply of Loans and Selected Banking and Macroeconomic Variables

The relation between the supply of loans and analyzed variables – positive relation (+) or negative relation (-)	
Return on assets (ROA) *	+
Provisions for provided loans / total loans (PL) *	-
Net interest margin (NIM) **	-
Interest rate of banking loans (IR) *	+
Return on equity (ROE) *	+

Note: \*, \*\* indicates stationarity to the level of significance 1%, 5%

Source: author's calculations

Table 1 shows the resulting relation between the supply of loans and the explanatory variables. The results of the panel regression analysis and the resulting equation indicate that the most important banking and macroeconomic factors affecting the supply of loans to non-financial corporations are return on assets, provisions for provided loans, net interest margin, interest rate of banking loans and return on equity. These variables significantly influence the supply of loans.

The results show that there was recorded a positive relation between the supply of loans and return on assets. This means that the increase (decrease) in return on assets will cause growth (decline) the supply of loans to non-financial companies. This is consistent with study Jiménez et al. (2012) that has demonstrated a positive impact on the supply of loans. Return on assets represents a profitability of credit activity of banks. The decline of this indicator becomes for banks lending less profitable. This should lead to limit lending and a decline in the supply of loans.

Another statistically significant variable is provisions for provided loans. There was recorded a negative relation between the supply of loans and provisions for provided loans. This means that the increase (decrease) in provisions for provided loans will cause decline (growth) the supply of loans to non-financial companies. Provisions for provided loans are formed for impaired receivables. Theoretical framework suggests that growth in provisions for provided loans becomes riskier lending for banks and banks will thus reduce the supply of loans.

Negative relation was recorded between net interest margin and supply of loans to non-financial companies. The increase (decrease) in net interest margin causes decline (growth) in supply of loans to non-financial companies. This was seen in a Czech study (Stavárek and Vodová, 2010). The authors presented a net interest margin as a measure of risk borrowers. This fact contradicts logical concept which presented for example Ghost (1999) and Pazarbasioglu (1997), when a decline in net interest margins becomes for banks lending less profitable. This should lead to a decline in interest margins to limit lending and therefore a decline in the supply of loans. The resulting negative impact of the net interest margin on the supply of credit is consistent with the concept of the net interest margin as a measure of risk borrowers. The reason may be information asymmetry and adverse selection where the lower net interest margin may signal a lower risk which makes banks more willing to lend. Conversely, higher net interest margins may indicate a higher risk allowing banks restrict their lending policies. Martin (1990) is inclined to this concept.

Positive relation was recorded between interest rate of banking loans and supply of loans to non-financial companies. This means that the increase (decrease) in interest rate of banking loans will cause growth (decline) the supply of loans to non-financial companies. This is consistent with study Erdogan and Senfleben (2009) and study of Agung et al. (2001). Agung et al. (2001) has argued that the higher the interest rate on loans, the higher the supply of credit and the bank has increased the amount of loans. Erdogan and Senfleben (2010) considered the interest rate of banking loans as the bank's profitability. The growth interest rate motivate banks to more lending. In the event of rising interest rate of banking loans increases the profitability of banks which are then willing to provide a larger volume of loans.

The results show that there was recorded a positive relation between the supply of loans and return on equity. This means that the increase (decrease) in return on equity will cause growth (decline) the supply of loans to non-financial companies. This is consistent with study Stavárek a Vodová (2010). Return on equity shows identical development as return on assets. Return on equity as well as return on

assets represents a profitability of credit activity of banks. The decline of this indicator becomes for banks lending less profitable. This should lead to limit lending and a decline in the supply of loans.

#### 4. Conclusion

The aim of this paper is to identify which banking factors and macroeconomic factors affecting the supply and availability of credit for Czech corporate sector in the period 2000 – 2014. There was tested the effect of variables such as the return on assets, return on equity, capital adequacy, interest margin, liquidity measured by the share of liquid assets to assets, share of provisions for loans, share of impaired loans to total loans, indicator of interbank position, inflation rate, unemployment, producer price index, exchange rate, repo rate, discount rate, interest rate of banking loans provided to non-financial companies, gross domestic product at constant prices and gross domestic product at current prices. The results of the panel regression analysis showed that the supply of loans affected mainly return on assets, provisions for provided loans, net interest margin, interest rate of banking loans and return on equity. The model results showed a positive effect of return on assets, return on equity and interest rate of banking loans at supply of loans to non-financial companies. The model results also showed the negative impact of the provisions for provided loans and net interest margin at supply of loans to non-financial companies. Other variables were not statistically significant.

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#### References

- AGUNG, J., KUSMIARSO, B., PRAMONO, B., HUTAPEA, E.G., PRASMUKO, A., PRASTOWO, N.J. (2001). *Credit Crunch in Indonesia in the Aftermath of the Crisis*. Jakarta: Bank Indonesia.
- BAEK, E.G.A., (2005). Disequilibrium Model of the Korean Credit Crunch. *The Journal of Korean Economy*, no. 2, pp. 313–336.
- ERDOGAN, B., SENFTLEBEN, CH. (2009). *Credit Crunch in Germany, Novelty or Reality?* German Institute for Economic Research Working Paper. Berlin: DIW.
- GHOSH, S.R., GHOSH, A.R. (1999). *East Asia in the Aftermath: Was There a Crunch?* IMF Working Paper 99/38. Mimeo: World Bank.
- JIMENÉZ, G., ONGENA, S., PEYDRÓ, J.L., SAURINA, J., (2012). Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications. *The American Economic Review*, vol. 102, no. 5, pp. 2301–2326
- LAFFONT, J.J., GARCIA, R. (1977). Disequilibrium Econometrics for Business Loans. *Econometrica*, vol. 45, no. 5, pp. 1187–1204.
- MARTIN, CH. (1990). Corporate Borrowing and Credit Constraints: Structural Disequilibrium Estimates for the U.K. *The Review of Economics and Statistics*, vol. 72, no. 1, pp. 78–86.
- MELITZ, J., PARDUE, M. (1973). The Demand and Supply of Commercial Bank Loans. *Journal of Money, Credit and Banking*, vol. 5, no. 2, p. 669–692.
- PAZARBASIOGLU, C.A. (1997). *Credit Crunch? Finland in the Aftermath of the Banking Crisis*. IMF Working Paper No. 96/135. Washington, D.C.: IMF.
- STAVÁREK, D., VODOVÁ, P. (2010). Analýza dlouhodobých vazeb na českém trhu úvěrů. *E+M Ekonomika a management*, no. 3, pp. 83–95.
- STAVÁREK, D., VODOVÁ, P. (2010). Aplikace nerovnovážného modelu na trh úvěrů v České republice. *E+M Ekonomika a management*, no. 4, pp. 96–109.
- VOGELVANG, B. (2005). *Econometrics – Theory and Applications with Eviews*. Harlow: Pearson Education Limited.

## Appendix

### Description of Used Variables

Abbreviation of variable	Description of variable	Source
L	Dependent variable to estimate supply of loans: the total volume of loans provided (mil. CZK)	Annual reports of banking institutions, BankScope database, ARAD
ROA	Return on assets: profit before tax/total assets	Annual reports of banking institutions, BankScope database
ROE	Return on equity: net profit/equity	Annual reports of banking institutions, BankScope database
PL	Provisions for provided loans/total loans	Annual reports of banking institutions, BankScope database
IL	Impaired loans (substandard, doubtful, loss)/total loans	Annual reports of banking institutions, BankScope database
CA	Capital adequacy of banks	Annual reports of banking institutions, BankScope database
LI	Liquidity: liquid assets/total assets	Annual reports of banking institutions, BankScope database
NIM	Net interest margin: interest rate of bank loans – interest rate of deposits	Annual reports of banking institutions, BankScope database
IP	Interbank position: (loans and advances to banking institutions - amounts owed to banking institutions)/total assets	Annual reports of banking institutions, BankScope database
I	Inflation rate measured by the customer price index	ARAD banking statistics
U	Unemployment	ARAD banking statistics
PPI	Producer Price Index	ARAD banking statistics
ER	Exchange rate EUR/CZK	ARAD banking statistics
RS	Repo rate	ARAD banking statistics
DS	Discount rate	ARAD banking statistics
IR	Interest rate of banking loans provided to non-financial companies	ARAD banking statistics
HDPco	Gross domestic product at constant prices	ARAD banking statistics
HDPcu	Gross domestic product at current prices	ARAD banking statistics

Source: author's processing