The Lending Channel of the Transmission Mechanism of Monetary Policy: Evidence from The Czech Republic

By

Tomas Juracka

THESIS

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Abstract

This thesis focuses on the lending channel of the transmission mechanism of monetary policy, particularly on its strength in the Czech Republic. First, the transmission mechanism and its channels are discussed. Second, the literature on the topic is reviewed, including many different views on the strength of the channels. Third, a brief history of Czech banking system is provided to explain the specifics of its evolution in the past two centuries. Fourth, an empirical model is developed based on the model introduced by Kashyap and Stein. The model is significantly altered to suit the character of the data available on the Czech Republic. Based on this model, the strength of the lending channel in the Czech Republic is questionable.

1. *Introduction*

During the recent financial crisis, the monetary policy of financial institutions holds a new importance. The question of which monetary policy is effective is more crucial than ever. Unfortunately, however, many important channels of transmission mechanism of monetary policy have weakened over time as will be shown later. The purpose of this paper is to examine the role of bank lending channel as a monetary policy channel in the Czech Republic.

There have been few earlier attempts to delve into the topic. Buchlikova (2001) explores microeconomic aspects of the lending channel of the transmission mechanism of the monetary policy which could not be uncovered by analysis of aggregate data. Her study focuses only on corporate loans. Another interesting paper, Pruteanu (2004), focuses on year 1996 – 2001 and examines two channels of the transmission mechanism – interest rate and credit channels. Mandel (1996) uncovered the problem of the stability of money velocity in the Czech Republic in his paper. Unlike the previous work, the purpose of this paper is to focus on the lending channel of the transmission mechanism and assess its strength based on the model build upon the data from years 1992 to 2009.

The argumentation is developed in several logical steps. Firstly, the desirability of monetary policy is briefly addressed. Secondly, the transmission mechanism is introduced and the reasons why it is weakening are explained. And finally, suggestions for improvement in effectiveness of monetary policy are presented.

The monetary policy of central banks is faced with new challenges. There seems to be widely spread agreement among the governing authorities that at least financial sector needs paternalistic control of benevolent and enlightened regulatory body. This body is expected to only follow the best interests of society. How dangerous and malign this belief is, has been developed in the works of many great economists (Osterfeld 2009; Rothbard 1962; Mises 1949; Hayek 1973-1979).

In spite of these strong objections, it is inevitable fact that politicians must show some effort in coping with current crisis if they want to be elected again, a fact that can hardly be overlooked. Also, a myriad of reasons in favour of reasonable regulation and

governmental interference was developed over the past century (Buchanan 1985, Krugman 2010A, Krugman 2010B). If arguments like information asymmetry, moral hazard and extremely harmful effects of the collapse of financial system are taken into consideration, the grounds for the regulation and monetary policy seem to be steady.

It is not a purpose of this thesis to fully discuss the desirability of the monetary policy and in order to address this issue the reference to some of the relevant literature was provided. However if the monetary policy is as widely accepted concept as it is among policy practitioners in the Czech Republic, the importance of highest possible efficiency in the conduct of the monetary policy cannot be overlooked. For this reason the strength and reliability of one of the most important channels, the lending channel of the monetary transmission mechanism, is examined for the Czech Republic.

First the overall view of transmission mechanism of monetary policy and its efficiency will be presented, then the brief history of the Czech banking, followed by the analytical part with a model testing the existence of the lending channel of the transmission mechanism of monetary policy in the Czech Republic.

2. *The Transmission Mechanism of Monetary Policy and its Channels*

Even if we deem monetary policy desirable, the question of their effectiveness rises. To discuss this topic further, the transmission mechanism of monetary policy must be explained first. The effects of changes in monetary policy take place through several steps and channels which are collectively called transmission mechanism.

As concisely explained in George at al. (n.d.), the changes in interest rates of central bank (such as discount rate) first influence market interest rates (e.g. bank deposit rates, consumer loan rates). Moreover, any forms of policy action and announcements have impact on expectations of all the agents in the economy about the performance of the economy and their confidence in these expectations. Furthermore, asset prices as well as exchange rates are affected. In the second phase of the transmission mechanism, previous changes influence "the spending, saving and investment behaviour of individuals and firms in the economy" (pg. 3). In the third phase, the effects depend on "the level of demand relative to domestic supply capacity" (pg. 3). So if for example

demand for labour is higher than the supply, the wages will rise (provided there are no frictions in the labour market) and this increase will lead to higher prices charged by the employers. In the final stage, the movements in exchange rates lead to direct and often delayed effects on the domestic prices of the foreign goods and services and to indirect effects on the prices of substitutes of the imported goods and services. These two effects together impact inflation.

The transmission mechanism is often divided into channels. All the effects described hold under the condition of *ceteris paribus*. The interest rate channel stands for increase (decrease) in official interest rates which subsequently leads to lower (higher) spending and declining (rising) overall price level as a result. Furthermore, credit channel stands for changes in loan activity of banks and other loan providers as the value of collaterals changes in response to changes in monetary policy variables while money channel refers to changes in bank liabilities. By exchange rate channel we mean the increasing (decreasing) exchange rate due to higher (lower) official interest rate which in turn makes assets in domestic currency more (less) attractive for foreign investors. The asset channel is the increase (decrease) in official interest rate leading to the change of long-term market interest rate in the same direction and consequently to lower (higher) price of bonds and securities due to discounting of future incomes. Finally, the balance sheet channel introduced in Ashcraft and Campello (2007) stands on the presumption that "higher interest rates increase debt service, erode cash flows, and depress collateral values" (pg. 1516) and hence decrease demand for loans.

3. The Issue of Efectiveness

After explanation of the terminology, the effectiveness of the transmission mechanism can at last be discussed. Unfortunately, there seems to be a lot of evidence suggesting that the traditional channels of transmission mechanism are weakening. Specifically, large banks, banks that are part of financial conglomerate and banks with a lot of liquidity are less responsive to monetary contractions (Kashyap & Stein 2000) because they do not need to rely on the loans from the central bank in response to the squeeze in liquidity. Favero, Giavazzi and Flabbi (1999) provide evidence that the credit channel is weak across Europe as loans of banks do not respond to monetary policy. Égert and

MacDonald (2008) state that exchange rate, asset price and credit channels are all weak in Central and Eastern Europe. Furthermore, Ferreira (2009) proves that banks are less responsive to changes in monetary policy as their "degree of foreign dependence and indebtedness" (pg. 8) grows. As shown in Kashyap and Stein (2000) and Ferreira (2009), large majority of the banks in USA and EU exhibit "high degree of foreign dependence and indebtedness" (Ferreira 2009, pg. 8) and are large or a part of large financial conglomerate and for that reason they are less responsive to monetary policy.

On top of all these deficiencies, expansionary monetary policy was applied to boost the economy and more and more commercial banks enjoyed excess liquidity as most developed countries struggled with the effects of the crisis. This effect was amplified by the fact that banks are less willing to lend money in the crisis. Apart for making the bank less responsive to monetary policy, excess liquidity also leads to immoral practices and more risky behaviour of the commercial banks because excess funds provide incentive to accept otherwise unacceptable risks. Also, scarce resources are used for inefficient uses as the loans provided to risky subject serve as means to buy scarce resources which are then used in endeavours which would be too risky if there was no excessive liquidity and therefore are wasteful (for more viz. Hunt 2007). The incentive to provide loans to riskier subjects is however partially offset by the banks' temporary unwillingness to lend money due to the crisis.

That does not conclude all the issues with transmission mechanism. Speculative channel (Hannsgen 2004) is another problematic point. Rapid and frequent changes in interest rates damage the economy due to speculative attacks.

Strong evidence for functioning channels of transmission mechanism is harder to find. Nevertheless, Ashcraft and Campello (2007) found strong evidence that balance sheet channel is firm, although this "channel accounts for only 14% of the aggregate response of bank lending to a policy innovation after four quarters [and] it explains about one-third of the aggregate response after eight quarters" (pg. 1516), which means that this channel is significant but does not explain majority of the reactions to the policy changes. As all previously presented studies clearly show, there is little doubt in the fact that transmission mechanism of monetary policy is weakening.

4. Ways to achieve better effectiveness

Now that the current deficiencies of transmission mechanism have been introduced, some examples of possible solutions can be addressed. The desirability of active monetary policy seems to be generally accepted at least in the political arena. If so, then the responsible authorities should make sure that such policy is effective. Therefore it is desirable to achieve stronger control over the financial markets to make monetary policy more effective.

The monetary policy stops being effective if interbanking loan rate leaves brackets given by overnight deposit and loan rates of central bank, in other words when there is too much or too little liquidity in the market. But how does this apply to the nonbanking loan providers which form majority of providers in USA, as bank loans form only 30 per cent of total debt liabilities of non-financial firms in the U.S. (Favero, Giavazzi & Flabbi 1999)? Their interest rate is not directly affected by this system. This could be solved by taking non-banking loan providers under the present regulatory umbrella, thus forcing them to meet similar standards as commercial banks.

Another, more important problem, lies with financial conglomerates which can find alternative internal sources of liquidity, as already mentioned. This could possibly be settled by greater control over them and also extended cooperation among central banks of different countries. Such approach would however go against flexibility of monetary policy in the sense of adapting to local conditions. Other possible measure is the power to break up the conglomerates if they are too large and can endanger and destabilize the financial system.

This approach would however possibly create more problems – it would be a powerful tool for governmental extortion of large private conglomerates. Such measures should be avoided, but for their inevitable appeal to the authorities they will most probably be implemented sooner or later. Thus the danger of power concentration should never be underestimated. As a general rule, whenever a new regulatory institution is created or an old one is endowed with a new power, it should be put under due scrutiny of responsible representatives of the public to ensure that the power will not be abused and this power should only be given when considered necessary.

The contemporary importance of monetary policy is hardly deniable. However, as many studies cited in this paper prove, most of the channels of the transmission mechanism of monetary policy are weak. If the authorities do not want to resign on the monetary policy, they must take actions to counter the factors weakening the mechanism. Few examples of such measures have been presented, such as control and regulations over non-banking loan providers, cooperation among central banks and power to break up financial conglomerates. The public representatives should however deeply consider pros and cons before applying any of these measures.

5. *Brief History of the Banking in the Czech Republic*

In order to make understanding of certain features of Czech banking system easier for the reader, history of Czech banking is introduced.

Modern banking started to develop in the Czech lands at the beginning of the 19th century but it was slower than in other parts of the Austrian-Hungarian Empire of which the Czech lands were part of. The reason for that was that the original mode of production was mostly agricultural up to the middle of the 19th century, so there was no need for extensive bank services. Only in the second half of the 19th century did the industrial development ask for fast evolution of banking sector (Pospisil, Hobza & Puchinger 2006, pg. 16).

Prior to foundation of the first Czech banks, Austrian banks operated in the Czech lands but they did not support development of the Czech business sector. Newly created Czech banks attempted to fill this hole in the market. The first Czech bank was *První občanská záložna* (First Civil Savings Bank) founded in 1857 followed by *Hypoteční banka Království českého* (Mortgage Bank of the Kingdom of Bohemia) in 1864 and *Živnostenská banka pro Čechy a Moravu* (Trade Bank for Bohemia and Moravia) in 1868. Especially the latter undergone quick and intense development. Foundation of Prague stock exchange in 1871 had a strong influence on further evolution of banking sector in Czech lands as it induced rising interest in trading stock and contributed to founding new bank houses in the Czech lands (Pospisil, Hobza & Puchinger 2006, pg. 16).

The crisis of 1873 had profound negative impact on Czech banking sector. It also affected price fluctuations in Prague stock exchange. Plummeting prices of stocks of enterprises which were also clients of banks led to decline in the stock prices of bank houses and as a consequence liquidity of the banks significantly deteriorated. The end of the 1870s was then marked with rapid liquidation of the most of the Prague banks, with only *Živnostenská banka pro Čechy a Moravu* surviving the turmoil. When the last echoes of the crisis dissipated, the Czech banking sector slowly stabilized in the 1890s. Fast development of banks can later be observed at the beginning of the 20th century. Table 1 shows the number of banks in the Czech lands in 1910 (Pospisil, Hobza & Puchinger 2006, pg. 17).

Table 1 - Number of Banks in the Czech Lands in 1910

Kind of Bank	Number of Banks
Czech Joint-Stock Banks	12
Land Banks	6
Subsidiaries and Expositures of the Czech Banks	33
German Banks (Joint-Stock Banks of Czech Germans)	10
Subsidiaries of the German Joint-Stock Banks	34
Subsidiaries of Vienna Banks	62
Subsidiaries of Other Banks of Austrian-Hungarian Empire	21
Secondary Loan House (Ltds)	62
Sum	240

The table was retrieved adapted from Pospisil, Hobza and Puchinger (2006, pg. 17)

Other parts of financial sector were developing at the same time, especially institutions focused on savings of and providing loans to mainly low-income households and middle class. Most important of these institutions were savings banks. First of them, *Schraňovací pokladnice pro hlavní město Prahu a Čechy* (Treasury House for the Capital City Prague and Bohemia), was founded in 1820 and since 1860 was known as *Česká spořitelna* (Czech Savings Bank), the bank with the longest tradition in the Czech Republic and one of the two largest Czech banks. Over the years the number of the savings banks flourished – there were 351 savings banks operating in Czechoslovakia by the year 1936. Apart from the savings banks, a myriad of small savings unions provided savings services, gave credit to individual enterpreneurs and supported other activities, namely collective buying. More specialized civil savings unions provided loan operations, bill of exchange operations and even larger mortgages except for accepting deposits.All these institutions focused on low-income and middle class strongly contributed to economic stability of the country, especially after the World War I. As was shown, the Czech banking system in pre-socialist era was characterized by very large number of relatively small banks and other financial institutions with similar functions (Pospisil, Hobza & Puchinger 2006).

The promising development of the banking system in the Czechoslovakia was disrupted by the adoption of the Soviet banking model after 1948. The most significant

characteristic of this system was centralization of functions of commercial and central banking into one institution. This functional concentration enabled using banks as a very effective element of control in the planned economy (Pospisil, Hobza & Puchinger 2006, pg. 17).

However, the banking system was slightly more complicated in reality even after 1948. The center of the system was *Státní banka československá* (State Bank of Czechoslovakia) founded in 1950, which concentrated the functions of the commercial banks and the central bank. Single savings banks and unions were transformed into state savings houses and their centralization was finished in 1967 when these were merged into one institution which was shortly after split into two institutions *Česká státní spořitelna* and *Slovenská státní spořitelna* (Czech State Savings House and Slovak State Savings House) because of forming of the federation. *Živnostenská banka pro Čechy a Moravu* (Trade Bank for Bohemia and Moravia) aquired exception in the new system and remained as a provider of international bank operations for individuals and selected foreign currency operations. *Investiční banka* (Investent bank) formed in 1958 served as a loan provider to state and cooperative companies and its functions were later transferred to *Státní banka československá*. The last important institution in socialist era banking was *Československá obchodní banka* (Czechoslovakian trade bank) which started its existence in 1965 as a result of efforts to create a new economic model in mid-60s. This bank, known as ČSOB, continued its existence even after the end of the socialist era to become one of the two largest banks in the Czech Republic(Pospisil, Hobza & Puchinger 2006, pg. 18).

The fall of socialism in 1989 meant gradual change of banking system back from one stage to two stage system. Politicaly unacceptable banking reform from the middle of 1980s was the cornerstone of the new legislation passed on the 1st of January 1990. State Bank of Czechoslovakia was redefined as an independent central bank with unique emission power under a name of *Česká národní banka* (Czech National Bank). Three new universal commercial banks were created. These banks remained in the state ownership for several next years. Creation of new commercial banks was allowed with minimal equity requirement of only 50 million CZK (approximately 3 million USD; this ammount was later raised to 300 million CZK, approximately 18 million USD). New laws also allowed for the entry of foreign banks into the Czech market (Pospisil, Hobza & Puchinger 2006, pg. 18).

The transition faced several severe problems. The problem number one were loans to state companies which could hardly be repaid. These loans were previously provided on the basis of governmental planning policy without considering the probability of returns. These bad loans would cause troubles to newly created commercial banks in competitive environment. Instead, a state institution, *Konsolidační banka* (Consolidation Bank), administered these loans. Second, no less significant, problem was the creation of new economical structure – necessity to create and support small and middle sized companies. *Českomoravská záruční a rozvojová banka* (Bohemian and Moravian Guarance and Development Bank) was established to fulfill this task with 50 % equity provided by state and 50 % by large commercial banks. Another significant change in this period was renewed membership in IMF (Pospisil, Hobza & Puchinger 2006, pg. 18, 19).

The year 1993 was marked with separation of Czech and Slovak Republic and creation of a new currency. The development in 1990s can be characterized as a time of economic growth. However, certain instability affected banking sector in this period, stemming mostly from continued loan provisions to state companies which could not cope in the new market structure, lack of experience of bank employees, deliberate fraud and problematic assessments of the projects of the new private firms. These problems were amplified in its gravity with new small banks. Central bank had to step in and solve the situation in 1996 under a „Consolidation programme II“ (the first stage of this programme was marked with creation of Consolidation Bank) (Pospisil, Hobza & Puchinger 2006, pg. 19).

One of the important specifics of Czech banking system came into existence in 1993 when commercial building savings societies was allowed. (Pospisil, Hobza & Puchinger 2006, pg. 19, 20). These societies provide opportunities to individuals to save money for buying flats and houses with certain state subsidy. These subsidy along with the fact that the money could be used on other expenses than just building expenses led to the fact that this kind of saving was by far the most profitable.

Bad loans remained the biggest problem in years 1996 and 1997 when a crisis hit the Czech banking system. The share of bad loans on total assets was 32 %. The crisis had strongest impact on small banks. However, next crisis in years 1999 and 2000 hit even three largest banks which were considered „too big to fail“ – namely *Česká spořitelna,*

Komerční banka and *Investiční a poštovní banka* (Investment and Post Bank). The latter had to be bailed out by the state and not even later sale of the bank could offset the huge costs of the operation. Overall costs of state interventions in banking sector between years 1990 and 2004 are estimated to 600 billion CZK (approximately 35 billions USD) (Revenda 2005).

In 1997, Czech banking system undergone abrupt monetary crisis which led to relaxing and later to leaving fixed exchange rate in favour of floating rate with fine-tuning interventions. The managed floating exchange rate was officially adopted on the 26th of May 1997 after many unsuccesful attempts to maintain the fixed rate with gradually extended floating range (Kocarnik 2007, pg. 1, 2).

During 1990s the three biggest commercial banks were privatized. ČSOB for example was privatized in 1999 (Vencovsky 1999, pg. 500 – 506). The minimal equity requirements kept on rising over the years. Creation of deposit insurance scheme increased public trust in the banking system. Gradually also mortgage banks and savings and loan unions were alowed (Pospisil, Hobza & Puchinger 2006, pg. 20). For illustration, Table 2 and a Figures 1 and 2 describe the number of banks between 1990 and 2004 in the Czech Republic is provided.

Table 2 Number of Banks in 1990-2004

Date	Number of banks	Banks with Decisive Czech Share	Banks with Decisive Foreign Share
1.1.1990	5	5	0
31.12.1990	9	9	0
31.12.1991	24	20	4
31.12.1992	37	26	11
31.12.1993	52	34	18
31.12.1994	55	34	21
31.12.1995	55	32	23
31.12.1996	53	30	23
31.12.1997	50	26	24
31.12.1998	45	20	25
31.12.1999	42	15	27

31.12.2000	40	14	26
31.12.2001	38	12	26
31.12.2002	37	11	26
31.12.2003	35	9	26
31.12.2004	35	9	26

Data for the table retrieved form CNB (2001) and CNB (2004).

Before moving on to the next part, a short overview of the present state of the banking system in the Czech Republic is offered. Tables 3 and 4 list the resident and affiliated banks active in the Czech Republic, respectively. Figure 3 shows the changing levels of the discount rate over the years 1990 – 2009. Table 5 and Figure 4 present the evolution of the size of the banking sector in the Czech Republic and the level of deposits and loans from clients over the years 2002 – 2010.

Table 3 - Banks with Residence in the Czech Republic

Name of Bank	Active Since
Banco Popolare Česká republika	1994
Citibank Eurobank	1991
Česká exportní banka	1995
Česká spořitelna	1969
Českomoravská stavební spořitelna	1993
Českomoravská záruční a rozvojová banka	1992
Československá obchodní banka	1965
Evropsko-ruská banka	2009
Fio banka, a.s.	2010
GE Money Bank	1998
Hypoteční banka	1991
J&T BANKA	1992
Komerční banka	1990
LBBW Bank CZ	1990
Modrá pyramida stavební spořitelna	1993
PPF banka	1993
Raiffeisenbank	2008
Raiffeisen stavební spořitelna	1993
Stavební spořitelna České spořitelny	1994
UniCredit Bank Czech Republic	1996
Volksbank CZ	1997
Wüstenrot hypoteční banka	2002
Wüstenrot - stavební spořitelna	1993

Table constructed by the author based on Businessinfo.cz (n.d.).

Table 4 - Affiliates of Foreign Banks in Czech Republic	
Name of Bank	Active Since
AXA Bank Europe	2009
Bank of Tokyo-Mitsubishi UFJ (Holland)	2006
BRE Bank	2007
COMMERZBANK Aktiengesellschaft	1992
Crédit Agricole Corporate and Investment Bank	2005
Deutsche Bank Aktiengesellschaft Filiale Prag	1993
Fortis Bank SA/NV	2005
HSBC Bank	1997
ING Bank	1993
Oberbank AG	2004
Poštová banka	2009
PRIVAT BANK AG DER Raiffeisenlandesbank Oberösterreich	2005
Raiffeisenbank im Stiffland eG	1995
Saxo Bank A/S	2009
The Royal Bank of Scotland	1992
Všeobecná úverová banka	1993
Waldviertler Sparkasse von 1842 AG	1994

Table constructed by the author based on Businessinfo.cz (n.d.).

Table 4 - Czech Banking System as of December 31, 2010		
Period	Total Assets (1000 EUR)	Deposits and Loans from Clients (1000 EUR)
31.12.2010	579545	193763
30.9.2010	520450	191462
30.6.2010	575067	204662
31.3.2010	526306	191112
31.12.2009	553039	195405
30.9.2009	533367	195489
30.6.2009	557234	215860
31.3.2009	578569	211859
31.12.2008	551391	193512
30.9.2008	470922	173999
30.6.2008	478336	187574
31.3.2008	447687	172771
31.12.2007	459808	181966
30.9.2007	400568	160016
30.6.2007	385756	165799
31.3.2007	366393	146968
31.12.2006	366821	148359
30.9.2006	340384	125035
30.6.2006	345611	129815
31.3.2006	321017	125248
31.12.2005	341569	129054
30.9.2005	315991	118556
30.6.2005	303960	110674
31.3.2005	259740	103927
31.12.2004	283635	108717
30.9.2004	256220	115102
30.6.2004	261076	111344
31.3.2004	216953	102932
31.12.2003	227504	101217
30.9.2003	201442	100833
30.6.2003	193689	98495
31.3.2003	195401	97140
31.12.2002	220445	99007
30.9.2002	201136	95310
30.6.2002	217786	99173
31.3.2002	221505	94844

Table constructed by the author based on ARAD (n.d.).

After briefly visiting the history of the Czech banking, the paper that inspired the analytical part of this paper is introduced.

6. Empirical Specifications

The main inspiration the model for this paper was a paper written by the authors Kashyap and Stein "What Do a Million Observations on Banks Say About the Transmission o Monetary Policy?" (2000). The goal of the paper Kashyap and Stein (2000) was to examine cross-sectional differences in the way that the policy shocks impact different banks in order to prove the existence of the lending channel of the transmission mechanism of monetary policy. More specifically, the authors focused on differences between banks of different sizes and varying balance sheet liquidity.

As authors concur, for lending view to be applicable, Modigliani-Miller proposition for banks must be proven wrong. According to the proposition, banks can freely switch between bonds and deposits at the margin (Kashyap & Stein 2000). If that is true, the shocks to the deposits do not affect banks' lending policy.

It is also difficult to distinguish between the loan supply effects and loan demand effects. The lending view however assumes decrease in loan supply, so "to resolve this ambiguity, Kashyap, Stein and Blinder (1992) show that while a monetary contraction reduces bank lending, it increases commercial paper volume. This fact would seem to suggest an inward shift in loan supply, rather than an inward shift in loan demand" (Kashyap & Stein 2000, pg. 3).

Due to previously mentioned difficulties with identification, the authors decided to observe the behaviour of individual banks rather than aggregate values. If their idea is right, the Modigliani-Miller theorem has to be wrong which means that banks cannot tap uninsured funding sources without frictions in the presence of monetary shocks. That also means that there would be stronger impact on some banks more than the others. When two similar banks which differ only in the strength of their balance sheet liquidity position and which do not have access to alternative sources of funding, the

bank with weaker position will cut its loans more profoundly when affected by monetary contraction. This led the authors to stating their main hypothesis: $\frac{\partial^2 L_{it}}{\partial B_{it} \partial M_t} < 0$.

L stands for the lending activity, B for balance sheet strength and M for monetary policy. Higher M means less restrictive policy. Second hypothesis is that the effect should be stronger for smaller banks (Kashyap & Stein 2000).

The data set used by the authors consisted of quarterly data for all reporting banks from the period 1976Q1-1993Q2, which amounted for 962,530 bank-quarters later divided into several groups for further testing. In their models, they used natural logarithm of lending as explained variable and four lags of natural logarithm of lending, balance sheet strength, geographic control, monetary policy variable, time variable and GDP. They tried models with different specifications, initially using two-step regression approach, later also one-step due to possible overspecifiaction of the two-step model. Three alternative measures of monetary policy were used: so called narrative approach based on Boschen-Mills (1995) index rating Fed policy in each month in five stances from "strongly expansionary" to "strongly contractionary"; federal funds rate and flexible VAR model(Kashyap & Stein 2000).

No matter what specifications of the model they used, the results were all approximately the same. According to the authors: "Within the class of small banks, changes in monetary policy matter more for the lending of those banks with the least liquid balance sheets. The results are for the most part strongly statistically significant, and are robust to a wide range of variations in estimation technique" (Kashyap & Stein 2000, pg. 29). Most other possible scenarios were disproved throughout the text, so at least for the studied period and area it seems difficult to deny the presence of the lending channel. However, this result does not say how important the lending channel is for aggregate economic activity (Kashyap & Stein 2000).

7. The Problems with Panel Data Sets in Finance

There could be multiple issues with model robustness as suggested in Kashyap & Stein (2000). To address these issues, the advice given in Petersen (2008) on methods of estimation of standard errors in panel data sets is utilized. The author warns against fallibility and insufficiency of the information provided in literature analyzed in his text.

The goal of his paper is to compare the methods and help the reader to choose the correct method. The most common forms of dependence in finance applications take two forms. The first is the correlation of the firm's residuals across years, also known as time-series dependence or unobserved firm effect. The second is the correlation of the year's residuals across different firms, also known as cross-sectional dependence or time effect. The author simulates panel data using both forms, individually and jointly as well, to estimate coefficients and standard errors for each method and then to compare their relative performance. He starts with examining "the sensitivity of standard error estimates to the presence of a firm fixed effect" (Petersen 2008, pg. 436) which can be often observed among variables such as dividends, financial leverage, and investment. As assessed by the author, only clustered standard errors provide unbiased results because the residual dependence due to the firm effect is accounted for by this method (Petersen 2008, pg 436).

One of the methods to deal with two sources of correlation proposed in Petersen (2008) is to "parametrically estimate one of the dimensions (e.g. by including dummy variables)" (Petersen 2008, pg. 458). Usually, the dummies are used of individual time periods as there are more firms as opposed to years in many panel data sets and this approach absorbs the time effect. Subsequently, the data is fixed by firm (Petersen 2008, pg. 458). In the case of fixed time effect, "the time dummies completely remove the correlation between observations in the same time period" (Petersen 2008, pg. 458), so only a firm effect remains in the data. Standard errors that are clustered by firm do not suffer from bias, while OLS as well as Fama-MacBeth standard error do in this case (Petersen 2008).

To make the parametric approach work, we need to correctly specify the dependence (Petersen 2008, pg. 458). The problem is that "if the time effect is not fixed, then time dummies will not remove the dependence completely and even standard errors clustered by firm can be biased" (Petersen 2008, pg. 458). The preference for a less parametric approach can then arise from the fact that many researchers do not know the exact form of the dependence. A viable alternative possibility for this case is to cluster on both dimensions at the same time. Petersen (2008) introduces an estimation of the variance-covariance matrix proposed by Cameron, Gelbach, and Miller (2006) and Thompson (2006) such as following:

$$V_{\text{Firm\&Time}} = V_{\text{Firm}} + V_{\text{Time}} - V_{\text{White}}$$

in which the standard errors are clustered by both firm and time. The first term stands for the standard errors that are clustered by firm. The second term stands for the standard errors that are clustered by time. Both these terms contain unspecified correlation between the two variables (correlation between observations with the firm fixed and varying years or the other way round). To avoid such double counting, "the White variance-covariance matrix is subtracted" (Petersen 2008, pg. 458).

The author concludes that "the standard errors clustered by firm are unbiased and produce correctly sized confidence intervals whether the firm effect is permanent or temporary" (Petersen 2008, pg. 475) while most other methods proposed in the literature that were tested by the author produced biased standard errors. "OLS, White, Newey-West (modified for panel dadta sets), Fama-MacBeth, or Fama-MacBeth corrected for first-order autocorrelation" (Petersen 2008, pg. 475) all failed to produce unbiased standard errors. Time effect makes things bit more complicated. In such case Fama-MacBeth gives unbiased standard errors as well as confidence intervals of a correct size (Petersen 2008, pg. 475). The same goes for standard errors that are clustered by time, however only if there are enough clusters (Petersen 2008, pg. 475). The rest of the text provides the reader with guidance how to choose the correct methods.

As the dataset in this paper suffered from firm effect, the standard errors were clustered by firm, while the time effect was not a problem.

The model developed by Kashyap and Stein (2000) inspired the model in this paper. Due to a vast difference in the size of the datasets – none of the datasets used for this paper had more than 300 observations while the dataset used by Kashyap and Stein (2000) had almost a million observations – the model used here is only a one step model. First, several models with different specifications were tested and later the best fitting model was transformed to adjust for the firm clustering effect described in the previous section.

Data for the model was extracted from the Bankscope database mostly and it was drawn from November and December 2010 version of the database. After carefully combining consolidated and unconsolidated data for different banks (only unconsolidated data for

banks with no subsidiaries was added) the dataset contained 267 observations from the years 1992 to 2009 in the version for the final model. Additional data, such as historical discount rates, was obtained from the web pages of the Czech National Bank. The initial versions of the model contained several variables, some of which were discarded because of their statistical insignificance. As the explained variable, a difference of natural logarithm of loans provided by the bank in the year was used. For explanatory variables, series of values were used. After testing models containing also trend dummy, lag of GDP and others, a simpler model was chosen. First monetary policy proxy was designed as a proxy shock estimated as a difference between actual value of overnight interest rate and estimated value from autoregressive model with four lags. This proxy however had opposite effect on lending than expected, possibly because of demand shocks. Different proxy was thus used – a relevant Czech Central Bank rate for discount rates (CNB, n.d.). The final model then came in two versions. First version contains difference of natural logarithm of lending for each bank in relevant year as dependent variable and natural logarithm of lagged total assets (proxy for size of the bank), change in monetary proxy, an interaction term of a change in monetary proxy and lagged balance sheet strength (balance sheet strength was calculated as a ratio of cash and securities to total assets) and lagged balance sheet strength. Second version excluded the interaction term. The models and the results follow:

Model – version with interaction term

$$\Delta \ln(L_{it}) = \alpha_t + \beta_t \ln(A_{it-1}) + \gamma_t \, \Delta M_t + \delta_t \Delta M_t B_{it-1} + \theta_t \Delta B_{it-1} + \varepsilon_t$$

List of variables:

Dependent:

- change in natural logarithm of loans

Independents:

- Lagged natural logarithm of total assets
- Change in CNB target rate (as of November)
- Interaction term (Change in CNB target rate * Lagged balance sheet strength)
- Lagged balance sheet strength (calculated as a ratio of cash and securities to total assets)

Preliminary results

Dependent Variable: $\Delta \ln(L_t)$			
Independent Variable	All Data	Large Banks (total assets > median)	Small Banks (total assets < median)
$\ln(A_{t-1})$	-0.035	-0.087***	-0.089
ΔM_t	-0.011	-0.037*	-0.018
$\Delta M_t * B_{t-1}$	0.023	0.163	0.098
B_{t-1}	-0.308	-0.021	-1.110
Constant	0.664**	1.228***	1.204
Observations	267	137	130

* p<0.10, ** p<0.05, *** p<0.01

Model – version without interaction term

$$\Delta \ln(L_{it}) = \alpha_t + \beta_t \ln(A_{it-1}) + \gamma_t \Delta M_t + \theta_t \Delta B_{it-1} + \varepsilon_t$$

Preliminary results

Dependent Variable: $\Delta \ln(L_t)$			
Independent Variable	All Data	Large Banks (total assets > median)	Small Banks (total assets < median)
$\ln(A_{t-1})$	-0.036	-0.084***	-0.095
ΔM_t	-0.006	-0.005	0.001
B_{t-1}	-0.226	0.390	-0.703
Constant	0.654***	1.098***	1.189
Observations	267	137	130

* p<0.10, ** p<0.05, *** p<0.01

To ensure statistic significance, data had to undergo data transformation suggested in paper Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches by Petersen (2008) for clustered standard error estimates.

The statistical significance of all the results was at least at 20 % significance level. The banks were divided into two subdatasets according to size, with large banks being those with total assets larger than median of total assets and small banks being those with total assets smaller than median of total assets. What we are interested in are the effects of monetary proxy change on the difference in natural logarithm of loans and the effects of balance sheet strength. We can see that the effects of change in monetary policy are stronger for larger banks in this dataset. This could be for example due to the fact that

some of the smaller banks have more specialized type of business. However there is no strict distinction between banks in the Czech Republic as it is in the USA, so it is difficult to exclude any small banks just based on the data available. We can also see that the interaction term influences the lending in the expected direction.

The model should be rerun in future with larger dataset as soon as this is attainable. The results so far are not very convincing as far as the strength of the lending channel of the transmission mechanism of monetary policy in the Czech Republic goes.

8. Conclusion

The contemporary importance of monetary policy is hardly deniable. However, as many studies cited in this paper prove, most of the channels of the transmission mechanism of monetary policy are weak. If the authorities do not want to resign on the monetary policy, they must take actions to counter the factors weakening the mechanism. As can be seen from the model developed in this paper, the strength of the lending channel in the Czech Republic remains questionable, even though possibly due to the insufficiency of the dataset. Few examples of such measures have been presented, such as control and regulations over non-banking loan providers, cooperation among central banks and power to break up financial conglomerates. The public representatives should however deeply consider pros and cons before applying any of these measures.

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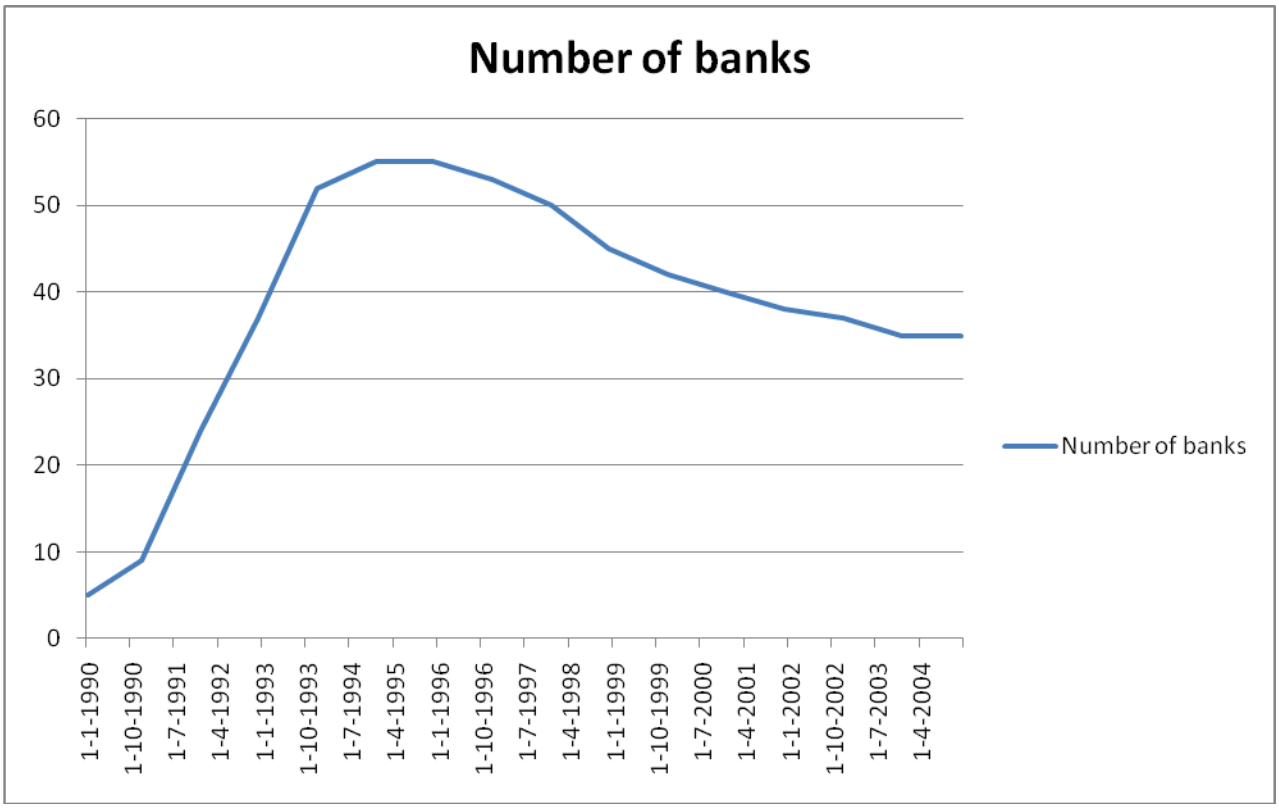
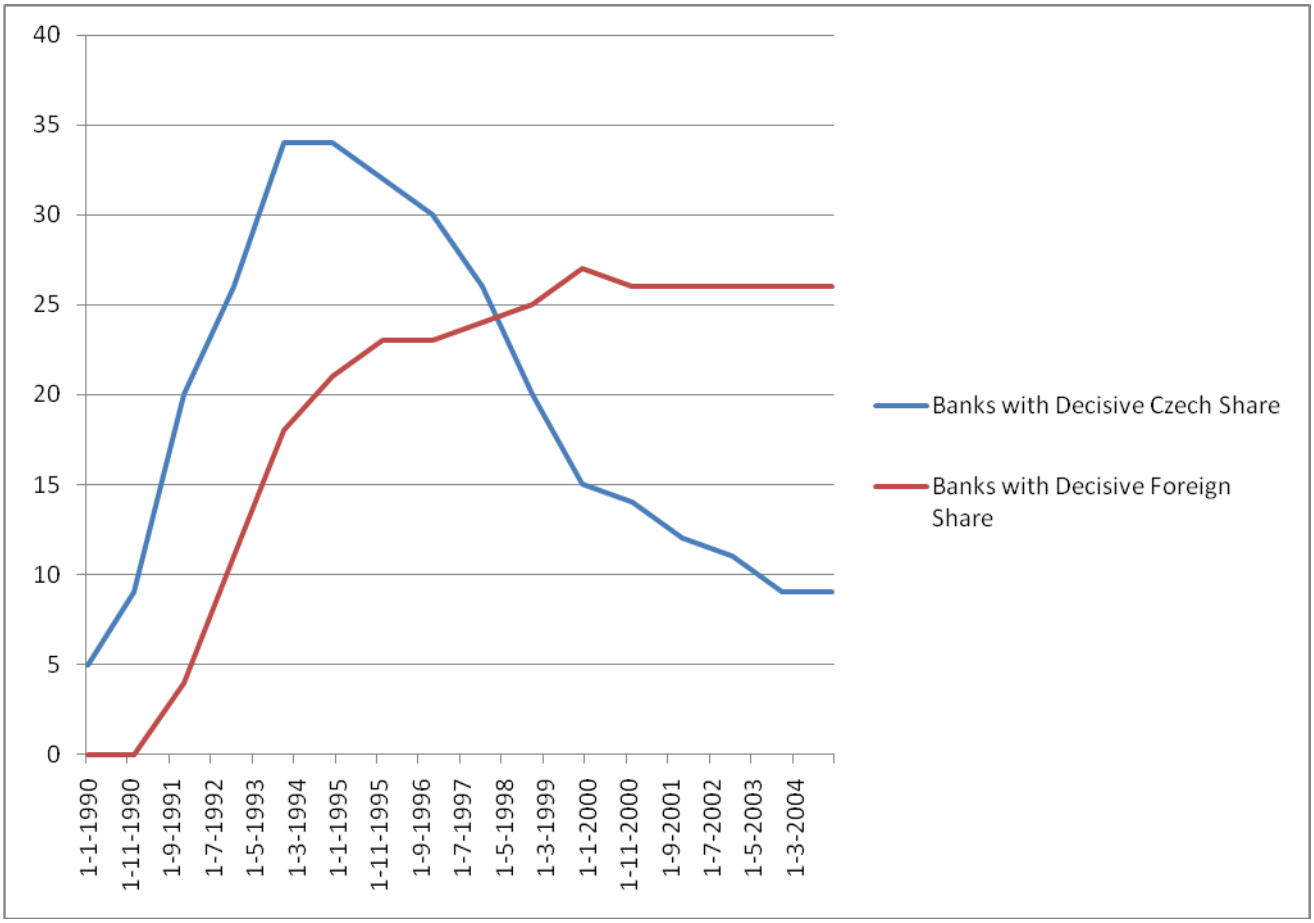
Appendix

Figure 1 – Number of Banks in the Czech Republic in Years 1990 – 2004



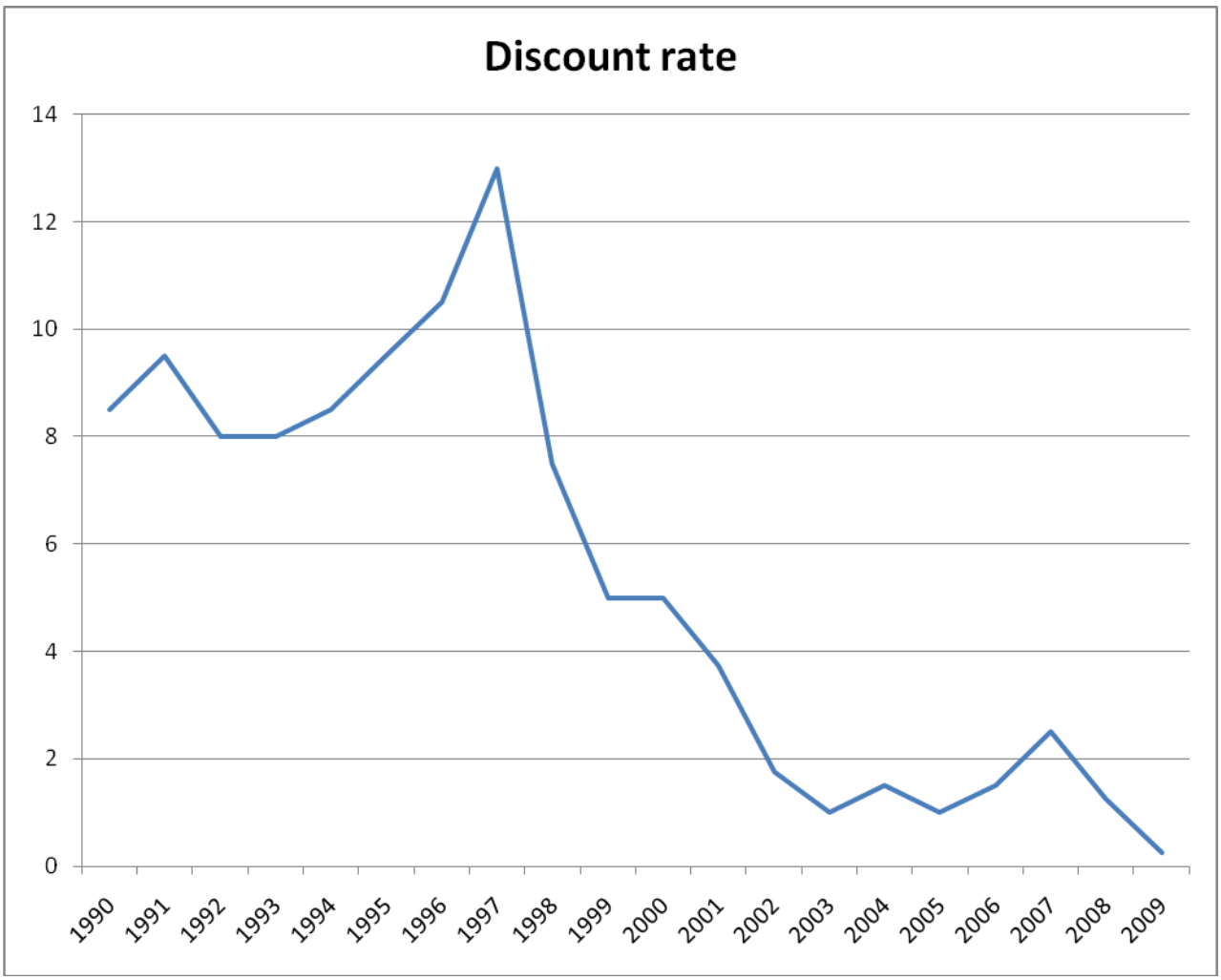
Graph was created by the author based on the data form CNB (2001) and CNB (2004).

Figure 2 – Number of Banks in the Czech Republic in Years 1990 – 2004 Divided Based on Ownership Structure



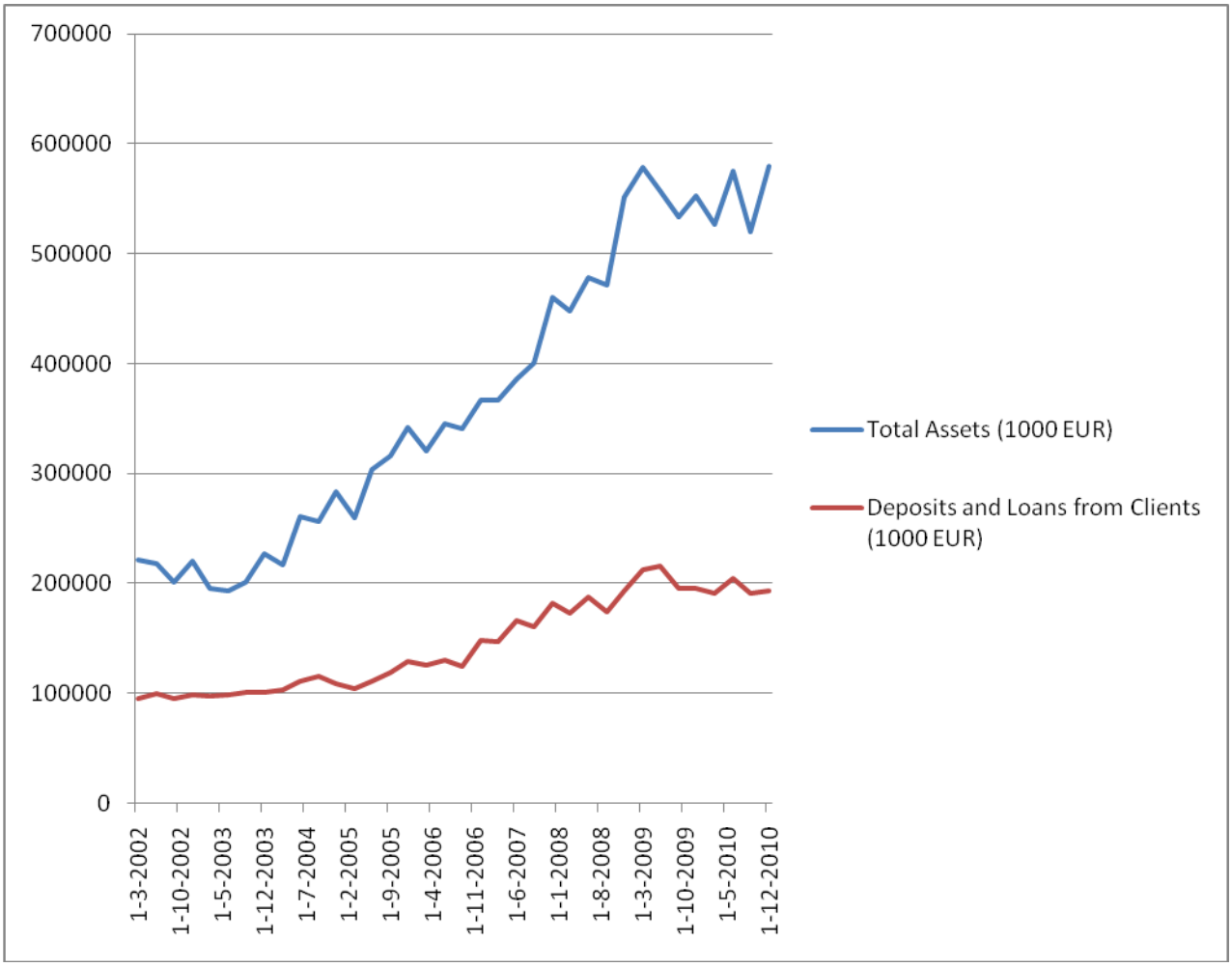
Graph was created by the author based on the data form CNB (2001) and CNB (2004).

Figure 3 – Graph of discount rates in the Czech Republic over the years 1990 – 2009



Graph was created by the author based on the data from ARAD (n.d.)

Figure 4 - Czech Banking System as of December 31, 2010



Graph was created by the author based on the data from ARAD (n.d.)