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Project Coordinator: Aleš Bulíř

The Role of Banks in the Czech Monetary Policy Transmission Mechanism

Anca Pruteanu [*]

Abstract

With this work, we aim to enrich the knowledge about the monetary policy transmission mechanism in the Czech Republic with empirical evidence on the impact of monetary policy on bank lending. Using a panel of quarterly time series for Czech commercial banks for the period 1996–2001, we study the overall effect of monetary policy changes on the growth rate of loans and the characteristics of the supply of loans. The characterization of the credit market's supply side allows us to make inferences on the operativeness of the credit channel (the bank lending channel and the broad credit channel) of the monetary transmission mechanism. We find that changes in monetary policy alter the growth rate of loans with considerably stronger magnitude in the period 1999–2001 than in the period 1996–1998. From the analysis intended to capture the characteristics of the supply of loans, we conclude that the lending channel was operative in the period 1996–1998: we find cross-sectional differences in the lending reactions to monetary policy shocks due to degree of capitalization and liquidity. For the subsequent period 1999–2001, the results also show distributive effects of monetary policy due to bank size and a bank's proportion of classified loans. In the context of steadily decreasing interest rates, this bolsters the supposition of credit rationing and hence that of an operative broad credit channel. At the same time, we find evidence of linear relationships between bank characteristics and the growth rate of loans, and again these relationships change between the two time periods. This bodes well with the changes in the structure and attitude towards lending of the Czech commercial banks.

JEL Codes: E48, E52, E51, E58, G21.
Keywords: Bank lending channel, broad credit channel, credit rationing, monetary transmission mechanism.

[*] Monetary and Statistics Department, Czech National Bank and CERGE-EI, Charles University. E-mail: anca.pruteanu@cnb.cz.

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Nontechnical Summary

In this paper we study the validity of the credit channel in the monetary policy transmission mechanism in the Czech Republic during the period 1996:1Q to 2001:4Q. The theory of credit channel states that the monetary transmission cannot be represented solely by the interest rate channel but it is affected by the direct impact of a monetary policy tightening on financial intermediation –the bank lending channel – and by the nature of the relationships between lenders and borrowers, especially in the presence of asymmetric information between them – the broad credit channel.

Similarly to the recent stream of empirical literature on the credit channel, we adopt the model specification of Kashyap and Stein (1995) to capture the effectiveness of the lending channel for the time span characterized by monetary tightening. Apart from the literature, we use the same model for the time periods characterized by decreasing interest rates, in order to make inferences on the broad credit channel. The model specification captures whether the fluctuations in the bank lending respond to monetary policy shocks, and, if so, whether there are important cross-sectional differences in the responses of banks with varying characteristics (size, liquidity, capitalization, ownership and ratio of classified loans to total loans). We use quarterly balance sheet data of Czech banks collected by the Czech National Bank.

We conduct the analysis on two consecutive time periods: 1996–1998 and 1999–2001. We find significant differences between the results characterizing the two periods as well as between the results characterizing banks belonging to different ownership groups.

The client loans react to monetary policy impulses with much stronger intensity in the second period. The 1998 introduction of a new monetary policy regime, followed by an easing of the monetary conditions, coupled with the unprecedented development of the banking sector and the recovery of demand after the 1997 crisis, could explain the stronger impact of the monetary conditions on the growth rate of client loans in the period 1999–2001.

We detect an operative bank lending channel due to capitalization and liquidity for the period 1996–1998. During the period 1999–2001, interest rates had a decreasing trend, hence it is not possible to identify a lending channel as motivated by the theory. Nevertheless, in this period we can distinguish distributive effects of monetary policy on bank lending due to bank size and to the proportion of classified loans in total loans, within banks with mainly foreign participation only. Big banks and banks having a higher ratio of classified loans banks seem to be less prone to increasing their growth rate of loans when monetary policy is relaxed. We perceive this outcome as evidence of a broad credit channel.

1. Introduction

A correct assessment of the monetary policy transmission mechanism is vital for understanding and foreseeing the effects of the monetary conditions on the real economy. A comprehensive view on about the monetary policy transmission necessitates extensive evidence on the reaction of each sector of the economy to policy changes.

In this work, we provide empirical evidence on the effect of monetary policy changes on bank lending, at microeconomic level, in the Czech Republic during the period 1996–2001. Based on the results, we make inferences on the effectiveness of the interest rate channel and credit channel of monetary policy transmission.

The mechanism by which the monetary policy is transmitted to the real economy has been the topic of extensive theoretical and empirical research in Western countries. Still, the exact mechanism has not yet been completely unveiled – Bernanke and Blinder (1995) refer to it as "a black box". The standard view of monetary policy transmission, known as the "money view" (which explains the monetary policy transmission through the interest rate channel), is generally accepted. However, numerous empirical studies (see Bean, Larsen and Nikolov (2002), for a comprehensive survey) focusing on Western economies point out that this channel cannot alone account for the transmission mechanism. An additional explanation for the monetary transmission mechanism is provided by the credit channel theory. This theory points out that a complete picture of monetary transmission needs to account for the possibility of financial frictions, whereas the interest rate channel theory ignores their existence. Specifically, the credit channel theory stresses that monetary policy may directly affect not only the demand for loans (through the interest rate channel), but also the supply of loans, and in this case the monetary transmission looks different than that depicted by the interest rate channel theory. More precisely, it states that in addition to the impact on firms and households, monetary transmission is affected by the direct impact of a monetary policy tightening on financial intermediation, as addition to the impact on firms and households, – this is being referred to in the literature as the bank lending channel – and by the nature of the relationships between lenders and borrowers, especially in the presence of asymmetric information between them – the broad credit channel. The credit channel theory stresses that in an economy where at least some borrowers are bank-dependent, the existence of financial frictions might significantly affect the monetary transmission mechanism, so the credit channel might have an important weight.

Starting in the early 1980s, there is a growing literature concerned with the validity of the credit channel theory. For the U.S. economy, among the adepts of a "pure interest rate channel", that is, supporters of the idea that financial intermediation plays a passive role in monetary transmission, are King (1986), Romer and Romer (1990), and Ramey (1993). Supporting theoretical and empirical evidence of the credit channel has been supplied by Bernanke (1983), Bernanke and Blinder (1995), Kashyap, Stein and Wilcox (1993), Gertler and Gilchrist (1993), Kashyap and Stein (1995, 1997, 2000), etc. Recently, in the context of the single monetary policy in the euro area, the topic of monetary policy transmission in general, and the validity of the credit channel theory in particular, has received extensive attention, as precise knowledge of the similarities and differences between the monetary transmission mechanisms in each country of the Euro area is necessary (see Kashyap and Stein, (1997), and ECB WPs 91–114).

Concerning the Czech Republic, the current thinking about the way monetary policy is transmitted to the real economy is grounded in the interest rate channel theory (CNB 2003). However, the empirical evidence is still scarce and tends to be limited to the aggregate economy. Izák (1997) and Pašaličova and Stiller (2002) empirically analyzed the relations between interest rates, aggregate loans and output and find significant causalities among them. Buchtíková (2001) attempts to characterize the credit channel by analyzing firm-level data, but the author insists that the results need to be taken with caution given the quality of the data. Nevertheless, it is a fact that in the Czech Republic most companies are still bank dependent and that the presence of financial frictions – specifically credit rationing – has often been mentioned (Bulíř (1997), Čihák (1998), Singer and Pospíšil (1999), and Hampl and Matoušek 2000)). Under these circumstances, the credit channel is a plausibly important channel of monetary transmission. With this paper, we aim to initiate work on the transmission mechanism information stemming from bank lending. In particular, we seek to infer whether the credit channel is of considerable importance in monetary transmission.

In our analysis, similarly to the recent stream of empirical literature on the credit channel, we adopt the model specification of Kashyap and Stein (1995) to capture the effectiveness of the lending channel for the time span characterized by monetary tightening. Apart from the literature, we use the same model for the time periods characterized by decreasing interest rates, in order to make inferences on the broad credit channel.

Kashyap and Stein's (1995) specification captures whether bank lending responds to monetary policy shocks, and, if so, whether there are important cross-sectional differences in the responses of banks with varying characteristics (in other words, distributional effects of monetary policy shocks). Evidence on whether monetary policy shocks affect bank lending speaks for the efficacy of monetary policy. It does not solely characterize the interest rate channel, as fluctuations in the growth rate of loans come from either the demand or supply side, or both, but it certainly allows inferences about its efficacy. The recent literature stresses that in circumstances of a monetary policy tightening, evidence on the distributional effects of monetary policy shocks characterizes the effect of monetary conditions on the supply of loans, hence shedding light on the effectiveness of the lending channel of the monetary transmission mechanism (see Bean, Larsen and Nikolov (2002)). In addition to this, we consider that under conditions of a monetary policy easing, evidence of the distributional effects of monetary policy on bank lending is meaningful as well, as it reveals differences, if any, in the reluctance of banks with varying characteristics to grant loans. Hence, it may actually characterize the effectiveness of the broad credit channel.

To perform this analysis, we use as bank characteristics those encountered in literature (bank size, degree of capitalization and degree of liquidity) and additionally the proportion of classified loans in total loans and the type of bank ownership. In an environment characterized by a high amount of bad loans, it might appear that the proportion of classified loans in total loans generates differences in the way banks are willing to grant loans as monetary policy eases. Also, knowledge about whether lending behavior varies between banks which have different types of ownership is an important piece of information for signaling changes, if any, in banks' lending behavior as a consequence of privatization. The model specification also captures the existence of linear relationships between bank characteristics and bank lending.

Over the last decade, the Czech banking sector has undergone a massive transformation process marked by numerous bank failures, the accumulation of huge amounts of non-performing loans (especially in the early phase of economic transition), and credit rationing blames. We intend to capture the time-varying characteristics, if any, of banks' lending behavior by conducting our analysis on two sub-periods: 1996–1998 and 1999–2001.

The paper is organized as follows. Section 2 presents a short review of the theory of the monetary policy transmission mechanism, with an emphasis on the credit channel theory, and some country-specific aspects to be accounted for when analyzing the credit channel. Section 3 describes the main developments, structure and specifics of the Czech banking sector during the second half of the economic transition process, with an emphasis on those features which are likely to influence the transmission of monetary policy. Section 4 introduces the model and describes the data we have used. Section 5 presents the estimation methodology and the results of econometric estimations. Section 6 contains the concluding remarks. Section 7 contains the Appendix.

2. Theoretical and Practical Aspects of the Credit Channel

2.1 Theoretical Aspects

According to the traditional view of monetary transmission – the money view – which explains monetary transmission through the interest rate channel, a change in the policy-induced interest rates affects long-term interest rates and the exchange rate, hence altering relative prices in the economy, the price of future consumption and investment relative to the price of present consumption, and the prices of foreign goods in terms of domestic goods (Bean, Larsen and Nikolov, 2002). Further, these may affect the real economy. However, the interest rate channel theory cannot fully explain the intensity, timing and composition of the responses of real variables to variations in monetary policy[1]. This failure is a consequence of the theory's strong assumption of frictions-free capital markets: it assumes that bonds and loans are perfect substitutes and banks play a passive role in the economy, solely that of attracting deposits. As regards the passive role of banks in the transmission mechanism, the interest rate channel theory claims that monetary policy shocks influence solely the cost of borrowing. Angeloni, Kashyap, Mojon and Terlizzese (2002) characterize the interest rate channel as "the response of aggregate demand components, GDP and prices to the change in the policy controlled interest rate that would take place if there were not capital market imperfections".

Appealing to financial frictions, the credit channel theory offers additional explanations for the timing and distributional effects of monetary policy, aiming at completing the picture of the monetary transmission mechanism. The literature recognizes two broad ways through which

[1] Bernanke and Gertler (1995) give an ample exposition of the main points of the transmission mechanism that the interest rate channel theory fails to explain.

financial frictions perturb the transmission mechanism as postulated by the interest rate channel theory: the bank lending channel and the broad credit channel[2].

The bank lending channel theory ascribes a special role to banks in the monetary transmission mechanism. It stipulates that a monetary policy tightening can affect not only the demand for loans (through the interest rate channel), but also the supply of loans. In other words, monetary policy affects not only borrowers, but also the banks themselves. The theoretical underlying mechanism is, broadly speaking, the following: a monetary policy tightening shrinks banks' reserves and consequently banks' deposits. Deposits are an important, if not the main, source of financing the lending. The theory stipulates that the responses of banks, in terms of their lending, in the aftermath of a monetary policy tightening might not be the same across banks. Specifically, banks can also encounter a moral hazard problem in the inter-bank market, such that bigger/better capitalized banks might have better access to external funding. In the same way, more liquid banks can use their liquidity to counteract the policy shock. So, a monetary policy tightening might have distributional effects on bank lending, due to some bank characteristics. In a larger context, the encompassing mechanism of this channel stipulates that a policy-induced change in open market interest rates will affect the banks' cost of external finance and consequently their ability to maintain and expand their loan portfolio. In seeking whether monetary policy affects the supply of loans, one faces an identification problem, since a fluctuation in the growth rate of loans might equally be caused by the demand for, or supply of, loans. In order to disentangle supply-side-induced fluctuations in the growth rate of granted loans, the recent stream of literature, following the seminal work of Kashyap and Stein (1995), uses bank characteristics (bank size, degree of liquidity and degree of capitalization) to analyze whether these can induce any difference in the reaction of banks to monetary policy shocks.

To support the existence of a bank lending channel there is a need for evidence that a monetary policy tightening causes shifts in the supply of loans and that there are some bank-dependent borrowers.

The broad credit channel theory pertains to the character of the relationships between borrowers and lenders, emphasizing that the problem of asymmetric information, which possibly characterizes the market for credits, can influence the monetary transmission mechanism. Asymmetric information between borrowers and lenders can lead to credit rationing and/or under-investment, further affecting the real economy. To verify empirically whether the broad credit channel is operative is not straightforward. For this, the empirical literature resorts to rather indirect evidence of enterprises facing credit constraints. Namely, we can distinguish two broad approaches: using aggregate data to estimate the curves for the supply of, and demand for, loans, or using firm level data to see whether financial variables (cash flow and net worth) explain the investment decisions.

We claim that inferences about asymmetric information in the credit market can be drawn not only from the outlook of companies, but also from characteristics of the credit market's supply side (from the banks' perspective). Specifically, we conceive the following strategy: to assess

[2] Bean, Larsen and Nikolov (2002) give an excellent survey of the two channels.

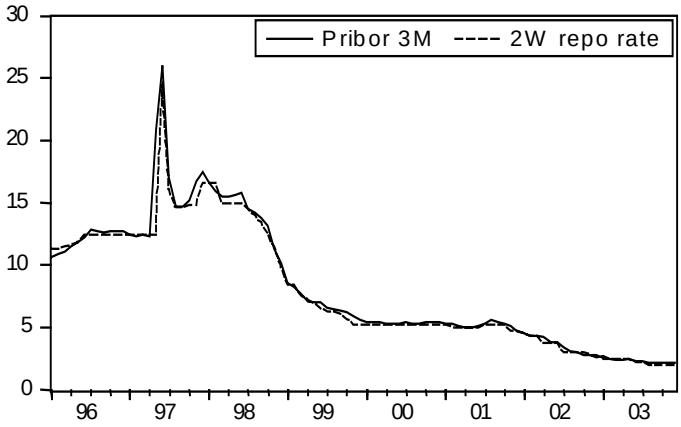
whether there is a homogenous lending reaction of banks during conditions of a monetary easing. Intuitively, a decline in policy-induced interest rates brings about an increase in the demand for loans. The question we ask is whether specific bank characteristics such as "the proportion of classified loans to total loans", "type of bank ownership" and "bank size" lead to differences in the responses of banks' lending to a monetary easing. This may answer the question of whether banks with different characteristics have different degrees of reluctance to lend out.

2.2 Practical Aspects of the Credit Channel Evidence in the Czech Republic

The analysis of the credit channel in the Czech Republic needs to account for both the development of interest rates (Figure 1) and the development of the minimum reserve requirement (Figure 2). The high volatility of interest rates between 1997 and mid-1998 was followed by a steady downward trend. From 1997 onwards, the minimum reserve requirement gradually decreased, and in October 1999, as part of the harmonization process with the Eurosystem, the Czech National Bank set – and has since maintained – the minimum reserve requirement at 2%[3].

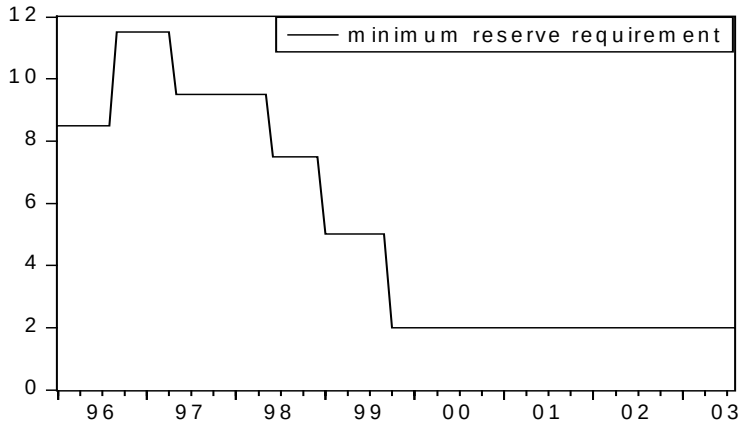
Hence, whereas the period 1996–1998 offers a good field to study whether there are differences in the way banks with different characteristics have coped with the episodes of monetary policy tightening in conditions of a high minimum reserve requirement, and hence to study whether the lending channel has been operative, for the subsequent period 1999–2001 the conditions of a low minimum reserve requirement and decreasing interest rates were not likely to accommodate the lending channel of monetary policy. However, even if the lending channel is not theoretically plausible for the period 1999–2001, it remains a question whether certain banks (with certain characteristics) refrained more or less from giving loans when interest rates were declining. We believe, as described in sub-section 2.1, that this may characterize the broad lending channel. We are particularly interested in whether there are differences in lending reactions between banks that have varying proportions of classified loans and between banks belonging to different ownership groups.

Figure 1: Interest rates



[3] Moreover, starting July 2001, "the interest rate applied to the minimum reserve requirement on inter-bank payment system accounts will be the same as that for the CNB's main repo operation".

Figure 2: Minimum reserve requirement

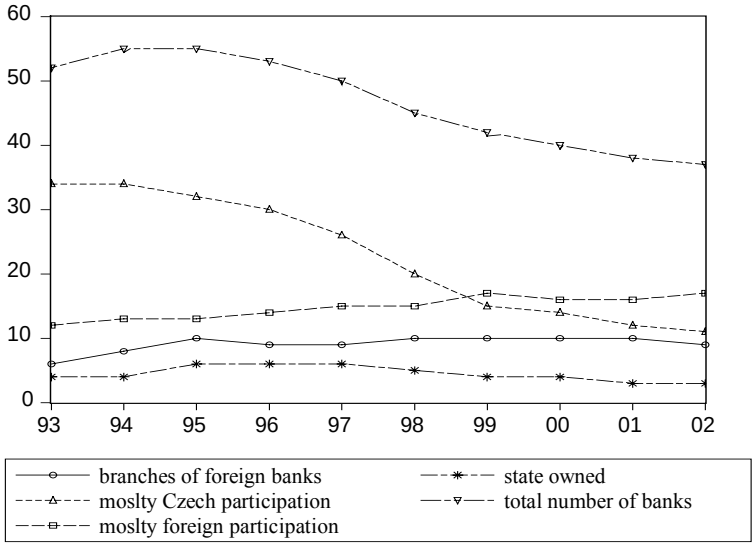


3. The Development of the Czech Banking Sector

In the last decade, there has been an ongoing process of consolidation of the Czech banking sector. This process has been slowed down by the problem of large volumes of bad loans inherited from the Communist era, exacerbated in the first half of the 1990s by governmentally-directed lending to large loss-making state-owned enterprises and careless lending practices accommodated by a loose legal framework and inefficient supervisory system. In several cases, this situation has culminated in bank failures. The state has taken numerous measures to speed up the consolidation process. Among them was the establishment of Konsolidační Banka (which in 2001 was transformed into Konsolidační Agentura – the Czech Consolidation Agency), a bank with the unique scope of collecting non-performing loans from the banking sector. Also, significant amounts of public funds were granted for the recapitalization of banks, mainly with a view to preparing the largest banks for privatization. With the privatization of Komerčni Banka in 2002, 80% of the Czech banking sector is owned by foreign banks. Although much diminished in recent years, classified loans are still a major issue, with classified client loans at 21.4% of total client loans.

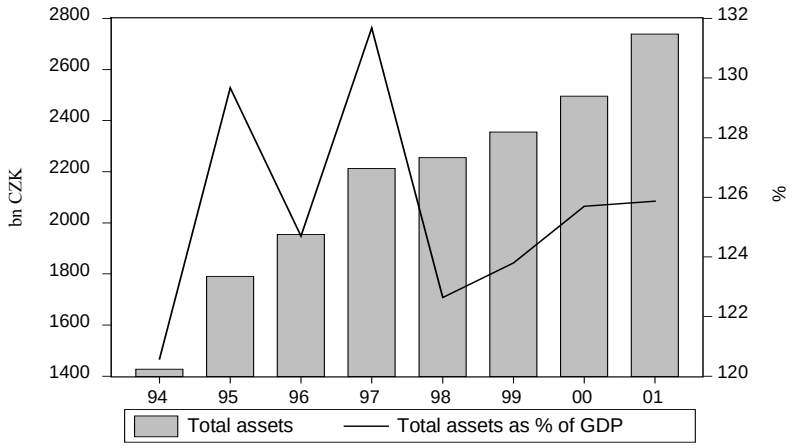
In the following, we present the evolution of several selected indicators to illustrate the development of the Czech banking sector in the last decade. As shown in Figure 3, the number of licensed banks decreased from 55 in 1994 to 37 at the end of 2002. Up to December 1999, the decline was mainly due to bank closures, whereas in 2000 and 2001 some mergers took place, further decreasing the total number of banks. Noticeable is the change in the ownership composition of the Czech banking sector: the number of Czech-controlled banks decreased from 34 in 1993 to 11 at the end of 2002, while the number of foreign-controlled banks increased from 12 to 15 in the same period. The number of foreign-owned banks that entered the market is actually higher than 3, but several mergers took place among them during the period. A history of entries, exits, mergers and privatizations is presented in Table 5 in the Appendix.

Figure 3: Number of banks



Despite the decrease in the number of banks, the total assets of the banking sector increased steadily. Figure 4 depicts the development of Czech banking sector's total assets in absolute value and as a percentage of GDP. At the end of 2001, banking sector assets amounted to 125% of GDP, the highest figure in the Central and Eastern European countries and comparable with those of Western countries.

Figure 4: Czech banking sector size



Unlike in the case of assets, a decreasing trend in the amount of loans granted is apparent. Figure 5 presents the evolution of client loans. Total loans (the sum of loans to clients, loans to government institutions, and loans to other banks) show a similar development. The drastic decrease in the amount of client loans between 2000 and 2001 is due – inter alia – to a sharp decrease in the amount of classified loans[4]. This can be also inferred from Figure 6, which depicts

[4] Classified loans halved during this period.

the evolution of newly granted loans. These declined between mid-1999 and 2000, albeit at a much slower pace than the stock of loans, then picked up again in 2001 and beyond.

Figure 5: Client loans

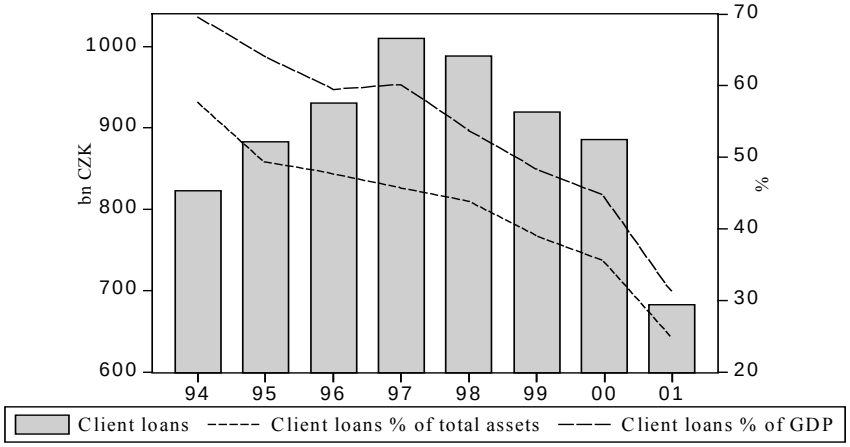
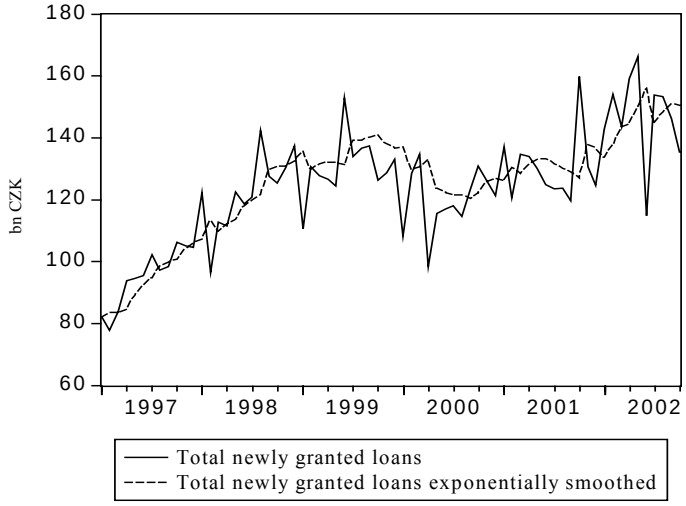


Figure 6: Total newly granted loans



The experience of Western countries has shown that certain characteristics related to the banking sector and its place within an economy are likely to influence the role of banks in the monetary policy transmission mechanism. As a preamble to our empirical analysis of the credit channel, we briefly characterize the Czech banking sector from the perspective of these features[5].

[5] See Ehrmann, Gambacorta, Martinéz-Pagés, Sevestre and Worms (2001) for an extensive analysis. Most of the characteristics we investigate here are inspired by their study.

The extent to which the financing of firms depends on banks directly affects the role of banks in monetary transmission. In the Czech Republic the banking sector accounts for almost 90% of the total assets of the financial sector. Only a few big companies can issue debt securities, so bank loans represent a very important source of financing. Reininger, Schardax and Summer (2002) evaluate different sources of external finance for companies relative to gross fixed capital investment in three Central European countries. The findings for the Czech Republic are presented in Table 1 below. Loans from domestic banks have the highest proportion among the external sources of finance, although the figure was slightly lower in 1999–2001 than in 1997–1998.

Table 1: Sources of external finance of the Czech companies

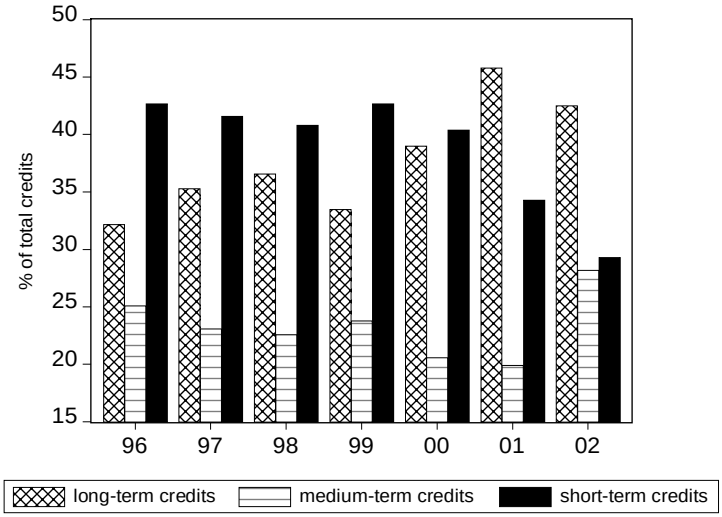
Sources:	**average in the years 1997-1998**	**average in the years 1999-2001**
Domestic source		
Bank credit	6.5	5.2
Bond issues	2.1	2.9
Equity issues	0.0	0.9
Foreign sources		
Intercompany loans	6.3	4.1
Bank loans	5.3	3.7
Bond issues	1.8	1.0

Source: Reininger, Schardax and Summer (2002, p 45).

Note: The numbers represent the changes in the stock (net flows) as percentages of gross fixed capital investment. In the case of bank credits, the numbers are adjusted for the transfer of non-performing loans to Konsolidační Banka.

Loan maturity is also to be considered when gauging the importance of banks in the monetary transmission mechanism: the larger the proportion of short-term loans in total loans, obviously, the more likely banks are to have a role in the transmission process, especially when the loans are granted with variable interest rates. Ehrmann et al. (2001) assess that a proportion of short-term loans in total loans of 35% or more signals an important role for banks in monetary transmission. As Figure 7 shows, in the Czech Republic short-term credits represented a considerable proportion of total loans during 1996–1999, but after 1999 this proportion had a decreasing trend, such that in 2002 short-term credits represented 29.3% of total credits. From the perspective of this criterion, banks may have had a more important role in the transmission mechanism up until 1999 than thereafter.

Figure 7: Time structure of credits



A high market concentration evidently might bring additional rigidity into monetary policy transmission. A comparison between the Czech Republic and the euro area ranks the Czech banking sector as highly concentrated – see Figure 8 vs. Table 2. Figure 8 displays the development of the Herfindahl indices of Czech market competition separately for loans, deposits and derivatives. Table 2 presents the overall Herfindahl index for countries of the euro area as of 1997 and for the Czech Republic as of 2001. Table 3 provides a more detailed breakdown of the Czech banking sector. In 2001, the three largest banks accounted for 61.6% – and the five largest banks for 71.86% – of the total assets of commercial banks. The largest three banks attract 77.48% of total deposits from clients and account for 57% of client loans.

Table 2: Banking structure of selected Euro area countries (pre EMU, 1997) and for the Czech Republic (2001)

	AT	**BE**	**FI**	**FR**	**DE**	**GR**	**IE**	**IT**	**NL**	**PT**	**ES**	**CZ**
Herfindahl index * 1000	75	106	337	45	19	110	126	29	129	94	40	143
Market share of five largest banks	45.3	57	78.8	32.6	31.5	57.3	35.9	30.1	21.7	48.6	38	71.8

Source: Ehrmann et al. (2001), p.13, Table 2, and Czech Banking Supervision Report (2001).

Note: AT-Austria, BE-Belgium, FI-Finland, FR-France, DE-Germany, GR-Greece, IE-Ireland, IT- Italy, NL-Netherlands, PT-Portugal, ES-Spain, CZ-Czech Republic.

Figure 8: Herfindahl indices of Czech market competition

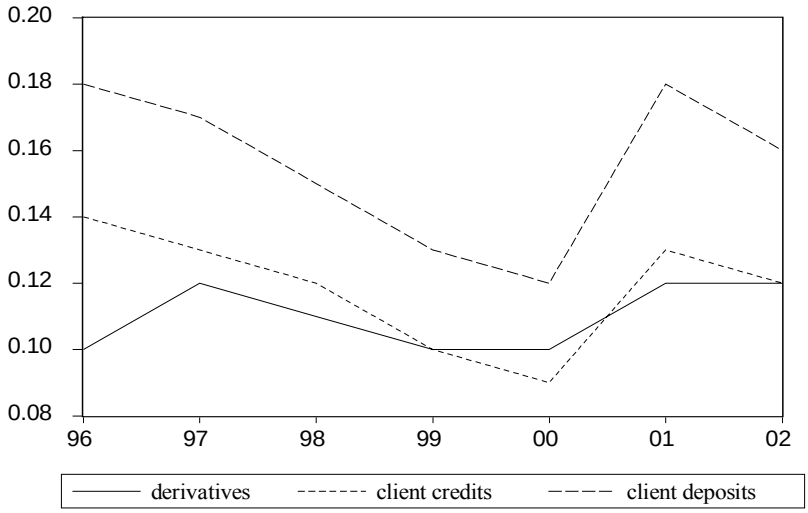


Table 3: The structure of the Czech banking sector as of December 2001

	Market share (in %)			% of total assets	
	Assets	**Client loans**	**Client deposits**	**Capital & reserves**	**Liquid assets**
Size					
3 largest banks	61.6[a]	57.01	77.5	–	–
	20.5[b]	19.0	25.8	11.9	49.8
5 largest banks	71.9	70.98	82.9	–	–
	14.4	14.19	16.6	10.1	48.9
Medium-sized banks	32.2	35.24	19.4	–	–
	2.5	2.71	1.5	7.7	48.9
Small banks	5.44	7.74	3.1	–	–
	0.36	0.51	0.2	23.9	49.6
Ownership					
Mostly Czech	7.3	6.1	2.8	–	–
participation	0.9	0.8	0.4	21.6	48.1
Mostly foreign	80.9	82.2	93.8	–	–
participation	5.8	0.6	6.7	15.6	51
Branches of foreign	11.9	11.7	3.4	–	–
banks	1.3	0.1	0.4	11.3	47.9

Source: Czech National Bank, own calculations.

Note: The three largest banks are considered as "big banks", "small banks have sizes below the median", "medium-sized" banks are the remaining banks.

a-group total; b-group mean.

The important weight of bank credit in corporate financing and the characteristics of the Czech credit market (maturity of loans and market concentration) point towards a significant role for the supply side and hence make the credit channel plausibly relevant to monetary policy transmission, especially in the period until 1999.

4. Methodology and Data

4.1 Model Specification

The econometric model follows and enriches with country-specific elements the entrenched specification introduced by Kashyap and Stein (1995). This specification, described in equation (1) below, relates the observed variation in the growth rate of bank loans to its lags, a monetary policy indicator, several control variables to account for the general economic situation (and hence for demand factors), certain bank characteristics, and – the key term of the analysis – to the **interaction** between the bank characteristic and the monetary policy indicator.

$$\Delta \log m_{it} = \sum_{j=1}^{l} \alpha_j \Delta \log m_{i(t-j)} + \sum_{j=1}^{l} \beta_j \Delta r_{t-j} + \gamma z_{i(t-1)} + \sum_{j=1}^{l} \delta_j [\Delta r_{t-j} z_{i(t-1)}] + \sum_{j=0}^{l} \varsigma_j \inf l_{t-j} + \sum_{j=0}^{l} \eta_j \Delta \log GDP_{t-j} +$$

$$+ \sum_{q=1}^{3} \theta_q dum_q + \nu_i + \varepsilon_{it} \qquad (1)$$

where

subscript **i**	denotes bank i, $i=\overline{1,N}$
subscript **t**	denotes quarter t, $t=\overline{1,T}$
m	total loans to clients (private non-banks) or client loans to residents
r	monetary policy indicator as measured by the 2-week repo rate[6]
infl	inflation
GDP	real GDP
z	bank characteristic: size, capitalization, liquidity, ownership, and ratio of classified loans to total loans, respectively
ν_i	individual bank effects
ε_{it}	error term
$\alpha, \beta, \gamma, \delta, \zeta, \eta, \theta$	parameters to be estimated

A complete analysis would incorporate information about the customers of each particular bank to account for the demand side. However, this information is not available. We use the growth rate of GDP and inflation as proxies for demand shocks.

The bank characteristics (z) are those motivated by the underlying theory of the bank lending channel: bank size, capitalization and liquidity, to which we add two more bank characteristics

[6] The analysis was also conducted with the 1Y Pribor as monetary policy indicator, but the results did not differ significantly from those we present in this paper.

that we see as relevant to an analysis of the Czech banking sector: type of ownership and proportion of classified loans in total loans (see section 2). Specifically, the bank characteristics are defined in the following way:

$$Size_{it} = \log A_{it} - \frac{1}{N_t}\sum_i \log A_{it}$$

$$Liquidity_{it} = \frac{L_{it}}{A_{it}} - \frac{1}{N_t}\sum_i \frac{L_{it}}{A_{it}}$$

$$Capitalization_{it} = \frac{C_{it}}{A_{it}} - \frac{1}{N_t}\sum_i \frac{C_{it}}{A_{it}}$$

$$\textit{Ratio of classified loans to total loans (COTL)}_{it} = \frac{CL_{it}}{TL_{it}}$$

where A_{it} represents total assets, L_{it} represents liquid assets[7], C_{it} represents capital and reserves, CL_{it} represents classified loans, and TL_{it} represents total loans of bank i at time t. The first three characteristics are normalized with respect to their average across all banks to eliminate possible trends.

Bank ownership is represented through dummy variables for each ownership group (banks with mostly Czech participation, banks with mostly foreign participation, and branches of foreign banks).

The model also allows for bank-specific effects (ν_i). The parameters of interest are those in front of the monetary policy indictor (β_j), which are meant to capture the direct overall impact of monetary policy changes on the growth in bank lending, and the coefficients in front of the **interaction** terms (δ_j), based on which we assess whether the considered bank characteristic makes any difference in the way banks react to monetary policy changes. The assumption that smaller / less capitalized / less liquid banks will react more strongly to monetary policy changes is equivalent to a significant positive parameter δ_j. In the case where we consider the COTL as the bank characteristic, a significant positive δ_j is interpretable as follows: the smaller the ratio of classified loans to total loans, the stronger the reaction to monetary policy impulses. The coefficient in front of the bank characteristic (γ) has also an illustrative role, describing whether there is a linear relationship between the growth rate of loans and the bank characteristic.

Given that there is no preceding analysis to address the reaction of bank lending to monetary policy changes at the micro level in the Czech Republic, for a preliminary insight into whether the growth rate of client loans responds to monetary policy shocks and macroeconomic conditions we first estimate a "benchmark model"[8], which does not include the bank characteristic (z) and the

[7] The literature recognizes as 'liquid assets' the cash, inter-bank deposits and securities. We are close to this in the sense that we built up the 'liquid assets' variable as the sum of 'fast liquid assets' and inter-bank deposits. The 'fast liquid assets' variable is built according to supervisor's definition, consisting of items related to 'cash' and 'securities'.

[8] $$\Delta \log m_{it} = \sum_{j=1}^{l} \alpha_j \Delta \log m_{i(t-j)} + \sum_{j=1}^{l} \beta_j \Delta r_{t-j} + \sum_{j=0}^{l} \varsigma_j \inf l_{t-j} + \sum_{j=0}^{l} \eta_j \Delta \log GDP_{t-j} + \sum_{q=1}^{3} \theta_q dum_q + \nu_i + \varepsilon_{it}$$

interaction between the bank characteristic and the monetary policy indicator ($\Delta r_t z_{(t-1)}$). The full model represented by equation (1) will be referred to as the "extended model".

4.2 Data

We use the balance sheet data of Czech banks collected by the Czech National Bank. The sample covers the period 1996:1Q to 2001:4Q. The analysis does not go before 1996 because the history of the 2W repo rate – the policy indicator – starts at the end of 1995. Balance sheet data are available for 2002 as well, but starting January 2002 an important methodological change regarding the recording of balance sheet items was introduced. Namely, up until January 2002 some items on the asset side of the balance sheet (i.e., classified loans, securities, etc.) are adjusted to account for banks' expectations about plausible losses. Starting 2002, these correcting items are no longer recorded on the asset side of the balance sheet, but in different categories on the liability side. Therefore, we opt to conduct the analysis only for the period until 2001.

We included all the 32 commercial banks licensed as of December 2001, plus one bank – Banka Haná – whose license was withdrawn at the end of 2000. Table 5 in the Appendix provides a history of entries, exits and mergers. Nine banks had their licenses withdrawn during the period 1996–2001, five banks during 1996–1998 and four banks during 1999–2001. However, all these were small banks: none had a market share bigger than 0.7% of the total banking sector in terms of assets. We include in our analysis only one of these banks, the one which had the largest market share and the longest history among them. Four mergers took place during the sample period, and we treat them according to the time the merger took place and the relative sizes of the banks involved. Namely, we treat the mergers of Banka Austria with Creditanstalt, Vereinsbank with Hypo bank, and Česká Spořitelna with Erste Bank Sparkassen with the commonly used backward aggregation of the entities involved. However, this procedure was not applied to the merger of Banka Austria Creditanstalt with Hypo Vereinsbank, because this merger took place in the last quarter of 2001, too close to the end of our sample period; in this case we just eliminated the 4Q 2001 observation for the resulting bank from the sample. In June 2000, IPB was sold to Československá Obchodní Banka (ČSOB). We treat the two banks as separate entities up to the moment of the sale and as one bank after the sale.

Our main analysis concerns total client loans (total loans to private non-banks), from which we have excluded bad client loans. Banks' bad loans were occasionally transferred to Konsolidační Banka (which became the Czech Consolidation Agency in 2001), so the changes in the volume of loans reflect, among other things, these transfers. Since we are interested in capturing the effect of the macroeconomic environment and changes in monetary policy on changes in the volume of loans, we removed bad loans from our data[9]. An identical analysis was conducted for the sub-category of client loans granted to residents. The results may shed light on whether lending behavior vis-à-vis residents has some separate characteristics. Still, we need to mention that the results concerning total client loans and client loans to residents are not fully comparable because of a methodological difference in the way data are recorded: total client loans are adjusted for expectations about plausible losses, whereas client loans to residents are not adjusted.

[9] This is a usual procedure in the empirical literature (see Ehrmann et al., 2001).

5. Estimation Method and Results

5.1 Estimation Method

Our rationale for employing a specification in growth rates rather than levels is two-fold: first, we are interested in capturing the differences in the reactions of banks to monetary shocks across different time periods, so our focus is on short-run relationships and not on long-run relationships (for which a specification in levels would be more appropriate); and second, the specification is supposed to circumvent the unit root problem – the data pre-testing that we performed revealed unit roots in the bank-level quarterly client loans series. Also, data tests show that the growth rates of client loans depend on their lagged values, the weight being on the first and/or second lags.

The specification described by equation (1), as well as its simplified version, the "benchmark model", are estimated by the Generalized Method of Moments as designed by Arellano and Bond (1991) (hereinafter "AB"). We use this methodology because of the inclusion of lagged dependent variable as an explanatory variable[10]. The methodology also accounts for the possible endogeneity of some variables, as is probably the case with the bank characteristics. AB's methodology first-differences the autoregressive model in order to eliminate the individual effect and "optimally exploits" the moment conditions using the lagged values dated t-2 and earlier of the dependent variable and lagged values of the predetermined variables as instruments. This ensures efficiency and consistency in the hypothesis of large N and small T, and provided that the model is not subject to serial correlation in ε_{it} and that the set of instrument variables used is valid (which is tested with the Sargan test). Should the disturbances not be serially correlated, it will be evidence of significant negative first-order serial correlation in the differenced residuals and no evidence of second-order serial correlation in the differenced residuals. AB design both a 1-step estimation and a 2-step estimation. The difference between them consists in the specification of an individual specific weighting matrix. The 2-step estimation uses the 1-step's residuals, so it is more efficient. But, AB mention that Monte-Carlo simulations suggest that the asymptotic standard errors for the 2-step estimators can be a "poor guide" and so they suggest that the inferences should be based rather on the one-step estimators. Consequently, we base our inferences on the 1-step estimation results.

Our sample follows 33 banks over 23 quarters (1996:2–2001:4), so it might be the case that the estimations through AB's GMM for the whole time span in the context of the asymptotic condition ($(N/T) \to \infty$) would be biased. Therefore, the asymptotic property of the estimators is an additional reason – besides those evoked by the evolution of interest rates and the minimum

[10] The presence of a lagged dependent variable among the regressors in a specification considering the individual effect as well (v_i in our case) brings about the situation of a right-hand regressor correlated with the error term. In this case, an OLS estimation would be biased and inconsistent. The Within estimator would be biased of O(1/T) and its consistency depends on T being large; the random effect GLS estimator in a dynamic panel data model is also biased; the instrumental variable (IV) estimation assures consistency but not necessarily efficiency, since it does not use all the available moment conditions and it does not consider the differenced structure of the residuals. Also, an MLE approach would require strong assumptions on the initial conditions and the distribution of the individual effect. See Baltagi (2001) for a complete analysis.

reserve requirement (see sub-section 2.2) – for which we insist on estimating the models on two almost equal sub-periods: 1996:2–1998:4 and 1999:1–2001:4.

5.2 Estimation Results

The analysis is conducted both for total client loans and for client loans granted to residents, on sub-period (1996:2–1998:4) and sub-period (1999:1–2001:4). The sample dimension allows us to include a maximum of two lags for each variable.

Tables 4 and 5 summarize the results of estimating the "benchmark model" and "extended model" respectively, both for total client loans and for client loans to residents. The reported figures represent the long-term coefficients[11]. The detailed estimation results as well as the sum of all coefficients pertaining to each variable – the "short-term coefficients" – are presented in the Appendix (Tables 7–12 for total client loans and Tables 13–17 for client loans to residents). For the "extended model", we report only the 1-step estimates because of space constraints, mentioning that the 2-step estimation results are supportive for those resulting from the 1-step estimates. The first- and second-order serial correlations in the differenced residuals are reported at the bottom of the tables (AR1 and AR2).

Table 4: Summary of the "benchmark model" GMM estimation results (long term coefficients)

Variable	**Dependent variable:**			
	growth rate of total client loans		**growth rate of client loans to residents**	
	1996-1998	**1999-2001**	**1996-1998**	**1999-2001**
Monetary policy	-0.26***	-0.89***	-0.23**	-1.03***
	(0.08)	(0.28)	(0.09)	(0.36)
Within BMCP[1]	-0.28***	-0.74***	-0.23**	-0.97***
	(0.09)	(0.26)	(0.1)	(0.35)
Within BMFP[2]	-0.27***	-0.94***	-0.24**	-1.004***
	(0.08)	(0.25)	(0.1)	(0.32)
Within BFB[3]	-0.28***	-0.93***	-0.24***	-1.14***
	(0.08)	(0.25)	(0.09)	(0.37)
GDP growth	137.9*	159.98***	126.5*	180.9**
	(72.2)	(51.1)	(11.24)	(66.54)
Inflation	-5.4	0.34	-5.2	0.24
	(3.7)	(1.96)	(3.7)	(1.72)

Note*:** Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

[11] The long-term coefficient of a variable is computed as the sum of its coefficients (of its lags and current values, where applicable) divided by one minus the sum of the coefficients of the lags of the dependent variable.

5.2.1 "Benchmark Model" Estimation Results

The estimation of the "benchmark model" reveals major differences, in terms of magnitude and significance, between the outcomes for the two sub-periods: for the second period we find a considerably stronger effect of monetary policy changes, a stronger influence of GDP growth, and, although not statistically significant, a positive impact of inflation (as opposed to negative in the previous period) on the growth rate of client loans.

Regarding the difference between the two periods in the effects of monetary policy on the growth rate of loans, there are several concurrent explanations. The policy-induced interest rate had very different evolutions in the two periods (sub-section 2.2). The difference in its effects on the growth rate of loans suggests an asymmetric response to monetary policy shocks. Apparently, this was even augmented by the 1998 change in monetary policy regime. At the same time, we need to account for the fact that the second period was a cornerstone for the development of the banking sector. Not only were privatizations, mergers and rapid growth of some banks going on, but the banks also started to offer a new banking service, i.e., mortgages. This, coupled with stronger demand following the stabilization of the economic conditions after the 1997 crisis, caused the monetary easing to strongly affect the growth rate of loans granted to clients. However, we need to mention that the point estimates are meaningful for the comparison between the two periods, but cannot be used to quantify the effect of a certain change in monetary policy. More specifically, the results represent the average impact of monetary policy across all banks, where the banks are considered with the same weight, but not with a ponder given by their market share or characteristics.

As regards the difference in the impact of the macroeconomic conditions between the two periods, the weaker influence of GDP growth in the first period is explicable by the financial problems encountered by many Czech companies in this period, and especially in 1997–1998. Inflation, which is meant to account for demand factors, seems to impinge negatively in the first period in the conditions of higher inflation and thus higher uncertainty.

For more insight into the determinants of the growth rate of loans, we distinguish between banks belonging to different ownership groups, i.e., banks with mostly Czech participation, banks with mostly foreign participation and branches of foreign banks. Table 3 also reports the effect of the monetary conditions on the growth rate of loans within each of the three ownership groups. It appears that while in the period 1996:2–1998:4 the reactions of the growth rate of loans to monetary policy changes are similar among the banks in all three groups, for the period 1999:1–2001:4 we can identify a weaker reaction of the banks with mostly Czech participation compared to the rest of the commercial banks[12]. Before looking for a supply-side-related explanation, we acknowledge that this may well be due to weaker reactions of the demand faced by banks with mostly Czech participation in the context of the privatization of the biggest Czech banks.

The outcomes concerning solely client loans granted to residents generally tell a similar story about the determinants of the growth rate of loans. Still, we view these results with more

[12] The coefficients were tested if they were statistically different from one another.

caution, since the data collection methodology differs slightly from that for total client loans (see section 4.2). As expected, we find a stronger effect of GDP growth on the growth rate of loans to residents than on the growth rate of total loans. Also, we can infer that in the period 1999–2001 monetary policy had unequal effects on the growth rate of loans granted to residents versus the growth rate of loans granted to non-residents: it seems that changes in monetary policy have a stronger effect on the growth rate of loans to residents. Again, this does not necessarily mean different behavior of the banks vis-à-vis residents/non-residents; again it might be demand-driven, with stronger demand for loans coming from residents.

5.2.2 "Extended Model" Estimation Results

The estimation of the "extended model" is meant to reveal features of the supply of loans. Of interest are the significance and magnitude of the linear relationships between the growth rate of loans and the bank characteristics – coefficient γ in equation (1) – and of the distributive effects of monetary policy on the growth rate of loans due to these bank characteristics – the interaction coefficients δ_j in equation (1). In order to capture the linear relationships and the distributive effects of monetary policy not only for the whole banking sector, but also within each ownership group, we also carry out estimates to account for the double interaction of each bank characteristic with bank ownership instead of the simple bank characteristic. Therefore, for the interpretation of the results, the figures presented in Table 5 need to be accompanied by an inspection of Tables 7–17 in the Appendix, showing the results of the estimations which account for this double interaction.

Table 5: Summary of the "extended model" GMM estimation results (long-term coefficients)

Variable:	**Dependent variable:**			
	growth rate of total client loans		**growth rate of client loans to residents**	
	1996-1998	1999-2001	1996-1998	1999-2001
Size	-0.40***	-0.31***	-0.50**	0.29*
	(0.13)	(0.09)	(0.19)	(0.17)
Size X monetary policy	-0.01***	-0.001	-0.003*	-0.002
	(0.001)	(0.003)	(0.002)	(0.013)
Capitalization	0.41**	-0.98	0.47**	-0.07
	(0.21)	(0.79)	(0.21)	(0.69)
Capitalization X monetary policy	0.06***	-0.24	-0.05***	0.05
	(0.02)	(0.2)	(0.01)	(0.17)
Liquidity	0.56**	1.86***	0.58**	0.77***
	(0.28)	(0.57)	(0.24)	(0.22)
Liquidity X monetary policy	0.03*	-0.24	0.024	-0.03
	(0.02)	(0.16)	(0.015)	(0.1)
Classified / Total loans (COTL)	1.36***	-0.57***	1.02***	-0.61***
	(0.44)	(0.22)	(0.34)	(0.24)
COTL X monetary policy	0.07**	0.04	0.05*	0.03
	(0.04)	(0.15)	(0.03)	(0.17)

Note*:** Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level.

The conclusions that we draw are mainly grounded in the estimation results concerning total client loans. Still, we also take into account the results concerning client loans to residents, as they may provide additional information regarding banks' behavior vis-à-vis residents.

The estimations with size as the bank characteristic reveal a significant linear negative relationship between bank size and the growth rate of total client loans in both periods and within all ownership groups, and significant distributive effects of monetary policy changes due to bank size, but only within certain ownership groups. More specifically, as regards the distributional effects of monetary policy, within the group of banks with mostly foreign participation we find a significant interaction coefficient, but of different signs for the two periods. Namely, the interaction coefficient has negative sign for the first period and positive sign for the second period. This means that in the first period, the bigger the bank, the more its lending was affected by the monetary policy conditions, and in the second period, the bigger the bank, the less its lending reacted to the monetary policy conditions. Still, this does not necessarily mean a change in their lending behavior, but, when accounting for the development of interest rates, we can interpret the result as indicating a relatively stronger reluctance to lend of the big banks from the group of banks with mostly foreign participation. That is, in the first period, which was marked by monetary policy tightenings, the big banks' growth rate of loans decreases more than that of the small banks. Further, in the second period, characterized by a decrease in interest rates, the big banks' lending grows at a slower pace than that of the small banks. We interpret this result as pointing to a broad credit channel. Also, in the period 1996–1998, within the group of foreign branches, the coefficient of the interaction term is positively signed: the smaller the branch, the stronger its lending was affected by monetary policy. This outcome is an evidence of a bank lending channel in the period 1996–1998.

The estimations focusing exclusively on loans granted to residents additionally reveal a preserved low willingness of the largest foreign branches to lend to residents, i.e., a significant negative relationship between size and the growth rate of loans granted to residents within the group of foreign branches.

Estimations with capitalization as the bank characteristic

Based on our results, only in the period 1996–1998 did capitalization affect the growth rate of loans and explain the impact of monetary policy on bank lending[13]. Furthermore, the outcomes for the estimation accounting for the capitalization–ownership double interaction reveal that during the 1996–1998 period, capitalization impinged positively on the growth rate of loans and could explain the lending behavior in reaction to monetary policy changes only within the groups of banks with mostly Czech and foreign participation. The distributional effects of monetary policy due to capitalization in the first period are probably due to the fact that in this period there were significant differences between banks' degrees of capitalization, some banks being under-

[13] For the second period, the estimation results (Table 10) show a significant negative coefficient of the interaction term for banks with mostly foreign participation, but this is most probably due to the fact that within this ownership group there is a significant negative correlation between size and degree of capitalization (the correlation coefficient between size and degree of capitalization is -0.65) and, as we can see in Table 9 in the Appendix, when accounting for size as the bank characteristic we obtain a positive interaction term.

capitalized. On top of this, the monetary tightening episodes of this period plausibly caused banks to resort to borrowing on the inter-bank market. Here the degree of capitalization could have brought about moral hazard problems such that less capitalized banks would encounter problems in borrowing, which would be further reflected in their lending. The fact that capitalization explains the lending behavior speaks for the existence of a lending channel of monetary policy in the period 1996–1998.

The estimations with liquidity as the bank characteristic show evidence of an overall significant linear effect of liquidity on the growth rate of loans in both periods – with much stronger intensity in the second period – and some evidence of a lending channel in the first period.

Concerning the linear relationship, in the first period, liquidity has explanatory power only within the banks with mostly foreign participation. In the second period this does not apply, but it appears valid both within the banks with mostly Czech participation and within branches of foreign banks. This probably signals changes in lending behavior stemming from changes in ownership composition following privatization.

As regards the distributive effects of monetary policy, the estimations accounting for the liquidity–ownership double interaction reveal that in the first period within the group of banks with mostly Czech participation, liquidity made a difference among the banks in their reaction to monetary policy changes: the more liquid banks could resort to their liquidity to counteract the tightening episodes of monetary policy. So, we can acknowledge some evidence of the lending channel due to liquidity. For the second period, the results are rather ambiguous as the coefficients of the interaction terms are significant but of opposite sign (the first lag is negative and the second is positive). Additionally accounting for bank ownership does not yield any additional information on the distributional effects of monetary policy due to liquidity.

Estimations with the proportion of classified loans in total loans (COTL) as the bank characteristic

The overall coefficients characterizing the linear relationship between COTL and the growth rate of loans have opposite signs for the two periods: positive for the first and negative for the second. The significant positive relationship in the first period is due to the group of banks with mainly Czech participation (Table 11). This bodes well with the suppositions of soft budget constraints within the domestically owned banks. However, for the second period the results show a change in the behavior of the banks with mainly Czech participation: COTL impinges negatively on the growth rate of loans. We see the same effect within branches of foreign banks. In this case the proportion of classified loans impinges negatively, especially on the growth rate of loans to residents. This is probably because most of the classified loans resulted from loans to residents.

The ratio of classified loans to total loans appears to impact the lending reaction to monetary conditions. In the first period, this effect is significant and positive for banks belonging to the groups with mainly Czech and foreign participation. That is, the higher the proportion of classified loans, the less the banks reacted to monetary policy. Here, if we consider the monetary tightenings of the period, we can speculate that this finding could fit the theory of soft budget constraints within banks having considerable amounts of non-performing loans. The outcome for

the second period seems more topical: although the overall coefficient of the interaction term is not significant, the analysis to account for the ownership–COTL double interaction reveals a significant positive coefficient for banks with mainly foreign participation, attesting to a smaller impact of monetary policy changes for foreign banks having a higher proportion of classified loans14. Given that in this period interest rates had a decreasing trend, hence the expected impact of monetary policy would be an increase in lending, this result supports the hypothesis of a stronger reluctance to lend in the case of banks with mostly foreign participation and with a high ratio of classified loans. To some extent, this could support the hypothesis of credit rationing, but according to our results only within the group of banks with mainly foreign participation.

6. Concluding Remarks

This work investigates the determinants of the growth rate of loans in the Czech Republic for the period 1996–2001, with special interest in identifying features of the supply of loans. It fits in the class of analyses seeking evidence of the credit channel of monetary policy. Using a panel of quarterly time series for Czech commercial banks, we pursue the following: (1) whether monetary conditions impact on bank lending; (2) whether there are linear relationships between certain bank characteristics (ownership, size, liquidity, capitalization, and proportion of classified loans to total loans) and the growth rate of loans; and (3) to characterize the effectiveness of the credit channel, whether there are distributional effects due to bank characteristics in the impact of monetary policy on bank lending. Under a monetary policy tightening, the existence of distributional effects of monetary policy is thought to reveal the effectiveness of the bank lending channel. In addition, we claim that evidence of distributional effects of monetary policy during periods of monetary easing can shed light on the characterization of the broad lending channel.

The analysis focuses both on fluctuations in total client loans and on fluctuations in the sub-group of client loans to residents over two consecutive time periods: 1996–1998 and 1999–2001. We find significant differences between the results characterizing the two time periods as well as between the results characterizing banks belonging to different ownership groups.

The estimation results show that client loans react to monetary policy impulses with much stronger intensity in the second period. This is even more apparent when analyzing loans to residents. The 1998 introduction of a new monetary policy regime, followed by an easing of the monetary conditions, coupled with the unprecedented development of the banking sector and the recovery of demand after the 1997 crisis, could explain the stronger impact of the monetary conditions on the growth rate of client loans in the period 1999–2001.

We find significant linear effects of all bank characteristics on the growth rate of loans. Bank size impinges negatively in both periods on the growth rate of total client loans, the highest magnitude being within foreign branches (especially for loans to residents). Capitalization seems to influence

[14] This does not seem to be due to the significant positive coefficient of the interaction term when accounting for size as the bank characteristic. The correlation coefficient between size and COTL within the banks with mostly foreign participation in the period 1999–2001 is only 0.37.

positively the lending of banks with mainly Czech and foreign participation during the first period only. The degree of liquidity has a supportive effect on the growth rate of loans, especially during the second period for branches of foreign banks and banks with mainly Czech participation. The ratio of classified loans to total loans has a positive impact on the growth rate of loans in the first period and a negative effect in the second period within banks with mostly Czech participation and branches of foreign banks. This supports the hypothesis of banks' soft budget constraints in the first period and non-performing-loans-related reluctance to lend out in the second period.

We detect an operative bank lending channel due to capitalization and liquidity for the period 1996–1998. Specifically, we see capitalization influencing the monetary policy impact on bank lending at a time when differences in the degree of capitalization could have impeded less capitalized banks' ability to acquire external finance on the inter-bank market during the episodes of monetary tightening. Liquidity appears to make differences in the lending reactions to monetary policy, but only within banks with mostly Czech participation.

During the period 1999:1–2001:4, interest rates had a decreasing trend, hence it is not possible to identify a lending channel as motivated by the theory. Nevertheless, in this period we can distinguish distributive effects of monetary policy on bank lending due to the proportion of classified loans in total loans and to bank size within banks with mainly foreign participation only. More specifically, we see that the lending of bigger banks and banks having a higher ratio of classified loans is less impacted by monetary policy changes. That is, these banks seem to be less prone to increasing their growth rate of loans when monetary policy is relaxed. We perceive this outcome as evidence of a broad credit channel.

References

ARELLANO, M. AND S. BOND (1991): "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, 58, 277–297.

ARELLANO, M. AND S. BOND (1998): "Dynamic Panel Data Estimations Using DPD98 for GAUSS: A Guide for Users".

BALTAGI, B. (2001): *Econometric Analysis of Panel Data – 2nd edition*, Chichester, GB: John Wiley & Sons.

BEAN, C., J. LARSEN AND K. NIKOLOV (2002): "Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications", ECB, WP 113.

BERNANKE, B. (1983): "The Determinants of Investment: Another Look", *American Economic Review*, 73(2), 71–75.

BERNANKE, B. AND C. LOWN (1991): "The Credit Crunch", *Brooking Papers on Economic Activity*, 2, 205–247.

BERNANKE, B. AND A. BLINDER (1992): "The Federal Funds Rate and the Channels of Monetary Transmission", *American Economic Review*, 82(4), 901–921.

BERNANKE, B. AND M. GERTLER (1995): "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *The Journal of Economic Perspectives*, 9(4), 27–48.

BLINDER, A. AND J. STIGLITZ (1983): "Money, Credit Constraint and Economic Activity", *American Economic Review*, 73(2), 297–302.

BUCHTÍKOVÁ, A (2001): Mikroekonomické aspekty transmisního mechanismu měnové politiky v úvěrovém kanále (Empirická studie), CNB WP 28.

BULÍŘ, A. (1997): "Monitoring of Borrowers under Asymmetric Information: The Czech Experience in the Early 1990s", in M. Mejstřík (eds.), *The Privatization Process in East-Central Europe: Evolutionary Process of Czech Privatizations*, Dordrecht, NL: Kluwer, 1997.

ČIHÁK, M. (1998): "První pětiletka v ČR jako první hospodářský cyklus", *Politiká ekonomie*, č. 2, 1998, 161–169.

CNB (2003): *The Czech National Bank's Forecasting and Policy Analysis System*, Coats, W., D. Laxton, D. Rose (eds.), CNB, Prague.

EHRMANN, M., L. GAMBACORTA, J. MARTINÉZ-PAGÉS, P. SEVESTRE, A. WORMS (2001): "Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area", European Central Bank, WP 105.

EUROPEAN CENTRAL BANK (2003): WPs 91–114 published in: Monetary Policy Transmission in the Euro Area, I. Angeloni, A. Kashyap and B. Mojon (eds.), Cambridge University Press.

FREIXAS, X. AND J. ROCHET (1997): *Microeconomics of Banking*, The MIT Press, 138–139, 184–185.

GERTLER, M. AND S. GILCHRIST (1993): "The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence", *Scandinavian Journal of Economics*, 95(1), 43–64.

HAMPL, M. AND R. MATOUŠEK (2000): "Credit Contraction in the Czech Republic: Causes and Effects", CNB, WP 19.

IZÁK, V. (1997): "Monetary Transmission Mechanism (Lending Channel)", CNB WP 90–98.

KAKES, J. (2000): "Monetary Transmission in Europe: The Role of Financial Markets and Credit", Cheltenham, UK, and Northampton, Mass.: Elgar; distributed by American International Distribution Corporation, Willison, Vt., 2000.

KASHYAP, A., J. STEIN AND D. WILCOX (1993): "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance", *American Economic Review*, 83(1), 78–98.

KASHYAP, A. AND J. STEIN (1995): "The Impact of Monetary Policy on Bank Balance Sheets", Carnegie–Rochester Conference Series on Public Policy, 42, 151–195.

KASHYAP, A. AND J. STEIN (1997): "The Role of Banks in Monetary Policy: A Survey with Implications for European Monetary Union", Federal Reserve Bank of Chicago Economic Perspectives, 2–18.

KASHYAP, A. AND J. STEIN (2000): "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy", *American Economic Review*, 90(3), 407–428.

KOTLÁN, V. AND M. MACHÁČEK (2000): "Is EMU an Endangered Species? Regional Impacts of the Single Monetary Policy", *Finance a úvěr*, 7–8, 306–405.

KISHAN, R. AND T. OPIELA (2000): "Bank Size, Bank Capital, and the Bank Lending Channel", *Journal of Money, Credit and Banking*, 32(1), 121–140.

KING, S. (1986): "Monetary Transmission: Through Bank Loans or Bank Liabilities?", *Journal of Money, Credit and Banking*, 18(3), 290–303.

MOJON B., A. KASHYAP, I. ANGELONI AND D. TERLIZZESE (2002): "Monetary Transmission in the Euro Area: Where Do We Stand", ECB, WP No. 114.

PAŠALIČOVA, R. AND V. STILLER (2002): "Vliv měnové politiky na vývoj bankovních úverů", *Finance a úvěr*, 6, 338–354.

PHILIPS, P. AND H. MOON (2000): "Nonstationary Panel Data Analysis: An Overview of Some Recent Developments", *Econometric Review*, 19(3), 263–286.

RAMEY, V. (1993): "How Important is the Credit Channel of Monetary Transmission", Carnegie Rochester Conference Series on Public Policy, 39(0), 1–45.

ROMER C. AND D. ROMER (1990): "New Evidence on the Monetary Transmission Mechanism", Brookings Papers on Economic Activity, 1, 149–213.

REININGER, T., F. SCHARDAX AND M. SUMMER (2002): "Financial System Transition in Central Europe: The First Decade", SUERF Studies No.16.

SINGER, M. AND J. POSPÍŠIL (1999): "Credit Crunch", Bulletin z 8. semináře České společnosti ekonomické v řadě "Ekonomické teorie a česká ekonomika", Praha, únor 1999.

SOLTTILA, H. AND V. VIHRIALA (1994): "Finnish Banks' Problem Assets: Results of Unfortunate Asset Structure or Too Rapid Growth?", Bank of Finland Discussion Papers, No. 23/94.

STIGLITZ, J. AND A. WEIS (1981): "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, 71, 393–410.

Appendix

Table 6: History of entries, exits and mergers

1995	32 banks with mostly Czech participation 13 banks with mostly foreign participation 10 foreign branches			
	entries	**exits**	**mergers**	**privatizations**
1996		Kreditní Banka Plzen		
		Prvni slezská banka		
1997	HSBC Bank	Banska		
		Ekoagrobanka		
		Realitbanka		
1998	GE Capital Bank	COOP Banka	Bank Austria+Credianstalt ⇒	ČSOB
		Pragobanka	⇒ Bank Austria Credianstalt	
		Westdeutsche Landesbank	Vereinsbank+HYPO ⇒	
		Velkomoravská Banka	⇒ Hypovereinsbank	
1999		Moravia Banka		
		Universal Banka		
2000		Banka Haná	Česka Spořitelna + Erste Bank Sparkassen	Česka Spořitelna
2001		Evrobanka	Hypovereinsbank + Banka Austria Credianstalt ⇒ HVB Bank	Komerčni Banka
2002			Komerčni Banka + branch Societé Generale	IPB sold to ČSOB

Table 7: "Benchmark model" GMM estimation for total client loans

Variable	**1996-1998**	**1999-2001**	
	1-step est.	1-step est.	2-step est.
Loans growth rate$_{t-1}$	-0.078	-0.017	-0.024
	(0.187)	(0.139)	(0.035)
Loans growth rate$_{t-2}$	0.157***	0.10*	-0.086***
	(0.037)	(0.056)	(0.022)
$\sum AR$ coefficients	0.078	-0.12	-0.11**
	(0.165)	(0.182)	(0.046)
Monetary policy$_{t-1}$	-0.15***	-0.83***	-0.67**
	(0.04)	(0.28)	(0.147)
Monetary policy$_{t-2}$	-0.08***	-0.17	0.11
	(0.014)	(0.136)	(0.11)
$\sum AR$ coefficients	-0.24***	-1.004***	0.78***
	(0.04)	(0.163)	(0.14)
GDP growth $_{t}$	71.75*	53.87***	39.72***
	(40.87)	(19.66)	(11.45)
GDP growth $_{t-1}$	20.57*	100.05***	82.81***
	(25.17)	(32.59)	(15.69)
GDP growth $_{t-2}$	34.75***	25.24	14.82
	(6.37)	(24.22)	(19.81)
$\sum$ coefficients	127.08*	179.16***	137.36***
	(65.19)	(48.25)	(29.72)
Inflation $_{t}$	10.10***	-6.2***	-4.4***
	(3.6)	(2.1)	(1.2)
Inflation $_{t-1}$	-1.2	1.1	0.8
	(2.4)	(1.1)	(0.6)
Inflation $_{t-2}$	-13.8***	5.5***	4.7***
	(4.3)	(1.9)	(0.1)
$\sum$ coefficients	-4.9*	-0.3	1.1
	(3.1)	(2.3)	(1.3)
p-value AR1/AR2	0.019/0.95	0.005/0.851	0.021/0.8
p-value Sargan	0.000	0.006	0.36

***Note*:** 1-step and 2-steps, respectively GMM estimation results; the dependent variable is the growth rate of total client loans;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level.

Table 8: "Benchmark model" GMM estimation for total client loans to account for banks' ownership

Variable	**1996-1998**	**1999-2001**	
	1-step est.	1-step est.	2-step est.
Loans growth rate$_{t-1}$	-0.08	-0.04	-0.04
	(0.187)	(0.122)	(0.04)
Loans growth rate$_{t-2}$	0.157	-0.11**	-0.10***
	(0.04)	(0.06)	(0.026)
BMCP[1]			
Monetary policy$_{t-1}$	-0.16***	-0.70***	-0.57***
	(0.042)	(0.27)	(0.14)
Monetary policy$_{t-2}$	-0.09**	-0.158	-0.09
	(0.018)	(0.135)	(0.113)
$\sum AR$ coefficients	-0.25***	-0.86***	-0.66***
	(0.05)	(0.26)	(0.16)
BMFP[2]			
Monetary policy$_{t-1}$	-0.15***	-0.92***	-0.68***
	(0.04)	(0.27)	(0.15)
Monetary policy$_{t-2}$	-0.09***	-0.16	-0.117
	(0.013)	(0.132)	(0.112)
$\sum AR$ coefficients	-0.25***	-1.08***	-0.80***
	(0.04)	(0.27)	(0.17)
BFB[3]			
Monetary policy$_{t-1}$	-0.17***	-0.91***	-0.66***
	(0.04)	(0.25)	(0.13)
Monetary policy$_{t-2}$	-0.09***	-0.168	-0.122
	(0.014)	(0.124)	(0.105)
$\sum AR$ coefficients	-0.26***	-1.07***	-0.78***
	(0.043)	(0.28)	(0.16)
GDP growth $_t$	61.8	55.57***	39.17***
	(40.82)	(18.58)	(11.52)
GDP growth $_{t-1}$	22.02	102.25***	79.95***
	(26.07)	(30.97)	(16.84)
GDP growth $_{t-2}$	36.9***	23.37	14.83
	(7.77)	(22.74)	(19.75)
Inflation $_t$	10.5***	-0.06***	-0.044***
	(3.9)	(0.02)	(0.011)
Inflation $_{t-1}$	-1.1	0.01	0.008
	(2.5)	(0.004)	(0.006)
Inflation $_{t-2}$	-14.1***	0.05***	0.046***
	(4.5)	(0.02)	(0.01)
p-value AR1/AR2	0.018/0.95	0.006/0.845	0.014/0.79
p-value Sargan	0.000	0.008	0.351

Note: 1-step and 2-steps, respectively GMM estimation results; the dependent variable is the growth rate of total client loans;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 9: "Extended model" GMM estimation results with size and size & ownership, respectively as bank characteristics for total client loans

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Size	Size & ownership	Size	Size & ownership
Monetary policy $(\sum coeff)$	-0.164***	-0.11*	-1.06***	-1.06***
	(0.063)	(0.065)	(0.34)	(0.33)
GDP growth $(\sum coeff)$	140.05**	188.27***	200.33***	206.6***
	(70.3)	(62.03)	(59.89)	(54.8)
Inflation $(\sum coeff)$	-4.8	-7.1***	-0.04	-0.003
	(3.1)	(2.4)	(2.4)	(2.2)
Size $_{t-1}$	-0.47***		-0.33***	
	(0.198)		(0.096)	
Size $_{t-1}$ (within BMCP[1])		-0.13		-0.27**
		(0.15)		(0.12)
Size $_{t-1}$ (within BMFP[2])		-0.29**		-0.19*
		(0.14)		(0.13)
Size $_{t-1}$ (within BFB[3])		-0.67***		-0.31**
		(0.25)		(0.18)
Interaction $_{t-1}$	-0.003***		-0.002	
	(0.001)		(0.017)	
Interaction $_{t-2}$	-0.002***		0.001	
	(0.001)		(0.012)	
Interaction $(\sum coeff)$	-0.005***		-0.001	
	(0.002)		(0.02)	
Interaction (within BMCP[1])		-0.0008		-0.07
		(-0.003)		(0.05)
Interaction (within BMFP[2])		-0.029**		0.042*
		(0.012)		(0.025)
Interaction (within BFB[2])		0.008**		0.014
		(0.004)		(0.036)
p-value MA1/MA2	0.03/0.79	0.02/0.98	0.008/0.8	0.005/0.615
p-value Sargan	0.00	0.27	0.07	1.00

Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of total client loans; Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level;

Interaction = Size x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 10: "Extended model" GMM estimation results with capitalization and capitalization & ownership, respectively as bank characteristics for total client loans.

Variable:	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Capitalization	Capitalization & ownership	Capitalization	Capitalization & ownership
Monetary policy $(\sum coeff)$	-0.22***	-0.18***	-1.03***	-0.99***
	(0.04)	(0.03)	(0.33)	(0.32)
GDP growth $(\sum coeff)$	143.9**	151.3***	184.7***	176.6***
	(66.6)	(74.78)	(58.1)	(54.7)
Inflation $(\sum coeff)$	-5.2*	-5.6*	0.5	1.2
	(3.0)	(3.3)	(2.4)	(2.3)
Capitalization $_{t-1}$	0.39*		-1.02	
	(0.22)		(0.81)	
Capitalization $_{t-1}$ (within BMCP[1])		0.46		-1.93**
		(0.34)		(0.81)
Capitalization $_{t-1}$ (within BMFP[2])		0.28*		-0.71
		(0.15)		(0.76)
Capitalization $_{t-1}$ (within BFB[3])		-0.63		0.44
		(0.79)		(0.91)
Interaction $_{t-1}$	0.03***		-0.27	
	(0.008)		(0.23)	
Interaction $_{t-2}$	0.03**		0.006	
	(0.014)		(0.08)	
Interaction $(\sum coeff)$	0.07**		-0.26	
	(0.02)		(0.20)	
Interaction (within BMCP[1])		0.06***		0.006
		(0.023)		(0.25)
Interaction (within BMFP[2])		0.097**		-0.33**
		(0.04)		(0.15)
Interaction (within BFB[2])		0.03		-0.10
		(0.04)		(0.35)
p-value MA1/MA2	0.025/0.96	0.02/0.88	0.005/0.53	0.005/0.35
p-value Sargan	0.00	0.02	0.02	0.9

Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of total client loans; Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level;

Interaction = Capitalization x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 11: "Extended model" GMM estimation results with liquidity and liquidity & ownership, respectively as bank characteristics for total client loans

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Liquidity	Liquidity & ownership	Liquidity	Liquidity & ownership
Monetary policy $(\sum coeff)$	-0.21***	-0.22**	-1.67***	-1.88***
	(0.06)	(0.08)	(0.42)	(0.51)
GDP growth $(\sum coeff)$	153.7**	142.7**	297.03***	324.4***
	(73.19)	(67.59)	(64.9)	(85.9)
Inflation $(\sum coeff)$	-5.9*	-5.9*	0.9	1.6
	(3.0)	(3.0)	(2.1)	(2.4)
Liquidity $_{t-1}$	0.54**		2.17***	
	(0.29)		(0.67)	
Liquidity $_{t-1}$ (within BMCP[1])		0.12		3.14***
		(0.32)		(1.05)
Liquidity $_{t-1}$ (within BMFP[2])		0.65**		0.37
		(0.31)		(1.07)
Liquidity $_{t-1}$ (within BFB[3])		-0.15		1.71*
		(0.55)		(0.96)
Interaction $_{t-1}$	0.008		-0.56	
	(0.01)		(0.53)	
Interaction $_{t-2}$	0.023**		0.28*	
	(0.009)		(0.15)	
Interaction $(\sum coeff)$	0.03*		-0.28	
	(0.016)		(0.18)	
Interaction (within BMCP[1])		0.05***		-0.36
		(0.02)		(0.48)
Interaction (within BMFP[2])		0.03		-0.04
		(0.025)		(0.18)
Interaction (within BFB[2])		-0.005		-0.30
		(0.03)		(0.22)
p-value MA1/MA2	0.024/0.76	0.003/0.97	0.004/0.88	0.039/0.87
p-value Sargan	0.55	0.067	0.11	0.98

Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of total client loans; Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level;

Interaction = Liquidity x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 12: "Extended model" GMM estimation results with COTL (classified loans / total loans) and COTL & ownership, respectively as bank characteristics for total client loans

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	COTL	COTL & Ownership	COTL	COTL & Ownership
Monetary policy $(\sum coeff)$	-0.32*	-0.37*	-0.8***	-0.7**
	(0.04)	(0.08)	(0.3)	(0.3)
GDP growth $(\sum coeff)$	69.5***	54.8**	150.3***	134.04***
	(25.16)	(27.4)	(54.8)	(56.7)
Inflation $(\sum coeff)$	-1.6	-1.2*	1.3	1.5
	(1.6)	(1.7)	(2.2)	(2.2)
$COTL_{t-1}$	1.02***		-0.67**	
	(0.25)		(0.3)	
$COTL_{t-1}$ (within BMCP[1])		1.27***		-0.65***
		(0.22)		(0.2)
$COTL_{t-1}$ (within BMFP[2])		0.29		-0.02
		(0.47)		(0.34)
$COTL_{t-1}$ (within BFB[3])		-0.35		-2.0***
		(0.61)		(0.74)
$Interaction_{t-1}$	0.02*		-0.05	
	(0.012)		(0.3)	
$Interaction_{t-2}$	0.033**		0.1	
	(0.016)		(0.2)	
Interaction $(\sum coeff)$	0.05**		0.04	
	(0.021)		(0.18)	
Interaction (within BMCP[1])		0.047*		0.32
		(0.03)		(0.21)
Interaction (within BMFP[2])		0.06***		0.47**
		(0.02)		(0.22)
Interaction (within BFB[2])		0.027		0.08
		(0.04)		(0.33)
p-value MA1/MA2				
p-value Sargan				

Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of total client loans; Standard errors in parentheses; */**/ denotes significance at 10%/5%/1% level;

Interaction = COTL x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 13: "Benchmark model" GMM estimation for total client loans to account for banks' ownership

Variable	Benchmark		Benchmark to account for ownership	
	1996-1998	**1999-2001**	**1996-1998**	**1999-2001**
Loans growth rate$_{t-1}$	-0.13	0.04*	-0.13	0.04
	(0.25)	(0.026)	(0.25)	(0.03)
Loans growth rate$_{t-2}$	0.12	-0.45***	0.12	-0.45***
	(0.11)	(0.07)	(0.11)	()0.07
Monetary policy$_{t-1}$	-0.15***	-1.13**		
	(0.04)	(0.55)		
Monetary policy$_{t-2}$	-0.08***	-0.31*		
	(0.01)	(0.17)		
$\sum AR$ **coefficients**	**-0.24*****	**-1.44*****		
	(0.04)	**(0.55)**		
BMCP[1]				
Monetary policy$_{t-1}$			-0.15***	-0.99**
			(0.04)	(0.5)
Monetary policy$_{t-2}$			-0.08***	-0.37***
			(0.013)	(0.14)
$\sum AR$ **coefficients**			**-0.23*****	**-1.37****
			(0.04)	**(0.54)**
BMFP[2]				
Monetary policy$_{t-1}$			-0.15***	-1.09**
			(0.04)	(0.49)
Monetary policy$_{t-2}$			-0.08***	-0.31**
			(0.011)	(0.46)
$\sum AR$ **coefficients**			**-0.24*****	**-1.4*****
			(0.04)	**(0.48)**
BFB[3]				
Monetary policy$_{t-1}$			-0.15***	-1.21**
			(0.04)	(0.54)
Monetary policy$_{t-2}$			-0.08***	-0.39***
			(0.011)	(0.14)
$\sum AR$ **coefficients**			**-0.24*****	**-1.61*****
			(0.04)	**(0.57)**
GDP growth $_{t}$	72.56**	70.9**	73.34**	71.5**
	(36.17)	(33.66)	(35.22)	(30.46)
GDP growth $_{t-1}$	20.57*	136.21**	20.37	137.4**
	(26.73)	(60.94)	(26.53)	(56.8)
GDP growth $_{t-2}$	33.6***	46.58	33.63**	54.3**
	(5.75)	(31.15)	(6.28)	(26.5)
$\sum$ **coefficients**	126.7***		127.3**	263.3***
	(63.2)		(65.6)	(93.9)
Inflation $_{t}$	9.2**	-8.2**	9.8**	-8.8**
	(3.8)	(0.41)	(0.4)	(0.4)
Inflation $_{t-1}$	-1.1	0.2	-1.1	0.09
	(2.4)	(1.4)	(2.4)	(1.2)
Inflation $_{t-2}$	-13.0***	8.9**	-0.13***	8.9**
	(4.3)	(4.2)	(0.04)	(3.7)
$\sum$ **coefficients**	-4.7		-4.7	0.2
	(3.1)		(3.1)	(2.6)
P-value AR1/AR2	0.015/0.8	0.006/0.25	0.014/0.85	0.006/0.24
p-value Sargan	0.000	0.000	0.000	0.05

***Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of client loans to residents;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

[1]BMCP means "banks with mostly Czech participation"; [2]BMFP means "banks with mostly foreign participation"; [3]BFB means "branches of foreign banks".

Table 14: "Extended model" GMM estimation results with size and size & ownership, respectively as bank characteristics for client loans to residents

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Size	Size & ownership	Size	Size & ownership
Monetary policy $(\sum coeff)$			-1.55***	-1.23**
			(0.8)	(0.48)
GDP growth $(\sum coeff)$			278.06	215.06***
			(129.7)	(73.3)
Inflation $(\sum coeff)$			0.08	0.7
			(3.0)	(3.2)
Size $_{t-1}$	-0.59*		-0.37*	
	(0.31)		(0.2)	
Size $_{t-1}$ (within BMCP[1])		-0.42		-0.18
		(0.46)		(0.12)
Size $_{t-1}$ (within BMFP[2])		-0.52*		-0.09
		(0.32)		(0.14)
Size $_{t-1}$ (within BFB[3])		-0.47**		-0.54*
		(0.24)		(0.3)
Interaction $_{t-1}$	-0.002*		0.017	
	(0.001)		(0.02)	
Interaction $_{t-2}$	-0.002*		-0.019	
	(0.001)		(0.018)	
Interaction $(\sum coeff)$	-0.003*		-0.003	
	(0.002)		(0.02)	
Interaction (within BMCP[1])		-0.03		-0.056
		(0.002)		(0.04)
Interaction (within BMFP[2])		-0.01**		-0.008
		(0.005)		(0.041)
Interaction (within BFB[2])		-0.0005		-0.006
		(0.002)		(0.04)
p-value MA1/MA2	0.03/0.44	0.034/0.41	0.015/0.49	0.008/0.388
p-value Sargan	0.1	0.013	0.05	0.9

***Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of client loans to residents;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

Interaction = Size x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 15: "Extended model" GMM estimation results with capitalization and capitalization & ownership, respectively as bank characteristics for total client loans

Variable:	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Capitalization	Capitalization & ownership	Capitalization	Capitalization & ownership
Monetary policy $(\sum coeff)$	-0.21***	-0.18***	-1.17**	-0.9**
	(0.04)	(0.03)	(0.52)	(0.35)
GDP growth $(\sum coeff)$	153.7***	143.8***	200.5**	154.5***
	(67.3)	(72.9)	(83.56)	(55.4)
Inflation $(\sum coeff)$	-5.7*	-5.2*	0.2	1.2
	(3.1)	(3.1)	(2.7)	(2.9)
Capitalization $_{t-1}$	0.43		-0.08	
	(0.23)		(0.85)	
Capitalization $_{t-1}$ (within BMCP[1])		0.67*		-2.64***
		(0.43)		(0.97)
Capitalization $_{t-1}$ (within BMFP[2])		0.03*		0.96
		(0.18)		(1.36)
Capitalization $_{t-1}$ (within BFB[3])		0.005		1.36*
		(0.71)		(0.81)
Interaction $_{t-1}$	0.025		-0.33*	
	(0.004)		(0.2)	
Interaction $_{t-2}$	0.02**		0.39*	
	(0.008)		(0.23)	
Interaction $(\sum coeff)$	0.044***		0.05	
	(0.01)		(0.22)	
Interaction (within BMCP[1])		0.06**		0.17
		(0.025)		(0.21)
Interaction (within BMFP[2])		0.05***		0.28
		(0.02)		(0.64)
Interaction (within BFB[2])		0.03		-0.07
		(0.04)		(0.38)
p-value MA1/MA2	0.03/0.41	0.003/0.23	0.04/0.52	0.004/0.36
p-value Sargan	0.009	0.000	0.023	0.031

***Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of client loans to residents;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

Interaction = Capitalization x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 16: "Extended model" GMM estimation results with liquidity and liquidity & ownership, respectively as bank characteristics for client loans to residents

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	Liquidity	Liquidity & ownership	Liquidity	Liquidity & ownership
Monetary policy $(\sum coeff)$	-0.2***	-0.14**	-1.6**	-
	(0.05)	(0.06)	(0.65)	
GDP growth $(\sum coeff)$	156.3**	157.6*	278.02**	-
	(71.6)	(82.7)	(110.7)	
Inflation $(\sum coeff)$	-6.2*	-6.2*	0.7	-
	(3.2)	(3.2)	(2.3)	
Liquidity $_{t-1}$	0.54**		1.05***	
	(0.27)		(0.28)	
Liquidity $_{t-1}$ (within BMCP[1])		0.35		1.83**
		(0.25)		(0.8)
Liquidity $_{t-1}$ (within BMFP[2])		0.5**		-0.48
		(0.21)		(0.86)
Liquidity $_{t-1}$ (within BFB[3])		0.34*		1.68**
		(0.21)		(0.66)
Interaction $_{t-1}$	0.004		-0.13	
	(0.008)		(0.13)	
Interaction $_{t-2}$	0.02***		0.09	
	(0.007)		(0.07)	
Interaction $(\sum coeff)$	0.022*		0.03	
	(0.012)		(0.15)	
Interaction (within BMCP[1])		0.03**		-0.04
		(0.014)		(0.27)
Interaction (within BMFP[2])		0.03		0.05
		(0.018)		(0.26)
Interaction (within BFB[2])		-0.015		-0.21
		(0.026)		(0.23)
p-value MA1/MA2	0.03/0.67	0.044/0.49	0.009/0.44	0.008/0.3
p-value Sargan	0.003	1.00	0.67	0.99

***Note*:** 1-step GMM estimation results; the dependent variable is the growth rate of client loans to residents;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

Interaction = Liquidity x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

Table 17: "Extended model" GMM estimation results with COTL (classified loans / total loans) and COTL & ownership, respectively as bank characteristics for client loans to residents

Variable	**Bank characteristic:**			
	1996-1998		**1999-2001**	
	COTL	COTL & Ownership	COTL	COTL & Ownership
Monetary policy $(\sum coeff)$	-0.28***	-0.27***	-1.2**	-0.92**
	(0.04)	(0.08)	(0.55)	(0.44)
GDP growth $(\sum coeff)$	103.3***	65.8*	210.7**	176.4**
	(38.7)	(43.5)	(94.6)	(73.5)
Inflation $(\sum coeff)$	-3.2	-1.1	1.1	1.1
	(2.2)	(2.1)	(3.4)	(4.2)
COTL $_{t-1}$	0.63**		-0.85***	
	(0.25)		(0.35)	
COTL $_{t-1}$ (within BMCP[1])		1.06***		-0.73*
		(0.15)		(0.4)
COTL $_{t-1}$ (within BMFP[2])		-0.15		1.26
		(0.41)		(1.03)
COTL $_{t-1}$ (within BFB[3])		0.17		-3.2**
		(0.43)		(0.37)
Interaction $_{t-1}$	0.013*		0.043	
	(0.008)		(0.21)	
Interaction $_{t-2}$	0.022*		-0.002	
	(0.014)		(0.14)	
Interaction $(\sum coeff)$	0.036**		0.04	
	(0.017)		(0.22)	
Interaction (within BMCP[1])		0.055**		0.04
		(0.024)		(0.24)
Interaction (within BMFP[2])		0.076***		0.94**
		(0.027)		(0.48)
Interaction (within BFB[2])		0.048		-0.46
		(0.03)		(0.44)
p-value MA1/MA2	0.02/0.56	0.02/0.63	0.008/0.32	0.07/0.5
p-value Sargan	0.11	1.00	0.00	0.008

Note: 1-step GMM estimation results; the dependent variable is the growth rate of client loans to residents;

Standard errors in parentheses; */**/*** denotes significance at 10%/5%/1% level;

Interaction = COTL x Monetary policy;

[1]BMCP means "banks with mostly Czech participation";

[2]BMFP means "banks with mostly foreign participation";

[3]BFB means "branches of foreign banks".

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Czech National Bank
Economic Research Department
Na Příkopě 28, 115 03 Praha 1
Czech Republic
phone: +420 2 244 12 321
fax: +420 2 244 14 278
e-mail: research@cnb.cz