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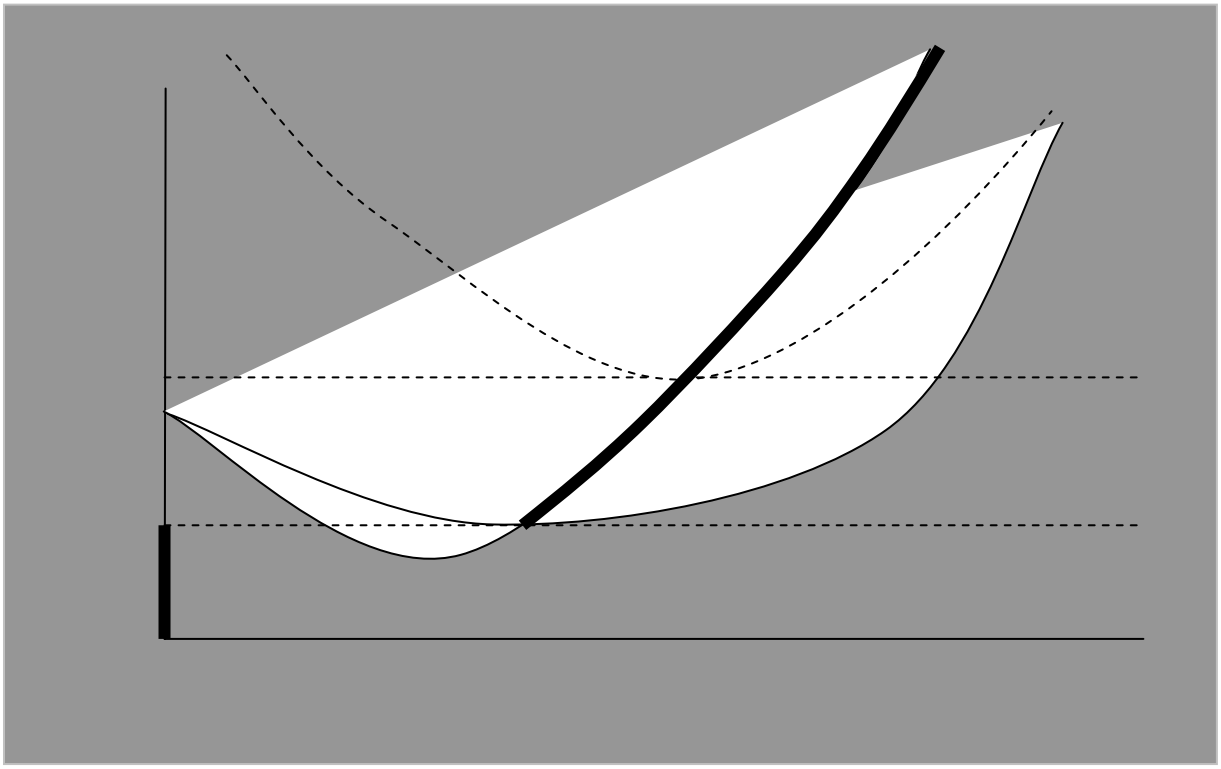

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ROMAN HORVÁTH *

Abstract

In this paper we examine a financial accelerator hypothesis analyzing the determinants of firm-level interest rates. Using a panel of the financial statements of 448 Czech firms in 1996-2002, we find that firm's balance sheet indicators are important determinant for the firm-level interest rates. Indebtness and market access matter in particular. The strength of balance sheets is procyclical. There is also evidence that monetary policy has stronger effects on small firms and during a period of the excess demand for credit (but not during a downturn).

JEL Classification: G11, G32

Keywords: Monetary policy transmission, interest rates, balance sheet channel, financial accelerator

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1. Introduction

An accurate understanding of monetary policy transmission is a key for efficient implementation of monetary policy. While there is large empirical evidence on monetary policy transmission mechanism in the Euro area (see Angeloni, Kashyap and Mojon, 2003), we still do not have sufficient knowledge about the transmission mechanism in the new EU member states (NMSs). This is striking for various reasons, e.g. as many of the NMSs are likely to join the Euro area in near future. This paper aims to bridge this gap by providing empirical evidence on the balance sheet channel in the Czech Republic.

Given an assumption of imperfect capital markets (information asymmetries and/or contract enforcement problems); there is a wedge between the cost of internal and external finance. Balance sheet channel links the cost of external finance to the financial position of the borrower.[1] As a result, under contractionary shock, firm's internal sources of funding typically worsen and firms become more dependent on external finance. However, at the same time the costs of external finance have a tendency to increase, as the financial health of borrower weakens. The greater dependence on external funding at time when the cost of external funding increase literature labels as financial accelerator effect (Bernanke, Gertler and Gilchrist, 1999). In consequence, the strength of balance sheet amplifies output fluctuations (Bernanke and Gertler, 1989).

According to Gertler and Gilchrist (1993), monetary policy might have asymmetric effects over the cycle, i.e. to be more potent in downturns than in booms.[2] In addition, Gertler and Gilchrist (1994) and Oliner and Rudebush (1996) suggest that monetary policy shocks have stronger effects on small firms than on larger firms as a result of unequal access to external financing. Boissay (2001) puts forward that financial accelerator effects might be particularly strong, when firms are credit rationed.

In this paper, we examine the aforementioned suppositions using a large dataset of the financial statements of Czech firms in 1996-2002. First, we study if balance sheet position affects the interest rate the firms are charged. Second, we analyze to what extent balance sheet position is procyclical. Third, we investigate if monetary policy has heterogeneous effects, i.e. affecting more strongly small firms and during the downturn. Forth, the specificity of Czech credit market in the 1990s offers a unique opportunity to study if the monetary policy shocks influence firms more when they are credit rationed.

As such, this paper contributes to existing evidence on the firm-level investment dynamics in the Czech Republic (Lizal and Svejnar, 2002a; Lizal and Svejnar, 2002b; Konings, Rizov and Vandenbusche, 2003 or Hanousek and Filler, 2004). In general, these authors study the role of

[1] Calstrom and Fuerst (1997), Kiyotaki and Moore (1997) and Bernanke, Gertler and Gilchrist (1999) are examples of modeling the interactions between the cost of finance and financial health of borrower.

[2] See also Kashyap, Lamont and Stein (1994). Another stream of literature – in order to obtain asymmetric effects of monetary policy – highlights the role of downward price rigidity; see Ball and Mankiw (1994). Nevertheless, recent empirical evidence from Euro area countries tends to challenge the assumption of downward price rigidity (Dhyne et al., 2005). To our knowledge, empirical evidence on downward price rigidity does not exist for the Czech economy. Empirical evidence from neighboring country –Slovakia – also suggests only weak evidence for downward price rigidity, as price decreases are quite common; see Coricelli and Horvath (2005).

ownership, credit rationing and soft-budget constraints. While all aforementioned studies provide important insights into the nature of Czech firm's investment dynamics, they typically employ the data from mid-1990s. More recently, Pruteanu (2004a) analyses whether banks credit rationed Czech enterprises during 1997-2002. To address the problems in identification of credit rationing[3], Pruteanu applies disequilibrium model of aggregate supply and demand for newly granted loans and draws the conclusion that credit rationing (e.g. excess demand for loans) occurred during the period 1999:1-2000:12. Consequently, we make use of this finding and test, if monetary policy has stronger effects during this particular period.

Typically, the econometric studies investigating the financial accelerator effects analyze the firm-level investment dynamics (see Vermeulen, 2002 or Berg, Hansen and Sellin, 2004). Only few studies focus on the determinants of firm-level interest rates within financial accelerator framework. Mojon, Smets and Vermeulen (2002) *inter alia* analyze firm-level interest rate dynamics in four largest Euro area countries in an error-correction framework. They find that firm's characteristics matter for the interest rates the firms are charged. In contrast to our results, they find little evidence that monetary policy in these countries has a heterogeneous impact on the firms and over the business cycle. Benito and Whitley (2003) study the factors affecting the firm-level interest rates in the UK in a dynamic panel setting and their results indicate that balance sheet position is important determinant of interest rates, too. In our paper, however, we apply slightly different estimation strategy than these two aforementioned studies.

In addition, we enrich the scarce literature on the monetary policy transmission in the Czech Republic. To our knowledge, this issue is studied systematically at the micro-level only by Pruteanu (2004b) and Schmitz (2004).[4] Pruteanu focuses on the bank-lending channel. She finds that monetary policy affects the growth rate of loans more strongly in 1999-2001 in comparison to 1996-1998. In addition, there is certain evidence that monetary policy had heterogeneous effects on bank lending in 1999-2001. Similarly, Schmitz studies the role of banks in monetary policy transmission in several EU new member states over the period 1990-2001. While Schmitz finds that bank lending reacts significantly to monetary policy tightening, she finds no evidence for heterogeneity in the monetary policy effects.[5]

The paper is organized as follows. Section 2 presents the description of our dataset as well as estimation methodology. In section 3, we present the descriptive statistics and regression analysis. We conclude in section 4. Finally, Appendix with some additional results and a detailed description of the construction of variables follow.

Data and Methodology

Data

[3] Note that the drop in the amount of credit does not necessarily imply credit rationing, as the demand for loans might have fallen as well (see e.g. Freixas and Rochet, 1997).

[4] At the macro level, Arnostova and Hurnik (2005) study monetary transmission mechanism in the Czech economy using VARs.

[5] In our opinion, the choice of sample period is highly problematic, as Schmitz's sample starts already in 1990. For example, interest rate ceilings were in use and the banks were solely owned by the state at

The data employed in this paper for the aggregate level analysis are derived from public database ARAD operated by the Czech National Bank. The data for the aggregate analysis include debt outstanding and interest rates. Both variables are coded according to their maturity as the short, medium and long-term (see Appendix A.3 for the details). Primarily, we use these data to estimate representative aggregate interest rate for a comparison with the firm-level sample interest rates.

The data for the firm-level analysis in the paper are obtained from company records by the private company 'ČEKIA Agency' as a part of their MAGNUS dataset. The unbalanced panel dataset covers the end of year financial statements of 461 non-financial companies from 1993 to 2002. For each firm, we have balance sheet and profit and loss accounts available. The dataset also contains a detailed description of economic activity for each firm. Using this information, we divide firms into 16 industries, as classified by the Czech Statistical Office: agriculture, food production, beverage and tobacco production, mining and processing of minerals and ors, textile & leather production, wood processing and paper production, chemical & pharmaceutics and rubber production, construction, metallurgy, machine building, electronics, power engineering, transportation, commerce, glass & pottery and the others.

As a prelude to estimation, we exclude the firm records, which suffer from apparent inconsistencies. First consistency check is simply to examine if the data takes on the expected values. For example, the value of assets should be positive. Analogously, the ratio of various items from financial statements should exhibit the expected values. For instance, the ratio of liquid assets to assets or debt to assets should lie between zero and one. On this basis, we exclude 6 firms from the sample.

Next, there are only three firm records in the dataset available for the year 1993, two for 1994 and six records for the year 1995. In consequence, we use the company records from only in the period between 1996 and 2002. Besides, majority of observations comes from the period 1999-2002. While for the year 1996, 1997 and 1998 dataset contains 17, 39 and 81 firms respectively, the number of firms in the years 1999-2002 is more than 300. Namely, there are 309, 390, 362 and 305 firms for the years 1999, 2000, 2001 and 2002, respectively. In total, the unbalanced sample counts for 1494 observations of 448 firms. Typically, we are able to track at least three subsequent years of the records for a given firm.

Estimation Methodology

In our paper, we first link the interest rate charged to a balance sheet position. Balance sheet position is approximated by the extent of leverage, liquidity, market access and the value of collateral. We also analyze, if small firms pay higher interest rates on average and also if the firm-level interest rates increase during downturn. Next, we examine if monetary policy shocks have hetererogeneous effects on firms according to their size. Finally, we investigate whether monetary policy affects firm-level interest rates more strongly during downturn and during (what may be labeled as) credit rationing period.

First, we estimate the equation linking balance sheet indicators to firm-level interest rates:

$$IR_{it} = \alpha_1 + \alpha_2 COLL_{t,t} / A_{i,t} + \alpha_3 DEBT_{i,t} / A_{i,t} + \alpha_4 CF_{i,t} / A_{i,t} + \alpha_5 ACCESS_{i,t} + u_i + e_{itt} \qquad (1)$$

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the outset of transition in the Czech Republic. Therefore, the results should be interpreted with caution.

Dependent variable, IR_{it}, represents the firm-level interest rate paid by the i-th firm at time t computed from the firm's financial statements (as the ratio of interest rate expenses to long-term debt excluding interest-free credits).[6] $COLL_{it}$ stands for the firm's collateral, which is represented by the firm's tangible and intangible assets, $DEBT_{it}$ is the company net debt. CF_{it} is the cash flow generated.[7] $COLL_{it}$, $DEBT_{it}$ and CF_{it} are normalized by A_{it}, which is i-th firm assets at time t. The extent of short-term financing is captured by $ACCESS_{it}$, which stands as the proxy for assessing the degree of market access of i-th firm at time t. This is calculated as one minus the ratio of short term debt to total debt. ui is an unobserved firm or industry fixed effect and eit is a error term. A detailed derivation of all the variables is presented in the Appendix A.2.

The sign of α_2 is expected to be negative. The firm with greater collateral value is likely to be charged smaller interest rate, as collateral secures the debt (Kiyotaki and Moore 1997). Estimated α_3 should yield positive sign. More leveraged firms are more likely to default and thus lender wants to be compensated by greater interest rate. The sign of α_4 should be negative. More liquid firms are likely to be charged smaller interest rate and thus cash flow should be negatively associated with firm-level interest rates. α_5 is likely to be negative. Firms with better access to external funds are likely to encounter smaller interest rates. The underlying supposition is that more risky firms are unable to receive long-term finance and thus are forced to finance their projects with short-term debt (Bougheas, Mizen and Yalcin, 2005).

Additionally, we investigate, if the interest rates charged are typically larger for small firms and/or during economic downturn. For convenience, balance sheet indicators ($COLL_{it} / A_{it}$, $DEBT_{it} / A_{it}$, CF_{it} / A_{it} and $ACCESS_{it}$) are labeled as X_{it} thereafter.

$$IR_{it} = \beta_1 + \beta_2 X_{i,t} + \beta_3 RECESSION_t + \beta_4 S_t + u_i + e_{it} \qquad (2)$$

In addition to the equation (1), we include two dummy variables into the equation (2). $RECESSION_t$ dummy captures, if the country records negative growth rates in time t. S_i is a dummy to assess, if small firms typically encounter greater interest rates.

[6] Benito and Whitley (2003) discuss the drawbacks this measure of firm-level interest rate may eventually have. If the firm reduces the amount of their debt substantially during in the course of the year, the resulting measure of firm-level interest rates based on end of year balance sheets may be 'artificially' high. To address the empirical relevance of this issue, we provide a correlation of our measure of interest rates and aggregate interest rates and also re-estimate all the equations with firms exhibiting interest rates above 25% (5% of sample). In addition, we estimate the equations without outliers, excluding 5% of smallest and highest interest rates. The empirical results suggest that this issue is of rather limited relevance in our sample. The obvious advantage of using this measure of interest rates is that it provides large cross-sectional information, which is otherwise hardly available.

[7] An alternative indicator of liquidity is the ratio of liquid assets to assets. In our sample, the correlation of liquid assets and cash flow (both normalized by assets) is 0.76. In consequence, we do not report the results with liquid assets, as the results are qualitatively very similar.

β_3 is expected to be positive for various reasons. For example, banks may contract their lending during downturn. Similarly, β_4 is likely to be negative, too. This is because small firms are more risky and/or entail greater agency costs for borrower (Bernanke and Gertler, 1990).

Next, we examine, whether there is a heterogeneity in monetary policy effects. We test this supposition in three steps. First, we estimate if the response to monetary policy shocks varies with the size of firm. Second, we assess, if the monetary policy is more powerful during the downturn, as compared to upturn. Third, we analyze, if monetary policy has greater effects during credit rationing period. The following three equations captures these issues more formally.

$$IR_{it} = \chi_1 + \chi_i X_{i,t} + \chi_3 i_t * S_i + \chi_4 i_t * M_i + \chi_5 i_t * L_i + u_i + e_{it} \quad (3a)$$

$$IR_{it} = \delta_1 + \delta_i X_{i,t} + \delta_3 i_t * RECESSION_t + \delta_4 i_t * BOOM_t + u_i + e_{it} \quad (3b)$$

$$IR_{it} = \phi_1 + \phi_2 X_{i,t} + \phi_3 i_t * CRUNCH_t + \phi_4 i_t * NOCRUNCH_t + u_i + e_{it} \quad (3c)$$

Equation (3a) links the firm-level interest rates to a vector X_{it} of balance sheet indicators and three additional explanatory variables. These are $i_t * S_i$, $i_t * M_i$ and $i_t * L_i$. i_t is an yearly average of 2-week repurchase rate (policy rate of the Czech National Bank), S_i, M_i and L_i are dummy variables for small, medium and large firms (according to the assets of firms), respectively. It is expected that $\chi_3 \succ \chi_4 \succ \chi_5$; e.g. that monetary policy shocks have the strongest effects on small firms, as compared to medium and large firms (Mojon, Smets and Vermeulen, 2002).[8]

Analogously, equation (3b) captures the effect of business cycle on the firm-level interest rates controlling for balance sheet indicators. $RECESSION_t$ is a dummy variable taking on unit value, if the economic growth has been negative in a given year. Conversely, $BOOM_t$ denotes the dummy variable stating when economic growth has been positive. In our sample, Czech Republic recorded negative year-on-year real GDP growth in 1997 and 1998 (-0.8% and -1%, respectively). It is further expected that $\delta_3 \succ \delta_4$; e.g. monetary policy is more potent during downturn.

Similarly to the equations (3a) and (3b), equation (3c) is constructed to assess the heterogeneous effects of monetary policy, when firms are largely credit rationed. Credit rationing, as captured by dummy variable $CRUNCH_t$, is defined as when there has been excess demand for the bank loans (see e.g. Stiglitz and Weiss, 1981). According to empirical study by Pruteanu (2004a), credit rationing of Czech enterprises has occurred mainly in

[8] It is noteworthy that piece-wise correlations of these three variables lie between -0.13 and -0.15 and thus, the level of multicollinearity is likely to be very low. Analogously, multicollinearity is not likely to be an issue when estimating the equations (3b) and (3c) as well.

1999:1-2000:12. Therefore, $CRUNCH_t$ takes a value of one in 1999 and 2000, zero otherwise. Boissay (2001) derives a model, which shows that financial accelerator is particularly strong, when firms are credit rationed. It is thus expected that monetary policy effects are likely to be stronger during this period and $\phi_3 \succ \phi_4$. As aforementioned, a detailed derivation of all the variables is presented in the Appendix A.2.

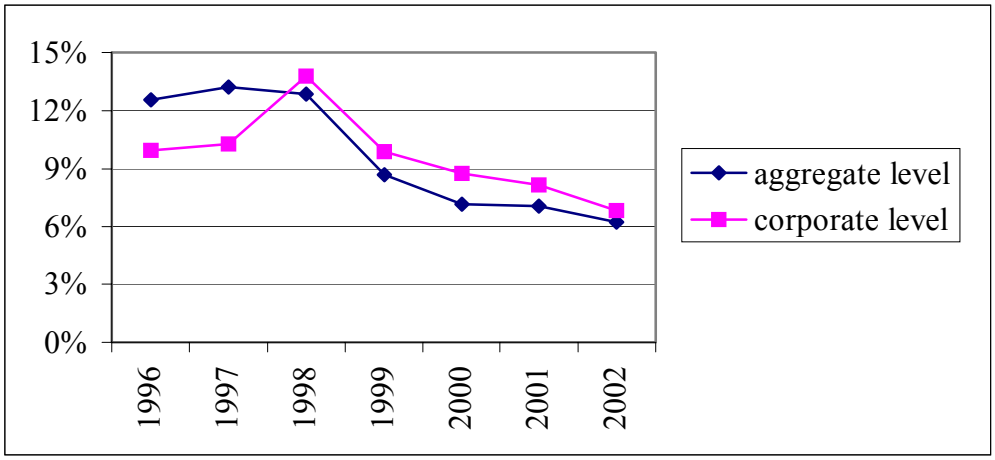
Regarding our econometric strategy, we do not apply dynamic panel data estimators (which is typical for this stream of literature) in this paper for two following reasons. First, if applied, the number of observations reduces to about 1/3, as time dimension of our sample is rather short. Second, the lagged dependent variable has been actually insignificant in all the specifications we estimated (not presented in the text). Additional issue is the eventual severe bias in the estimates, when dynamic panel data estimators are applied to small samples. Nerlove (2002) emphasizes that Arellano-Bond method is inappropriate, when the time dimension of panel is short. In consequence, the estimation of the presented equations is based on the instrumental variables static panel data models. The list of instruments is as follows: exogenous explanatory variables, selected industry and time dummies.

3. Empirical Results

In this section, we investigate empirically the financial accelerator effects in the balance sheets of Czech firms. First, we analyze the role of balance sheet position in explaining the firm-level interest rates. Second, we study if the monetary policy of the Czech National Bank exhibited heterogeneous effects in the sample period, i.e. have stronger effects on small firm, during downturn and during credit rationing period.

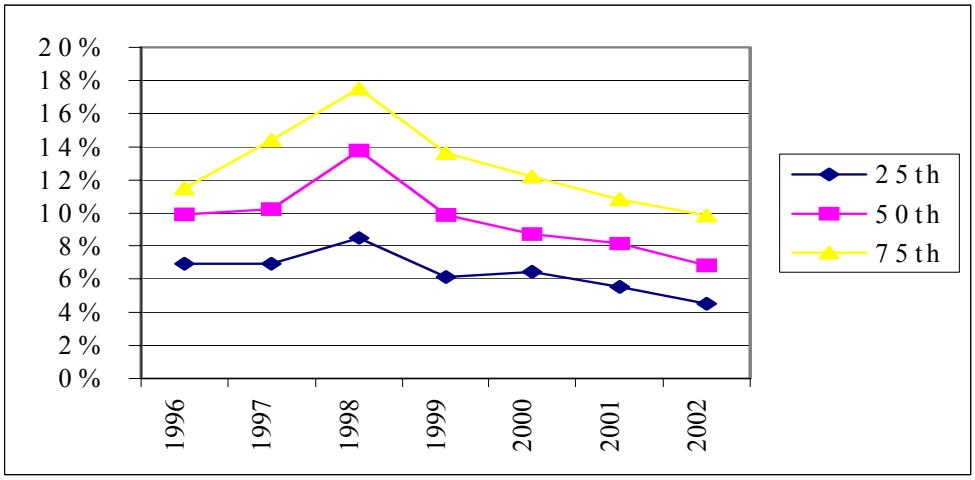
The adequacy of our measure of sample firm-level interest rate is examined in Chart 1. We compare this interest rate with the aggregate interest rate. Aggregate interest rates are calculated as the weighted average of inter-bank interest rates according to their maturity (see Appendix A.3 for the details on the construction). The weights are determined by the amount of outstanding loans. The sample interest rates are well correlated with the aggregate interest rates and thus our sample is likely to be representative.

Chart 1 - Interest Rates, Corporate and Aggregate Level



Next, we present the distribution of firm-level interest rates in Chart 2. The chart provides evidence of a large firm heterogeneity in terms of interest rates they pay to the banks. Besides, it seems that the cross-sectional variation in the interest rates depends on the mean firm-level interest rate. When the average rates are higher, the variation increases. This means that the firm heterogeneity tends to increase during the bad times. Eventually, it tells that credit conditions worsen more than proportionally for certain firms during the downturns. For instance, the firm-level interest rate at 25th percentile stands at around 7% and increases to 8% during the downturn, while the corresponding increase at 75th percentile is from 12% to 18%. Benito and Whitley (2003) using UK data find similar pattern in firm-level interest rate dynamics as well.

Chart 2 – Distribution of Firm-level Interest Rates



Note: The chart presents 25th, 50th and 75th percentiles of the firm-level interest rate over time.

Table 1 –Firm-level Interest Rates

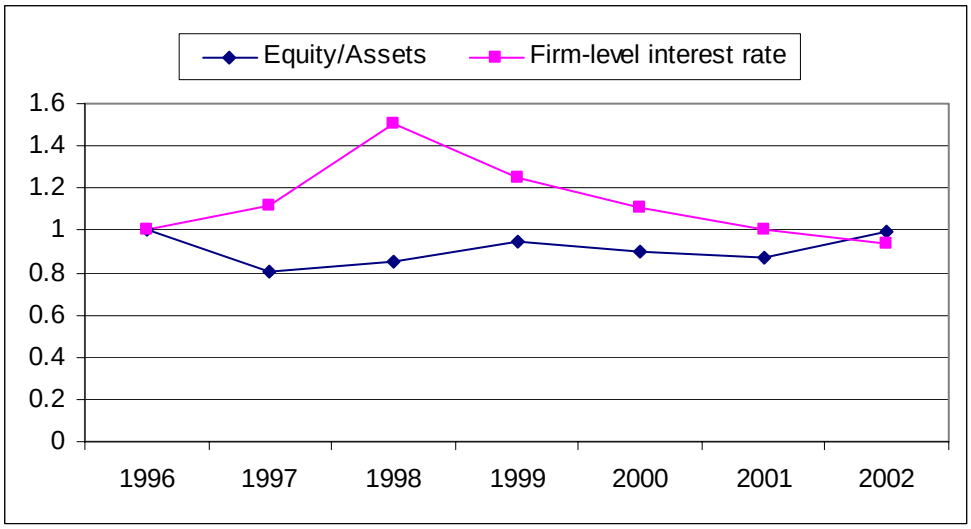
	Mean	Std. Err.	No. of Obs.
Small firms	12.04	0.48	493
Medium firms	9.67	0.32	493
Large firms	8.86	0.36	508
Downturn	12.88	0.71	120
Boom	10.02	0.24	1376
Credit rationing	10.94	0.35	699
No credit rationing	9.65	0.29	797

Note: See the main text for explanation of the terms in table.

Table 1 presents the descriptive statistics on firm-level interest rates. Generally, the interest rate, the firms pay, decrease with the size of firm. Rates are also higher in downturn, as compared to boom. Similarly, the result show that interest rates increased during the period when firms tend to be credit rationed. Empirical investigation in this section aims to uncover the reasons behind this variation in interest rates, focusing specifically on the monetary policy effects.

Chart 3 shows that when internal sources of financing deteriorate, the credit conditions are likely to be tight. This either suggests the presence of financial accelerator effect or simply the increase of firm's default risk, when internal sources weaken. The ability to finance investment from internal sources is proxied by ratio the firm's equity to its assets. The credit conditions are assessed simply by the sample mean of firm-level interest rate.

Chart 3 – Internal Sources of Financing and Interest Rates

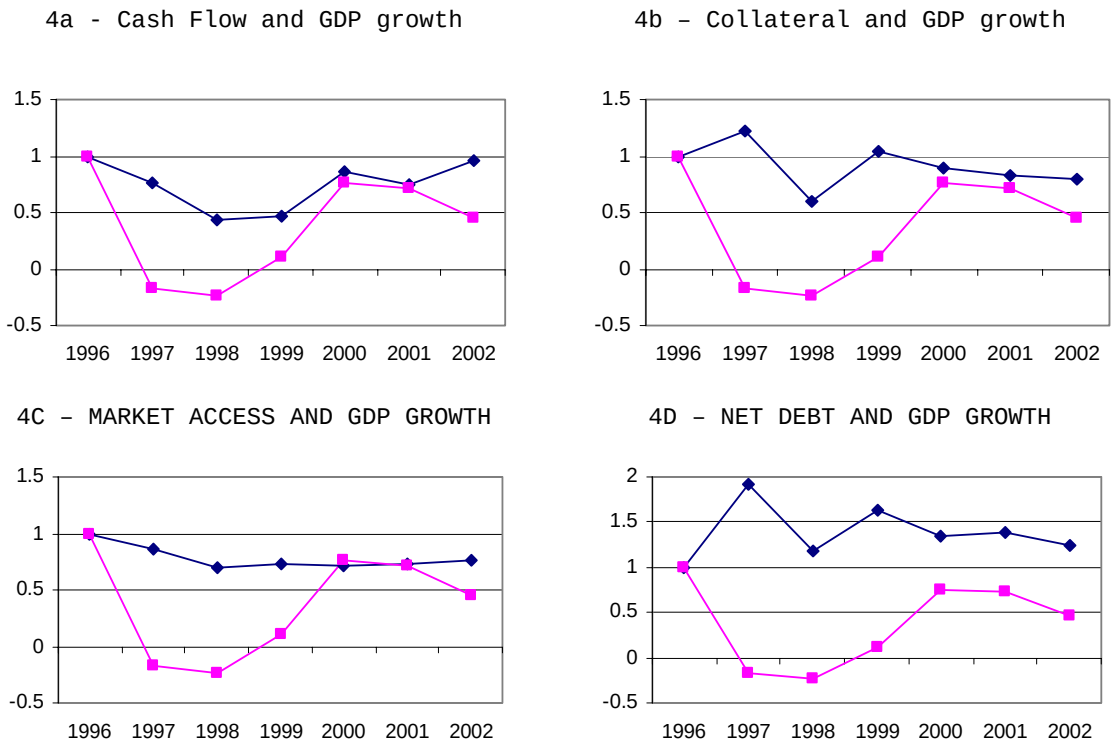


Balance sheet indicators are procyclical, to a large extent. Chart 4 plots the GDP growth and balance sheet indicators (all normalized to one in 1996 and in real terms).[9] There is a remarkable deterioration in the strength of balance sheet indicators during the downturn in 1997-1998. For example, firm's collateral value as well as cash flow dropped by some 40-

[9] Alternatively, the results are analogous using output gap instead.

50% from 1996 to 1998.[10] Market access worsens since 1996 and recovers only gradually. Additionally, Appendix A.1 in Table 7-8 presents some descriptive statistics of the balance sheet indicators.

Chart 4 – GDP growth and Balance Sheet Indicators, 1996-2002



Next, we study how the firm's balance sheet position affects the level of interest rates the firm is charged. We present the determinants of individual (firm-level) interest rates in Table 2 (estimation of the equation (1) is carried out by IV panel data fixed effects estimator).[11] We report the results for five various specifications together to give some insights of the sensitivity of the estimates. The results suggest that, among the balance sheet indicators, leverage and market access matter in particular. There is also certain evidence that firms generating large cash flow pay typically smaller interest rates (see also Table 9 in Appendix A.1). In addition, we report the results for the effect of economic downturn on the firm-level of interest rates. The results indicate that Czech firms have been charged greater interest rates during the slowdown of the economy.

[10] This number seems to be very high at first glance, but note that in case the value of capital did not change from 1997 to 1998, the corresponding fall in our collateral measure would be around 20% (that time inflation rate slightly above 10% and the assumed 8% annual depreciation of capital).

[11] In several specifications, random effects estimator has been consistent, as indicated by Hausman test. We do not report these results for the sake of space. We also re-estimated all the specifications with the bootstrapped standard errors. In majority of specification, bootstrapped errors has been close to asymptotic standard errors. The results with bootstrapped standard errors are not presented either.

Table 2 – Determinants of Firm-level Interest Rates

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	8.80**	6.31	8.33**	6.19	3.42*
	(3.50)	(4.12)	(3.58)	(4.14)	(1.95)
Market Access	-39.8*	-46.65	-48.84**	-49.14*	
	(24.7)	(26.23)	(25.71)	(26.96)	
Cash flow		-38.04		-33.50	
		(27.32)		(27.68)	
Downturn			2.10*	1.91	1.62***
			(1.22)	(1.29)	(0.94)
Fixed Effects	1.20**	1.06	1.14*	1.03	1.89***
R-sqr. overall	0.003	0.01	0.01	0.01	0.07
Observations	1494	1494	1494	1494	1494

Note: ***, ** and * - denotes significance at 1%, 5% and 10%, respectively. Asymptotic standard errors in brackets. Net debt and cash flow are divided by assets (see section 2.2).

Remarkably, collateral has been insignificant in all the specifications probably reflecting the difficulty with law enforcement during the sample period (see Roland and Verdier, 2003). The results with collateral as an explanatory variable are thus presented only in the Appendix A.1 Table 9. Similarly, we test for potential non-linearities by including the squared values of the explanatory variables, but they are not significant as well (not presented).

Table 3 gives the results for the determinants of firm-level interest rates investigating the impact of downturn and small firms in particular. Small firms typically pay higher interest rates, as it is more difficult for lenders to monitor them. However, significant small firm and downturn variables do not necessarily imply the financial accelerator effects. It may simply reflect greater risk of firms during the downturn or greater risk inherent in small firms, respectively. For this reason, we investigate if monetary policy shocks propagate more strongly to the small firms (or during downturn), controlling for balance sheet indicators as the proxy of firm's risk.

Table 3 - Determinants of Firm-level Interest Rates

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	8.38*	6.25		3.73**	1.82*
	(4.53)	(4.74)		(1.82)	(1.69)
Market Access	-53.03	-50.65	-2.08		
	(35.87)	(34.16)	(7.75)		
Cash flow		-34.6			
		(32.08)			
Small firms	46.86	34.48	18.57**	19.19**	14.04*
	(59.17)	(57.40)	(7.79)	(9.12)	(8.45)
Downturn					1.57*
					(0.92)
Fixed Effects	0.74	0.79	2.29**	1.70***	2.09***
R-sqr. overall	0.02	0.03	0.03	0.01	0.002
Observations	1494	1494	1494	1494	1494

Note: For mnemonics, see Table 2.

Table 4 - Determinants of Firm-level Interest Rates, Size of Firm and Monetary

Policy

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	1.00		-1.38		
	(2.01)		(1.54)		
Market Access	-18.23**	-15.87**			
	(8.73)	(6.66)			
Repo*Small Firm	1.07***	0.98***	0.92***	0.94***	0.95***
	(0.38)	(0.29)	(0.34)	(0.32)	(0.32)
Repo*Medium Firm	-0.17	0.15	0.15	0.02**	0.06
	(0.38)	(0.27)	(0.35)	(0.29)	(0.34)
Repo*Large Firm					-0.06
					(0.31)
Fixed Effects	2.31**	2.68***	2.78***	2.49***	2.48***
R-sqr. overall	0.06	0.09	0.07	0.03	0.03
Observations	1494	1494	1494	1494	1494

Note: For mnemonics, see Table 2.

Table 4 documents a heterogeneous impact of monetary policy on firms. Controlling for the strength of balance sheet indicators, we find that small firms react more strongly to monetary policy shocks, in comparison to medium and large firms. The coefficient on the product of repo rate and small firm dummy is always by far largest and significant. Interestingly, we find weak evidence that monetary policy affects the interest rates that the large firms are charged. This may indicate that large firms have close ties with the banks and therefore, monetary policy shocks are likely to have smaller impact on them. Overall, our results correspond to Vermeulen (2002), who finds that financial accelerator effects have been strongest for small firm's investment dynamics in a sample of four largest Euro area countries. To the contrary, the result of Mojon, Smets and Vermeulen (2002) do not point to that monetary policy effects would be stronger of small firm's interest rates.

Table 5 - Determinants of Firm-level Interest Rates, Downturn and Monetary Policy Effects

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	-5.94***				
	(2.23)				
Market Access	-17.30***	-26.98***		-14.20**	-9.06
	(7.58)	(7.56)		(6.53)	(6.43)
Repo*Downturn	0.67***	0.48***	0.29***	0.18***	
	(0.12)	(0.09)	(0.09)	(0.05)	
Repo*Boom	1.09***	0.70***	0.35**		-0.03
	(0.24)	(0.18)	(0.17)		(0.10)
Fixed Effects	2.96***	2.55***	2.64***	2.80***	2.79***
R-sqr. overall	0.13	0.07	0.02	0.07	0.07
Observations	1494	1494	1494	1494	1494

Note: For mnemonics, see Table 2.

Table 5 displays the results on the asymmetric effect of monetary policy over the business cycle. There are several studies investigating the potential asymmetry of monetary policy. Using Austrian data over the period 1976-1998, Kaufmann (2002) finds that monetary policy effects are indeed asymmetric over the business cycle. Similarly, Peersman and Smets (2005) find the asymmetric impact of monetary policy on industrial production in the Euro area countries.

Contrary to expectations laid in the previous section, our results do not suggest that monetary policy is more potent during the downturn. Rather it seems that monetary policy effects are actually stronger during boom period, despite coefficients on $i_t * RECESSION_t$ and $i_t * BOOM_t$ are not always statistically different. In our opinion, the lack of asymmetric effects of monetary policy may reflect rather short time sample or specificity of Czech credit market during the 1990s. Credit market has been characterized by rather soft budget constraints at the outset of transition and subsequent credit rationing at the end of the 1990s (Hampl and Matousek, 2000).

Table 6 - Determinants of Firm-level Interest Rates, Credit Rationing and Monetary Policy Effects

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	-5.20***				
	(1.90)				
Market Access	-12.61*	-22.84***		-9.35	-10.38
	(7.47)	(7.07)		(6.37)	(6.60)
Repo*Credit Rationing	0.75**	0.56***	0.42***	0.17***	
	(0.12)	(0.10)	(0.10)	(0.06)	
Repo*No Credit Rationing	0.51***	0.39***	0.27***		0.03
	(0.09)	(0.08)	(0.08)		(0.05)
Fixed Effects	3.19***	2.66***	2.64***	2.79***	2.8***
R-sqr. overall	0.13	0.08	0.02	0.07	0.07
Observations	1494	1494	1494	1494	1494

Note: For mnemonics, see Table 2.

Table 6 presents the results for heterogeneous impact of monetary policy depending on credit conditions. If the credit conditions are tight, it is likely the small policy rate changes trigger greater reaction in the firm-level interest rates, than otherwise. We identify tight credit conditions using the results of Pruteanu (2004a). Pruteanu finds that period 1999:1-2000:12 might be labeled as credit rationing period, as her empirical results suggest that moderate excess demand for bank loans has existed in this period. She argues that excess demand has been a consequence of downturn in 1997-1998 and continuing instability in the banking sector. After an economic recovery the demand for loans has enhanced, however this was not followed by the sufficient growth in the loan supply given the lack of improvement in the issues related to very high level of bad loans in the Czech banking sector. Indeed, our results suggest that monetary policy has significantly stronger effects on firm-level interest rate in 1999-2000, e.g. during credit rationing period. Our results are therefore in line with Boissay (2001). Boissay presents a model in which financial accelerator effects are particularly strong in the presence of credit rationing.

4. Conclusions

In this paper, we study the determinants of firm-level interest rates using a panel of the financial statements of Czech firms over the period 1996-2002. Namely, we assess the role of firm's financial position on the cost of external finance. In addition, we examine, if monetary policy has heterogeneous effects on firms according to their size and if the response to monetary policy effects are time-varying. Examining the heterogeneity of monetary policy shocks allows us assessing existence of financial accelerator effects in the Czech economy.

Overall, the results suggest that balance sheet indicators are important determinant of balance sheet indicators. We find that, among balance sheet indicators, leverage and market access (maturity structure of debt) matter in particular. Besides, the strength of balance sheet indicators is procyclical, to a large extent. We also find evidence on the heterogeneous impact of monetary policy shocks. Monetary policy has stronger effects on small firms in comparison to medium and large firms. Yet, we find no evidence that monetary policy effects depends on business cycle. On the other hand, monetary policy is more potent during period when the banks credit rationed the firms.

To sum up, the results in this paper indicate that balance sheet indicators are important determinant of interest rates the firms are charged by the borrowers and monetary policy shocks propagate unequally accross the firms and over time suggesting existence of financial accelerator effects.

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Appendix

A.1 Additional Results

Table 7 – Descriptive Statistics

	Assets	Cash Flow	Int. rate	Market Access	Net Debt
Mean	3896273	326471	10.20	27.04	868762.4
Median	836426	47029	8.46	18.71	151275.5
Maximum	202000000	22734922	83.79	100	55383697
Minimum	40561	-9750211	0	0	-539928
Std. Dev.	14113927	1651051	8.57	27.18	3339631
Skewness	10.24	7.74	3.29	0.93	10.74
Observations	1494	1494	1494	1494	1494
No. of Firms	448	448	448	448	448

Table 8 – Year Averages of All Variables

	Assets	Cash Flow	Collateral	Interest Rate	Market Access	Net Debt
1996	2946585	329320.7	1487655	9.34	36.53	475108.1
1997	4047294	268358.4	1956749	10.47	31.23	980659.9
1998	2376038	171819.8	1075408	14.04	25.65	678681.5
1999	3902052	192052.1	1940313	11.69	26.74	980361.5
2000	3873551	371072	1740596	10.36	25.77	836090.3
2001	3849908	330184.2	1632949	9.35	26.6	872800.2
2002	4405218	449294.4	1682072	8.73	28	848533.5

Table 9 - Determinants of Firm-level Interest Rates

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Net Debt	-4.06	10.07	10.05		
	(12.41)	(22.14)	(14.2)		
Market Access	-45.15**	-53.95*	-27.93		
	(19.3)	(29.2)	(21.82)		
Cash flow	-3.55	-49.94	-51.07	-51.62**	-53.31**
	(49.5)	(83.43)	(51.7)	(26.26)	(26.66)
Collateral	14.18	-5.15	-6.35	4.66	0.76
	(16.07)	(29.24)	(15.57)	(9.08)	(9.93)
Downturn		2.16			
		(1.96)			
Small firms			2.42		1.26
			(2.61)		(1.20)
Fixed Effects	1.48***	0.69	0.74	1.54***	1.48***
R-sqr. overall	0.06	0.002	0.01	0.001	0.001
Observations	1494	1494	1494	1494	1494

Note: For mnemonics, see Table 2. Net debt, cash flow and collateral divided by assets.

A.2 Construction of Variables for Estimating Equations (1) – (3)

The firm-level interest rate for i-th firm, IR_{it}, at time t is computed as follows: $IR_{it} = INREX_{it} / LDEBT_{it}$, where $INREX_{it}$ are interest expenses from the Profit-Loss

Account and long-term debt $(LDEBT_{it})$ is a sum of non-current liabilities and bank loans and borrowings from Balance Sheet, all for i-th firm at time t. The total amount of debt outstanding from provisions and short-term liabilities is not used, as no interest is paid in this case.

To compute the collateral value of illiquid assets - $COLL_{it}$, we first estimate the depreciation rate as follows: $DEPRECIATION_{it} = \alpha + \beta CAPITAL_{it} + e$, where $DEPRECIATION_{it}$ is a depreciation of tangible and intangible fixed assets from Profit-Loss Accounts and $CAPITAL_{it}$ is a sum of tangible and intangible fixed assets from the Balance Sheets.

Having estimated the above equation by the fixed effects estimator, the results indicate that annual depreciation rate is 8.3% (simple OLS reports the value of 8.4%). This rate is somewhat higher than findings reported by Lizal (1999). Lizal, using comparable methodology, estimates the annual rate of depreciation between 4.8-5%.[12] The data used in Lizal's paper are from the period 1992-1995 and this may explain the differences between our and his results. Nevertheless, our results are consistent with Czech accounting system since the depreciation rate may legally range between 2 and 20%. Controlling for industry effects influences the estimated depreciation only minimally. As a result, we work with depreciation rate of 8%, when deriving the value of collateral.

In this regard, the estimated rate of depreciation is used to compute collateral value of illiquid assets as: $COLL_{i,t} = I_{i,t} + (1-\delta)K_{i,t-1}$, where $COLL_{i,t}$ is the collateral value of illiquid assets in i-th firm at time t, $I_{i,t}$ is i-th firms' investment at time t, $K_{i,t-1}$ is a booked value of illiquid assets at time t-1 and δ is rate of depreciation as computed above. As $I_t = K_t - K_{t-1}$, the value of collateral is computed finally as follows: $COLL_{i,t} = K_{i,t} - \delta K_{i,t-1}$.

Market access $ACCESS_{it}$ is measured as one minus the ratio of short-term debt to the total company debt. Short-term debt is the current liabilities from Balance Sheets. Total company debt is calculated as the sum of current liabilities, non-current liabilities and bank loans and borrowings from Balance Sheets. This proxy estimates the extent of short-term financing.

Cash flow CF_{it} generated by the firm is calculated as the sum of the depreciation of the tangible and the intangible assets and the net income from Profit-Loss Accounts.

$RECESSION_t$ dummy takes on a value of 1, when the GDP y-o-y growth is negative (In our sample, these are the years 1997-1998). Analogously, $BOOM_t$ dummy has zero value, when y-o-y growth is positive.

$i_t * S_i$, $i_t * M_i$ and $i_t * L_i$ are a product of the year average of 2-week repurchase rate of the Czech National Bank and small, medium and large firm dummy, respectively. S_i dummy takes on a value of 1, when the firm's assets are smaller than 33rd percentile of the sample.

[12] Some of his alternative specifications lead to the estimate of annual depreciation about 6.3%.

M_i dummy takes a value of one, when firm's assets are between 33rd and 66th percentile. L_i dummy is one, when firm's assets are between 33rd and 66th percentile.

$CRUNCH_t$ is a dummy having the value of one in 1999-2000, when firms were credit rationed (see the main text), zero otherwise. On the other hand, $NOCRUNCH_t$ value is one in 1996-1998 and 2001-2002, zero otherwise.

A.3 Construction of Weighted Aggregate Interest Rates

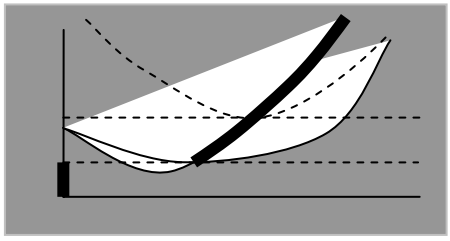
We use the weighted aggregate interest rate to compare with the sample firm-level interest rates (see Chart 1).

We compute this interest rate as a weighted average of interest rate at the monthly frequency. The volume of debt outstanding weights maturity structure of interest rate for each maturity as follows:

$$AIR_{it} = \frac{st_{it}}{st_{it} + mt_{it} + lt_{it}} sir_{it} + \frac{mt_{it}}{st_{it} + mt_{it} + lt_{it}} mir_{it} + \frac{lt_{it}}{st_{it} + mt_{it} + lt_{it}} lir_{it}$$

Where AIR_t is aggregate interest rate at time t, st_t is the amount of short-term debt outstanding at time t, mt_t is the amount of mid-term debt outstanding at time t, lt_t is the amount of long-term debt outstanding at time t, sir_t is short-term interest rate paid by firms at time t, mir_t is mid-term interest rate paid by firms at time t and lir_t is long-term interest rate paid by firms at time t.

We use the data on monthly interest rate on loan balances and the monthly statements on loans and receivables from clients. These all variables are divided according to their maturity. Short-term instruments are labeled those with maturity less than 1 year, medium-term instruments have maturity between 1 and 5 years and long-term instruments are with maturity over 5 years. Data period spans from January 1996 to December 2002.



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