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Relationship Lending in the Czech Republic

Adam Geršl and Petr Jakubík*

Abstract

This paper presents the results of an analysis of data on individual bank loans of non-financial corporations in the Czech Republic taken from the CNB's Central Credit Register. It focuses on the question of how firms obtain financing from domestic banks. The results show that the vast majority of non-financial corporations use the services of just one relationship lender. Small and young firms in technology- and knowledge-intensive industries tend to concentrate their credit needs in a single bank, whereas less creditworthy firms and firms in cyclical industries tend to borrow from more than one bank. The analysis also reveals different behaviour of firms towards financing banks in the case of multiple lenders. Finally, it turns out that the level of credit risk at bank level decreases in line with the extent to which firms applying single relationship lending occur in the bank's portfolio.

JEL Codes: G21, G32.

Keywords: Credit risk, relationship banking.

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Nontechnical Summary

This paper provides the first evidence on the phenomenon of relationship lending in the Czech Republic. The analysis is based on data on individual bank loans of non-financial corporations in the Czech Republic taken from the CNB's Central Credit Register and focuses on the question of how firms obtain financing from domestic banks. These data have not previously been used for analytical purposes, so this paper represents the first research study drawing on this original source of data.

Relationship lending is usually defined as a situation where there are close ties between the firm and the lender. The usual indicator of this model is the number of lenders, with the existence of just one bank corresponding to relationship lending. However, for large firms, which often use the services of multiple banks, this indicator is too restrictive; we thus use also an alternative indicator of the share of the most significant bank in the company's total debt.

Relationship lending may be the optimal financial strategy for many companies, as a relationship lender has a good knowledge of the firm's credit history and performance and can react optimally to its evolving financing needs. From the bank's perspective, relationship lending may be an attractive business strategy, since it maximises the benefits while minimising the necessary borrower monitoring costs. This reduces the main problem of banking business, namely the information asymmetry between borrower and lender.

The results show that the vast majority of non-financial corporations use the services of just one relationship lender. Small and young firms in technology- and knowledge-intensive industries tend to concentrate their credit needs in a single bank, whereas less creditworthy firms and firms in cyclical industries tend to borrow from more than one bank.

The data also reveal that firms applying relationship lending have a higher share of overdrafts and debit balances in their total bank debt than companies that do not apply this model. This may be linked with company size, since relationship lending is applied more by small firms. They usually have more volatile revenues, as they have a smaller number of clients, and so they are forced to use overdraft or debit facilities more often for their day-to-day operations.

The analysis of firms using multiple banks showed that firms usually have two large banks as the first two most important lenders, while medium-sized banks and foreign banks branches occupy more distant places in the order of financing importance. As the lending services offered to firms by all the large banks are broadly similar, this might indicate that firms opt for the "large–large" combination as a strategy for avoiding the "hold-up" problem (i.e. the problem of being "captured" by one relationship lender). The firm's

bargaining position as regards lending conditions improves over time, as its credit history is known to more than one bank.

For firms using multiple banks, it was shown that firms behave differently towards different banks in terms of the extent to which they use overdrafts or FX loans. Interestingly, as regards the firms' behaviour towards different banks in the event of repayment difficulties, the data indicates that a half of firms with two relationship lenders tend to default with their main bank and keep up their repayments with the second bank.

The paper also analyses whether the financing model chosen has a significant effect on the credit risk of relationship lenders. It turns out that the level of credit risk at bank level decreases in line with the extent to which firms applying single relationship lending occur in the bank's portfolio. This result can be explained by a better knowledge of such clients by the bank and more effective risk management in this segment and is largely in line with the theoretical literature.

1. Introduction

The global financial crisis that started in summer 2007 has raised concerns about how banks trying to maintain sensible solvency and liquidity values will respond in their traditional portfolios, i.e. primarily in the segment of lending to non-financial clients. The signals so far suggest that banks have responded vis-à-vis their customers by tightening all three dimensions of their financial conditions, i.e. the volume of loans (or new loans), the interest conditions (higher interest rates) and the non-interest conditions (the collateral required and the proportion of project self-financing). From firms' perspective, the situation may thus be highly unfavourable, as the critical situation in the financial markets coupled with high risk aversion reduces the opportunities for market financing using market instruments (bonds, equities and other securities). At times of financial turbulence, bank financing thus becomes the primary source of external finance again, giving banks a relatively strong position in determining the financial conditions.

The financial conditions can also be affected by whether a firm borrows from just one relationship lender or whether it obtains financing from multiple banks. Relationship lending[1] is most often cited as a phenomenon of the German banking system, but the available anecdotal evidence suggests that this model might be also present in other economies, including the Czech Republic. An important question is whether this bank financing model is beneficial to the firm at a time of economic crisis.

This paper sets out to determine which bank financing model predominates in the Czech Republic, what its main characteristics are, and what factors the choice of bank financing model depends on at firm level. We also analyse whether the model chosen has a significant effect on the credit risk of relationship lenders.

This paper uses internal data from the database of the CNB's Central Credit Register (CRC), which since 2002 has been recording all new credit relationships between companies and banks in the Czech Republic. These data have not previously been used for analytical purposes, so this paper represents the first research study drawing on this original source of data.[2]

Section 2 provides a short review of literature, while section 3 presents the CRC data used. Section 4 contains numerous descriptive statistics regarding the model of bank financing of

[1] Some papers use the term "relationship banking" (e.g. Giovanni et al. 2001); we decided to use the term "relationship lending" as we focus only on the lending side of a possibly much richer relationship between firms and banks that could also include deposit accounts and investment banking services.

[2] A first version of this analysis was published as a special feature in the Czech National Bank's Financial Stability Report 2008/2009 (Geršl and Jakubík, 2009).

firms in the Czech Republic. Section 5 analyses the determinants of the choice of the number of lending relationships at firm level, and section 6 tests the effect of the application of relationship lending on the credit risk of banks. Section 7 concludes.

2. Literature Review

Relationship lending may be the optimal financial strategy for many companies, as a relationship lender has a good knowledge of the firm's credit history and performance and can react optimally to its evolving financing needs. From the bank's perspective, relationship lending may be an attractive business strategy, since it maximises the benefits while minimising the necessary borrower monitoring costs. This reduces the main problem of banking business, namely the information asymmetry between borrower and lender. "Service packages" for businesses and "customised financing" are indeed a manifestation of a business model that focuses on a single bank winning a client and financing all its needs. A theoretical approach to different types of bank financing can be found in Janda (2007).

According to the conclusions of previous studies, company characteristics and competition are important determinants of the bank-customer relationship (Petersen and Rajan, 1994; Nam, 2004; Elsas, 2005). These studies also reveal that companies with a relationship lender have easier access to loan financing (Elsas and Krahnen, 1998; Harhoff and Körting, 1998), although an effect on interest conditions has not been unambiguously proved (Stein et al., 2007; Elsas and Krahnen, 1998; Harhoff and Körting, 1998; Gorton and Schmid, 1996).

It is relevant to ask whether relationship lending is beneficial to the firm during a recession. This would be true if the above arguments concerning easier access to financing apply even at times of financial distress. Giovanni et al. (2001) tested the impact of relationship lending on small and medium-sized firms in Korea during the financial crisis of 1997–1998. They pointed out that relationship lending with surviving banks has a positive effect on firms during a financial crisis. They argue that for many viable small and medium-sized firms in Korea, relationship lending reduced liquidity constraints and thus diminished the probability of firms' bankruptcy. However, one counter-argument is that the consequences of cancelling a line of credit to a company may be greater in the case of relationship lending, because the company has no credit history with any other bank and so its chances of raising alternative bank financing under reasonable interest conditions are reduced. Nevertheless, this argument has not been empirically confirmed in the literature.

Petersen and Rajan (1994) define relationship lending as a situation where there are close ties between the firm and the lender. The usual indicator of this model is the number of lenders, with the existence of just one bank corresponding to relationship lending. However,

for large firms, which often use the services of multiple banks, this indicator is too restrictive. Even if it uses multiple banks, the firm may have a truly close, tight and long-term relationship with just one lender. The existing literature offers three main indicators of close ties: (a) the number of lending relationships, (b) the share of the most significant bank in the company's total debt, and (c) the duration of the main lending relationship (Ongena and Smith, 2001; Memmel et al., 2007). The share of the most important bank turns out to be the indicator with the highest information value for close ties between a company and a bank (Elsas, 2005).

There are not many research studies focusing on the relationship between the model of bank financing and credit risk. Theoretical approaches to this research question support the argument that banks that apply a business model focusing on relationship lending tend to experience lower credit risk in their portfolios (von Thadden, 2004).[3] An area of research that relates bank financing and credit risk is the soft budget constraint literature, which argues that especially in emerging market economies where alternative external corporate financing is not available, weak (state-owned) banks have incentives to fund projects with negative net present value, leading to accumulation of credit risk (Dewatripont and Maskin, 1995).[4] Empirical studies that relate the bank financing model and bad loan accumulation include Diaz-Alejandro (1985) and Corsetti, Pesenti and Roubini (1999).

Some literature emphasises the positive aspects of single relationship lending. This relationship allows creditors to take a longer view of investments and reduce financial constraints for firms in temporary difficulties (Rajan, 1992; Hoshi, Kashyap and Scharfstein, 1991). For this reason, the single bank relationship is proposed as an optimal model for transition economies, where external non-banking sources of financing are limited (Aoki and Patrick, 1994).

3. Data

The CNB's Central Credit Register contains data on all balance sheet (and some off-balance sheet) exposures of domestic banks (including branches of foreign banks) to resident and non-resident legal entities and to sole traders. Each record (line in the database) is a loan-specific record containing bank, firm, month and year, and a number of firm-, bank- and loan-specific information. The data are at monthly frequency. The register was established at the end of 2002 and contains not only all new loans provided since that date, but also all bank loans already existing at the end of 2002. For example, the oldest loan registered in the Credit Register (in December 2002) had been provided to a Czech company in 1990. The

[3] The logic is explained in Section 6.

[4] For a recent discussion of the soft budget constraint literature see Janda (2009).

database is thus not truncated, with the exception of loans provided and repaid before 2002. The reporting of loan data is not subject to any reporting limit.[5]

Anonymised data on bank loans (balance-sheet exposure) to non-financial corporations were used for the analysis. Loans to non-residents, sole traders, the public sector and financial institutions were not taken into account. In all, the sample contained almost 8 million records describing the individual loans of around 120,000 companies in the period from December 2002 to December 2008 at monthly frequency.

For each firm, there is information on size (total turnover and number of employees), industry, legal form and ownership (public, private-domestic, private-foreign). Banks do not report data on companies' balance sheet or performance to the register, thus basic data on companies are uploaded to the register from the RES register of firms operated by the Czech Statistical Office. This has three main shortcomings: first, the data on companies from the RES are uploaded every month and the characteristics of firms are always overwritten with the newest record.[6] Second, the data on size (total turnover and number of employees) are given only in categories (16 categories of turnover and 20 categories of number of employees). For the analysis, we replaced the number of the category with the mean value of each category. Finally, the data on size (either employment or turnover) are available only for about half of the firms (60,000 companies).

Using the information on each firm's loans, we constructed variables describing the number of lending relationships, debits/overdrafts as a percentage of total debt, FX loans as a percentage of total bank loans, the year of the oldest granted loan, the firm's "age" (computed as the difference between the year of the observation and the year of the oldest granted loan) and client creditworthiness (using information on the default rate in previous years). For each firm, we also created variables related to their three most important lenders (in terms of the banks' share in the firm's total borrowings from domestic banks), namely the amount of the share, selected data on the bank and selected data on the credit relationship with that bank, i.e. the above-mentioned characteristics of the relationship (debt and foreign currency ratios, year of oldest loan and information on default).

Finally, we created variables at individual bank level, i.e. the 12M default rate in the corporate loan portfolio[7], the bank's market share in total loans to non-financial corporations, and the shares of various types of debtors and selected sectors and loans in the

[5] The only exception is current account overdrafts up to an amount of 70 euros, which are not reported.

[6] Thus, these firms' characteristics are time-invariant. For example, if a firm changed ownership from private-domestic to private-foreign, the credit register would overwrite the older record (domestic ownership) with the newer one (foreign ownership) in all months over the whole life of the loan.

[7] The 12M default rate was computed as the proportion of the bank's claims that will fall into the category "in default for more than 90 days" within 12 months.

total corporate loan portfolio (foreign currencies, foreign-controlled corporations, small and medium-sized enterprises, etc.). Due to the anonymised dataset, we did not have the identities of individual banks. The only thing we have for the banks is the bank group (large banks, medium-sized banks, small banks and foreign bank branches).

To be able to run regressions, we further adjusted the dataset in two areas: first, the size of the dataset had to be reduced. Thus, the original monthly frequency was changed to quarterly frequency. Given that the data are stock data, this change did not lead to any need for recalculations. Second, the dataset was split into a "firms dataset" and a "banks dataset" so that we could run panel data models, similarly to Memmel (2007, p. 10).

4. Model of Bank Financing of Firms in the Czech Republic

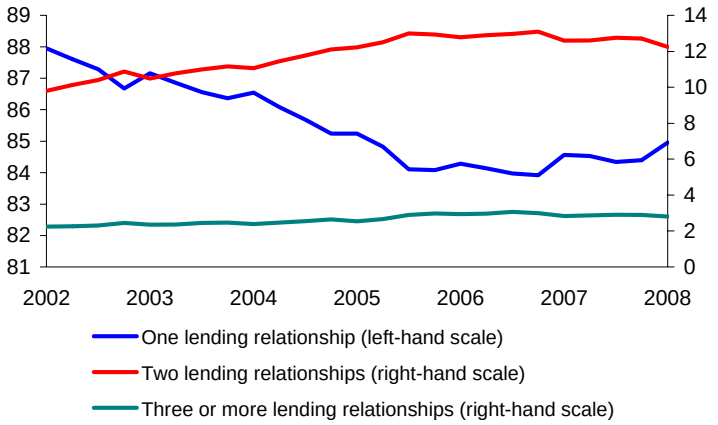
For the purposes of this paper we use two indicators of relationship lending, namely the number of lending relationships and the share of the most significant bank. For the latter, we additionally construct a dummy variable taking the value of 1 when the share of the main bank is more than 80%. In the text that follows, "single relationship lending" refers to the situation where a firm borrows from a single bank. The situation where one bank has a dominant share in a company's borrowings (more than 80%) we term "dominant relationship lending".[8]

The analysed data on the number of lending relationships reveal that relationship lending predominates in the Czech Republic. At the end of 2008, 85% of all non-financial corporations had just one lender, 12% had two and only around 3% had three or more (see Chart 1). Over the past six years, however, single relationship banking has been declining in significance, as almost 90% of companies were applying this model in 2002.

[8] Another suitable indicator for measuring relationship lending could be the Herfindahl index of concentration of creditors. However, in this study we do not use this measure of lender concentration, leaving it instead for follow-up research.

Figure 1: Proportion of Companies by Number of Lending Relationships

(% of total number of companies in given period)



Source: CNB (CRC), authors´ calculations

It is interesting to compare this figure with Germany, which is considered by theoreticians and practicians alike to be the classic example of single relationship lending (the Hausbank model). In a study based on the Deutsche Bundesbank credit register, Memmel et al. (2007) state that only around 45% of companies in 2002 applied single relationship lending (see Table 1).[9] A comparison of the distribution of the number of lending relationships between the Czech Republic and Germany reveals that German firms use the services of multiple banks to a far greater extent.[10] This difference may be partly due to the different relative size of corporations and banks. Germany has far more large enterprises and small regional banks, so consortium financing is the only option for many large companies.[11]

[9] Memmel et al. (2007) analysed bank loans from the Deutsche Bundesbank credit register for the period 1993–2004, but the frequency was only yearly.

[10] Memmel et al. (2007) report a maximum value of 197 for the variable "number of lending relationships". In the Czech Republic the maximum number is 11.

[11] This reason is supported by the fact that the data used for the analysis of Germany in Memmel et al. (2007) come from the Deutsche Bundesbank credit register, which only contains loans that exceed EUR 1.5m, i.e. loans primarily to large corporations.

Table 1: Comparison of Distribution of Number of Lending Relationships between Czech Republic and Germany

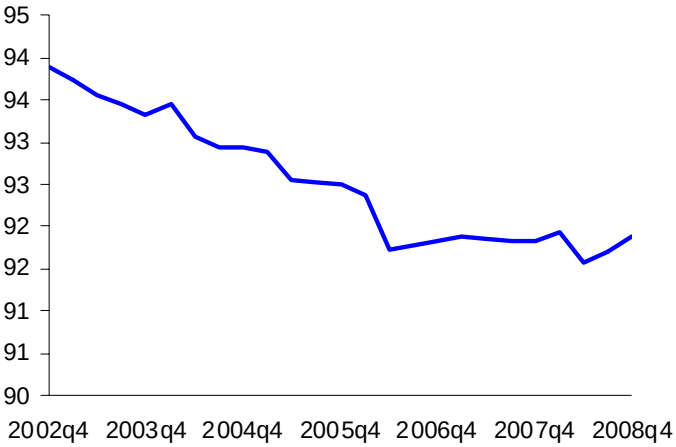
No. of lending relationships	in % of all companies		
	CZ (2008)	CZ (2002)	Germany (2002)
1	85.0	88.0	43.5
2	12.2	9.8	23.2
3	2.2	1.7	11.4
4	0.4	0.4	5.8
5	0.1	0.1	3.8
6	0.0	0.0	3.3
7	0.0	0.0	2.1
8	0.0	0.0	1.4
9	0.0	0.0	1.1
10+	0.0	0.0	4.3

Source: CNB (CRC), authors´ calculations; Memmel et al. (2007)

In the other indicator of relationship lending, i.e. the share of the most important bank in a company's total bank debt, the proportion of companies applying dominant relationship lending is of course even higher (see Chart 2). But this indicator is declining over time as well. In Germany, the figure is somewhere between 50% and 60% (Schmieder et al., 2008). For the Czech Republic, the mean share of the most important bank (for the whole sample of all companies regardless of number of financing banks) is almost 97%, which is, of course, due to the high proportion of firms with a single relationship lender, with a range of 14% to 100%. Stein et al. (2007) report an average for this indicator of around 60% (with a minimum of 9% and a maximum of 100%).

Figure 2: Proportion of Companies Applying Dominant Relationship Lending

(% of total number of companies in given period)



Source: CNB (CRC), authors´ calculations

Given that single relationship lending prevails among Czech firms, it is not surprising that large banks[12] dominate as single relationship lenders (see Chart 3). Roughly 70% of companies with single relationship lenders choose a large bank as their only bank, while around 20% choose a medium-sized bank. The role of branches of foreign banks and small banks is limited in this regard.[13] This is somewhat surprising, as the evidence from Germany shows that usually small and medium-sized banks act as relationship lenders. The reasons might include factors related to competition among the smaller banks, a preference for limiting concentrations, institutional factors and the legislative environment.[14]

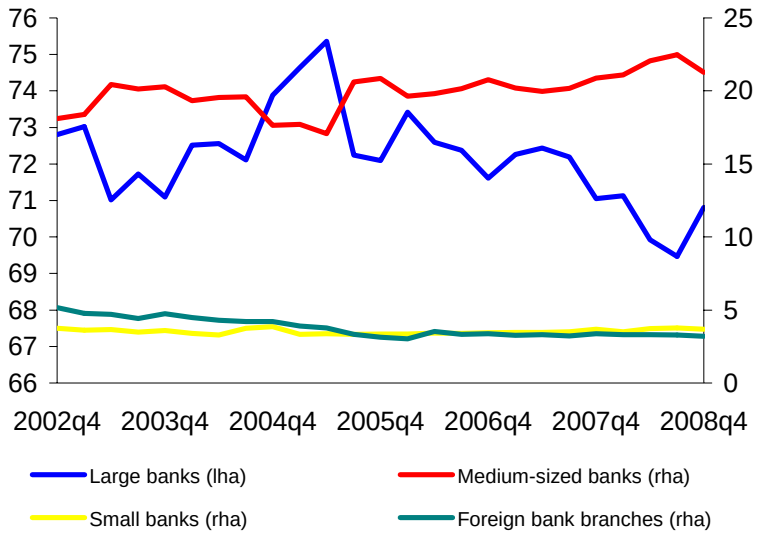
[12] The group "large banks" consists of the four largest banks in the Czech Republic according to total assets. Their joint market share in the relevant loan market segment (loans to non-financial corporations) was around 66% and surprisingly stable over all 7 years of data availability.

[13] The role of medium-sized banks was not significantly reduced by the change of form of Citibank from a medium-sized bank to a branch of a foreign bank in 2008.

[14] Some of the factors could be tested by including more variables for banks, such as assets or equity; unfortunately this has to be left for follow-up research, as the dataset was anonymised and these data were not available in the credit register.

Figure 3: Single Relationship Lenders by Bank Category

(percentage of companies with single relationship lender from given group)



Source: CNB (CRC), authors´ calculations

Note: The chart does not contain building societies, whose role as single relationship lenders is minimal.

The data offer more interesting information on which first and second most important banks are chosen by firms using multiple banks. The role of foreign bank branches, for instance, could be greater here, since these banks offer companies certain specialised services. The average share of the first most important bank (for firms that have more than one relationship lender) in the total debt of the firm is 77% and the share of the second relationship lender is 20%. Table 2 shows the distribution of firms with two relationship lenders by the group of the first and second relationship lender. It turns out that large banks also have the largest share in the role of second bank, including for firms that already have a large bank as their first lender.

As the lending services offered to firms by all the large banks are broadly similar, firms may opt for the "large–large" combination as a strategy for avoiding the problem of being "captured" by one relationship lender (Schmieder et al., 2008). Memmel et al. (2008) show on German data that firms applying single or dominant relationship lending reduce their share with the largest bank in favour of another bank over time as they grow. The firm's bargaining position as regards lending conditions thus improves over time, as its credit history is known to more than one bank. This has been theoretically described as a "hold-up" problem for example in Bannier (2009).

Table 2 also shows that the second most common combination of relationship lenders is large–medium-sized or medium-sized–large (with a very similar number of firms), followed by foreign bank branch–large (or large–branch). In these cases, a greater role is probably played by the firm's specific requirements, geographical location (accessibility of the bank), efforts made by banks to target specific clients and, for foreign-controlled corporations, existing ties between the firm's owners and the bank.

Table 2: Distribution of Relationship Lenders by Bank Group for Firms with Two Relationship Lenders

(% of total number of companies for all periods)

		Second relationship lender			
		Large banks	Medium-sized banks	Small banks	Foreign bank branches
First relationship lender	Large banks	35.2	19.1	2.3	5.4
	Medium-sized banks	19.1	3.3	0.7	1.7
	Small banks	2.2	0.7	0.1	0.3
	Foreign bank branches	6.8	1.9	0.4	0.5

Source: CNB (CRC), authors´ calculations

For the sake of completeness, we should mention that for firms using the services of three or more banks, large banks again play the most important role, followed by medium-sized banks and foreign bank branches. The most common bank combination for these firms is thus large–large–large. The factors here may include the firm's size (the need for syndicated financing in large firms) and the strategy of avoiding capture and cutting financing costs, although historical ties may also play a role. The largest banks were all to some extent specialised in the past decade, so companies used the services of large banks for different purposes (payments, investment vs. operating vs. export financing, etc.). Owing to the conservative nature of large domestic firms, these ties apparently still survive, even though these banks now operate essentially as universal banks offering practically every banking service.

The CRC contains information on whether a company borrows in the form of an overdraft or debit balance. This is an indirect indicator that the firm also has a current account with a particular bank and that it therefore uses the bank for routine payments with other trading partners. The data reveal that firms applying dominant relationship lending have a higher

share of overdrafts and debit balances in their total bank debt than companies that do not apply this model (50% versus 36% of total bank debt). This may be linked with company size, since dominant relationship lending is applied more by small firms (see below). They usually have more volatile revenues, as they have a smaller number of clients, and so they are forced to use overdraft or debit facilities more often for their day-to-day operations.

For firms using multiple banks, detailed data on their lending relationships allow us to analyse whether firms behave differently towards different banks. In the case of overdrafts and debit balances, it turns out that firms obtain overdrafts from their main bank to a lesser extent than from other banks in the sequence (Table 3).

Table 3: Differences in Behaviour towards Various Relationship Lenders

(average indicators in %)

Share of overdrafts and debit balances in bank debt

	One relationship lender	Two relationship lenders			Three or more relationship lenders			
		Total	**1st bank**	**2nd bank**	**Total**	**1st bank**	**2nd bank**	**3rd bank**
2002	44,6	27,9	27,9	41,2	13,1	11,8	20,3	28,4
2005	57,9	42,7	41,6	56,0	30,2	27,8	35,3	44,5
2008	46,5	37,3	35,7	53,4	32,3	30,8	38,0	49,0

Share of foreign currency loans in bank debt

	One relationship lender	Two relationship lenders			Three or more relationship lenders			
		Total	**1st bank**	**2nd bank**	**Total**	**1st bank**	**2nd bank**	**3rd bank**
2002	8,8	8,0	7,8	8,8	11,4	11,9	11,0	15,4
2005	5,4	3,3	3,2	4,6	6,0	6,1	5,9	6,3
2008	3,5	2,7	2,8	3,2	4,3	4,4	4,3	6,0

Source: CNB (CRC), authors´ calculations

One of the reasons may be that second and subsequent relationship lenders finance companies' other needs (in particular operations), in which overdrafts naturally have a greater weight. Moreover, firms may behave more cautiously towards their main bank in the overdraft area and probably do not make full use of overdraft or debit facilities. This behaviour has not changed significantly over time, even though the rate of overdraft use has changed.

Similar behaviour can be observed for the share of FX loans. The average share of FX loans in firms' total bank debt has steadily decreased from around 9% in 2002 to 3.5% in 2008.[15] This share differs little between firms applying dominant relationship lending and other firms, but firms with three or more banks have a higher share of FX loans than firms with two relationship lenders (see Table 3). These tend to be larger firms with a strong export orientation. It also turns out that in the case of multiple bank financing the share of FX loans is usually higher for more distant banks. This is to some extent consistent with the finding that foreign bank branches, which specialise in providing FX loans or financing international trading, tend to occupy second or third place in the order of financing importance.

The final issue in the area of firms' different behaviour towards different banks is their strategy in the event of repayment difficulties. An analysis of the data reveals that firms with two relationship lenders tend to default with their main bank (on average almost 50% of firms with repayment difficulties) and keep up their repayments with the second bank. A further 30% of firms stop repaying both banks simultaneously.[16] At first glance, this situation contrasts with the conclusions of the analysis of behaviour in the area of debit balances and overdrafts, where firms try to maintain a good credit history with their main bank. A more detailed analysis reveals, however, that firms defaulting primarily with their main bank likewise use overdraft and debit facilities with them to a greater extent. In the case of three or more relationship lenders, the situation is heterogeneous and no dominant model of behaviour can be identified. In percentage terms, the most frequently observed phenomenon is default with all three relationship lenders (around 22% of cases), followed by default with the first two banks (20% of cases) and default with the first bank (16% of cases).[17]

[15] This is the unweighted average. The decline is due to a decrease in this share in individual firms and partly also to the appreciation of the Czech koruna against other currencies, as well to a change in the set of firms towards a higher proportion of (for example smaller) firms using mostly koruna loans. The relatively small average amount of this share (as compared to the often cited share of FX loans in total loans provided by domestic banks of around 30%) is due to the high proportion of smaller firms with mostly koruna loans.

[16] At the end of 2008, this situation switched towards equal default vis-à-vis both relationship lenders (50% of all firms in default in 2008 Q4).

[17] Unfortunately, the credit register does not include variables on bank size, ownership, performance and balance sheet structure, so a number of potentially important research questions related to different behaviour to different lenders is not analysed.

5. Analysis of the Determinants of the Choice of Single Relationship Lending

Empirical studies analysing the determinants of the choice of bank financing model by individual firms (Memmel et al., 2007) find a particularly important role for the size, age and creditworthiness of the firm, the technology and knowledge intensity and cyclicality of the industry, and the type and size of the lender/lenders. The industry- and firm-level characteristics indicate a positive correlation between a firm's size and age and its number of lending relationships, and a negative correlation between the creditworthiness of the firm and the technology and knowledge intensity of the industry and the number of lending relationships. Stein et al. (2007) set out detailed arguments from the theoretical literature supporting these correlations, arguments that are based to a large extent on the problem of information asymmetry and strategic behaviour of firms. The geographical location of the firm may also play a role, as firms from smaller communities away from financial (regional) centres may tend to borrow from the single bank that is most accessible to them. For foreign firms, ties between parent companies and foreign banks may also play a role. It is reasonable to assume, therefore, that Austrian firms, for instance, will borrow mainly from banks owned by Austrian banking groups.[18]

We analyse the determinants of the choice of bank financing model using classical regression (the pooled OLS method), fixed-effects panel regression and random-effects panel regression in order to capture the effects of variables that do not vary over time.[19] The share of the main relationship lender in the firm's total bank debt (i.e. actually the loan concentration) was used as the dependent variable.[20] The explanatory variables used were firm characteristics (turnover, age of firm, risk of firm), selected industry-level variables, namely the cyclicality of the industry (the correlation between the industry's gross added value and overall GDP) and a dummy variable for high and medium-high technology and

[18] Variables capturing corporations' geographical ties and countries of origin were not available, so the influence of these factors was not tested in the analysis.

[19] The firm size information does not vary over time as it is taken from the turnover categories in the RES (Register of Economic Agents) database and is always overwritten in the CRC historical data by the latest information.

[20] Alternatively, we also used the number of banks the firm borrows from. Given the nature of this variable, which takes discrete values between 1 and 11, in this case we used Poisson regression, which takes the categorical nature of the dependent variable into account. The results, however, are in line with the aforementioned findings.

knowledge intensity industries.[21] As the effect of firm size on bank loan concentration may be non-linear, a dummy variable was used for medium-sized and large firms.[22]

The regression results confirm that larger and older enterprises have less concentrated loans and hence a greater number of relationship lenders (Table 4).[23] Some non-linearity of the effect of firm size on the share of the largest relationship lender was also confirmed, although its size is relatively small (about 2 percentage points). Firms in technology- and knowledge-intensive industries tend to concentrate their borrowing needs in one bank, whereas firms with lower creditworthiness as measured by the default rate in the past two years borrow from more than one bank (although this fixed-effects model does not find a significant effect). The results are consistent with findings for the German economy (Memmel et al., 2007; Stein et al., 2007).

Table 4: Regression Results for Bank Financing Model

(OLS, fixed-effects model (FE) and random-effects model (RE))

Dependent variable: Share of main relationship lender	OLS (1)	OLS (2)	FE	RE
Turnover	**-0.0000847*** **	**-0.0000892*** **		**-0.0000657*** **
	[0.00000061]	[0.00000061]		[0.0000014]
Age of firm	**-0.00254*** **	**-0.00239*** **		**-0.00218*** **
	[0.000029]	[0.000029]		[0.000059]
Dummy for technology- and knowledge-intensive industries	**0.00634*** **	**0.00700*** **		**0.0101*** **
	[0.00032]	[0.0016]		[0.00062]
Cyclicality of industry	**0.0289*** **	**-0.0388*** **	**-0.0338*** **	**-0.0124*** **
	[0.00061]	[0.0014]	[0.0011]	[0.00087]
Risk of firm (past default rate)	**-0.00840*** **	**-0.00758*** **	**0.000294**	**-0.00330*** **
	[0.00069]	[0.00069]	[0.00087]	[0.00078]
Dummy for medium-sized and large firms	**-0.0192*** **	**-0.0140*** **		**-0.0217*** **
	[0.00041]	[0.00043]		[0.00096]
Constant	**0.969*** **	**0.941*** **	**0.982*** **	**1.003*** **
	[0.00057]	[0.00067]	[0.00081]	[0.00092]
Industry dummies	**no**	**yes**	**no**	**no**
No. of observations	717346	717346	717346	717346
No. of firms	63088	63088	63088	63088
R-squared	0.08	0.09	0.01	0.01

Note: standard error in parantheses, ***p<0.01, **p<0.05, *p<0.1

[21] See CZSO, *Klasifikace zpracovatelského průmyslu podle technologické náročnosti* [Classification of manufacturing by technology intensity] and *Klasifikace odvětví služeb podle znalostní náročnosti* [Classification of services by knowledge intensity].

[22] Variables other than the given ones proved to be insignificant. Descriptive statistics of the relevant variables used in the regressions can be found in Appendix.

[23] Information on turnover is not available for all firms, so the regressions using this variable were performed only on a subsample containing roughly half the number of firms.

As regards the industry cyclicality effect, Stein et al. (2007) do not find a significant effect of this variable for German firms. The OLS results without industry dummies and the two panel estimates on the other hand differ in our case and are significant in both cases. Economic intuition would suggest that firms in procyclical industries should use multiple relationship lenders and have less concentrated loans, as indicated by the panel estimate results, because banks do not like to be the single relationship lenders of too procyclical and hence relatively risky firms. It might be that some of the firms (or industries) are responsible for this result, so we run OLS with industry dummies. In this case, the results are compatible with the panel regression results (Table 4).

6. Effect of Application of Single Relationship Lending on Banking Portfolio Risk

Does a bank's orientation towards clients applying dominant relationship lending have an effect on its portfolio risk, and is that effect positive or negative? The above analysis of the determinants of the choice of relationship lending model showed that firms with higher creditworthiness (lower default risk) tend to concentrate their loans in a single dominant relationship lender.[24] According to von Thadden (2004) this is consequence of a dynamic process where creditworthy clients stay with their main relationship lender while uncreditworthy clients switch to the model of multiple relationship lenders. Over time, the higher proportion of firms applying dominant relationship lending with such lenders should thus give rise to a lower corporate portfolio default rate. However, large firms, which are generally less risky but due to their size are often financed by syndicated loans from several banks, may have the opposite effect.

To answer this question, we performed a panel regression in which the dependent variable was the default rate in banks' corporate loan portfolio. The explanatory variables used were portfolio characteristics, macroeconomic indicators and in particular an indicator for the bank's orientation towards "single" clients as measured by the ratio of loans to clients applying dominant relationship lending to the bank's total loan portfolio (Table 5).[25]

The panel regression results reveal that an orientation towards clients applying dominant relationship lending has a positive effect on the bank's loan portfolio quality. This result can be explained by a better knowledge of such clients by the bank and more effective risk management in this segment and is largely in line with the theoretical literature (Rajan, 1992; von Thadden, 2004).

[24] Although the fixed-effects panel regression results did not support this conclusion, the alternative estimates of the effect of this variable on the number of relationship lenders confirm it.

[25] Descriptive statistics of all variables used in the regressions can be found in the Appendix.

Behr et al. (2007) discuss the benefits of specialisation versus diversification of banks. However, concentrating on relationship borrowers cannot be interpreted as a pure specialisation strategy, as relationship borrowers can come from different industries and have different characteristics. Thus, by focusing on relationship borrowers, banks can reap the benefits of diversification as well.

The panel regressions containing all the banks did not prove any dependence of their credit risk on the economic cycle as measured by GDP growth.[26] This is largely due to the inclusion of numerous small and medium-sized banks, whose share in the credit risk of the banking sector's total loans is relatively negligible. However, these banks, given their relatively small loan portfolios, different strategies and specialisations in selected segments of the economy, can show relatively sizeable changes in portfolio structure and performance that are not primarily correlated with the economic cycle.[27] If we perform this regression for large banks only, dependence on the economic cycle is confirmed.

Table 5: Panel Regression Results for Credit Risk

(fixed-effects model; all banks excluding banks with zero default rate)

Dependent variable: 12M default rate	All banks	Large banks
Share of clients applying dominant relationship banking	**-0.125*** **	**-0.105** **
	[0.038]	[0.049]
Share of small corporations in total portfolio	**0.109** **	**0.129*** **
	[0.049]	[0.045]
Share of foreign-controlled corporations in portfolio	**-0.0986** **	**0.00899**
	[0.043]	[0.049]
Share of forex loans in portfolio	**0.0987*** **	**-0.0296**
	[0.038]	[0.062]
GDP growth (y-o-y)	**0.00181**	**-0.00394*** **
	[0.0018]	[0.00099]
Constant	**0.0706** **	**0.0754** **
	[0.028]	[0.037]
No. of observations	412	100
No. of banks	17	4
R-squared	0.06	0.25

Note: standard error in parantheses, ***p<0.01, **p<0.05, *p<0.1

[26] The other macroeconomic variables were either insignificant or had a sign inconsistent with economic intuition.

[27] Some small and medium-sized banks, for example, applied an aggressive strategy to win market share, leading to growth in the credit risk of their portfolios at times when the economy was growing strongly.

An orientation towards small firms fosters a higher default rate, although this factor is reflected in higher client interest rates. Moreover, single or dominant relationship lending, where the main bank knows the company well and is better able to manage the risks, predominates in small companies. A lower default rate is fostered by greater orientation of banks towards foreign-controlled corporations and a lower proportion of FX loans. The last two factors, however, are insignificant in large banks.

7. Conclusions

This paper provided the first evidence on relationship lending in the Czech Republic using data on individual bank loans of non-financial corporations in the Czech Republic taken from the CNB's Central Credit Register. These data have not previously been used for analytical purposes, so this paper represents the first research study drawing on this original source of data.

The results of the analysis of the model of bank financing of firms in the Czech Republic revealed a high relevance of single (sole) relationship lending. This model is applied primarily by small and young firms in technology- and knowledge-intensive industries. By contrast, less creditworthy firms and firms in cyclical industries tend to borrow from more than one bank.

The data also revealed that firms applying relationship lending have a higher share of overdrafts and debit balances in their total bank debt than companies that do not apply this model. This may be linked with company size, since relationship lending is applied more by small firms, which usually have more volatile revenues are forced to use overdraft or debit facilities more often.

The analysis showed that for firms with more than one lending relationship, the most common combination is to have two large banks as main lenders. Medium-sized banks and foreign banks branches occupy more distant places in the order of financing importance. As the lending services offered to firms by all the large banks are broadly similar, this might indicate that firms opt for the "large–large" combination as a strategy for avoiding the "hold-up" problem of being "captured" by one relationship lender. The firm's bargaining position as regards lending conditions improves if its credit history is known to more than one bank.

For firms using multiple banks, it was shown that firms behave differently towards different banks in terms of the extent to which they use overdrafts or FX loans. Interestingly, as regards the firms' behaviour towards different banks in the event of repayment difficulties,

the data indicates that a half of firms with two relationship lenders tend to default with their main bank and keep up their repayments with the second bank.

The paper also analyses whether the financing model chosen has a significant effect on the credit risk of relationship lenders. It turns out that the level of credit risk at bank level decreases in line with the extent to which firms applying single relationship lending occur in the bank's portfolio. This result can be explained by a better knowledge of such clients by the bank and more effective risk management in this segment and is largely in line with the theoretical literature.

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Appendix

Table A: Descriptive Statistics of Variables Used in Regressions

Variable	Mean	Std. Dev.	Min	Max
Firm's variables				
Turnover in CZK mil	88.46	261.55	0.10	2,000.00
No of employees	51.13	264.02	0.00	12,000.00
Age of the firm in years	8.90	4.99	1.00	19.00
Cyclicality of the industry (correlation with the GDP)	0.77	0.22	-0.31	0.95
Risk of firm (past default rate)	0.09	0.26	0.00	1.00
Year of the oldest loan	2,000.10	4.99	1,990.00	2,008.00
Total debt in CZK mil	124.00	990.00	0.00	134,000.00
Share of FX loans in the fim's debt	0.05	0.21	0.00	1.00
Share of overdrafts in the firm's debt	0.50	0.48	0.00	1.00
No of financing banks	1.18	0.50	1.00	11.00
Share of main relationship lender	0.97	0.11	0.14	1.00
Bank's variables				
Bank's 12M default rate	0.02	0.05	0.00	0.41
Share of clients applying dominant relationship banking	0.61	0.25	0.05	1.00
Share of small corporations in total portfolio	0.41	0.31	0.00	1.00
Share of foreign-controlled corporations in portfolio	0.27	0.25	0.00	1.00
Share of forex loans in portfolio	0.18	0.22	0.00	0.99
Macroeconomic variables				
GDP growth (y-o-y) in the CZ	5.04	1.49	1.80	6.90
GDP growth (y-o-y) in the euro area	1.90	0.87	0.30	3.40
Exchange rate CZK/EUR	29.07	2.45	24.09	32.86
Inflation (y-o-y) in the Czech Republic	2.72	2.02	-0.35	7.35
3M Pribor	2.71	0.76	1.75	4.21
3M Euribor	3.14	1.06	2.03	5.02

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