FUNDING COSTS AND LOAN PRICING BY MULTINATIONAL BANK AFFILIATES

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Abstract

We conduct a theoretical and empirical investigation of the influence which the financial condition of a multinational bank group may have on the lending rates of its affiliates. We first propose a model of bank lending to risky clients in which the implicit opportunity costs of lending by a foreign bank affiliate are influenced by the abundance/scarcity of funds within the multinational conglomerate. The model predicts that parent banks' influence should be stronger in loan segments with more pronounced information asymmetry problems. We then formulate an empirical model of the spread charged by the affiliate to clients over the local interbank rate as a function of affiliate-level controls and a parent influence variable. This model is tested for three categories of commercial non-financial borrowers (domestically owned firms, foreign-owned firms and the self-employed) from the ten biggest banks in the Czech Republic under foreign control. Evidence of parent influence on lending spread is found in a limited number of cases of banks and borrower classes for which the constraint on fund flow within the parent bank group is likely to be tight, particularly when the borrower class is of strategic importance for the affiliate's overall performance.

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Nontechnical summary

The paper undertakes a theoretical and empirical analysis of the role which the condition of a parent bank may have on the interest rate-setting of its affiliate – a subsidiary or branch – in a foreign country. The host country under consideration in the empirical part of the study is the Czech Republic, whose banking sector is dominated by institutions under foreign control: more than 80 per cent of banking sector assets, deposits and loans are held by banks with a foreign majority shareholder or by foreign bank branches.

The latest global financial crisis has led to the collapse of several multinational banks (MNBs) in industrial countries and has negatively affected most of the surviving ones. The repercussions for financial stability have been tangible both in the countries of incorporation of MNBs and, in some cases, in the host countries of their affiliates. Subsequently, real effects in the form of disrupted credit creation have followed the purely financial ones and contributed to the transition of the financial turmoil into a global recession. Naturally, mechanisms of shock propagation through internationally active banks are now at the center of policymakers' attention. Indeed, of all the changes in financial regulation that have been introduced worldwide in reaction to the global crisis, the most radical ones have to do with the regulation of multinational banking activities.

However, the ability of MNBs to transmit credit shocks, both positive and negative, across borders is not limited to periods of financial turmoil. Excess funds within a bank group can, to an extent, be transferred between parent and affiliates. Affiliates in host countries with tight financing constraints (high money market rates, tough competition for deposits, etc.) may take recourse to funds from the parent. Conversely, affiliates with an overhang of free liquidity may receive incentives from the parent to divert funds from local lending to preferential alternatives abroad with a higher yield (including lending to the parent itself up to the standing regulatory limit). This has implications for the affiliate's loan pricing and volume, as described by the theory of internal capital markets in complex organizations. Models developed within this theory explain fund allocation between divisions in a firm, be it financial or non-financial, depending on statistics of future earnings, informational imperfections and manager incentives.

Accordingly, we are interested in the possible manifestations of MNB-internal capital market functioning in the price of host country credit as a general, not necessarily crisis-related phenomenon. We develop a model in which the lending rate charged by an MNB affiliate is an endogenous function of commonly observed characteristics of borrower performance, the degree of borrower informational opacity and, finally, funding costs. The last-mentioned may be influenced by the costliness of funds within the parent bank group. An important caveat is that the influence is only present if, given the frictions in the internal capital market, the net benefit from accessing it by the affiliate is positive. Otherwise, it would be preferable to limit funding to host country sources only. The model predicts that both the equilibrium lending rate and the potential parent influence on it will be different for different groups of borrowers differing in informational opacity.

Subsequently, we apply the empirical model obtained to foreign bank affiliates in the Czech Republic. Our sample consists of the ten largest foreign-owned commercial banks. For them, we use data on interest rates on new loans at monthly frequency for the period between January 2005 and June 2008 from the internal data base of the Czech National Bank. The data started being collected in the current structure exactly at the start of our sample period.

Besides interest rates and loan volumes, they also contain a crude sectoral classification of borrowers. Among the latter, we focus attention on non-financial legal persons, in particular domestically owned firms, foreign-owned firms and self-employed individuals. We use several control variables on the affiliate level plus a "parent bank condition" variable in order to capture the scarcity of funds in the internal capital market at the MNB group level. We then test the presence and significance of this parent effect for monthly volume-weighted averages of interest rates in each of the named borrower categories.

Our empirical findings can be summarized as follows. There is no uniform home country (of the parent bank) effect in the form of a money market rate differential influence on interest rates charged by the affiliate in the host country. That is, the intra-banking group flow of funds seems to be immune to cross-border interbank market shocks. On the contrary, the parent's stock price, at least at times when it is mirroring its current and prospective earnings correctly, contains more information on affiliate funding than both the money market rate differences and the bond yield spreads of that bank. Furthermore, parent bank effects are absent in banks with slack fund flow constraints to/from the parent. The said constraint is usually not uniformly tight across loans to all categories of borrowers, but instead comes about as a consequence of the special importance of a certain segment of clients for the affiliate (and hence for its performance inside the bank group). If these borrowers happen to be more informationally opaque than the average, loans to them are more exposed to the parent effect.

The results tell us about the possibility of host country monetary policy transmission disruptions as a consequence of the large-scale presence of foreign bank affiliates. It seems that parent bank influence does not have to be a dominating factor in interest-rate setting on aggregate, but can influence the cost of credit in those borrower categories that are of major importance for the affiliate. So, whereas monetary policy is targeted at the credit conditions for everyone, foreign-controlled banks are able to interfere with this policy in a particular class of economic agents that are strategically significant for its business. Altogether, the parent influence, although occasionally statistically significant, appears to be of subordinate importance economically, at least in the Czech banking sector in the pre-2008 crisis period.

Neither the banks whose data we analyze nor the economies in which they operate were themselves the sources of financial turmoil. Also, owing to their prevailing deposit-over-loan overhang and adherence to the traditional commercial bank business model at the same time as increasing leverage became "fashionable" around the world, many Czech banks got into the position of net creditors to their parents. Thus, the evidence from the Czech banking sector is not particularly useful for analyzing extreme crisis-related events in the banks directly involved. Rather, the Czech experience is useful for assessing the impact of evolving parent bank standing in the market on latent poorly observable components of lending rates (and volumes) in the absence of extreme events. Only then, by extrapolating the assembled experience to "extraordinary" periods, might one be able to make inferences about the impact of shocks originating in the epicenter of the financial turmoil on credit markets lying on its periphery.

1. Introduction[1]

In many small open economies around the world, foreign bank affiliates – both branches and subsidiaries – nowadays own a majority of all banking assets. This is the case, for instance, in various Latin American and Central and Eastern European countries. Foreign bank affiliates usually have access to intrabank funding from their parent banks, which can be used to complement domestic funds coming from deposits and interbank borrowing. Therefore, the high degree of foreign bank penetration in such countries means that domestic factors – in particular the central bank policy rate and average borrower risk – may not be the only determinants of the interest rates charged on loans to the private sector. Conversely, foreign bank affiliates with excess funding may use the bank holding's internal capital market to channel a part of these funds to the parent bank, which can then use them itself or reallocate them to other subsidiaries within the same bank holding with a shortage of funds.[2] The total funding costs of foreign bank affiliates will thus be a blend of domestic and foreign factors. To set the final lending rate charged to a particular borrower, a foreign bank affiliate will then charge a borrower-specific risk premium on top of this averaged cost of funding.

The financial stability aspects of foreign bank involvement in the host country financial sector have not, until recently, been systematically addressed from the regulatory or macro-prudential viewpoint. When dealing with a financial institution under foreign control, policymakers only have access to standard instruments that do not distinguish resident from non-resident owners, and have to choose them on an ad hoc basis. Nor do the usual Basel II mechanisms of banking supervision include any tools specially designed for multinational bank affiliates. At the same time, in turbulent times such as the current financial crisis, transmission of shocks from country to country through local affiliates of internationally active banks becomes a major concern. Under such circumstances, the transmission is both

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[2] This latter case of excessive affiliate liquidity happens to be heavily represented in the banking sector of the Czech Republic, the country whose foreign-owned banks we analyze in the empirical part of the paper. In particular, deposits exceeded loans on the balance sheets of 7 out of 10 banks in our sample in the period covered. Although the exact numbers are confidential, there is informal evidence that, in recent years, Czech subsidiaries have been net creditors of their parent banks. Formally, there is a regulatory limit on credit to the parent that does not differ from that to other counterparties (exposure to one single counterparty may not exceed 20 per cent of the bank capital), but it is unlikely that this limit in volume terms has ever been approached in practice. Nevertheless, the "open credit line" in the direction of the parent institution seems to be exploited continuously and plays a non-negligible role in the asset-liability management of most Czech banks under foreign control.

evident and of high relevance for financial stability. Shock propagation can work in two directions. Either the parent's condition deteriorates to the point of inability to maintain the liquidity and/or solvency of its affiliates (e.g. the near-failure and rescue of Fortis Group in the Benelux countries in September 2008), or the affiliate's asset values fall so much that the parent is overburdened with guarantee calls and balance sheet repair needs in them (the case of Scandinavian banks in the Baltic states or Austrian banks in some East European countries in the latest phase of the crisis).[3] Both cases potentially entail disruption in the provision of credit in the host country of any affiliate of the troubled multinational bank, even though the spillover magnitude cannot be reliably predicted by a simple rule. The ongoing crisis will undoubtedly inspire new research in this area. However, parent-affiliate bank interactions can play a role in the absence of outright financial turmoil as well. Also in "regular" times, understanding the relative importance of foreign factors in determining lending rates as charged by foreign bank affiliates is vital for accurately evaluating monetary policy transmission in financially integrated countries. Such an understanding would be helpful in predicting to what extent a financial shock affecting a multinational bank group or an economy in which it is present is likely be transmitted across borders irrespective of the overall state of financial stability.

For instance, solvent and well-diversified parent banks may be able to attract relatively cheap equity. As a result, they can charge their foreign affiliates less in the internal capital market of the bank group (see the research referenced in Section 2). These affiliates can then profit from this cost advantage by lowering their lending rates, and expand credit supply. Besides the financial strength of the parent bank, internal funding costs may also reflect opportunity costs from the parent bank's perspective. Parent banks may use the internal capital market to let some subsidiaries, those in countries with a better economic outlook, grow faster whereas they want to put a brake on credit growth in less profitable subsidiaries. Altogether, in an affiliate of a foreign bank, the overall funding cost may differ substantially from the costs of domestic funding in the form of, for instance, domestic deposits and the interbank money market. It should then be a matter of empirical analysis to determine the significance of the discussed "parental" cost component in the actual lending rate setting of foreign bank affiliates.

[3] It is true that neither the banks whose data we analyze in the empirical part of the present paper, nor the economy in which they operate satisfy the named conditions. Therefore, evidence from the Czech banking sector is not particularly useful for analyzing extreme crisis-related phenomena in the banks directly involved. Rather, the Czech experience is useful for assessing the impact of events in the epicenter of the financial turmoil on markets lying on its periphery.

With this motivation in mind, we develop a theoretical model of the relationship between a foreign bank affiliate, with access to intrabank funding from its parent bank, and a risky client. The equilibrium lending volume and lending rate are determined by the opportunity cost of the affiliate's funding, which, in turn, depends on the financial condition of the parent bank. We then propose a number of empirical priors that follow from this model.

The lending rate charged to a specific borrower can be divided into two components: the bank's cost of funding and a credit spread on top of this. The spread will reflect the risk profile of the borrower as well as the level of competitiveness of the banking system. We expand the traditional view focused on borrower characteristics by including more lender characteristics as a determinant of lending rates. This adjusted focus is relevant since in practice one can observe situations in which different lender types charge different lending rates to similar customers.[4] In principle, lender characteristics can influence loan pricing through the cost of funding and, more generally, a number of related parameters on the liability side. Larger banks may, for instance, have access to cheaper deposit funding and thus be able to pass some of that cost advantage on to their customers. In addition, different banks may have different policies with regard to the credit spreads they charge depending on their growth strategy and risk appetite.

Most importantly, investigating the specific group of bank characteristics related to foreign ownership, we conjecture that, notwithstanding competition between banks for borrowers, funding costs create a first-order effect in the negotiated lending rate. In particular, we expect that there are situations in which foreign bank affiliates optimally adjust their rate-setting policy depending on the incentives provided by their parent bank.

Subsequently, we apply the empirical model obtained to foreign bank affiliates in the Czech Republic. We collect data on interest rates on new loans in ten commercial banks, all of them under foreign control, at monthly frequency, for the period between January 2005 and June

[4] The difference is not so much in the magnitude as in the dynamics observed against the background of the domestic credit cycle. As anecdotal evidence, in a number of bank loan datasets available to regulators, one can discern different reactions to an external shock such as the U.S. subprime mortgage crisis. After the outbreak of the crisis, smaller affiliates of liquidity-squeezed parents seemed to shift their rates upward collectively, whereas larger affiliates with a sufficient deposit base kept tracking – although not one-to-one – the host country's monetary policy changes. An even better picture of the same phenomenon is given by mortgage loans, with specialized institutions (which act on a more or less standalone basis regardless of the controlling shareholder) having since July 2007 had a distinctly different time pattern of rate-setting compared to those universal banks which stood under close foreign control.

2008. The data at our disposal started being collected in the current structure exactly at the start of our sample period. Besides interest rates and loan volumes, they also contain a rough sectoral classification of borrowers. Of those, we focus our attention on non-financial legal persons only, and additionally isolate domestically owned firms, foreign-owned firms and self-employed individuals. After constructing several control variables on the affiliate level, we complete the empirical model with a "parent bank condition" variable in order to capture scarcity of funds in the internal capital market of the multinational bank group as a whole. We then test the presence and significance of this parent effect for monthly volume-weighted averages of interest rates in each of the named borrower categories.

The degree of detail of our affiliate-level information is substantially higher than that of the information on parent banks (essentially, the only reliable monthly data on their operation and condition present in the public domain is that extractable from market prices of their traded liabilities). Therefore, the empirical exercise we undertake is necessarily crude and cannot guarantee the detection of all subtleties of internal capital market workings in a multinational bank group. Nevertheless, it is possible to set up criteria for both the cases in which the parent effect is unlikely to be important and the cases in which it becomes prominent enough even to surface through all the noise present in our data.

Accordingly, our empirical findings can be summarized as follows. Parent bank effects are absent in banks with slack fund flow constraints to/from the parent. The said constraint is usually not uniformly tight across loans to all categories of borrowers, but instead comes about as a consequence of the strategic importance of a certain segment of clients for the affiliate (and hence for its performance inside the bank group). Banks that concentrate on informationally more opaque borrowers, be they domestic or foreign residents, are more exposed to the parent effect. Finally, there is no uniform home country (of the parent bank) effect in the form of a money market rate differential influence on interest rates charged by the affiliate in the host country. That is, the intra-banking group flow of funds seems to be effectively disconnected from short-term interbank market influences. Apparently, cross-financing between entities in different countries of operation is subject to detailed earmarking and other bank-internal constraints that do not allow for easy interaction with short-term liquidity management. Symptomatically, the parent's stock price, at least at times when it is mirroring its current and prospective earnings correctly, contains more information on affiliate funding than both the money market rate differences and the bond yield spreads of that bank.

The remainder of this paper is structured as follows. In Section 2, we review the related literature, after which Section 3 sets out the theoretical model. Section 4 then describes the results of our empirical analysis of the parent bank effect. Section 5 concludes.

2. Literature review

Our paper is related to two main strands of the financial intermediation literature. The first one is the theory and empirics of banks' lending rates. For most developed countries, there is considerable formal and informal evidence of sizeable cross-sectional variation of lending rates across banks (see e.g. Berlin and Mester, 1999, for the U.S., or Gambacorta, 2008, for Italy). Initially, the most popular explanation of this variance made use of client heterogeneity. Indeed, the traditional subject of credit risk theory is explaining banks' lending rates by focusing on the relationship between the credit quality of the borrower and the interest rate spread. A comprehensive overview is provided by Duffie and Singleton (2003). Compared to that, papers dealing with bank-specific determinants of lending rates are less numerous (see e.g. Green, 1998, Kishan and Opiela, 2000, Gambacorta and Mistrulli, 2004). Aspects of rate-setting related to interbank competition are empirically studied in Corvoisier and Gropp (2002).

The second research area to which our paper may be relevant is the study of bank-internal capital markets and their role in lending decisions. There are few theoretical explorations of the loan pricing of vertically integrated banks. Industrial organization theory has dealt with the effects of vertical integration on product pricing – see, for example, Grossman and Hart (1986) or Helfat and Teece (1987). Studies of the vertical integration phenomenon in the financial intermediation literature have looked mostly at its causes and relation with market structure (Berlin and Mester, 1998), but not at its consequences for interest rate-setting. A lot of attention has been given to the impact of refinancing conditions in the context of monetary policy transmission through the banking sector (Bernanke and Gertler, 1995). This literature has primarily analyzed the effect on the volume of bank lending, not so much that on the interest rates charged. A related influential theoretical contribution is Froot and Stein (1998), which draws a general picture of an internal capital market within a bank holding consisting of various divisions. This theory was developed in a number of papers by both Stein himself and others (see e.g. Gertner, Scharfstein, and Stein, 1994, Stein, 1997, Scharfstein and Stein, 2000, and Scharfstein, 1998). More recently, Inderst and Müller (2003) and Inderst and Faure-Grimaud (2005) added a contract-theoretical extension of the same approach to the conglomerate capital structure. To our knowledge, none of the variants of the Froot and Stein model have ever been sufficiently detailed to provide a lending rate-setting rule for a bank division dependent on headquarter preferences. The present paper is intended to bridge this gap.

Our approach to modeling loan pricing by a bank has a number of qualitative similarities with an early model of Stiglitz and Weiss (1981). In particular, banks take into account the consequences of interest charged on the firm's ability to repay. Also, in both their and our model adverse selection and moral hazard effects are present. Nevertheless, we manage to avoid a number of ambiguities present in the original Stiglitz and Weiss (1981) construction: there is a variable endogenously determined loan volume, there are no artificial restrictions on the investment project risk structure, markets clear at all times, and the optimal lending rate is obtained as either an internal or a corner solution depending on the bank's costs.[5] Going further, in our model we allow a foreign bank affiliate's costs of internal funding to reflect the cost of capital of the parent bank, which will itself depend on the financial characteristics of the latter.

A number of empirical studies find that the presence of foreign banks may limit the effectiveness of monetary policy because affiliated banks have fewer problems in attracting non-reservable funds as they can rely on access to an internal capital market and thus can close any funding gaps they may experience relatively easily (Ashcraft and Campello, 2002; Ehrmann and Worms, 2001). This literature forms part of a wider literature on internal capital markets, with seminal contributions by Gertner et al. (1994) and Stein (1997). Empirical evidence on internal capital markets within banking groups is only available for the United States. Houston et al. (1997) show for bank holding companies that the credit growth of a subsidiary is negatively correlated with the loan growth in other U.S. subsidiaries of that holding. Dahl et al. (2002), again only for U.S. bank holding companies, show that such

[5] The omission of a number of formal conditions that would guarantee an internal equilibrium solution was one of the weak points of the original Stiglitz and Weiss (1981) approach, subject to a critique by Arnold and Riley (2009). This may have set limits on its technical – if not conceptual – impact on the subsequent theoretical literature on bank lending. Our model is free of this weakness. Moreover, both an interior bank-optimal interest rate and a corner (i.e. maximal feasible) rate are legitimate possibilities depending on the parameters of the model.

correlated credit growth patterns are due to net equity financing flows between the parent bank and its various subsidiaries. Ashcraft (2008) demonstrates that banks that are affiliated with a multi-bank holding company are less likely to experience financial distress. Affiliated banks are also able to recover more quickly in case of such distress because of capital injections by the parent company. Finally, De Haas and Van Lelyveld (2010) and Derviz and Podpiera (2007) find that lending by subsidiaries of foreign banks is sensitive to home-country economic growth as well as to the financial health of the parent bank and of other subsidiaries in the same banking group. Again, all of these papers focus on the effects of lender characteristics on the amount of lending rather than the interest rates charged to borrowers. This paper differs in that we have an explicit focus on the effect of lender characteristics, in particular foreign ownership, on the pricing of their loans.

3. A general bank-client lending model

In this section we sketch a bank-client model of a financial institution that operates in an oligopolistic banking sector.[6] The model contains the usual informational asymmetry-related inefficiencies in bank lending known from the financial intermediation theory, such as deviations from first-best interest rates and credit volume induced by moral hazard and adverse selection. We will derive some consequences of these frictions that are likely to be important in our context of foreign-controlled bank operation. This theoretical analysis will enable us to suggest a list of relevant explanatory variables for loan prices set by a given lender at a point in time. A more detailed formal treatment of the model is given in the Appendix.

3.1 Definitions

An affiliate of a multinational bank, like any other bank, is faced with a trade-off. It can set a high offered lending rate, which means high revenue from solvent borrowers, but also a higher probability of default due to moral hazard. It can also set a lower rate, which will reduce the default probability but at the same time reduce interest income on non-defaulting loans. Given this trade-off, the foreign bank affiliate chooses an optimal lending rate that maximizes its profitability over time. Importantly, this optimal rate will depend on the

[6] The fact that, generically, the bank-client relationship is not fully competitive on either part was recognized by the literature a long time ago. Santomero (1984) is an example of this early consensus. A more recent view of the same phenomenon is linked to the concept of client "catch-up" in a specific bank, see e.g. Bonaccorsi di Patti and Dell'Ariccia (2004) or Dell'Ariccia and Marquez (2004).

affiliate's cost of funds, which in turn are a function of parent bank characteristics. In particular, we expect that – in line with the literature on internal capital markets cited in Section 2 – the foreign bank affiliate's funding costs are partly determined by the parent bank's financial strength and alternative investment opportunities.

Let there be two agents, a foreign bank affiliate (the "bank") and a firm (the "borrower"), and two periods. In the first period, the agents play a leader-follower game in which the bank moves first by announcing the lending rate and the borrower then decides on the loan volume it demands at this rate.[7] The borrowed funds are invested in a project that produces revenues in the second period. If the borrower earns less than it owes to the bank in period 2, it will go bankrupt and all revenues will go to the bank. The revenue is uncertain and the knowledge the borrower and the bank have ex ante about its probabilistic properties is asymmetric.[8]

The bank sets its lending rate r based on the anticipated investment decision of the firm, but without knowing either the borrower-specific productivity component or its weight in the compound productivity value (borrower type). Expectations must thus be taken over realizations of these two variables. The bank faces cost of funds i per unit of lending. These can be actual costs or opportunity costs. We next discuss this cost formation mechanism in a foreign bank affiliate and after that the optimal lending rate setting for a given level of i.

3.2 Funding costs

Let us assume that the amount of credit extended by the affiliate is equal to C and earns gross revenue $C+R(C)$. The amount C needs to be funded and this funding, in a purely domestic bank, would come from capital, K, and the totality of borrowed domestic sources, H, normally comprising deposits and the domestic money market. In a foreign bank affiliate, the picture becomes more complex. Funds coming from the controlling shareholder (parent bank) are not just capital in either the accounting or regulatory sense. For one thing, if the affiliate is a branch rather than a subsidiary, capital does not exist and one can only talk about the budget allocated to that division by the headquarters. For another, even if the affiliate is a separate

[7] This arrangement dates back to Stiglitz and Weiss (1981), although the leader-follower aspect of the game is not explicitly mentioned there. We believe it to be preferable to a simultaneous move set-up, on the grounds of both analytic transparency (a simultaneous-move game between the same parties would but rarely allow for a pure-strategy equilibrium) and realism: borrowed volumes are seldom firmly fixed in advance; a major part of loans is granted in the form of credit lines on which borrowers draw depending on current need.

[8] In practice, the various degrees of asymmetric information correspond to different types of bank-client relationships, ranging from arm's length banking to relationship banking.

legal entity (subsidiary), its relationship with the parent is rarely limited to the provision of mandatory capital (e.g. subsidiaries are often overcapitalized). But, most importantly, parent banks often engage in maintaining a variable debt position w.r.t. the affiliate by either lending to, or borrowing from it, depending on the liquidity available on either side. So, instead of capital funding in which K is a small percentage of C as per the regulatory requirements, one faces a net position S of the affiliate vis-à-vis the parent that can be both positive and negative. Accordingly, and omitting the posts which are irrelevant to the present analysis, the balance sheet identity of the affiliate can be written as $C=H+S$ as opposed to $C=H+K$ for domestic banks. The exact split of the funding between the two available sources depends on their prices.

Clearly, if the affiliate can acquire cheap liquidity from the parent, the effective cost of funds faced by it sinks below the domestic level (as determined by the price of H). On the contrary, even if the domestic cost of funds is low but the parent bank's demand for liquidity makes it offer a high price in the *internal capital market* of the holding company, funds intended for domestic lending become relatively expensive due to a high *opportunity cost*. In what follows, we offer a simple formal model of funding cost determination based on the above trivial considerations.[9]

Let us assume that the average interest rate on domestic funds (deposits and money market loans) is a function p of the volume. Specifically, let the domestic market for liquidity be characterized by the supply function

$$p(H) = i^h + q\left(\frac{H}{H_0}\right)$$

with $q \geq 0$, $q(h)>0$ (<0) for $h>1$ ($h<1$), $q'(h)>0$ for $h \neq 1$, $q(1)= q'(1)=0$. In the above formula, i^h is the "base" interest rate applicable to standard funding amount H_0 (i.e. the rate that the affiliate would face if it were cut off from the parent and only used domestic financing), whereas a positive increasing function q represents a mark-up for volumes above H_0 or a discount for volumes below H_0. The condition $q'(1)=0$ ensures that interest p remains close to i^H for values of H close to the base level.

[9] We are fully aware that there are many ways to model internal capital markets in a bank holding, as the corresponding literature testifies (see the references in Section 2). For example, Froot and Stein (1998) derive fund allocation between bank divisions driven almost entirely by risk-sharing considerations. We take a more crude approach with many drastic simplifications, avoiding, i.a., the question of fair bank-internal pricing of funding opportunities under uncertainty as such. Instead, we focus on the qualitative link between the mean relative costliness of the foreign funding channel and the sign of the parent-affiliate position S.

The funds coming from (or going to) the parent bank are assumed to have an implicit internal capital market price i^s, set by the parent bank. For simplicity, we consider a flat rate i^s independent of *S*, although one can easily generalize to cases with an elastic supply schedule for *S* without changing the nature of the results.

Next, we assume that, when deciding about the balance sheet structure (the optimal split between *H* and *S*), the affiliate manager takes the lending volumes determined between the affiliate and its clients as given. That is, neither *C* nor its decomposition into individual loan volumes discussed earlier enter into the top manager's model for *p* and i^s.[10] In such a case, the affiliate manager's task is simply to minimize the funding costs $p(H)H+i^sS$ with respect to *H* and *S* subject to the balance sheet identity $C=H+S$. Then, under our assumptions on the host country's supply of lendable funds, this program has a single internal solution $\hat{S}$ characterized by the first-order condition

$$p'(C-\hat{S})\cdot(C-\hat{S})+p(C-\hat{S})-i^s=0. \quad (1)$$

Depending on the values of i^h and i^s and the elasticity properties of the domestic liquidity supply mark-up function *q*, this condition yields the optimal position $\hat{S}$, which can be both positive (parent lends to affiliate) and negative (affiliate lends to parent). To obtain some intuition about which case obtains when, let us normalize the problem in the following way. Given that *C* is exogenous to the affiliate top management, one can put $H_0=C$ (i.e. when the affiliate maintains no credit relationship with the parent, its base funding demand is exactly equal to the credit extended). Then, the optimal choice of no cross-border fund flow $\hat{S}=0$ will be made exactly when $i^s=i^h$. When i^s is higher, the affiliate will be lending to the parent, and when it is lower it will be borrowing from it.

In the generic case of non-zero $\hat{S}$, the first-order optimality condition (1) implies that the overall funding costs (in view of earlier definitions, we denote them *iC*) are equal to

$$iC=i^sC-q'\left(\frac{H}{C}\right)\frac{H^2}{C}.$$

[10] This can be justified, for example, by referring to lower-level loan officers negotiating with individual clients conditioned on the fund cost value but otherwise being unconstrained. The top manager takes those unconditional decisions into account when deciding about *H* and *S* and setting the fund costs for the low management. This simplified set-up is sufficient for the argument we pursue here but could be easily relaxed if one wanted to address, for example, strategic interactions between management levels within the bank.

In other words, the optimally chosen cost of funds for the affiliate is

$$i = i^s - q'\left(\frac{H}{C}\right)\left(\frac{H}{C}\right)^2 .$$

For well-behaved marginal mark-ups q' (i.e. those that stay close to zero for realistic *H*/*C* ratios) one obtains funding costs that are mainly driven by the "outside option" i^s, at the same time lying somewhat below it thanks to the existence of domestic financing (since $q' \geq 0$). This happens regardless of i^s being above or below the domestic funding cost level i^h. So, we conclude that, in a foreign bank affiliate as opposed to a domestically-controlled bank, one may see a *disconnect* of the internal funding costs from the monetary conditions in the host country. In view of the lending rate determination model with which we proceed in the next subsection, this disconnect should have implications for loan pricing by foreign bank affiliates, a conjecture that can be cast in an empirically testable form.

Before discussing the lending rate dependence of the funding costs, one must take care of another empirically relevant case, namely the one in which the optimal balance sheet is not given by the first-order condition (1). In other words, there is no internal solution for the affiliate manager problem of optimally mixing host and parent funds. This happens if the price i^s of the outside option is sufficiently low, so that (1) has no solution inside the interval of feasible domestic budgets *H*. Informally, the situation is that of a foreign position *S* (either positive or negative) being redundant since domestic financing sources cover the whole loan demand. Taking recourse to parent funds would be too expensive in view of the transaction costs expressed by the non-linearity in *q*. This situation can be formally expressed in an alternative way as a slack parent funding constraint of the affiliate. A priori, such natural autarchy cannot be ruled out, and it is also fairly relevant empirically, as will be shown in Section 4.

3.3 Lending rate determination

Given the cost of funds *i*, the bank will optimize its expected profit with respect to the lending rate *r*. Due to the possibility of default, the expected profit depends on both *r*, the information structure and borrower liability clauses. For non-empty ranges of *i* and the other parameters of the model, there exists an internal solution *r** for which the first-order condition

$$i = r^* + K(\lambda, \theta_A, \theta_T, r^*) = M(\lambda, \theta_A, \theta_T, r^*) \quad (2)$$

is satisfied. The meaning of the parameters in (2) is as follows. Parameter λ stands for the limits to the liability of the borrower expressed as his default costs. They range from zero under limited liability to 100 per cent of the unpaid portion of the loan under unlimited liability. θ_A are the parameters of the borrower productivity distribution and θ_T the parameters of the borrower information type distribution. Recall that type stands for the split between the joint lender-borrower uncertainty and the component privately observed by the borrower but not the bank, of the productivity variable. The exact formulae for K and the roles of liability limits and information asymmetry in them in important special cases with regard to λ and T are given in the Appendix.

It turns out that, with growing i, the space of model parameters for which a solution to (2) exists shrinks, and it becomes more likely that the global optimal value of r is formally equal to $+\infty$. The latter case of a non-existent internal solution obtains if the cost of funds is so high that the expected bank revenue always increases with the lending rate. Naturally, there must be mechanisms outside the present model that put a check on unlimited lending rate increases, such as competition in the loan market. So, the fact that for certain i-values equation (2) does not have a solution simply means that, in such circumstances, the approximation of reality used by the model does not generate an explicit upper bound on lending rates.[11] The prediction of the model is then read simply as lending rates becoming "high" in an unspecified fashion. One could call them *selective lending rates*, as opposed to the *accommodative rate* corresponding to the internal solution. The reason is that by setting a high r, the bank consciously selects only highly productive clients as borrowers, and also counts on high default rates among them. Under the accommodative rate, only a small number of defaults are expected. In the Appendix, we argue that selective lending rates are more likely under limited borrower liability and significant bank-borrower information asymmetry. A balanced mixture of borrower information types is able to eliminate the selective rate outcome or at least limit its occurrence to situations with an exceptionally high cost of funds. Nevertheless, if selective rate-setting becomes prominent in a bank's decision-making, the accommodative and selective rate-setting rules may follow different statistical models.

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[11] This outcome is analogous to the corner interest rate solution, which, according to the Arnold and Riley (2005) critique of Stiglitz and Weiss (1981), is the sole possible outcome when the formal attributes of the latter model are taken literally. Our setting is immune to this critique since the equilibrium breaks down only under extreme parameter values and, unlike in Stiglitz and Weiss (1981), is not a consequence of the chosen generic risk factor distributions.

Ideally, one should be able to separate the accommodative lending rates coming out of the internal optimum as per (2) from the selective ones and only use the former in any empirical application.[12]

More generally, numerical solutions of the model indicate that, for a given funding cost and average borrower performance, the optimal lending rates should grow with the degree of bank-borrower information asymmetry as well as the borrower sensitivity to downside risk (on the scale from unlimited to limited liability).

What is even more important for the present study is that our model predicts the named two factors to be in a positive relationship with the lending rate *sensitivity to funding cost changes*. That is, the lowest dependence on funding costs is expected for the interest rate paid by a hypothetical completely transparent borrower carrying the full consequences of a possible default, whereas the highest dependence is expected for the rate paid by a completely opaque borrower not liable at default. Why is this the case? To get an intuitive answer, observe that the case of complete borrower transparency (common uncertainty) and full liability at default corresponds to a market in which the value of the loan is priced fairly based on all relevant information. Naturally, this information should include the cost of lending for the bank, which is being adequately passed through into the rate paid for the loan. As soon as the situation begins to deviate from the "efficient market" baseline, either toward a privately observed component of technology or reduced liability at default, the fair loan pricing also breaks down. One of the consequences is an overshooting in the funding cost pass-through to the lending rate. In a special subsection of the Appendix, we illustrate this phenomenon with the help of a toy model. The latter is obtained by stripping the general setup of most of its general quantitative attributes and leaving just two extreme cases (full informational symmetry against full opacity) under the simplest possible form of uncertainty. A similar formal exercise could be put forward to visualize the role of limited liability.

In the toy model considered, the all-private information case generates an excess funding cost pass-through into the lending rate compared to the symmetric uncertainty case – an overshooting – around the critical value of the funding cost. This happens because under private information, the borrower self-selective reaction to the cost rise is more abrupt: the

[12] Sometimes, the task looks accomplishable since the available cross-section of rates exhibits a clear upper cluster that can be identified with the cases when a selective rate is being charged. When the corresponding histogram is more even, more elaborate techniques of vetting the upper end of the histogram might be needed.

whole low-productivity segment of borrowers gives up investment. The bank, anticipating this, concentrates on extracting maximum rents from the remaining high-productivity segment only. Therefore, the lending rate rises more than under symmetric uncertainty, when some rents from low-productivity borrowers are also possible ex ante. The same effect, although sufficiently smoothed out by continuous distribution of risks and borrower information types, can be detected in the general model as well, as witnessed by the numerical comparative statics results reported in the Appendix. When the bank in question belongs to a multinational group, one can expect that the parent component of the funding costs is also passed through with amplification when opaque borrowers are concerned.

The key empirical implication of the theory discussed in this section is that the cost of funds in a multinational bank (MNB) affiliate is a mixture of affiliate-level, borrower-level and parent influences that, in an optimizing bank, lead to pass-through of the MNB-internal capital market price into affiliate lending rates. In the next section, we set up an empirical model to measure the presence of the pass-through and its strength. Indeed, as the theory suggests, the influence of the parent bank within a given affiliate is heterogeneous across borrower categories. Based on the theory, we expect the funding cost sensitivity of the lending rate to grow with bank-borrower information asymmetry and decline with the borrower's growing downside risk at default. Neither characteristic is easily observable. Nevertheless, one can try to proxy them along more readily available dimensions such as size and ownership, by assuming that small locally owned firms are more opaque than large foreign-owned ones. The former should also represent a more traditional case of limited liability at default. Accordingly, one expects to find a stronger parent bank impact with local as opposed to foreign-owned companies. However, the same theoretical argument (see Subsection 3.2) points at the special circumstances under which the parent effect can be visible: a funding constraint in the affiliate. Indeed, if the constraint is slack (there are more funds the affiliate can access in the host country than it wishes to lend and the parent is not seriously fund-constrained either), funding costs in the internal capital market of the banking group no longer play a role, and the affiliate decides based on local factors alone. The situation does not have to pertain to all borrower classes, only to those that have a less-than-strategic role in the loan portfolio. In the empirical section that follows, we identify a number of such banks and make a connection between the relative importance of their loans in a particular category and the lack of parent influence on their price.

4. Estimation
4.1 Data

The time span of the observations is 2005:01 through 2008:06. The initial date coincides with the beginning of availability of the used data structure in bank reports and the final date marks the end of the period prior to the acceleration of the global financial crisis. The group of banks selected for the study is made up of the ten biggest institutions – either banks with foreign controlling shareholders (subsidiaries, seven institutions) or foreign bank branches (three institutions) – operating in the Czech retail commercial banking market. If one leaves out specialized institutions (such as building societies) and special purpose government-run banks, then this group of banks under foreign control essentially comprises all non-negligible participants in the Czech commercial banking market. They currently own more than 85 per cent of all banking assets in the Czech Republic, and their shares in deposits and loans also exceed 80 per cent of the sector aggregates. In one of these ten cases, two banks' data were aggregated to reflect a merger of the corresponding parent banks. The *de facto* merger took place in 2005 even though the two institutions did not start operating in the Czech Republic under a common name until late in 2007. Another foreign-owned institution took over a smaller locally owned one in the course of 2006 and 2007, which had to be reflected in the construction of the consolidated data.

The paper uses data from the internal CNB database of the volumes of, and interest rates on, individual newly granted loans to non-financial businesses, from which we construct several bank-level aggregate measures to be used in the estimation. The raw data on loans are available at monthly frequency, and their current structure in the reports collected by the CNB exists since January 2005. The overwhelming majority of these loans (91 per cent) are in Czech koruna (CZK), while over 6 per cent are in euro and the rest are in other currencies, mostly USD. In this study, we only consider loans in CZK, as the most representative segment. Using these loan-level data, we construct volume-weighted lending rates for three broad categories of borrowers as identified in the CNB database: domestically owned firms, foreign-owned firms and self-employed entrepreneurs. We also construct an aggregate lending rate series by pooling the three named and the remaining legal person borrower categories. Thus, we have four borrower classes altogether: all, domestic firms, foreign firms and the self-employed.

Not all the banks in our set lent to all three named borrower classes during every month covered by the sample. Therefore, only the aggregate (volume-weighted) lending rate series exist for all ten banks; rates charged to domestically owned and foreign-owned companies exist for all months in the sample for nine banks each (although these two lender sets are not identical) and loans to the self-employed exist for only six banks. This circumstance determines the cross-section size of the four pools considered.

As the dependent variable in all the regressions we used the lending spread, defined as the difference between the said volume-weighted monthly average of rates charged (for the given borrower class) and the average Prague Interbank Offer Rates with 12 month maturity (1Y PRIBOR) for the same month. The spread with respect to the 1Y interbank rate was chosen in accordance with the standing rate-setting convention: both the prime rate of the bank and the rates negotiated with loan applicants use this quoting rule. Most often, it is applied not just to floating rate loans (which dominate the sample anyway), but to fixed rate contracts as well.

The controls used to co-explain interest rate variation on the affiliate level are the writedown percentage of the loan portfolio value (due to loan defaults or reclassification), the deposit growth rate and the interest margin, all at monthly frequency. The last two indicators were constructed using 12-month moving averages, so that they also contain information on up to 11-month-lagged values by construction. This averaging was conducted not only out of the purely technical need to smooth excessively volatile monthly series, but also because it seemed unlikely to us that the lending policy-relevant information contained in these two variables would be spread around the bank completely within one month's time. Rather, we expect it to be absorbed gradually by those who decide about new loan pricing. Essentially, the writedown figures are also lagged (by one month) by construction: as a consequence of the formal non-standard loan definition, writedowns reported in a given month refer to losses actually booked one month earlier.

Controlling for the local, affiliate-level drivers of lending rates is necessary to capture the role of the parent bank channel of loan fund provision (or crowding out) accurately. Therefore, we had to choose variables that characterize parent bank factors in affiliate funding costs. One of the obvious factors to try is the home-host interest rate differential, standing for the relative cost of funding in the parent bank domicile in general. Another is the parent bank credit spread obtained from bond yields (or CDS rates). Finally, one ought to look for information contained in other data on parent liabilities, of which the most natural and universally available across the set of banks and time span analyzed is the common stock price. Essentially, there are no other publicly accessible quantitative data at monthly frequency than equity price ones that would get closer to proxying the scarcity of funds in the internal capital market of a banking group. So, one has to use them no matter how many distortions they might contain.

To be precise, the explanatory variable we use is the parent bank stock performance *relative* to the equity index for the sector of financials.[13] This is applied in inverse form: the financials stock index is divided by the stock index of the bank (both normalized to unity on the first month of the sample), so that values above one mean under-performance and those below one mean over-performance compared to the peers in the sector. This choice results in a stationary time series for every bank and is meant to capture the relative ease of access by the banking group to interbank market funds in the home country, while eliminating from consideration equity market movements common to all institutions in the sector.

Descriptive statistics of the lending rates discussed are featured in Table 1, panel (a), and those of the lending spreads are shown in panel (b). In the latter case, we also provide the standard inputs into the Jarque-Bera statistic. Only aggregate spreads are featured in that table (all borrowers together), since they alone exist for all ten banks. Clearly, even in the short sample we are restricted to, the deviations from normality are quite mild. The skewness and kurtosis values in the individual borrower classes (not shown) do not differ dramatically from the aggregates.

The equity performance index described above proved to be the only feasible explanatory variable for the lending spread on the parent bank side. Specifically, according to our findings, the credit spreads for individual banks do not systematically differ from the sector-wide aggregates for the same spread against government bond benchmarks. Apparently, traders in the bonds of most big and medium-sized banks do not have access to bank-specific information that would make their prices of different institutions' issues systematically different, except for random fluctuations. In other words, this market (not unlike the forex market) appears to be a severe case of herding behavior. So, with the beginning of the subprime mortgage troubles in summer 2007, all credit spreads in the financials segment embarked upon an upward path collectively, making statistical separation of individual institutions from the sector credit spread index problematic. Accordingly, we had to give up on using credit spreads as a reliable bank-specific variable.

[13] Stock price data are from DataStream.

As regards the home-host interbank market rate differential, this variable appears to be universally insignificant for affiliate lending spreads (even in cases where the parent effect captured by the equity index is significant – see below). Therefore, although it was included in the original specification, we later removed the interest rate differential from the regressor list, so that quantitative results on this variable are not reported in the sequel. We discuss possible reasons for this outcome at the end of the next subsection.

4.2 Hypotheses and estimation approach

As was mentioned in Subsection 3.2 (the model of funding costs), one should look at the parent bank's influence on loan pricing in the affiliate as a kind of "recessive gene" that only gains visibility if other stronger influences are absent. Indeed, in the simple model of that subsection, the price of funds set in the internal capital market of the bank group influences the cost of funds in the affiliate only when the constraint on domestic funds is binding and their price is sufficiently high. As one may reasonably conjecture, for many Czech banks – or at least for a number of their important lines of business – this constraint was pretty far from binding in the period covered by our sample. This should hold for banks with a sufficiently wide deposit base in the absence of major expansions into new market segments, mergers or restructuring events.

In order to recognize an unconstrained affiliate in the above sense, one can try the following measure. Along with the volume-weighted lending rate, we construct a similarly defined volume-weighted deposit rate and calculate the resulting loan-deposit spread time series (same monthly frequency, deposit rate values lagged by one period). A bank for which this loan-deposit spread is close enough to white noise can be viewed as an enterprise with no particular need for additional funding: objectively, it operates with a stable average profit target set by loan officers based on the latest recorded costs of funds in deposit form (which, in those cases, is the only form relevant to the affiliate).[14] We established that a number of affiliates in our sample pass this criterion. For them, one should not expect the parent effect to be prominent in the lending spread decomposition.

We quantified the said loan-deposit rate spread criterion by means of the estimated coefficient in the regression of this spread on the time variable, i.e. the loan-deposit spread slope value.

[14] Note that, as mentioned earlier, in this interpretation, although loan officers *quote* lending rates to loan applicants as spreads w.r.t. the money market rate (1Y PRIBOR), what they are actually guided by is the spread w.r.t. the average deposit rate. This must be true for unconstrained banks since they do not have to borrow in the interbank market (or interact with the internal capital market of the parent bank group).

Unconstrained banks should be those whose absolute slope value is sufficiently close to zero. In the last column of Table 4, exact numbers are given. As one can observe, there is a clear separation of absolute slope values above and below, say, the 0.02 level (the actual separating interval has a width of 0.008). So, the banks with low time trends in the loan-deposit spread (shown in italics in Table 4) are the ones for which no parent effect should be expected. As the results discussed in the next subsection demonstrate, this criterion works for all but one bank.[15]

When the lending rate cannot be satisfactorily explained as a constant mark-up over the past deposit rate, we invoke affiliate-level controls and external influences, including our proxy for the cost of funds on the bank group level. To have a better chance of capturing the parent bank influence correctly, one would first need a sufficiently powerful set of local explanatory variables of the lending spread. Here, the choice, in spite of the abundance of data in the supervisory database, is relatively limited, since there are many strong correlations between indicators taken from balance sheets. We selected the three mentioned in the previous subsection (interest margin, loan value write-down ratio and deposit growth) since they represent the three main influences on the lending rate setting to be expected within a bank (as illustrated by the theory of Section 3 and the Appendix): prospective borrower performance hence earnings and debt service potential, default risk, and increase/decrease in available internal funds.

As will become clear from the estimation results in the next subsection, none of the three bank-level controls works equally well for all affiliates. In particular, the explanatory power of the interest margin and write-downs varies considerably between banks, and deposit growth is not of any importance except in a couple of cases. We do not pursue this quest for a satisfactory "bank-internal" statistical model of the lending spread any further, since the relevant internal decision process inside a bank, let alone the operation of the internal capital market within a multinational bank, is unobservable and no set of officially reported indicators, be it the observed market price data or the "semi-observable", i.e. supervisory, data, will be ever able to quantify it in accordance with any theoretical model. Attempts at a more accurate model would go against the practically attainable degree of external visibility of the bank decision process. For our purposes, it is sufficient that the three selected affiliate-

[15] And even for that particular bank, the slope is significantly different from zero if one takes the lending rate in the foreign firms category for which the parent effect shows up. Although one would expect the aggregate lending rate value to be primarily relevant (the same loan officer usually deals with applicants from more than one borrower class), it could be a wrong assumption if the bank is big and division competences within it are narrowly specialized.

level variables in conjunction with a parent variable show some degree of explanatory power and point in the right direction.

To conduct our empirical analysis, we form four pooled objects (one for each of the borrower classes and one aggregate one). We aimed at working with stationary variables, and accordingly, the spread-type series, growth rates and financial ratios that we use are typically stationary unless measured within short time windows of transitory developments in the market. In conformity with this objective, the dependent variable (lending spread) as well as the four mentioned explanatory variables (the three affiliate-level ones and the relative parent equity index) are stationary at the pool level along the temporal dimension: both the Levin-Lin-Chu test (the common unit root hypothesis) and the Im-Pesaran-Shin test (the individual unit roots hypothesis) strongly reject non-stationarity for all four pools. As regards the same variables for individual banks (which we also used in parallel in independent regressions of bank-level lending spread models with insignificant regressors removed – see Subsection 4.3), their stationary behavior was also verified, with the probabilities of incorrect unit root rejection by the standard ADF test never exceeding one per cent.

For each of the pools, we regress the affiliate lending spread on the three affiliate control variables discussed and the parent influence variable with the help of a bank fixed effect specification. Formally, the estimated equation for borrower class *b* (*b*=domestic firms, foreign firms, the self-employed, all non-financial borrowers) is

$$ls_{it}^{b} = c_i^{b} + ai_i^{b} im_{it} + aw_i^{b} wr_{it} + ad_i^{b} dg_{it} + ap_{it} peq_{it} + \varepsilon_{it}^{b}.$$

Here, i is the bank index, t is the period (month in the range 2005:01–2008:06), c_i^b is the bank fixed effect and ε is the error term. *ls* (the dependent variable) is the lending spread in class *b*, *im* is the interest margin (12M moving average), *wr* is the percentage of write-downs of the current value of loans, *dg* is the deposit growth rate (the ratio of two subsequent 12M moving averages of deposit levels less one) and *peq* is the inverse of the parent equity index relative to the financials index – the parent effect we are looking for.

The originally included 1Y EURIBOR-PRIBOR[16] differential was dropped from all the regressions as uniformly insignificant. One can conjecture that this insignificance has to do with the specifics of the internal capital market mechanism. Apparently, parent banks do not either systematically raise funds in the home country money market to be channeled into

[16] This differential was tried both with and without exchange rate adjustment.

affiliates (funds they *do channel* come from other sources) or use funds borrowed from affiliates to lend in the interbank market at home. That is, shifting funds between country units is subject to constraints and detailed earmarking which one cannot detect in the official data releases. Otherwise, the chosen specification produces some useful insights that we comment on next.

4.3 Results

The results of our pooled regression exercises are collected in Table 2, whose four panels feature the outcomes in domestically owned firms, foreign-owned firms, self-employed physical persons and all non-financial borrowers.

With the exception of one borrower class and one bank, wherever the parent impact is significant, it has the right sign, i.e. a potential increase in the costs of funds for the parent bank (and the whole banking group) leads to an increase in affiliate lending spreads *ceteris paribus*.

The parent bank influence is not present in every affiliate. It tends to be statistically insignificant for affiliates satiated with host country depositor funds. Moreover, the parent bank effect can materialize in loans to one borrower class and be absent in others, suggesting that credit funding policy toward different categories of clients in an affiliate can be more or less autonomous from the bank group-wide directives. So, lending to the self-employed, as the riskiest segment of all, seems to be typically funded from local sources. Lending spreads charged to the self-employed do not show any significant parent influence, except for one bank in which this category of borrowers occupies a more prominent position than elsewhere in the sample.

The greatest bank-by-bank dispersion of the results on parent influence shows up in credit to foreign-owned firms. This is probably a consequence of different weights of loans to non-residents for different affiliates. That is, the less important foreign firms are, the less their pricing is dependent on the parent situation.

Altogether, in banks for which the effect is traceable in the first place, loan pricing to domestically owned firms shows the highest degree of parent influence. This is perhaps due to the fact that this segment is dominant in the loan portfolio and thus plays a strategic role for the affiliate's overall performance and is more closely observed by the parent's management.

Formally, due to the prominence of domestic firms in the client base, one sees significance of the parent bank's situation for the aggregate lending spread (all borrower classes) for most banks in which the effect is significant in the domestic firm credit category.

As could be expected, the poorest results (in terms of both estimation diagnostics and the overall significance of the explanatory variables, including the parent influence) are obtained in cases where the bank group underwent structural changes that affected its stock value. The most prominent case of this was a takeover of the parent by another bank and subsequent delisting on the home stock exchange. The remaining small quantity of stock traded in other exchanges, although its price was growing above that of its peers, had, for obvious reasons, very little to say about the internal fund cost in the newly emerging holding.

Altogether, either we obtain a totally insignificant parent influence represented by stock performance, and, as we conjecture, this is mainly the case in affiliates with unconstrained funding – see Table 4. (Recall that we measure this lack of constraints by means of the proximity to zero of the time trend in the loan-deposit interest rate difference.) Or, the parent influence on lending spread is clearly significant for the given bank and borrower class. This outcome survives when one goes over from individual bank regressions to a pooled regression (or back). That is, cross-sectional interactions are not the principal driving force of the results obtained. On the other hand, abandoning the pool in favor of individual bank models has the advantage of allowing us to remove insignificant affiliate-level variables from the individual affiliate regressions. Some results concerning the significance of parent situation become sharper when one excludes insignificant controls. These excluded variables are different for different banks, meaning that bank-internal mechanisms of fund allocation and loan pricing can be quite diverse. Nevertheless, in most bank cases, we were able to find factors with a fair explanatory power over the loan pricing. A summary of the significance of the individual variables in the collection of bank-by-bank regressions, for each of the borrower classes considered, is given in Table 3.

5. Conclusion

We have developed a theoretical modeling approach to explaining lending rates to risky borrowers by a bank facing costly funding, and applied it to the problem of lending rate determination by an affiliate of a multinational bank group. The effective cost of funds is not identical to either the domestic depositor rate or the inter-bank rate, but is co-driven by the costliness of lendable funds within the parent banking group. The latter, although unobservable, is somehow reflected, for instance, in the price developments of the traded securities issued by the parent. Altogether, the bank lending rate should depend on the probabilistic properties of borrowers' future uncertain performance, the type of information asymmetry and the external cost of funds. The first two factors should be then responsible for the observed considerable variation of interest rates for a given bank within each time period. The third factor (funding costs), beside a possible dependence on the affiliate's own performance, should derive from the depositor base, the host country monetary conditions, and the parent bank's condition.

To assess the relative role of the parent effect in loan pricing, we took data on the lending rates of the ten biggest Czech commercial banks under foreign control. In the data, one can distinguish three significant classes of borrowers (domestic non-financial firms, foreign-owned non-financial firms and the self-employed), so we formed a cross-section of lending rate series for each class, plus another one for all borrowers. For each borrower class, we created a pooled object and regressed the volume-weighted lending spread with respect to the Czech interbank market on three bank-level controls (interest margin, classified loan value write-down ratio and deposit growth rate) and the parent group stock performance relative to the peer group of financial institutions. This pooled regression produced banks both with and without a tangible parent bank effect in each borrower class. The class with the most occurrences of a parent effect was foreign-owned firms, followed by domestically owned firms.

We were able to separate the cases of banks with slack funding constraints, for which no significant parent influence on lending rates can be either expected or found, and the rest, for which the parent factor plays a role in loan pricing in at least one borrower class. (This divides our ten-member bank pool into two equal halves.) The parent impact, when present, always competes with either comparably or more significant local explanatory factors of the affiliate lending rate, so that its role would be very hard to identify without a detailed knowledge of bank balance sheet developments. Therefore, parent influence is unlikely to act as the "headline news" or the driving force behind publicly conspicuous changes in the price of credit, at least in the absence of major global financial distress. Rather, it occupies the role of a "recessive gene" that can only become important when all other usual drivers of lending spreads fail to exercise their influence.

The results shed new light on the effects that a large-scale presence of foreign bank affiliates can have in their host countries, in particular as regards their influence on the (in)effectiveness of local monetary policy. It seems that parent bank influence does not have to be a dominating factor in interest-rate setting on aggregate, but can influence the cost of credit in those borrower categories that are of major importance for the affiliate as clients. Accordingly, whereas the host country monetary policy is targeted at credit conditions for everyone, foreign-controlled banks are able to interfere with this policy in a particular class of economic agents that are strategically significant for its business. Altogether, the said parent influence, although occasionally statistically significant, appears to be of subordinate importance economically, at least in the Czech banking sector in the pre-2008 crisis period.

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Appendix: Details of the bank lending model

A.1 General set-up

The exposition here refers to a specific form of firm technology as described below. Extensions to other production functions, such as Cobb-Douglas, are immediate.

Let a firm (the borrower) be undertaking a project entirely financed by debt. If amount I is invested in period one, $(1+A)I-\frac{kI^2}{2}$ will be generated in gross revenue during the next period. Here, A is the uncertain productivity parameter and $k>0$ is a capital installation cost parameter (known and constant). Out of this gross revenue, $(1+r)I$ must be repaid to the bank. Therefore, the borrower is solvent if and only if the after-interest net revenue (profit) $(A-r)I-\frac{kI^2}{2}$ is not negative. Otherwise, the borrower defaults and the lender receives $(1+A)I-\frac{kI^2}{2}<(1+r)I$ in the default work-out procedure.[17]

Both the bank and the borrower are assumed to be risk-neutral. Negotiations about the loan volume and the interest rate take place as a leader-follower game between the borrower and the bank. The bank first announces the lending rate r to be charged. After that, the borrower decides how big a loan to take at this rate. At the time of the negotiations, the bank knows the distribution of productivity and the related gross revenue, but not the exact value for the specific borrower, which will only be revealed by the realized revenue of the project at time two. We assume that the borrower not only knows the overall distribution of productivity, but also has partial knowledge of its own productivity and the likely project revenues. Formally, let there be a continuum of investor types indexed by $\rho\in[0,1]$. The productivity parameter A of a ρ-type investor is described by $a=\log A=b+\rho c$. Later, we will provide numerical examples with normally distributed $b\sim N(\mu,\eta)$ and $c\sim N(0,\sigma)$.[18] The ρ-type distribution varies depending on the market segment under consideration. The component b is known exactly to the investor, whereas component c is uncertain. The bank and the borrower have the same knowledge about c, namely its distribution. In addition, the bank is also uncertain about the value of b (i.e. b is the private information of the borrower). For the bank, the whole log-productivity a is a single random variable with a known borrower type-dependent distribution. A borrower of type $\rho=1$ corresponds to the maximum degree of common (bank as well as investor) uncertainty, whereas a borrower of type $\rho=0$ refers to the situation where the borrower has perfect knowledge about her future revenues. There are thus two "endpoint" alternatives. In the case of full information asymmetry ($\rho\to+0$), the borrower knows the exact value of A in advance. In the common uncertainty case ($\rho>0,\eta\to+0$), she only knows the distribution, just like the bank.

To formulate the main technical results, we use the following notation. The probability density functions of b, c and ρ are denoted by φ_b, φ_c and τ. Further, the survival functions of b and c are:

$$\Phi_b^+(x)=\int_x^{+\infty}\varphi_b(t)dt\,,\ \Phi_c^+(y)=\int_y^{+\infty}\varphi_c(u)du$$

and the symbols $\Psi_b^+(x)$ and $\Psi_c^+(\rho,v)$ stand for the tail-expectations:

[17] The exact functional form is immaterial for the qualitative outcome of the model. The chosen linear-quadratic specification with an installation costs term has been chosen because it reduces analytical complexity, at the same time providing some robustness. For instance (and as opposed, for example, to a Cobb-Douglas production function case), convex capital adjustment costs guarantee that the players have well-defined reaction functions even outside the equilibrium path. At the same time, the optimal choices of the players turn out to be independent of the cost parameter k.

[18] The essence of the results is unaffected by the exact specification of the distributions.

$$\Psi_b^+(x) = \int_x^{+\infty} e^t \varphi_b(t)dt\ ,\ \Psi_c^+(\rho, y) = \int_y^{+\infty} e^{\rho u} \varphi_c(u)du\ .$$

The specific value of the latter function when y=-∞ (i.e. $\Psi_c^+(\rho,-\infty)$) is denoted by $z(\rho)$. Finally, we define the functions θ_b and θ as follows:

$$\theta_b(x) = \frac{\Psi_b^+(x)}{\Phi_b^+(x)},\ \theta(\rho, y) = \frac{\Psi_c^+(\rho, y)}{\Phi_c^+(y)}.$$

We need the following technical assumption to obtain well-defined optimal investment decisions:

Assumption 1 *For every $\rho \in (0,1]$, $\theta(\rho,y)$ asymptotically approaches $e^{\rho y}$ as y converges to +∞.*

In the proof of Lemma 1, we explain why this assumption holds in the case of a normally distributed c. We now introduce an auxiliary function $(x, \rho, r) \mapsto v(x, \rho, r)$ as the implicit function solving the equation

$$e^{x+\rho v(x,\rho,r)} = \frac{1}{2}\left(e^x \theta(\rho, v(x, \rho, r)) + r\right). \tag{A1}$$

As will be explained shortly, $v(x,\rho,r)$ is the lower bound of systemic productivity values y for which, given lending rate r, a firm of type ρ with specific productivity component x would optimally invest and survive. For ease of use, we introduce the shorthand notation $\Theta(x, \rho, r) = \theta(\rho, v(x, \rho, r))$.

The survival boundary is different if the borrowers face unlimited liability. As will become clear in the next subsection, as a consequence of different investment decisions in the unlimited liability (UL) case, a borrower of type ρ with private productivity component x survives if and only if $c > v_0(x,\rho,r)$ and threshold v_0 defined by

$$e^{x+\rho v_0(x,\rho,r)} = \frac{1}{2}\left(e^x z(\rho) + r\right). \tag{A1UL}$$

Furthermore, whereas investors with limited liability always borrow a positive amount (see Lemma 1), we will show that UL-borrowers only undertake the project if their private productivity component is not too low (not below $l(\rho,r)=\log r-\log z(\rho)$).

A.2 Decisions of the borrower

Because the borrower is risk-neutral, she maximizes the expected project revenue (where the expectation is taken only over the uncertain component c of her future productivity) net of interest costs. Let the bank announce lending rate r. A borrower of type ρ with productivity realization $e^{b+\rho c}$ who decides to borrow a strictly positive amount I, then survives if and only if $e^{b+\rho c} - r > \frac{kI}{2}$ or $c > C(I, b, \rho, r) = \frac{1}{\rho}\left(\log\left(r + \frac{kI}{2}\right) - b\right)$. This borrower earns $\left(e^{b+\rho c} - r\right)I - \frac{k}{2}I^2$ if she survives and zero if she defaults. The optimal investment choice is given in the following lemma.

Lemma 1 *Under limited liability, a borrower of type ρ>0 with a specific productivity component b who is offered credit at a lending rate r, optimally invests the amount*

$$I = J(b,\rho,r) = \frac{e^b\Theta(x,\rho,r) - r}{k} = \frac{2\left(e^{b+\rho v(b,\rho,r)} - r\right)}{k}, \tag{A2}$$

which is always positive but converges to zero if either b approaches -∞ or r approaches +∞.
Proof:
The expected earnings of the borrower (recall that he knows the realization of *b*) who invests *I*>0 is

$$\int_{C(I,b,\rho,r)}^{+\infty}\left[\left(e^{b+\rho y} - r\right)I - \frac{kI^2}{2}\right]dy = e^b\Psi_c^+(\rho, C(I,b,\rho,r))I - \Phi_c^+(\rho, C(I,b,\rho,r))\left(rI + \frac{kI^2}{2}\right).$$

It is easy to check that this quantity is maximized by $\hat{I}$ which solves the following implicit equation:

$$\hat{I} = \frac{e^b\theta\left(\rho, C(\hat{I},b,\rho,r)\right) - r}{k},$$

as long as $\hat{I}$ is positive. (Note that, at $\hat{I}$, the borrower's objective has zero partial derivative with respect to *C*, given its definition as the default point.) Assuming that the solution exists as a regular function of (*b*,*ρ*,*r*), let us put $v(b,\rho,r) = C(\hat{I}(b,\rho,r),b,\rho,r)$. This is the lower bound of the no-default *c*-realizations *under investment rule* $\hat{I}$. Combining this definition with the definition of function *C* in the first paragraph of this subsection, we arrive at characterization of function *v* by equation (A1). It is now straightforward to check that $\hat{I}$ satisfies the double equality (A2).

To complete the proof, it remains to verify that *J* given by (A2) is indeed strictly positive and has the asymptotic properties stated in Lemma 1. To do this, observe that (A1) and (A2) jointly allow one to express *J* as

$$J(b,\rho,r) = \frac{e^b\theta\left(\rho, v(b,\rho,r)\right) - e^{b+\rho v(b,\rho,r)}}{k}.$$

Therefore, *J* is positive as long as $\theta(\rho,v(b,\rho,r)) > e^{\rho v(b,\rho,r)}$. This inequality for an arbitrary value of $y=v(b,\rho,r)$ is equivalent to

$$\int_y^{+\infty}\left(e^{\rho t} - e^{\rho y}\right)\varphi_c(t)dt > 0,$$

which is clearly satisfied, so that the optimally invested amount is, indeed, everywhere positive.

To prove the announced asymptotic properties, it is sufficient to observe that *v*(*b*,*ρ*,*r*) goes to plus infinity when either *b*→-∞ or *r*→+∞. This is so because in both cases, the firm needs an increasingly high realization of systemic productivity component *c* in order to compensate for either low specific productivity component *b* or tight credit conditions *r* and survive. But then, Assumption 1 guarantees that $\theta(\rho,v(b,\rho,r))$ and $e^{\rho v(b,\rho,r)}$ are asymptotically close, rendering small investment volumes. Specifically, if *c* is normally distributed, *θ* is a ratio of two complementary error functions. The known asymptotics of the latter result in loan volumes of an order not exceeding $\dfrac{\rho\sigma^2}{v(b,\rho,r) - \rho\sigma^2}$ •

Borrowers of type *ρ*>0 face uncertainty about their earnings due to the presence of a non-trivial systemic productivity uncertainty *ρc*. Therefore, although they have an incentive not to default, some of them eventually will, owing to low realizations of *c*. Given limited liability at default (i.e. earnings net of interest payments cannot fall below zero), a borrower of type ρ with a specific productivity component x that calculates expected earnings will only take into account those realizations of c that exceed $v(x,\rho,r)$. If, on the other hand, she had maximized the unconditional expectation of after-interest earnings (i.e. including the expectation over those c-realizations that would make net earnings negative in the absence of limited liability), she would have borrowed the following "unlimited liability" quantity of funds:

$$J^{UL}(x,\rho,r) = \frac{e^x z(\rho) - r}{k} < J(x,\rho,r).$$

This is true for $x > l(\rho,r)$, i.e. when J^{UL} is positive. Otherwise the investment project will not be undertaken and there will hence be no borrowing. The difference between J and J^{UL} reflects that adverse selection and moral hazard play a role in the investment choice. Interestingly, even in the case of unlimited liability, the borrower is always solvent in expectation because the expected net revenue in this case is $\frac{\left(e^x z(\rho) - r\right)^2}{2k}$. This is lower than the expected earnings based on a loan volume J under limited liability, but higher than the unconditional expected earnings based on the same loan volume. The quantitative difference only becomes significant under low firm-specific productivity b-realizations, which make up only a small fraction of the total borrower mass.[19] Therefore, adverse selection and moral hazard are unlikely to play a central role in the testable implications of the discussed theory. To facilitate the discussion of the empirical implications of this model it is useful to consider three special cases, the aforementioned unlimited liability case and two cases that concern systemic and private information.

A.2.1 No limited liability clause for borrowers. Borrowers could be firms that are run by managers with a compensation scheme that is a function of after-interest earnings, e.g. a fixed fee, plus a percentage of actual – positive or negative – earnings. Similar remuneration schemes, also in a much more general setting than the present one, have been considered by, for instance, Hui (2003). As mentioned above, borrowers with b-realizations that satisfy $e^b z(\rho) > r$ invest a positive amount $J^{UL}(b,\rho,r)$. Some of them, those whose systemic productivity realizations are low ($c \le v_0(b,\rho,r) = \frac{1}{\rho}\log\frac{e^b z(\rho) - r}{2}$), become insolvent. However, in expectation they earn a positive after-interest profit and do not default.

Importantly, borrowers with a low privately known productivity component ($e^b z(\rho) < r$) do not undertake the project in the absence of a limited liability clause. In our model, adverse selection only becomes an issue when limited liability induces some low-productivity borrowers to invest despite their expected negative after-interest earnings.[20] In addition, moral hazard emerges in the case of limited liability because everyone borrows in excess of the quantity that would be optimal unconditionally on default. After the systemic productivity realization c is revealed, not just the borrowers with $c \le v_0(b,\rho,r)$ become insolvent, but also those with $v_0(b,\rho,r) \le c \le v(b,\rho,r)$.[21]

A.2.2 No private information In this case, both the bank and the borrower face the same common source of investment project uncertainty c (for definiteness, $\rho=1$) whereas the component b of productivity is a known constant. In this environment of common uncertainty (CU) about default, the investor borrows $I^{LCU}(r) = J(b,1,r)$ in the limited liability case and $I^{UCU}(r) = J^{UL}(b,1,r)$ in the unlimited liability case.

[19] Fig. 1 shows the optimal investment volumes with and without limited liability as functions of firm-specific productivity b.

[20] According to Lemma 1, borrowers with $e^b z(\rho) < r$ invest positive, if small, amounts.

[21] Comparing the definitions of v and v_0 in (A1) and (A1UL) and using the fact that $z(\rho) < \theta(\rho,y)$ for every $y > -\infty$, one easily verifies that $v_0 < v$ everywhere.

A.2.3 No systemic uncertainty This "lender only" (LO) uncertainty is a limit case of the model with ρ=0. The borrower knows the exact realization of variable b perfectly, whereas the bank only knows the distribution of b. If the lending rate is not too high ($r<e^b$), the firm is capable of investing an optimal positive amount by borrowing $I^{LO}(b,r)=\frac{e^b-r}{k}$ and earning a strictly positive after-interest profit with certainty. Such an investor does not default. On the other hand, if the privately known productivity falls short of the loan interest ($r>e^b$), she neither borrows nor invests.

The expected revenue of the bank is given by:

$$L(r)=\int_0^1\tau(\rho)\int_{-\infty}^{+\infty}\varphi_b(x)\int_{-\infty}^{v(x,\rho,r)}\left[e^{x+\rho y}J(x,\rho,r)-\frac{kJ(x,\rho,r)^2}{2}\right]\varphi_c(y)dydxd\rho$$

$$+\int_0^1\tau(\rho)\int_{-\infty}^{+\infty}\varphi_b(x)\int_{v(x,\rho,r)}^{+\infty}rJ(x,\rho,r)\varphi_c(y)dydxd\rho-\int_0^1\tau(\rho)\int_{-\infty}^{+\infty}\varphi_b(x)iJ(x,\rho,r)dxd\rho\,. \qquad \text{(A3)}$$

The two outer integrals are the aforementioned expectations over ρ and b. The inner integral over realizations of c is split into the parts corresponding to default (c below $v(x,\rho,r)$) and survival (c above $v(x,\rho,r)$).

The expected revenue differs from (A3) in the case of unlimited borrower liability. As was explained in the previous subsection, the bank takes expectations over b exceeding $l(\rho,r)$. For all realizations of borrowers' private uncertainty, there is no borrowing. Also, the survival threshold of c-realizations is $v_0(x,\rho,r)$ and not $v(x,\rho,r)$. As a result the expected revenue is

$$L^{UL}(r)=\int_0^1\tau(\rho)\int_{l(\rho,r)}^{+\infty}\varphi_b(x)\int_{-\infty}^{v_0(x,\rho,r)}\left[e^{x+\rho y}J^{UL}(x,\rho,r)-\frac{kJ^{UL}(x,\rho,r)^2}{2}\right]\varphi_c(y)dydxd\rho$$

$$+\int_0^1\tau(\rho)\int_{l(\rho,r)}^{+\infty}\varphi_b(x)\int_{v_0(x,\rho,r)}^{+\infty}rJ^{UL}(x,\rho,r)\varphi_c(y)dydxd\rho-\int_0^1\tau(\rho)\int_{-\infty}^{+\infty}\varphi_b(x)iJ^{UL}(x,\rho,r)dxd\rho\,. \qquad \text{(A3UL)}$$

Returning to the limited liability case, recall that when systemic uncertainty is present ($\rho>0$), those investors of type ρ who decide to take the loan always borrow a positive amount (Lemma 1) regardless of r and b. However, high lending rates and/or low realizations of the private productivity component make the numbers of such borrowers decrease and their investment volumes fall to zero, so that their contribution to the bank's revenue becomes negligible. On the contrary, when all productivity uncertainty is private information (the LO case, ρ=0), only highly productive ($b>\log r$) investors borrow. Accordingly, the bank only takes expectations over the (b-) productivity interval ($\log r,+\infty$). If distribution τ is atomic at 0, one needs to treat it as a separate component of (A3). Conditioned on the realization of ρ=0, this part of the expected bank profit from the loan is equal to

$$L^{LO}(r)=\int_{\log r}^{+\infty}(r-i)I^{LO}(x,r)\varphi_b(x)dx\,.$$

We can now state the conditions governing the optimal lending rate choice by the bank. Let $J_r(x,\rho,r)$ be the partial r-derivative of the optimal investment volume J defined by (A2) in Lemma 1 for the limited-liability borrowers. This partial derivative is strictly negative everywhere and we define the negative of its expectation with regard to ρ and b by $H(r)$:

$$H(r) = -\int_0^1 \tau(\rho) \int_{-\infty}^{+\infty} \varphi_b(x) J_r(x,\rho,r) dx d\rho .$$

Further, define an auxiliary function G by

$$G(r) = -\int_0^1 \tau(\rho) \int_{-\infty}^{+\infty} \varphi_b(x) \left\{ \Phi_c^+(v(x,\rho,r)) J(x,\rho,r) + J_r(x,\rho,r) e^x \left(z(\rho) - \Theta(x,\rho,r) \right) \right\} dx d\rho .$$

In the case of unlimited borrower liability, the necessary auxiliary functions analogous to G and H are defined as

$$H^{UL}(r) = \int_0^1 \tau(\rho) \Phi_b^+ \left(l(\rho,r) \right) d\rho$$

and

$$G^{UL}(r) = \int_0^1 \tau(\rho) \int_{-\infty}^{+\infty} \varphi_b(x) \left\{ r \left[1 + \Phi_c^+(v_0(x,\rho,r)) \right] - e^x \Psi_c^+(v_0(x,\rho,r)) \right\} dx d\rho .$$

The two lemmas that follow describe how the bank's profitability depends on the interest rate charged in the limited liability case and the unlimited liability case, respectively:[22]

Lemma 2 *When all borrowers enjoy limited liability, the derivative of the bank profit function L with respect to the lending rate r equals*

$$\frac{dL}{dr} = H(r)i - H(r)r - G(r) . \tag{A4}$$

Proof: By inspection of (A3), we observe that the partial derivative of its right-hand side w.r.t. the default cut-off value v is zero since at $c=v(x,\rho,r)$ the investment revenue is exactly equal to the debt service payment. This means that, in order to calculate dL/dr, it suffices to partially differentiate (A3) w.r.t. r and J. After some algebra, one arrives at (A4) with G and H as defined prior to Lemma 2 •

Lemma 3 *When all borrowers face unlimited liability, the derivative of the bank profit function L^{UL} with regard to the lending rate r is equal to*

$$\frac{dL^{UL}}{dr} = H^{UL}(r)i - H^{UL}(r)r - G^{UL}(r) . \tag{A5}$$

Proof: This time, one needs to observe that the partial derivative of (A3UL) w.r.t. the default cut-off value v_0 is zero under optimal investment (for the same reasons as given in the proof of Lemma 2). Moreover, the partial derivative of L^{UL} with respect to the positive investment cut-off point l is also zero (since, under zero investment at $x=l(\rho,r)$, the bank profit is automatically zero as well). It remains to calculate the partial derivatives of L^{UL} w.r.t. r and J^{UL} and observe that $J_r^{UL} = -\frac{1}{k}$. After some algebra, one obtains (A5) •

A.3 Informational opacity and cost of funds impact

[22] The two special cases named in Subsections A.2.2 and A.2.3 (entirely private borrower information and common uncertainty) lead to separate results discussed in A.4.

In the following, we illustrate our claim from Section 3 that informational opacity makes the interest rate charged to the borrower more sensitive to the lender's own costs. We use an extremely simplified version of the model from Sections 3, A.1 and A.2 with easily obtainable closed-form solutions. Although the chosen simplification disables the model in terms of extended comparative statics analysis, it is useful to illustrate the main qualitative point we need to make.

Let us take the same bank-borrower game as before, but drastically simplify the uncertainty structure. Now, the productivity of the firm can take on only two values, high (A^H) with probability π and low (A^L) with probability 1-π.

We consider two cases: common uncertainty, in which neither the bank nor the borrower find out the realization of *A* until the second period, and purely private information, in which, at the time of loan negotiations, the borrower knows exactly whether it is of type *H* or *L*, whereas the bank only knows the distribution of *A*.

Recalling the discussion at the end of Subsection 3.3, we observe that equilibria of the resulting game can be either accommodative (lending rate *r* is below A^L, so that no firm defaults) or selective ($A^L<r<A^H$, only good performers survive and repay). If the funding cost *I* is sufficiently high (e.g. higher than A^L; the actual division point i^s may actually lie even lower), accommodative equilibria are impossible. So, we shall study the case when the defined market, initially in an accommodative equilibrium with *I* just below i^s, is subject to a minor upward shock ΔI to *I* moving it slightly above i^s. Therefore, the new equilibrium is selective. We shall next find out what this change means for the optimal lending rate.

Let us first inspect the case of common uncertainty and denote by $\overline{A}$ the average productivity $\pi A^H+(1-\pi)A^L$. It is easy to see that under the linear-quadratic technology the optimal loan volume decision of the borrower faced with the lending rate *r* is $J^A(r)=\dfrac{\overline{A}-r}{k}$ in the accommodative equilibrium and $J^S(r)=\dfrac{A^H-r}{k}$ in the selective equilibrium (the result depends only on A^H because the borrower rationally counts on receiving nothing if in default after the A^L realization). The lending rate chosen by the bank, after a bit of algebra, can be seen to equal $\hat{r}^A=\dfrac{\overline{A}+i}{2}$ in the accommodative case and change to the level $\hat{r}^S=\dfrac{A^H-(1-\pi)A^L+i}{1+\pi}$ in the selective case.

Next, consider the case of fully private borrower's information about *A*. In the accommodative equilibrium, each type of borrower now selects its own credit level, namely, $I^{H,L}(r)=\dfrac{A^{H,L}-r}{k}$. In the selective equilibrium, the low type does not borrow at all, whereas the high type borrows $I^S(r)=\dfrac{A^H-r}{k}$ (note that only the *functional form* coincides with I^HI and J^SI; the actual levels are different due to different equilibrium lending rate values). After some more algebra, we obtain the lending rate for the accommodative equilibrium on the level $\hat{r}^A=\dfrac{\overline{A}+i}{2}$, the same as in the common uncertainty case. After the forced transition to the selective equilibrium due to the upward shift of *I*, this rate rises to level $r^{*S}=\dfrac{A^H+i}{2}$. The result only depends on A^H because the low type borrower does not participate.

Now let us compare the magnitude of the r-shift following the i-shift in the two cases. Under common uncertainty,

$$\hat{r}^S - \hat{r}^A = \frac{i+\Delta i}{1+\pi} - \frac{i}{2} + \frac{1-\pi}{2(1+\pi)}\left[(2+\pi)A^H - (3+\pi)A^L\right].$$

Under private-only information, the r-shift is simply

$$r^{*S} - \hat{r}^A = \frac{1-\pi}{2}\left(A^H - A^L\right).$$

Unless the productivity realizations A^H and A^L are too far apart, and under some technical assumptions about the magnitude of i, the shift in the lending rate caused by the cost of funds crossing the equilibrium-separating threshold is higher in the fully private information case.

A.4 Comparative statics of the general model

Since it is hard to give preference to a particular combination of liability and information structure a priori, we start by inspecting several representative cases. This will be done by calculating function M on the right-hand side of the first-order condition (2) numerically for normally distributed values of borrower-specific and systemic productivity risks b and c. For ease of comparison, the same mean of the net return $A=e^{b+\rho c}$ (this mean will be equal to 7 per cent in the calculated examples) is used throughout, with the mean of b and the standard deviations of b and c mutually constrained to satisfy this restriction. Further, since there is no a priori-preferred distribution of borrower type ρ, we shall investigate specific values of ρ individually (formally, this corresponds to assuming density τ concentrated very close to the given ρ value). In particular, we will take ρ=0, ρ=1 and one intermediate value. Later, one can make amendments for the effect of averaging w.r.t. ρ.

Next, note that when all information is private (lender-only (LO) uncertainty), the extent of borrower liability is no longer important. This is because loans are taken only by those borrowers who are certain not to default under an optimally selected credit volume. In the LO case, the r-derivative of the corresponding bank profit component is

$$\frac{dL^{LO}}{dr} = \frac{\Phi_b^+(\log r)}{k}\left[i - 2r + \theta_b(\log r)\right]. \tag{A6}$$

This can be established, for instance as a limit case of either (A3) or (A3UL) with $\rho\to+0$ and with the distribution τ getting atomic at zero. The distribution of c is no longer relevant and it is, for instance, easy to see that $v_0(b,+0,r)=-\infty$ for every borrower who takes a non-zero loan (since she knows she can invest without insolvency risk). On the other hand, when there is no private information (b, instead of being random, is just a constant b_0), the cases of limited and unlimited liability differ. In that case, the distribution τ is atomic at unity and the needed modifications of (A3) and (A3UL) can be obtained by using the appropriate values of integrands in the definitions of G and H (G^{UL} and H^{UL}). More precisely, put

$$h^{LL}(r) = -J_r\left(b_0,1,r\right),\ h^{UL}(r) = \Phi_b^+(l(1,r)),$$

$$g^{LL}(r) = -\Phi_c^+(v(b_0,1,r))J(x,\rho,r) - J_r(b_0,1,r)e^{b_0}\left(z(1) - \Theta(b_0,1,r)\right),$$

$$g^{UL}(r) = r\left[1 + \Phi_c^+(v_0(b_0,1,r))\right] - e^{b_0}\Psi_c^+(v_0(b_0,1,r)).$$

The r-derivative of the bank profit function is equal to

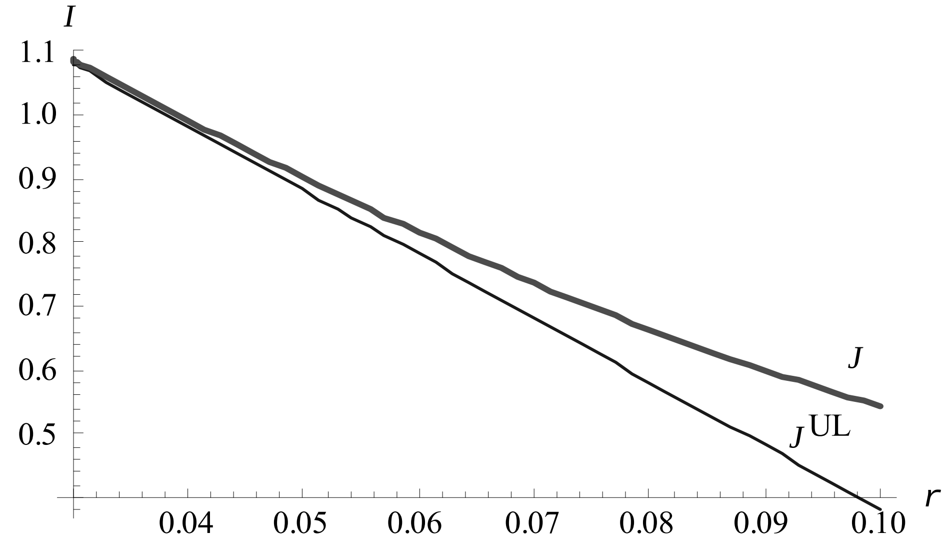
$$\frac{dL^{\kappa}}{dr} = h^{\kappa}(r)i - h^{\kappa}(r)r - g^{\kappa}(r), \ \kappa\text{=CULL, CUUL,} \qquad \text{(A7)}$$

Acronyms CULL and CUUL stand for "common uncertainty-limited liability" and "common uncertainty-unlimited liability", respectively.

The mechanism of determining the optimal lending rate on the basis of condition (2) is illustrated in Fig. 2, where the values of bank-determined rate r are on the horizontal axis and the external financing costs i are on the vertical axis. The latter (actual or opportunity) costs of funds are fixed at level i^{ext}=3 per cent. Panel (a) of the graph shows the realizations of the function $r \mapsto M(r)$ for two purely public information cases (ρ=1, trivial b-distribution at b_0) with (LL) and without (UL) limited borrower liability and the purely private information/lender-only (LO) uncertainty case (ρ=0, each borrower knows his productivity exactly). The optimal rate is obtained at the crossing of the horizontal i^{ext}=0.03 line and the corresponding M-schedule i^{LL}, i^{UL} or i^{LO}. Panel (b) shows the application of the model to the limited liability and unlimited liability borrower cases when both public and private information is present, specifically with ρ=0.5. One sees that the i^{UL}-schedule is strictly increasing in r in the range of reasonable r-values, i.e. leads to a unique optimal lending rate. On the other hand, the i^{LL}-schedule is non-monotonic and bounded from above and, generically, either crosses the i^{ext}-line twice (in which case the lower of the two r-values satisfying (2) is profit-maximizing for the bank) or not at all. Panel (b) shows the situation in which the i^{LL}-schedule attains a maximum just below the i^{ext}-level.

Fig. 1 Investment volume with and without limited borrower liability

(a) fixed b, variable r



(b) fixed r, variable b

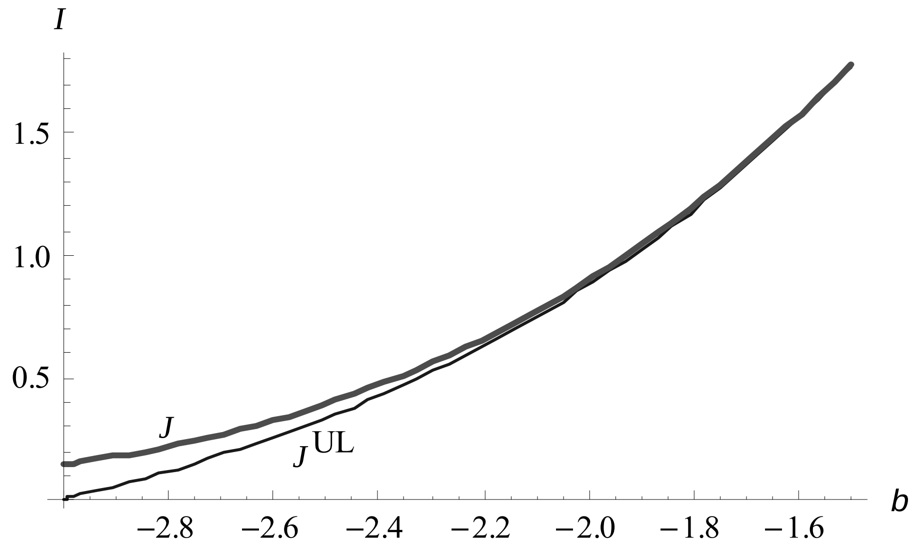


Fig. 2 Lending rate determination for different borrower types

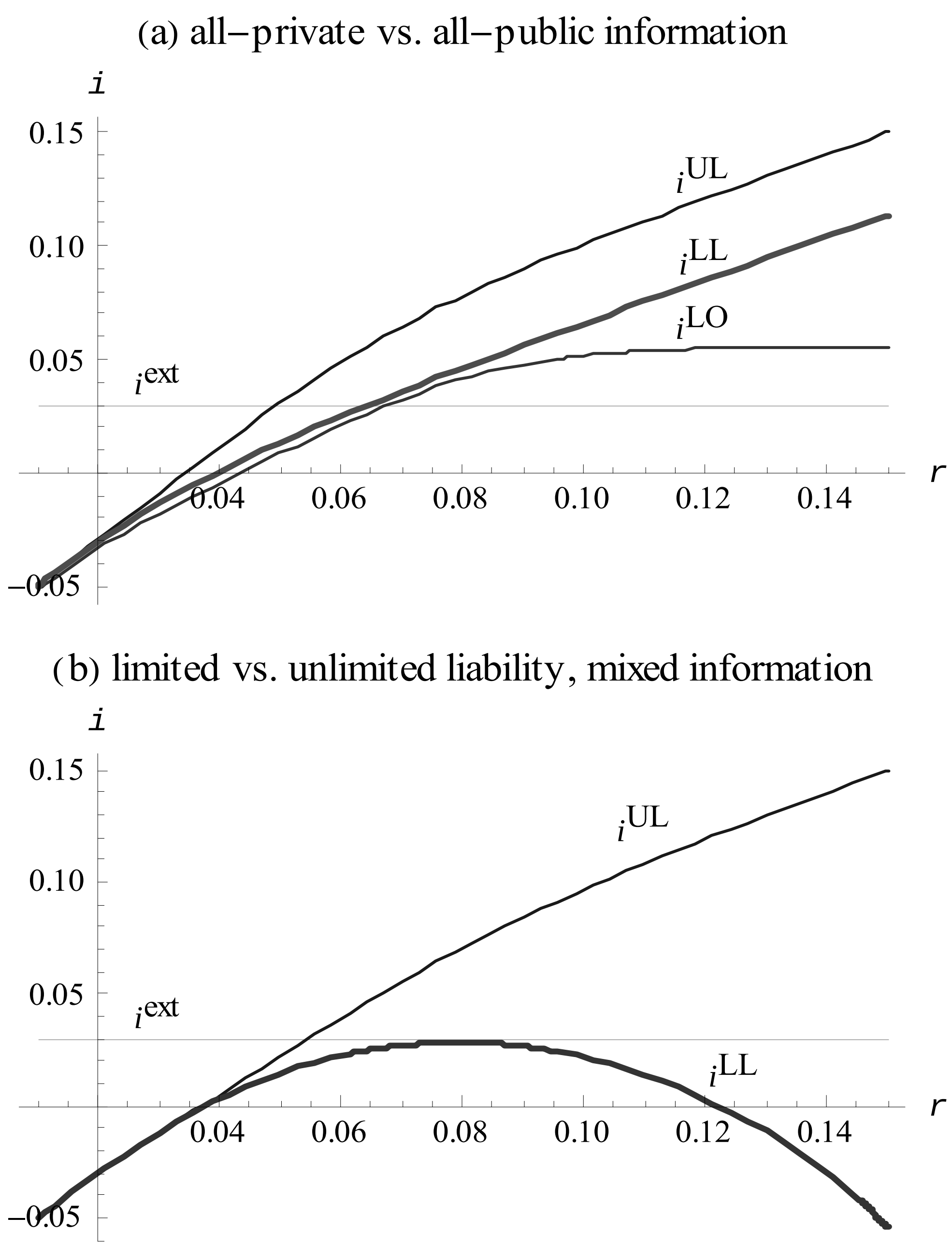


Table 1 Descriptive statistics
(a) lending rates

Bank ID	Borrower class											
	Domestic firms				Foreign firms				Self-employed			
	mean	*sd*	*max*	*min*	*mean*	*sd*	*max*	*min*	*mean*	*sd*	*max*	*min*
1	3.98	0.61	5.45	2.93	6.96	3.61	10.05	2.78	3.05	0.60	4.53	2.10
2	4.68	0.31	5.82	3.49	6.08	0.67	7.33	4.74	4.40	0.49	6.26	3.21
3	5.53	0.25	6.85	4.75	8.13	0.51	9.38	6.57	5.91	3.20	12.13	3.51
4	5.16	0.61	6.75	3.58	6.51	0.86	8.55	4.63	5.18	1.73	7.79	2.09
5	3.84	0.64	6.24	2.88	8.46	2.75	12.16	5.12	3.17	0.56	4.70	2.29
6	4.17	0.61	5.75	3.10	5.28	1.34	7.27	3.49	3.58	0.62	5.11	2.52
7	3.76	0.38	5.08	2.70	-	-	-	-	3.37	0.53	4.79	2.39
8	4.41	0.59	6.14	3.36	7.80	0.83	9.55	6.41	3.97	1.51	7.24	2.27
9	4.72	0.38	6.00	3.69	6.06	0.42	7.52	4.64	4.51	0.30	5.73	3.34

(b) lending spreads, aggregate

Bank ID	Mean	Median	Max	Min	Std. Dev.	Skew-ness	Kur-tosis	Jarque-Bera stat.
1	0.6487	0.6090	1.1957	0.1404	0.2698	0.1303	2.1930	1.2586
2	1.6669	1.6500	2.3500	1.1000	0.3287	0.3199	2.2722	1.6430
3	2.6241	2.5529	3.7954	1.8310	0.5098	0.3912	2.2626	2.0230
4	1.7497	1.8027	3.1880	0.4147	0.6560	0.1084	2.6765	0.2654
5	0.7110	0.6518	1.4271	0.2765	0.3014	0.6788	2.7843	3.3067
6	1.0091	0.9900	1.3845	0.7346	0.1805	0.1842	1.8305	2.6311
7	0.5734	0.5624	1.0042	0.0826	0.1961	0.0124	2.8555	0.0376
8	0.9692	0.9818	1.7661	0.2528	0.4027	0.1034	2.1459	1.3516
9	1.7151	1.5906	3.4666	0.5380	0.6216	0.8666	3.5466	5.7802
10	0.2938	0.2463	2.4600	0.0270	0.4951	0.4177	2.4371	1.7755

Table 2a Pooled regression results, domestically owned firms

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.081737	1.035742	-0.078916	0.9371
INTMARG_1	-0.053381	0.591768	-0.090207	0.9282
INTMARG_2	-1.554128	0.830827	-1.870579	0.0623
INTMARG_3	0.380823	1.144520	0.332736	0.7395
INTMARG_4	1.792028*	0.914350	1.959894	0.0508
INTMARG_5	-0.245408	0.588005	-0.417357	0.6767
INTMARG_6	0.566315	0.437262	1.295139	0.1962
INTMARG_7	-1.224014***	0.367292	-3.332534	0.0010
INTMARG_8	-0.888641	0.774055	-1.148034	0.2518
INTMARG_9	-1.154515	1.021938	-1.129731	0.2594
WRITEDOWN_1	0.966589***	0.355672	2.717644	0.0069
WRITEDOWN_2	0.276278	0.173501	1.592371	0.1123
WRITEDOWN_3	0.370416**	0.160463	2.308429	0.0216
WRITEDOWN_4	3.128798***	0.758805	4.123323	0.0000
WRITEDOWN_5	0.192738	0.154385	1.248423	0.2128
WRITEDOWN_6	0.118903	0.256006	0.464455	0.6426
WRITEDOWN_7	-0.923800	2.341503	-0.394533	0.6934
WRITEDOWN_8	0.637689	0.755510	0.844051	0.3992
WRITEDOWN_9	0.501075	0.668340	0.749731	0.4539
DEPGR_1	-0.308370**	0.155618	-1.981588	0.0483
DEPGR_2	-0.388084***	0.144192	-2.691440	0.0075
DEPGR_3	-0.110567	0.214048	-0.516554	0.6058
DEPGR_4	1.312250**	0.565106	2.322132	0.0208
DEPGR_5	-0.115644*	0.060172	-1.921878	0.0555
DEPGR_6	0.032521	0.036353	0.894588	0.3717
DEPGR_7	-0.005857	0.028013	-0.209091	0.8345
DEPGR_8	0.039283	0.084153	0.466809	0.6409
DEPGR_9	-2.207177**	0.858038	-2.572353	0.0105
PAREQ_1	1.051139*	0.644437	1.606172	0.0992
PAREQ_2	0.354591	1.015352	0.349230	0.7271
PAREQ_3	0.120513	1.102047	0.109354	0.9130
PAREQ_4	1.521117	1.064183	1.429376	0.1538
PAREQ_5	0.082778	0.680905	0.121571	0.9033
PAREQ_6	0.939586**	0.381387	2.463604	0.0143
PAREQ_7	-0.263551	0.341805	-0.771057	0.4412
PAREQ_8	0.705005	1.192625	0.591137	0.5548
PAREQ_9	-1.193786	1.169335	-1.020910	0.3080

Fixed Effects (Cross)		Weighted Statistics			
_1—C	-2.052912				
_2—C	3.728461	R-squared	0.848291	Mean dep var	1.662268
_3—C	-1.949288	Adjusted R-squared	0.828245	S.D. dep var	0.816664
_4—C	-9.709287	S.E. of regression	0.314947	Sum sq resid	33.03080
_5—C	1.354781	F-statistic	42.31784	D-W stat	1.498368
_6—C	-0.616158	Prob(F-statistic)	0.000000		
_7—C	2.773265	Unweighted Statistics			
_8—C	1.340461	R-squared	0.848291	Mean dep var	1.496057
_9—C	5.130676	Sum squared resid	33.03080	D-W stat	1.500263

Table 2b Pooled regression results, foreign-owned firms

Variable	Coefficient	Std. Error	t-Statistic		Prob.
C	-4.128000	3.788860	-1.089510		0.2767
INTMARG_1	0.068896	0.505003	0.136427		0.8916
INTMARG_2	-2.867210**	1.324365	-2.164971		0.0311
INTMARG_3	3.814211	6.664114	0.572351		0.5675
INTMARG_4	*5.864842***	2.280553	2.571676		0.0106
INTMARG_5	-0.525444	0.428712	-1.225632		0.2212
INTMARG_6	-0.239210	1.000772	-0.239026		0.8112
INTMARG_7	-0.532109	0.322435	-1.650284		0.0998
INTMARG_8	1.293085	1.714224	0.754327		0.4512
INTMARG_9	-0.341964	0.917497	-0.372714		0.7096
DEPGR_1	-0.241715*	0.132801	-1.820131		0.0696
DEPGR_2	0.346486	0.229846	1.507469		0.1326
DEPGR_3	-0.896283	1.246322	-0.719143		0.4726
DEPGR_4	-0.067854	1.409475	-0.048142		0.9616
DEPGR_5	-0.033505	0.043871	-0.763710		0.4456
DEPGR_6	-0.024788	0.083202	-0.297931		0.7659
DEPGR_7	-0.003184	0.024592	-0.129475		0.8971
DEPGR_8	-0.126303	0.186366	-0.677715		0.4984
DEPGR_9	-3.197908***	0.770348	-4.151252		0.0000
WRITEDOWN_1	0.823355***	0.303523	2.712657		0.0070
WRITEDOWN _2	-0.199599	0.276566	-0.721704		0.4710
WRITEDOWN_3	0.818199	0.934314	0.875722		0.3818
WRITEDOWN_4	3.506231	1.892596	1.852604		0.0648
WRITEDOWN_5	0.282212***	0.112562	2.507167		0.0126
WRITEDOWN_6	0.999636	0.585927	1.706077		0.0889
WRITEDOWN_7	-1.362282	2.055534	-0.662739		0.5080
WRITEDOWN _8	*-3.050483**	1.673153	-1.823194		0.0692
WRITEDOWN_9	2.027359***	0.600037	3.378725		0.0008
PAREQ_1	0.629040	0.558485	1.126334		0.2608
PAREQ_2	1.348881	1.618503	0.833413		0.4052
PAREQ_3	1.574143	6.416808	0.245316		0.8064
PAREQ_4	7.452600***	2.654264	2.807783		0.0053
PAREQ_5	0.578399	0.496445	1.165081		0.2448
PAREQ_6	0.245478	0.872889	0.281225		0.7787
PAREQ_7	-0.342723	0.300060	-1.142180		0.2542
PAREQ_8	0.207406	2.641190	0.078527		0.9375
PAREQ_9	0.925860	1.049831	0.881913		0.3785
Fixed Effects (Cross)			Weighted Statistics		
_1--C	1.605812				
_2--C	9.494600	R-squared	0.792370	Mean dep var	1.585355
_3--C	-14.56651	Adjusted R-squared	0.764935	S.D. dep var	1.271137
_4--C	-21.12466	S.E. of regression	0.767706	Sum sq resid	196.2613
_5--C	4.402514	F-statistic	28.88209	D-W stat	1.909176
_6--C	3.977735	Prob(F-statistic)	0.000000		
_7--C	5.640885		Unweighted Statistics		
_8--C	8.000476	R-squared	0.792370	Mean dep var	1.189497
_9--C	2.569140	Sum squared resid	196.2613	D-W stat	2.197800

Table 2c Pooled regression results, self-employed persons

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.311336	1.917978	0.162325	0.8712
INTMARG_2	1.571620	1.637673	0.959667	0.3383
INTMARG_4	*2.342748**	1.279552	1.830912	0.0685
INTMARG_5	1.176049	3.382190	0.347718	0.7284
INTMARG_6	0.245913	2.347771	0.104743	0.9167
INTMARG_8	-3.330674**	1.663701	-2.001966	0.0465
INTMARG_9	0.138914	1.565471	0.088736	0.9294
WRITEDOWN_2	0.787978**	0.341994	2.304074	0.0221
WRITEDOWN_4	2.953173***	1.061881	2.781077	0.0059
WRITEDOWN_5	1.246049	0.888021	1.403175	0.1620
WRITEDOWN _6	1.087301	1.374561	0.791016	0.4298
WRITEDOWN_8	1.734148	1.623842	1.067929	0.2867
WRITEDOWN_9	2.689334***	1.023807	2.626798	0.0092
DEPGR_2	-0.473340*	0.284222	-1.665390	0.0972
DEPGR_4	0.963441	0.790816	1.218288	0.2244
DEPGR_5	0.428870	0.346109	1.239118	0.2166
DEPGR_6	-0.192368	0.195189	-0.985551	0.3254
DEPGR_8	*0.389263***	0.180873	2.152130	0.0325
DEPGR_9	-3.911403***	1.314399	-2.975812	0.0032
PAREQ_2	0.478610	2.001396	0.239138	0.8112
PAREQ_4	0.944392	1.489231	0.634147	0.5266
PAREQ_5	-3.239397	3.916547	-0.827105	0.4091
PAREQ_6	-1.238478	2.047763	-0.604796	0.5459
PAREQ_8	-1.762991	2.563348	-0.687769	0.4923
PAREQ_9	2.474043	1.791263	1.381173	0.1686
Fixed Effects (Cross)				
_2--C	-1.796238			
_4--C	-8.919876			
_5--C	4.175954			
_6--C	1.661770			
_8--C	9.014556			
_9--C	-4.136166			

Weighted Statistics

R-squared	0.628407	Mean dependent var	4.874778
Adjusted R-squared	0.579865	S.D. dependent var	2.101770
S.E. of regression	0.949429	Sum squared resid	200.1142
F-statistic	12.94578	Durbin-Watson stat	1.371575
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.628407	Mean dependent var	3.759960
Sum squared resid	200.1142	Durbin-Watson stat	1.126590

Table 2d Pooled regression results, all non-financial borrowers

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.722634	1.015397	0.711676	0.4771
WRITEDOWN_1	0.890683***	0.264904	3.362287	0.0009
WRITEDOWN_2	0.097465	0.159659	0.610461	0.5419
WRITEDOWN_3	0.263217	0.201489	1.306357	0.1922
WRITEDOWN_4	2.160484**	1.010352	2.138348	0.0331
WRITEDOWN_5	0.268383**	0.122386	2.192921	0.0289
WRITEDOWN_6	0.239807	0.253311	0.946689	0.3444
WRITEDOWN_7	-0.221503	1.602632	-0.138212	0.8901
WRITEDOWN_8	0.373102	0.596458	0.625530	0.5320
WRITEDOWN_9	0.747822	0.567429	1.317913	0.1883
WRITEDOWN_10	1.001339	1.286352	0.778433	0.4368
INTMARG_1	0.255651	0.440748	0.580039	0.5622
INTMARG_2	-2.176244***	0.764542	-2.846467	0.0047
INTMARG_3	-0.090751	1.437149	-0.063147	0.9497
INTMARG_4	-1.184992	1.217460	-0.973331	0.3310
INTMARG_5	-0.308685	0.466129	-0.662231	0.5082
INTMARG_6	0.209086	0.432659	0.483258	0.6292
INTMARG_7	-0.451402*	0.251392	-1.795611	0.0734
INTMARG_8	-0.644173	0.611099	-1.054123	0.2925
INTMARG_9	-0.939161	0.867638	-1.082434	0.2798
INTMARG_10	-0.734305	0.553992	-1.325480	0.1858
DEPGR_1	-0.228909**	0.115904	-1.974987	0.0490
DEPGR_2	-0.160784	0.132688	-1.211741	0.2264
DEPGR_3	-0.032948	0.268775	-0.122586	0.9025
DEPGR_4	0.881233	0.752440	1.171166	0.2423
DEPGR_5	-0.066794	0.047700	-1.400284	0.1623
DEPGR_6	0.040675	0.035970	1.130794	0.2589
DEPGR_7	0.009985	0.019173	0.520752	0.6029
DEPGR_8	0.071129	0.066437	1.070615	0.2850
DEPGR_9	-2.404614***	0.728485	-3.300843	0.0011
DEPGR_10	0.004757	0.043380	0.109654	0.9127
PAREQ_1	1.462432	0.487424	3.000326	0.0029
PAREQ_2	-0.161687	0.934345	-0.173048	0.8627
PAREQ_3	0.468917	1.383816	0.338858	0.7349
PAREQ_4	*-3.077473***	1.416964	-2.171878	0.0305
PAREQ_5	0.138102	0.539774	0.255851	0.7982
PAREQ_6	0.890685**	0.377372	2.360232	0.0188
PAREQ_7	-0.189316	0.233947	-0.809226	0.4189
PAREQ_8	0.983396	0.941550	1.044443	0.2970
PAREQ_9	-0.692468	0.992780	-0.697504	0.4859
PAREQ_10	5.970522***	1.764313	3.384049	0.0008

Fixed Effects (Cross)		Weighted Statistics			
_1--C	-3.952297				
_2--C	4.644054	R-squared	0.869408	Mean dep var	1.371386
_3--C	-0.584416	Adjusted R-squared	0.852113	S.D. dep var	0.812780
_4--C	2.850419	S.E. of regression	0.316529	Sum sq resid	37.07060
_5--C	0.218738	F-statistic	50.27048	D-W stat	1.630739
_6--C	-1.107817	Prob(F-statistic)	0.000000		
_7--C	0.623432	**Unweighted Statistics**			
_8--C	0.095694				
_9--C	2.851910	R-squared	0.869408	Mean dep var	1.196087
_10--C	-5.639718	Sum squared resid	37.07060	D-W stat	1.690376

Notes:
Effects specification: Cross-section fixed (dummy variables)
Method: Pooled EGLS (Cross-section weights)
Sample: 2005M01 2008M06
Observations included: 42
Cross-sections included: 10
Total pool (balanced) observations: 420
Linear estimation after one-step weighting matrix
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Table 3 Individual bank regressions

Bank	Borrower class											
	Domestic firms				Foreign firms				Self-employed			
	im	*wd*	*dg*	*peq*	*im*	*wd*	*dg*	*peq*	*im*	*wd*	*dg*	*peq*
1		*	*	*		*	*	*				
2	*		*	+	*					*	*	
3		*										
4	-	*	-	+	-	*		*		*		
5		*	*			*				*	-	
6	*			*		*						
7	*				*							
8	*					-			*		-	
9	*		*	-		*	*	*		*	*	*

Notes: *im* – interest margin, *wd* – writedown ratio, *dg* – deposit growth rate, *peq* – parent equity relative to sector index
* means significance at least at 10 % level in full and reduced specifications, + is significance at least at 10% level in at least one specification, - means significance with wrong sign

Table 4 Parent effect and loan-deposit rate spread

Bank	Significance of parent equity performance							Slope of the loan-deposit interest rate spread
	Pooled regressions			Bank-level regressions				
	DF	FF	SE	Aggregate	DF	FF	SE	
1	+				+	+		0.026
2								*-0.0007*
3								*-0.0068*
4		+				+		*-0.007*
5								*0.0004*
6	+				+			0.024
7								*0.008*
8								*0.015*
9						+	+	-0.023
10				+				0.028

Notes: DF – domestic firms, FF – foreign firms, SE – self-employed
+ means significance at least at 10% level
loan-deposit spread slope values in *italics* lie below the separation point of 0.02 in absolute value