Distances and Small Business Credit Constraints: the French case

Salima DJEDIDI

Abstract  Deregulation and progress in information and communication technologies have increased the geographical expansion of banking structures and instruments. This makes banks operationally close to the borrowers. At the same time, banking industry consolidation have induced a geographical concentration of banking decision centers and strategic functions, leading to an increase of the functional distance that separates the decision center of a bank from its operational branches. The aim of this paper is to evaluate the impact of these two trends on SME lending. Our findings on French data show that increased functional distance and operational proximity are positively associated with the investment-cash flow sensitivity, considered as a measure of financing constraints. These adverse effects are particularly acute for small firms.

Keywords SME lending ∙ functional distance ∙ operational proximity ∙ financing constraints ∙ investment-cash flow sensitivity

JEL classification G21 ∙ G34 ∙ R51

1. Introduction

Over the last decade in France, all categories of credit institutions have known a substantial decrease of the number of their establishments. This decrease was about 22% for commercial banks whose number decline from 386 in 1997 (including 199 French banks and 187 foreign banks) to 290 in 2008 (including 135 French banks and 155 foreign banks). It was about 36% for mutual and cooperative banks whose number decline from 161 in 1997 to 103 in 2008 (see Appendix 1, Figure 1).

This fall of the number of bank’s institutions have been following a longstanding trend. Thus, since the law bank of January 24, 1984, the French Banking sector have been engaged in an intense movement of restructuring, which resulted in a steady decrease of the number of credit institutions (see Appendix 1, Figure 1). The number of credit institutions established in France (excluding Monaco) has declined from 2001 in 1984 to 722 in 2008 (-64%) and during the last ten years, their number has decreased of about 40% (1209 in 1998).

The dynamic movement of reorganization and renovation of banking structures has been accompanied by a strengthening, since the early 2000s, of the banking system’s supply.

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Figure 2 (see Appendix 1) shows that the number of branches, which was maintained during fifteen years in a range of 25500 to 26000, is in progress since 2000 (27893 at the end of 2008 excluding branches of the postal bank). Also, the number of Automated Teller Machines (ATMs), which exceeds that of branches since 1997, almost doubled over the last ten years (51690 in 2008, against 29407 in 1998). Finally, the information and communication technology progress favored the expansion of impersonal methods to conduct businesses, such as Internet-banking, home-banking, or phone-banking. These changes reflect both a research of productivity gains among French credit institutions and a strong dynamism and also a deep technological change in distribution channels.

Both of these phenomena have a spatial dimension. The geographical diffusion of banking structures and instruments due to technological progress contributed to the ease of access to banking services by savers and borrowers established locally. It refers to the so called “operational distance” considered in the banking literature. It largely depends on the physical distance that separates banks from their clientele. With respect to organizational structure, the wave of mergers and acquisitions that have reduced the number of banks and have created large national and multinational bank holding companies, have induced a geographical concentration of banking decision centers and strategic functions, leading to an increase in the “functional distance” that separates the decision center of a bank from its operational branches.

In this paper, we focus on the French banking industry in order to assess the effects of these contrasting trends of spatial diffusion-concentration on financing constraints for local SMEs.

A large literature is devoted to assessing the impact of banking consolidation on local development. The vast majority of these studies follow a bank-based approach where they compare the lending behavior of small banks, theoretically considered as best suited to deliver relationship lending and therefore considered “close” to the need of local SMEs, with the lending behavior of large banks, considered as more “distant”. They find differences in relationship lending with larger institutions tending to lend to older and larger SMEs with stronger financial statements (Haynes et al. 1999; Cole et al. 2004; Scott 2004; Berger et al. 2005). There is also evidence that as lending decisions are made higher in the organizational structure there is less emphasis on soft information penalizing small opaque firms (Liberti and Mian 2009).

A few other studies follow a market based approach, where the analysis is carried out at the local market level (Avery and Samolyk 2000; Berger et al. 2007; Bonaccorsi and Gobbi 2001; Collender and Shaffer 2003). This approach has the advantage of directly assessing the net impact of banking industry structure on local borrowers.

In this paper, we follow the same market-based approach adopted by Alessandrini et al. (2009). Following Alessandrini et al. (2009), we have tried to overcome the oversimplification of the morphological structure’s measure of the local banking industry provided in the literature by introducing a more accurate measure of the functional distance of local banking systems from local economies. Using a pooled sample of 2915 French SMEs, we find that both operational and functional distances play a significant role in explaining financing constraints to local firms.
The remainder of the paper is organized as follows. The next section presents the main theoretical and empirical works related to our subject. Section 3 describes the data and the distance variables. Section 4 displays the dynamic investment econometric model performed and the different results obtained. The last section concludes.

2. Related Literature

2.1. Distance and Lending Decisions: theory and evidence

Economic theory recognizes physical distance as causing potentially relevant economic costs for both the bank granting a credit and the firm seeking financing. These costs are not only pecuniary such as transportation costs, but also may be informational costs induced by the extra efforts required from the bank to access the creditworthiness of potential borrowers or to monitor firm’s investments. The review of the theoretical literature on spatial pricing highlights two broad channels through which distance affects lending decisions: transportation costs and asymmetry of information. Physical closeness to the potential borrower (and or to the local economy) allows the minimization of these costs by easing the process of soft information’s collection that is relevant for small business lending. This private information, added to hard data on borrowers, improves the quality of borrowers’ screening and monitoring. In this way, the likelihood of doing type two errors decreases (Gehrig 1998; Zazzaro 2002) as well as the probability of credit rationing equilibria (Williamson 1986).

However, great operational proximity of a lending bank to borrowers may negatively affect financing conditions. First, Market imperfections arise because, for given physical locations of borrower and lender, distance creates an imbalance in the competitive environment in the credit market if we consider that the severity of the asymmetric information problems intensifies with distances. In particular, banks that are close to firms gain an informational advantage over competitors thus they certify the quality of borrowers and therefore charge a certification premium over loan interest rates. Consequently, firms are informationally captured by the lending bank that can charge higher interest rates to such borrowers (Sharpe 1990; Hauswald and Marquez 2006). It is called the “hold up” phenomenon. Second, a “winner’s curse” type phenomenon is possible when the information on borrower’s quality is imperfectly shared by all banks. Banks in vicinity are considered as informed since they access easily and with low costs to firm’s information. The other banks are less informed and face increasing adverse selection problems when approaching locally captured firms. As a result, they would be conservative in terms of loan interest rates and acceptance standards (Broecker 1990; Shaffer 1998). Consequently, distances weakens the bank’s capability to extract rents from relationship borrower, at the same time as it aggravates adverse selection problems with respect to transaction borrowers.

The empirical findings seem to confirm both the advantages and drawbacks of geographical distance on loan conditions. At the bank level, Petersen and Rajan (2002) are the first to find evidence of spatial price discrimination in bank lending. Using the 1993 National Survey of Small Business Finance (NSSBF), they find that a borrower located in vicinity of the lender pays on average 126
points more than a borrower located 9 miles (the sample median) from the lender. However, the estimated coefficient might be potentially biased due to the omission of control variables including the proximity of potential competitors, the banking market concentration and the nature of the bank-firm relationship. Besides, Petersen and Rajan (2002) don’t examine the actual distance between the lending office and the firm but an estimated one calculated on the basis of firm’s transparency and creditworthiness. Because estimated distance increases with firm’s transparency, the findings suggest that banks engage spatial loan price discrimination and that higher quality firms (firms away from the banks) pay lower risk premium. Degryse and Ongena (2005), analyzing detailed contract information from more than 15,000 large Belgian bank loans to small firms, provide first comprehensive evidence on the occurrence of spatial loan pricing. Unlike Petersen and Rajan (2002), Degryse and Ongena (2005) control for some of the aforementioned control variables like the distance between the borrower and other competing banks, as well as measures of banking competition. They find that the expected loan rate decrease by 14 basis points when the time travelling increase from zero to 4 minutes (the sample median). A symmetric and qualitatively similar effect on loan price is obtained from an analogous increase in the distance to the closest competitor. Degryse and Ongena (2005) confirm that the spatial price discrimination is essentially caused by transportation costs without completely remove adverse selection as an alternative explanation. Agarwal and Hauswald (2006), using a dataset from a major U.S. bank, find results in line with the results in Degryse and Ongena (2005). They find that a borrower located in vicinity of the lender pays on average 195 points more than a borrower located 2.6 miles (the sample median) from the lender. In addition, an increase in the distance to the closest competitor from zero to 0.55 miles (the sample median) raises the loan price by 55 basis points. The statistical significance of these relations disappears when they control for the bank’s proprietary information (the bank’s internal credit score). Consequently, they conclude that the geographical distance is a simple proxy for lender’s informational advantage, buttressing for models of price discrimination based on information asymmetries. Mistrulli and Casolaro (2008), using detailed information on more than 370,000 bank loans granted to firms by more than 120 Italian banking institutions, find that the physical closeness of the borrower to the bank headquarters is associated with higher interest rates and that this effect is lower for large banks compared to small intermediaries.

With regard to credit availability, it is rather easy, in a theoretical perspective, to explain why banks may optimally decline credit applications from small businesses that are geographically remote (Hauswald and Marquez 2007; Carling and Lundberg 2005). In fact, information about small businesses is thought to be soft and has had to be collected by lenders over time through repeated interactions between loan officers or branch managers and firms (Berger and Udell 1995; Petersen and Rajan 1994). This implies that the lender has to have a local presence. However, empirical evidence on the existence of geographical credit rationing is mixed. In fact, Petersen and Rajan (2002) find that remote applicants are more likely to be declined credits in the U.S. but this effect is strongly decreasing over time. Agarwal and Hauswald (2007) find that credit availability decrease with the bank-borrower distance and increase with the borrower-competitor distance. However, the statistical significance of these relations disappears when they control for the bank’s proprietary information (the bank’s internal credit score) concluding that the geographical distance is a simple proxy for lender’s
informational advantage. However, Carling and Lundberg (2005), using data on corporate loans granted between 1994 and 2000 by a leading Swedish bank, find no evidence of geographical credit rationing. Uchida et al. (2008), using a unique Japanese data set and the same methodology as Berger et al. (2005) obtained no evidence of geographical credit rationing in Japan.

At the market level, Avery and Samolyk (2000), using U.S. data, find that the number of banks operating in a Metropolitan Statistical Area is positively but weakly related to the growth rate of SME’s loans in the local market, whereas the number of offices has no impact at all on this growth rate. Using Italian data, Bonaccorsi and Gobbi (2001) find that the branch density (the ratio of branches to population) in a province is positively related to the volume of credit for small borrowers but it is negatively associated with the volume of bad loans. Benfratello et al. (2008), using a rich data set on innovation at the firm level for a large number of Italian firms over the 90’s, find that the banking development (computed as the number of branches divided by population) affects positively the probability of process innovation, particularly for small firms and for firms in high(er) tech sectors and in sectors more dependent upon external finance. There is also some evidence that banking development reduces the cash flow sensitivity of fixed investment spending, particularly for small firms.

2.2. Why Should the Geographical Distribution of Banks’ Decisional Centers affects Small Business Lending? Theory and evidence

The process of financial integration in the European and US banking industry in the 1990s was accompanied by the debate that mostly highlights the benefits of strengthened competition in credit markets, greater efficiency and the geographical reach of banking groups through affiliated banks and branches. This would have assured an adequate response to the need of local economies. However, the growing body of research examining the effects of bank consolidation and organizational structure on lending policies raises the question, for a long time neglected, of the cost of the predictable geographical concentration of decisional centres and the increasing size and complexity of bank organisation induced by the spectacular wave of bank mergers and acquisitions. Put differently, this body of research highlights the fact that the organizational complexity of the institutions to which the loan office belongs is as much important as the operational proximity in the process of credit allocation to small businesses.

Theoretical arguments suggest that small banks might be more able to deliver relationship lending because their simple organizational structure does not require the transmission of soft information necessary for the SME lending decision process (Stein 2002). Thus, banking consolidation may be detrimental for small businesses if the great complexity of banks organizational structure leads to a substitution of transaction lending based on hard information for relationship lending based of soft information, which is no good for opaque SMEs.

In small business lending, the bank bases its credit decisions largely on private or soft information about the firm and its owner that is collected through multiple interactions over time and across products (Boot 2000; Berger and Udell 2002). The bank invests in obtaining firm-specific information, which is often propriety in nature. Consequently, “soft”
information may confer the bank with a competitive informational advantage over banks that base their decision on public information and thus obtain a less precise signal of the creditworthiness of the firm. However, the collection method of this information needs to be personal, making soft information hardly verifiable and thus difficult to transmit to upper echelons of banking organization and to store. For a complex bank organizational structure, characterized by branches operating in areas distant from their headquarters, many critical issues may deter it from engaging in intensive soft information activities, i.e. small business lending.

**The risk of an imperfect strategic communication between the principal – the senior manager and the agent – the local officer**

The seminal paper by Crawford and Sobel (1982) shows that the person who sends information (here the local officer) may deliberately manipulate this information if his preference is not perfectly aligned with that of the recipient of this information (here the senior manager). In fact, bank’s local officers are expected to compete for limited internal resources and to carry out specific investments (Ozbas 2005). They derive a greater benefit from larger budgets, prompting them to exaggerate their estimates of profitability in order to increase their likelihood of obtaining more resources. This is particularly possible since soft information on business activities is concentrated in the hands of local bank officers. Taking advantage of asymmetric information’s problems within the bank, local bank officers may manipulate this information inducing noisy communications (Dessein 2002; Harris and Raviv 2005). Consequently, the inexistence of specific channels to communicate this soft information within a bank requires costly internal organizational adjustments.

**The control costs induced by the decentralization of lending decisions**

Stein (2002), who investigates how the organizational structure of a bank affects the incentives of loan officers to produce and use different types of information, suggests that local loan officers in hierarchically complex organizations will have less ex-ante incentives to collect and use information, particularly the soft one. This is because they do not generally have decision-making authority and must transfer the information to the upper echelons of the banking organization (see also Aghion and Tirole 1997). Given the soft nature of this information, it is more likely to be neglected and not integrated into the decision process. Anticipating this behaviour may reduce the incentive to make efforts to collect it. Of course, one can argue that a loan officer is actually obliged to fill a report when he evaluates several attributes of an applicant (e.g. honesty and managerial competence). It is what we call the “hardening” of soft information that eases its process of transmission to upwards (Petersen 2004). The model in Stein (2002) suggests that in this case banks with simple organizations may still have an efficiency advantage in providing relationship financing than more complex banks, since the incentives problems turns into a bureaucracy problem.

However, when the activity of production and information processing is delegated to local loan officers, they are granted considerable authority, particularly because of the ability to manipulate soft information. The decentralization of decision-making involves the development of control mechanisms. Giving the role of local loan officer in the information’s
collection and process, one control mechanism proposed in the literature consists on trying to modify his utility by applying optimal combinations of salary and budget allocation.

Consequently, the optimal organizational structure minimizes communication costs and expected information losses that result from both horizontal and vertical communication of subjective information.

The severity of communication and incentive problems as well as their negative impact on lending policies and credit allocation grows with distance between hierarchical levels. Functional distance condenses physical and economic attributes. Firstly, it is reasonable to believe that the greater the physical distance between the bank’s headquarter and the local branch, the more difficult it is for the senior manager to gather reliable information from the local officer, monitor his actions and efficiently centralize credit decision making. Secondly, an important part of the information about the economic structure of the local market information is recoverable only by local loan officers with detailed knowledge of the particular economic environment within which they operate. They may accumulate a unique informational capital on which strictly depends the capacity of selecting good projects but that is non codified and therefore impossible to transmit to the top management. Thus, the greater the gap between the economic structures of the parent bank and local branch locations, the greater the informational asymmetry within the bank. In this case, agency problems are particularly acute.

There are indirect empirical evidences of the existence of agency and communication costs related to the distance between bank hierarchical levels. First, number of studies show that mergers and acquisitions between large or out-of-state banks generate a reduction in SME lending however those involving small or in-state banks impact, in the long run, positively small business lending (Keeton 1996; Berger et al. 1998; Cole and Walraven 1998; Peek and Rosengren 1998; Sapienza 2002; Alessandrini et al. 2008). Second, some other studies provided evidence that large out-of-market owned and foreign banks allocate fewer resources to small business lending than other banks because they have a real competitive disadvantage in evaluating their creditworthiness (Keeton 1995; Cole et al. 2004; Carter et al. 2004; Alessandrini et al. 2005; Berger et al. 2005; Carter and McNulty 2005; Mian 2006). Consisting with incentive problems characterizing geographically dispersed banks, Ferri (1997) found that large national banks tend to significantly limit the average time spent by a loan officer in a specific branch in order to restrain agency costs due to its informational rent.

The implications arising from the trade-off between delegation and control have been deeply analysed in the principal-agent theory. Liberti (2004) found empirical evidence consistent with the idea that empowering local loan officers increases the effort they devote to evaluate and monitor the creditworthiness of borrowers, and improves the performance of the bank. However, Liberti does not control for monitoring costs that the parent bank spends on controlling loan officers and the performance of their loan portfolios (Udell 1989; Berger and Udell 2002). These monitoring costs seem to have strong positive correlation with the organisational complexity of the bank and the degree of autonomy of local managers.

A more direct indication of the importance of distance-related bank communication frictions is given by Liberti and Mian (2009) that analyse a large multinational bank operating in Argentina. They find that the sensitivity of the amount of credit facility to soft information
is lower for credit lines approved at a distance hierarchical level, whereas the opposite is true for the sensitivity of the amount of credit facility to hard information.

At the market level, with regard to the Italian economy, Bonaccorsia and Dell’Ariccia (2004) find that the creation of industrial firms in a giving province is positively associated with the share of deposits held by banks headquartered in the same province (a measure of functional distance). Collender and Shaffer (2003), studying the impact of functional distance on local economic growth, find that the impact of the number of bank offices operating locally on local economic growth differs significantly with the locus of their ownership.

3. Data and variables

3.1. Data

To test the effects of spatial diffusion-concentration on SME lending, we build up a panel dataset containing information on firms, bank branches, head office locations, and macro variables in France at the departmental level. The time period considered is 2001 – 2008.

The database relies on four main sources:
- SME specific information drawn from DIANE²: we consider French manufacturing enterprises from which we exclude those who are subsidiaries of groups because of their financial dependence of the group.
- The geographical distribution at the departmental level of all bank branches drawn from the Bank of France.
- The composition of Banking groups and the location of bank head offices drawn from banks annual reports.
- Macroeconomic data at the departmental level of population is from the National Institute of Statistics and Economic Studies (INSEE).

After cleaning, the full sample contains 2915 French SMEs. Table 1 defines the variables employed in the empirical specifications and provides their mean, median, standard deviation and sources.

3.2. Measuring distances

3.2.1. The local banking system operational proximity

The notion of operational distance is the one usually examined in the banking literature and corresponds to the physical distance which separates the borrower from each lending office. It is conceivable to assume that the number of bank branches in a giving geographical area (here the department) is typically positively related to the operational proximity (OP) of the banking system to this area. One measure, drawn from the literature, of the operational proximity of the banking system from the department $d$ is the branch density in this department:

$$OP_d = \frac{\sum_{k=1}^{Kd} Branch\ number_k}{Population_d} * 10000$$

Where $Kd$ is the number of banks operating in the department $d$.
3.2.2. The local banking system functional distance

Functional proximity is usually measured as the proportion of local credit market (in terms of branches or deposits) controlled by banks that concentrate their activities in a delimited area. This measure implicitly assumes that functional distance is a dichotomous character that concerns only some, usually small, mutual and cooperative, banks and not the others. According to Alessandrini et al. (2009), functional distance is “a character shared to some extent by all banks that, given the localism of their decisional centres and strategic functions, are necessarily close to some areas and far from others”. To this respect, while a department with banking system formed by only local credit banks has the lowest value of functional distance indicators; it is also true that two departments with equally functionally distant banking systems may show very different proportion of local banks.

We adopt the measure of functional distance at the departmental level advanced by Alessandrini et al. (2009). We compute the functional distance of the local banking system from department $d$ by weighting the proportion of each bank branches operating in the province $d$ by the physical distance indicator that captures the severity of information asymmetries between the senior manager at the parent bank and the bank officer at the local branch. Organizational frictions induced by these information asymmetries are considered positively correlated to the physical distance between the bank’s headquarter and the local lending office.

The functional distance indicator is:

$$FDKM_d = \sum_{k=1}^{kd} \frac{Branch\ number_k}{\sum_{k=1}^{kd} Branch\ number_k} \times \ln(1 + Physical\ distance_{dh})$$

The physical distance is the kilometric orthodromic distance between the local capital town (also called a prefecture) of the department $d$ in which the branch is located and the local capital town of the department $h$ where the head office of the own (parent) bank is headquartered.

3.2.3. Descriptive statistics

Figures 3 and 4 show an increase (on average) of both operational proximity and functional distance of the banking system to French departments. Whereas, it is worth noting that functional distance has increased at higher pace than operational proximity showing that the trend toward the internal grouping of mutual networks is stronger than the recent process of banking supply system reinforcement. The regional distribution of distance indicators in 2008 shows that the banking system is operationally more proximate to the East, West, and Center than to the North and South (See Figure 3 (b)). It is functionally more distant to the East, Center, North, and South than to the West (See Figure 4 (b)). However, it is interesting to mention that the 2001–2008 regional operational proximity growth rate is the highest in the North and in the South, and that the functional distance growth rate is the highest in the West, Center and East (See Figure 3 and 4).
3.3. Measuring credit constraints

We say that a firm is credit constrained when:

- It is credit rationed à la Stiglitz and Weiss (1981). In this case, the firm apply for a loan to a bank or financial intermediary and have the application partially or totally rejected even if it is willing to pay a higher interest rate (or collateral) to obtain the credit.
- It faces credit difficulties in terms of high interest rates and/or collateral guarantees which enable it to accept the credit proposed.

The elusiveness of this notion makes it hard to measure. In fact, what we generally observe in the firms balance-sheets is the quantity of loan made, not the amount requested and the amount granted. Therefore, many proxy variables where proposed in the literature.

The proxy of financing constraints used in this paper is drawn from the large strand of literature which investigates the sensitivity of firm’s investment to the cash flow (Fazzari et al. 1988; Kaplan and Zingales 1997). Fazzari et al. (1988) classify firms according to whether they were likely to be financially constrained on the basis of their size, dividend payouts and capital structure. These characteristics determine whether they are more sensitive to the supply of internal funds measured by cash flow. The highest sensitivities to cash flow are found for firms classified as financially constrained. Many further studies have followed the same methodology including Chirinko and Schaller (1995), Hubbard et al. (1995), Calomaris and Hubbard (1995), as summarized by Hubbard (1998).

A more recent literature has raised criticisms about the use of cash flow sensitivity as a reliable measure of financing constraints. Kaplan and Zingales (1997) and Kaplan and Zingales (2000) have argued that the classification adopted by Fazzari et al. (1988) tends to assign firms incorrectly. They make use of more detailed information in financial statements from annual reports to categorize the same firms over an identical sample period into “financially constrained”, “possibly financially constrained” and “not financially constrained”. Using this new classification, they find that financially constrained firms have the lowest sensitivity of investment to cash flow. Clearly (1999), using a larger dataset, also finds that the most constrained firms have the lowest sensitivity. Allayannis and Mozumdar (2004) show that the results of Kaplan and Zingales(1997) can be explained by a few influential observations however the findings of Clearly (1999) can be explained by observations of firms with negative cash flows. The main message underlying Kaplan and Zingales as well as Clearly works is that firms under distress might suffer from law cash flow sensitivity, so that for severely constrained firms the usual relationship found in the literature might be reversed. What we think is that the use of investment-cash flow sensitivity as a measure of financing constraints should not be critical if cash flow weakly (or don’t) forecast future profitability or sales growth. This seems to be the case of our sample.
Table 1: Data description

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>The firm-level ratio of investment to previous capital stock. Investment is measured as the variation between t and t-1 of the firm's capital stock (defined as tangible and intangible assets, gross of depreciation allowances)</td>
<td>.0605</td>
<td>.0302</td>
<td>.190</td>
<td>Author's calculation on Balance Sheet data in DIANE (Bureau Van Dijk)</td>
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<tr>
<td>(I/K)</td>
<td></td>
<td></td>
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<tr>
<td>Explanatory variables</td>
<td>The departmental indicator of the organizational structure of the local banking system. It is measured by the functional distance of the local banking system from the local borrowers, computed as the ratio of bank K branches to total branches in department d weighted by the logarithm of 1 plus the orthodromic distance between the department of the branch and the department where the parent bank is headquartered. The departmental indicator of the local banking system operational proximity to a department d. It is a measure of the branch density in this department, computed as the number of bank branches in department d per 10000 inhabitants. The firm-level ratio of cash flow to previous capital stock. It is computed as net profit plus depreciation allowances.</td>
<td>3.423</td>
<td>3.290</td>
<td>1.123</td>
<td>Author's calculation on Bank of France data and Banks annual reports</td>
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<tr>
<td>FDKM</td>
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<tr>
<td>OP</td>
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<td>(CF/K)</td>
<td></td>
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<tr>
<td>Growth</td>
<td>The firm’s annual growth rate of total sales.</td>
<td>.048</td>
<td>.029</td>
<td>.217</td>
<td>Author's calculation on Balance Sheet data in DIANE (Bureau Van Dijk)</td>
</tr>
<tr>
<td></td>
<td>Category</td>
<td>Description</td>
<td>Size 1</td>
<td>Size 2</td>
<td>Size 3</td>
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<td>Size 1</td>
<td>is 1 if [11 - 20] employees, in %</td>
<td>16.26</td>
<td>36.95</td>
<td>36.69</td>
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<td></td>
<td>Size 2</td>
<td>is 1 if [21 - 50] employees, in %</td>
<td></td>
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<td></td>
<td>Size 3</td>
<td>is 1 if [51 - 250] employees, in %</td>
<td></td>
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<tr>
<td></td>
<td>Size 4</td>
<td>is 1 if [251 - 500] employees, in %</td>
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<td></td>
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<td>tech1</td>
<td>tech1</td>
<td>is 1 if the firm is affiliated to a low technology manufacturing sector</td>
<td>31.43</td>
<td>46.42</td>
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<tr>
<td>tech2</td>
<td>tech2</td>
<td>is 1 if the firm is affiliated to a medium-low technology manufacturing sector</td>
<td>49.23</td>
<td>49.99</td>
<td></td>
</tr>
<tr>
<td>tech3</td>
<td>tech3</td>
<td>is 1 if the firm is affiliated to a medium-high technology manufacturing sector</td>
<td>12.48</td>
<td>33.06</td>
<td></td>
</tr>
<tr>
<td>tech4</td>
<td>tech4</td>
<td>is 1 if the firm is affiliated to a high technology manufacturing sector</td>
<td>3.5</td>
<td>18.37</td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>North</td>
<td>is 1 if the firm is located in the North of France (Insee region codes:</td>
<td>29.67</td>
<td>45.68</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>11 - 21 - 22 - 31), in %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>West</td>
<td>is 1 if the firm is located in the West (Insee region codes:</td>
<td>15.4</td>
<td>36.09</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>23 - 25 - 52 - 53), in %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>Center</td>
<td>is 1 if the firm is located in the Center (Insee region codes:</td>
<td>9.29</td>
<td>29.03</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>24 - 74 - 83 and Insee department codes: 86 - 79), in %</td>
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<td></td>
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<tr>
<td>East</td>
<td>East</td>
<td>is 1 if the firm is located in the East (Insee region codes:</td>
<td>27.58</td>
<td>44.69</td>
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<tr>
<td></td>
<td></td>
<td>26 - 41 - 42 - 43 - 82), in %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South West</td>
<td>South West</td>
<td>is 1 if the firm is located in the South West (Insee</td>
<td>12.22</td>
<td>32.75</td>
<td></td>
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</table>

Firm data in DIANE (Bureau Van Dijk)
<table>
<thead>
<tr>
<th>Region Code</th>
<th>Description</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>South East</td>
<td>72 – 73 and Insee department codes: 16-17, in %</td>
<td>5.83</td>
<td>0</td>
<td>23.43</td>
</tr>
<tr>
<td>tdum</td>
<td>temporel dummies for the period 2001 - 2008</td>
<td>12.5</td>
<td>0</td>
<td>33.07</td>
</tr>
</tbody>
</table>

Firm data in DIANE (Bureau Van Dijk)
Figure 3 Panel (a) plots the number of branches per 10,000 inhabitants over the period 2001-2008 in North, West, Center, East and South regions. Panel (b) shows branch density in 2008 in the 96 French departments, classified in percentiles. Source: Bank of France and own elaboration.

Figure 4 Panel (a) plots the evolution of functional distance calculated weighting branches by kilometers over the period 2001 – 2008, in North, West, Center, East and South regions. Panel (b) shows functional distance in 2008 in the 96 French departments, classified in percentiles. Source: Bank of France and own elaboration.
4. The Investment-cash flow sensitivity econometric model and results

4.1. Dynamic investment model

We test the effects of operational proximity and functional distance on the sensitiveness of firm investment to cash flow by estimating a dynamic panel investment model. The autoregressive investment model of order 1 is:

\[
\left( \frac{I_t}{K_{t-1}} \right)_{id} = \delta_0 + \delta_1 \left( \frac{I_{t-1}}{K_{t-2}} \right)_{id} + \delta_2 \left( \frac{CF_t}{K_{t-1}} \right)_{id} + \delta_3 \left( \frac{CF_t}{K_{t-1}} \right)_{id} \times OP_{dt} + \delta_4 \left( \frac{CF_t}{K_{t-1}} \right)_{id} \times FDKM_{dt} + \delta_5 \text{Growth}_{idt-1} + \delta_6 \text{Growth}_{idt} + \mu_i + \vartheta_t + \varepsilon_{it} \tag{1}
\]

\text{Growth} \text{ is the growth rate of sales which is a proxy of firm’s profitability. } \mu_i \text{ and } \vartheta_t \text{ are individual and time specific effects and } \varepsilon_{it} \sim IID(0, \sigma^2_{\varepsilon}). \text{ Geographic and technological}
intensity industry classification dummies are included in the basic specification of equation (1) to control for fixed effects.

Financially constrained firms are more likely to exhibit a positive correlation between cash flow and investment. Therefore, the marginal effect of cash flow on investment may be used as a proxy for financing constraints.

Giving that the aim is to estimate the indirect effect of distance on investment, we include two interaction terms between cash flow and operational proximity and functional distance respectively \( \left( \frac{CF_{t}}{K_{t-1}} \right) \times OP \) and \( \left( \frac{CF_{t}}{K_{t-1}} \right) \times FD KM \).

According to the specification (1), the measure of the sensitivity of investment to cash flow is:

\[
\frac{\partial (I)}{\partial (CF)} = \delta_2 + \delta_3 OP + \delta_4 FD KM
\]  

(2)

The impact of operational and functional distances on financing constraints depends on the signs taken by \( \delta_3 \) and \( \delta_4 \).

Giving that smaller firms are more likely to be rationed than greater ones, it is interesting to examine whether:

- the marginal effect of cash flow on investment is higher for small firms;
- the operational and functional distances affect differently small and large firm’s investment sensitivities to cash flows.

To do this, we perform two other specifications by adding two interaction terms between firm size and \( \left( \frac{CF_{t}}{K_{t-1}} \right) \times OP \) and \( \left( \frac{CF_{t}}{K_{t-1}} \right) \times FD KM \) respectively.

4.2. Estimation methodology

The dynamic structure of the model by the inclusion of a lagged dependent variable makes usual estimators of fixed effect panel data biased and inconsistent. By construction, the correlation between the lagged dependent variable and the error component renders the OLS estimator biased and inconsistent even if the \( \varepsilon_{it} \) are not serially correlated (Sevestre and Trognon (1985)). For the fixed effects (FE) estimator, the Within transformation wipes out the fixed effects but the correlation still persists between the transformed lagged dependent variable and errors, even if the \( \varepsilon_{it} \) are not serially correlated. It is well noting that only if \( T \to \infty \) will the Within estimator of \( \delta_1 \) be consistent for the dynamic error component model, which is not the case.

An alternative to the Within estimator consists on applying OLS to the model written in first differences. In this case, correlation between the predetermined explanatory variables and the reminder error is easier to handle. This solution is less satisfactory because unlike Within
estimator, the FD estimator is biased and inconsistent even when N and T both tend to infinity.

The instrumental variable (IV) estimation methods (Anderson and Hsiao (1981)) are known to have better performances than these usual methods. They lead to consistent but not necessarily efficient estimates of the parameters in the model because it suffers from a significant loss of degrees of freedom, and it does not take into account the differenced structure on the residual disturbances.

For all these reasons, we decided to use the Generalized Method of Moments (GMM) and, in particular, the system-GMM (Blundell and Bond 1998) that is known to be more efficient than the Anderson and Hsiao (1982) estimator. The Blundell and Bond (1998) GMM method is based on the estimation of a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments).

4.3. Results

4.3.1. Functional distance and SME financing constraints

Table 3 displays the estimation results of the basic and augmented specifications. On the whole, the results on the sensitivity of investment to cash flow are consistent with those on credit constraints described in the section 2. Investment of firms in departments with a functionally more distant banking system is more sensitive to cash flow, and this effect decreases with size.

The positive coefficient on the interaction term $\left(\frac{CF}{\delta_{t-1}}\right) * FD KM$ shows that the marginal effect of cash flows on investment is increasing with $FD KM$. In fact, we are always unable to reject the null hypothesis $\delta_4 > 0$. It is worth noting that even if the coefficient on cash flow is negative, the overall estimated marginal effect (2) is positive. In fact, using estimated coefficients from regression (2) and average values of the different variables including OP, we could calculate the value of $FD KM$ beyond which the marginal effect of cash flow on investment become positive. This value is below the fifth percentile, showing that the marginal effect is positive in almost 95% of cases. These findings confirm the idea that the severity of communication and incentive problems as well as their negative impact of lending policies and credit allocation grows with the distance between bank’s hierarchical levels (Alessandrini et al. 2009)

The results of the first augmented specification point out significant differences in the impact of functional distance on investment-cash flow sensitivity according to firm size. From column (3), we can observe that the larger is the SME, the lower is the contribution of $FD KM$ to the marginal effect of cash flow on investment. This relation seems to be linear and is significant for $SIZE 3$ and $SIZE 4$ SMEs’ groups. These findings are broadly consistent with the theoretical prediction by which larger firms suffer less from the lack of banks’ decisional centres in the department where they are located.
4.3.2. Operational proximity and SME financing constraints

Interestingly, Table 3 shows that operational proximity has qualitatively the same significant adverse effect on investment-cash flow sensitivity as functional distance which confirms the informational capture that an operationally close banking system may exercise on local borrowers as well as adverse selection problems arising when approaching these locally captured firms (Hauswald and Marquez 2006).

The impact of operational proximity on investment-cash flow sensitivity also differs according to firm size. From column (4), we can observe that the larger is the SME (the largest group of SME considered), the lower is the adverse impact of operational distance on financing constraints. This confirms the theoretical prediction by which small firms suffer more from hold up problems than larger firms because of their opacity.

The consistencies of these results are confirmed by the validation of the instrument set at 5% and the reject of serial correlation in the original error, as desired. The dummies are generally not significant, expect for dummies relatives to 2001 and 2002 years that shows positive and significant coefficients, expect for industry dummies which shows significantly higher investment capabilities for low and medium technological sectors.

Table 3 The effect of distances on investment cash flow sensitivity. This table shows the one step System-GMM estimation of equation (1) using Stata 10.1 SE package. Time, geographic and technological intensity industry classification dummies are included in all regressions, not shown for reasons of space. As instruments, we use lags of endogenous and predetermined variables from t-1 to t-2. A first specification test is the Arellano-Bond test for zero autocorrelation tests of first, second and third orders AR (1), AR (2) and AR (3). A second specification test is the Sargan test of Over-Indentifying Restrictions (OIR Sargan test). P-values are reported for all these tests.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(I/K)</th>
<th>(I/K)</th>
<th>(I/K)</th>
<th>(I/K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>((I/K))</td>
<td>0.0649(^a)</td>
<td>0.0653(^a)</td>
<td>0.0666(^a)</td>
<td>0.0665(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.00947)</td>
<td>(0.00947)</td>
<td>(0.00947)</td>
<td>(0.00947)</td>
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<tr>
<td>Growth</td>
<td>0.101(^a)</td>
<td>0.100(^a)</td>
<td>0.0996(^a)</td>
<td>0.0994(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.00764)</td>
<td>(0.00764)</td>
<td>(0.00764)</td>
<td>(0.00764)</td>
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<tr>
<td>(Growth)(_1)</td>
<td>0.00229</td>
<td>0.00234</td>
<td>0.00267</td>
<td>0.00272</td>
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<tr>
<td></td>
<td>(0.00772)</td>
<td>(0.00772)</td>
<td>(0.00772)</td>
<td>(0.00772)</td>
</tr>
<tr>
<td>(CF/K)</td>
<td>0.0142(^a)</td>
<td>-0.0864(^a)</td>
<td>-0.0828(^a)</td>
<td>-0.0807(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.00370)</td>
<td>(0.0264)</td>
<td>(0.0264)</td>
<td>(0.0264)</td>
</tr>
<tr>
<td>(CF/K)*FSDKM</td>
<td>0.00879(^b)</td>
<td>0.0130(^b)</td>
<td>0.00772(^b)</td>
<td>0.00362(^b)</td>
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<td>(0.00361)</td>
<td>(0.00414)</td>
<td>(0.00362)</td>
<td>(0.00362)</td>
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<tr>
<td>(CF/K)*OP</td>
<td>0.0170(^a)</td>
<td>0.0173(^a)</td>
<td>0.0187(^a)</td>
<td>0.00491</td>
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<tr>
<td></td>
<td>(0.00470)</td>
<td>(0.00470)</td>
<td>(0.00470)</td>
<td>(0.00491)</td>
</tr>
</tbody>
</table>
5. Conclusions

In this paper, we have tried to assess the impact of geographical diffusion of banking structures and instruments as well as geographical concentration of decisional and strategic centres of banking institutions over the period 2001 – 2008 on firms’ financing constraints. Our econometric exercise consistently show that increased functional distance made financing constraints more binding, reflected by the positive coefficient relying it with the investment cash-flow sensitivity. These negative effects are particularly evident for small firms ([11 – 50] workers). Interestingly, operational proximity has qualitatively the same significant adverse effect on investment-cash flow sensitivity as functional distance which confirms the informational capture that an operationally close banking system may exercise on local borrowers as well as adverse selection problems arising when approaching these locally captured firms (Hauswald and Marquez 2006).

One implication of our findings is that the consolidation of the French banking industry, leading to an increase of the functional distance may aggravate financing problems of small local firms, especially in peripheral departments. As Alessandrini et al. (2009) and before Berger and Udell (2006) have pointed out, these negative externalities of market deregulation could be reduced by "favoring a change in emphasis in bank organization from the search of

\[
\begin{align*}
(CF/K)\times FDKM \times SIZE2 & = 0.000253 \\
(CF/K)\times FDKM \times SIZE3 & = -0.00629^b \\
(CF/K)\times FDKM \times SIZE4 & = -0.0293^a \\
(CF/K)\times OP \times SIZE2 & = -0.000156 \\
(CF/K)\times OP \times SIZE3 & = -0.00384^c \\
(CF/K)\times OP \times SIZE4 & = -0.0214^a \\
\text{Constant} & = -0.947^b \\
\text{Observations} & = 20404 \\
\text{Number of firms} & = 2915 \\
\text{OIR Sargan test} & = 0.249 \\
\text{AR(1)} & = 0.000 \\
\text{AR(2)} & = 0.615 \\
\text{AR(3)} & = 0.101
\end{align*}
\]

\[\text{(0.393)} \quad \text{(0.393)} \quad \text{(0.393)} \quad \text{(0.475)} \]

^a Statistical significance at the 1% level
^b Statistical significance at the 5% level
^c Statistical significance at the 10% level
economies of scale by standardized, arm's-length lending technologies, to economies of scope by making specialized credit instruments available to local firms”.

Finally, our results are particularly suggestive of the persistent importance of relationship lending for small opaque borrowers despite the technological progress that significantly expands the ability of banks to produce hard information and therefore substitute transactions-based lending for relationship lending and Basel II recommendations that push banks to develop sophisticated credit scoring models, largely based on hard information, to assess the credit risk.

Acknowledgments  I am grateful to Didier Fichaux and Loïc Dorléans (Bank of France) for providing us the banks’ location files (FIB) that allows us to build up our interest variables. For useful comments, I thank François Etner as well as the participants at the “9th International Conference of the Middle East Association” (Istanbul) for helpful suggestions.

Appendix 1

Figure 1 (a) The French banking sector consolidation. (b) The emblematic internal grouping of cooperative networks. Source: CECEI annual reports and own elaboration.
**Figure 2** Branches. ATMs and employees evolution in the French banking system, 1999 – 2008. Source: CECEI annual reports and own elaboration
Figure 2 French SMEs Investments’ financing plan, 2004 – 2009. Source: the OSEO biannual surveys on SMEs and own elaboration.

Appendix 2

Table 4 Geographic and Size distribution of the SME sample

<table>
<thead>
<tr>
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<tr>
<td>North</td>
<td>1072</td>
<td>2479</td>
<td>2448</td>
<td>609</td>
<td>6608</td>
</tr>
<tr>
<td>West</td>
<td>389</td>
<td>1167</td>
<td>1608</td>
<td>310</td>
<td>3474</td>
</tr>
<tr>
<td>Center</td>
<td>359</td>
<td>802</td>
<td>846</td>
<td>108</td>
<td>2115</td>
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<tr>
<td>East</td>
<td>1006</td>
<td>2431</td>
<td>2401</td>
<td>470</td>
<td>6308</td>
</tr>
<tr>
<td>South-West</td>
<td>532</td>
<td>1172</td>
<td>999</td>
<td>123</td>
<td>2826</td>
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<tr>
<td>South-East</td>
<td>436</td>
<td>567</td>
<td>255</td>
<td>69</td>
<td>1327</td>
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<tr>
<td>France</td>
<td>3794</td>
<td>8618</td>
<td>8557</td>
<td>1689</td>
<td>22658</td>
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Table 5 Pairwise Correlation Matrix

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<thead>
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<th>(I/K)</th>
<th>(CF/K)</th>
<th>FD KM</th>
<th>OP</th>
<th>Growth</th>
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</thead>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CF/K)</td>
<td>0.0656***</td>
<td>1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FD KM</td>
<td>-0.0003</td>
<td>0.0324***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OP</td>
<td>0.0109*</td>
<td>0.0045</td>
<td>0.2060***</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>0.1986***</td>
<td>0.0711***</td>
<td>0.0028</td>
<td>0.0007</td>
<td>1</td>
</tr>
</tbody>
</table>

***, **, * significant at the 1%, 5% and 10% levels respectively
References


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Ferri G (1997) Branch manager turnover and lending efficiency: Local vs. national banks. BNL Quart Rev 50: 229-247
Mistrulli PE, Casolaro L (2008) Distance, lending technologies and interest rates. 21th Australasian Finance and Banking Conference 2008 paper
Ozbas O (2005) Integration, organizational process and allocation of resources. J Finan Econ 75: 201–242


1 This terminology was introduced by Alessandrini, Croci and Zazzaro (2005) and used in number of studies
2 DIANE : DIsque pour l’ANalyse Economique, edited by the Bureau van Dijk (92, rue de Richelieu 75002 Paris)
3 Also called “as the crow flies distance” or “great –circle distance” and defined as the shortest distance between any two points of a sphere.
4 Other proxies for credit rationing are those of Kugler (1987) and King (1986) that attempt to estimate equilibrium credit rationing. Clearly (1999) uses multiple discriminant analysis to identify firms with financial constraints.