# Banks, Distances and Financing Constraints for Firms*

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**Abstract**

The wave of bank mergers and acquisitions has deeply changed the geography of banking industry. While the number of bank branches has increased in almost every country, reducing the *operational distance* between banks and borrowers, bank decisional centres and strategic functions have been concentrated in only a few places within each nation, increasing the *functional distance* between banks and local communities. In this paper, we carry out a multivariate analysis to assess the correlation of functional and operational distances with local borrowers' financing constraints. We apply our analysis on Italian data at the local market level defined as provinces. Our findings consistently show that increased functional distance makes financing constraints more binding, it being positively associated with the probability of firms being rationed, investment-cash flow sensitivity, and the ratio of credit lines utilized by borrowers to credit lines make available by banks. These adverse effects are particularly evident for small firms and for firms located in southern Italian provinces. Furthermore, our findings suggest that the negative impact on financing constraints following the actual increased functional distance over the period 1996-2003 has substantially offset (and sometimes exceeded) the beneficial effects of the increased diffusion of bank branches occurring during the same period.

Keywords: Local banking systems; Functional distance, Operational proximity, Financing constraints.

JEL classification: G21; G34; R51.

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## 1. Introduction

Following the deregulation of credit markets and technological progress, the geographical diffusion of banking structures and instruments has increased in almost every country. This trend has reduced the *operational distance* between banks and borrowers. At the same time, because of the spectacular wave of bank mergers and acquisitions experienced in European and U.S. credit markets, bank decisional centres and strategic functions have been concentrated in only a few places within each nation. The spatial concentration of banking power has greatly increased the physical and economic distance that separates the locus of control of local lending offices from borrowers, that is, the *functional distance* between banks and local communities.

Despite the conspicuousness and ubiquity of these contrasting trends of spatial diffusion-concentration in banking systems, their importance for local economies and borrowers has not yet been scrutinized in depth by the literature. Indeed, according to a well established view the geography of banking power *per se* has no reason to affect the bank-firm relationship. What really matters is only that local credit markets are integrated and competitive, a condition that deregulation, information technology and financial innovations have made increasingly concrete. In this view, the geographical reach of banking holdings through affiliated banks and branches as well as the high mobility of financial flows should guarantee an adequate response to the needs of local borrowers, regardless of the locus of control of local bank offices.

However, is the location of a bank's decisional and strategic centres really neutral? Are the choices of local loan officers actually insensitive to the physical distance from the head offices of their own parent banks? Do the institutional and cultural differences between the bank's locus of control and the local communities where its branches operate shape the nature of lending relationships? In a word, does the *functional distance* of the banking system from the local economy matter for financing constraints?

A large body of literature has been devoted to assessing the impact of consolidation on various aspects of the bank-firm relationship[1]. However, these studies may offer only very indirect answers to the questions raised above. Usually researchers follow a bank-based approach by comparing the behaviour of some types of banks considered close to the needs of local borrowers with the behaviour of other banks regarded as "distant" from local economies: small *versus* large banks, local *versus* national banks, in-market owned *vs* out-of-market owned banks; domestic vs foreign banks (Gilbert and Belongia 1988; Keeton 1995; Berger and Udell 1996; Peek and Rosengren 1998; Sapienza 2002; Alessandrini *et al.* 2005; Berger *et al.* 2005; Mian 2006). Then, depending on the emergence of differences in lending conditions, credit to small firms, screening and communication technology, relationship lending, efficiency and productivity between these two types of institutions, the morphology of the local banking system is said to be effective or ineffective for local borrowers and economic development. Some studies try to appraise the total impact of consolidation on local borrowers by looking at the dynamic changes in the behaviour of consolidating banks and the reactions of incumbent and *de novo* entrant lending institutions (Berger *et al.* 1998; Goldberg and White 1998; Whalen 2000; Focarelli et al. 2002; Evanoff and Örs 2002; Alessandrini *et al.* 2006). However, even in these articles the importance of the locus of the bank decisional power is only very backstage.

A few other studies follow a market-based approach, where the analysis is carried out at the local market level (Avery and Samolyk 2000; Bonaccorsi and Gobbi 2001; Collender and Shaffer 2003; Benfratello *et al.* 2005; Berger, Rosen and Udell 2005). The advantage of this approach is being able to directly assess the net impact of the morphological structure of the local banking industry (in terms of consolidating status, size and ownership) on local borrowers and economies.

In this paper we adopt the market-based approach. As a measure of the operational distance of the banking system to local economies we use the density of branches computed as the ratio of the number of banks' branches to population (the same indicator is employed by Bonaccorsi and Gobbi 2001; Benfratello *et al.* 2005). As a measure of functional distance we build an indicator that takes

[1] For some detailed surveys see, Berger *et al.* (1999), Alessandrini *et al.* (2003), DeYoung *et al.* (2004).

into account the ownership structure of the local lending offices. In this vein, Collender and Shaffer (2003) partition local bank branches into in-market and out-of-market owned branches and measure the ownership structure of the local banking systems both as the number of branches in the two categories and the ratio of out-of-market owned branches to total bank branches in the local market (a similar measure is employed in Bonaccorsi and Dell'Ariccia 2004). In this way, however, they end up treating all the out-of-market owned bank offices as homogeneous category, regardless of the economic and physical distance between the market in which they are located and the locus of control of the office.

In this paper, we overcome this extreme assumption by introducing a more accurate measure of the functional distance of local banking systems from local economies. Specifically, we calculate functional distance as the number of local branches weighted by the physical and cultural distance which separates them from the locus where their own bank is headquartered. Physical distance is computed in kilometres. Cultural distance, instead, is measured as the absolute value of the difference of the social capital (proxied by the participation in referenda) of the local economies where the bank branch and its head office are located respectively.

Therefore, we carry out a multivariate analysis to assess the correlation of operational and functional distances with local borrower financing constraints. We apply our analysis on Italian data at the local market level defined as provinces. Given the difficulties in measuring the financing constraints for firms, to robustly assess the impact of distances on financing constraints we run three types of econometric exercises on three different proxies for this quantity. The first exercise consists in evaluating, on the basis of survey data, whether functional and operational distances affect the likelihood of firms being rationed. The second exercise consists of an investment-cash flow sensitivity analysis, in which the estimated model comprises an interactive variable between cash flow and distance. The third exercise investigates the association between the two notions of distance and the degree to which the lines of credit granted to local firms are actually in use.

On the whole, our results suggest that the functional distance adversely affects the availability of credit to local firms, and that this effect is particularly significant for small businesses. Moreover, we find that the negative impact of functional distance survives independently of the density of bank offices operating in the province (the operational distance of the banking system), and the degree of competition of the credit market.

The paper proceeds as follows. Section 2 discusses why operational and functional distance between bank offices and borrowers should impact on the lending relationship and selectively reviews the related empirical findings in the literature. Section 3 describes the data and the distance variables. Section 4 displays our three empirical exercises, illustrating for each of them the dependent and control variables, the empirical models and methodologies, the results and robustness checks. Section 5 concludes.

## 2. Why should operational and functional distances affect financing constraints?

### 2.1. *The Operational distance*

The notion of distance usually examined in the banking literature is the one we label operational distance, and refers to the physical distance which separates the borrower from each lending office.

#### A. *Theory*

The theoretical reasons why the operational distance (proximity) may affect financing constraints for firms rests on informational asymmetries that unsettle bank-firm relationships. First, the physical closeness to the local economy allows each bank to complement 'hard' data on borrowers with relevant 'soft' information collected locally on an informal basis. Such information improves the quality of borrowers' screening and monitoring and makes these actions less costly. In this way, the probability of erroneously denying credit to good borrowers reduces (Gehrig 1998; Zazzaro 2002) as well as the likelihood of credit rationing equilibria (Williamson 1986; 1987). Thirdly, informationally more opaque local borrowers may benefit from the entry of outside banks in local credit markets because this can produce an expansion of relationship-based loans from local institutions that redirect their activity in favour of local small businesses for which they have informational rents, so as to insulate them from the competition of outside lenders (Boot and Thakor 2002; Hauswald and Marquez 2002; Dell'Ariccia and Marquez 2004).

However, great operational proximity of banks to borrowers may also adversely impact on financing constraints. First, relative physical proximity gives market power to the lending bank that can, therefore, charge higher interest rates to such borrowers. Secondly, operational proximity may engender both "winner's curse" type phenomena and negative externalities. For example, if the screening of borrowers' quality is imperfectly correlated across banks and each bank cannot observe whether or not their applicants have been previously rejected by other banks, a larger number of competitors operating in the local market may push banks to be more conservative in terms of loan interest rates and acceptance standards (Broecker 1990; Riordan 1993, Shaffer 1998). Moreover, when the local credit market is served by many banks, firms in temporary financial distress may have difficulty seeking rescue from their lenders, because each bank cannot appropriate more than a small fraction of the future benefits from such rescues (Dinc 2000). Finally, a large number of competitors facilitate multiple bank relationships (Detragiache *et al.* 2000). This mitigates hold-up problems for borrowers, but also reduces the incentives of banks to screen applicants and worsen adverse borrower selection problems.

B. *Evidence*

Available empirical findings seem to corroborate both the positive and negative traits of the operational proximity of banks to local economies. At the bank level, Degryse and Ongena (2005) analyse the behaviour of a single Belgian institution and, consistent with spatial competition models with price differentiation, find that the physical closeness of borrowers to the lending office is associated with higher interest rates, whereas their closeness to the lender's competitors reduces interest rates. Petersen and Rajan (2002) find the same inverse relation between interest rates and distance. However, they do not examine to the actual distance between the lending office and the firm but an estimated measure of the potentially reachable distance on the basis of firms' transparency and creditworthiness.

With regard to credit availability, Carling and Lundberg (2002), on analysing the behaviour of a single Swedish bank, find no evidence for a direct relation between distance and the probability of the bank giving borrowers a low rating. Brevoort and Hannan (2004), instead, find that the probability of a bank lending in a given area reduces with physical distance between the center of the local market and the nearest office of that bank, and, consistent with models of strategic information acquisition, show that for small banks this detrimental effect of distance is stronger and increasing over time. The positive association between the number of banks operating in a given market and the recourse to relationship-based lending is documented also by Degryse and Ongena (2004) and Elsas (2005) on Belgian and German data respectively.

At the market level, Bonaccorsi and Gobbi (2001), using Italian data, find that the density of branches (the ratio of branches to population) existing in a province is positively associated with the credit availability for firms (particularly for small firms) located in that province, whereas it is negatively associated with the share of bad loans. This finding is only partially confirmed by Bonaccorsi (2003) who shows that the number of bank branches operating in a province *j* reduces the share of credit lines utilized by firms located in the same province, but increases the share of credit that is collateralized. The number of branches operating in the same municipality as firms has, instead, exactly the opposite effect. Benfratello *et al.* (2005) show that the density of branches in Italian provinces increases the probability of firms introducing innovations, while it only slightly affects the sensitivity of investment to the cash flow.

Using U.S. data, Avery and Samolyk (2000) find that the number of banks operating in a Metropolitian Statistical Area is only weakly associated with small business lending growth in the local market, whereas the number of offices has no impact at all on such a variable. Shaffer (1998) considers the effect of operational distance on local economies and shows that household income in

U.S. metropolitan areas grows faster where the number of banks is higher. Finally, Farinha and Santos (2002) find that in Portugal the entry of a new bank is correlated with an increase in the probability of firms switching from single to multiple borrowing relationships.

2.2. *The Functional distance*

The functional distance (proximity) of a banking system from (to) local borrowers stems from within the bank and has to do with the locus of control of the local bank offices and their decisional autonomy.

A. *Theory*

From a theoretical point of view, the importance of functional distance for lending policies of local bank branches has its roots in two ubiquitous (and connected) phenomena: (i) the institutional, social and cultural differences across communities; (ii) the asymmetrical distribution of information within organisations.

Local economies often appreciably differ in their own economic, institutional, social and cultural environment. Local bank managers, by sharing a common set of habits, social norms and business language with borrowers, may accumulate a unique informational capital on which the capacity of the bank to select good projects strictly depends. However, information on local borrowers in the hands of local bank managers is to a large extent "soft" and not easily transferable to the upper echelons of the banking organization. This generates a number of consequences that adversely affect bank-firm relationships.

a. *Agency and hold-up costs.* – Where the objectives of local and senior managers diverge and bank-specific investments by the former may be carried out, agency and hold-up problems arise. In such cases, the CEOs at the parent banks have to cope with an organisational trade-off between decentralization of lending decisions and hierarchy. At one extreme, either to stimulate initiative in collecting and processing information (Aghion and Tirole 1997) or avoid noisy communications

(Dessein 2002; Harris and Raviv 2005) or also generate optimal investment incentives (Aghion *et al.* 2004; Roider 2004; Takáts 2004), the parent bank may give loan officers full discretion on lending decisions, restricting the monitoring of officers to the performance of the loans they grant. Moreover, managers at local offices may be only rarely replaced, so as to have the opportunity to build embedded ties with local firms (Uzzi and Lancaster 2003). At the opposite extreme, the senior managers of the bank may take upon themselves the final decision on any loan proposal made by local loan officers, monitor the behaviour of the latter by setting up a rigid system of screening procedures based on hard information, and impose frequent turnover of local managers to reduce their informational rents (Stein 2002; Novaes and Zingales 2004). Whatever the combination of delegation and control, significant organisational diseconomies arise which, everything else being equal, reduce the profitability of relational-based lending.

b. *Influence activities*. – Local loan officers may waste resources and effort in trying to influence the decisions of senior managers at the parent bank on the distribution of resources, job assignments and power within the organization (Milgrom 1988; Milgrom and Roberts 1990). Such influence activities generate considerable costs for the bank in terms of: (i) time and effort that local and parental managers divert from their due tasks of screening worthy projects and employing resources efficiently; (ii) information manipulation and inefficient decisions; (iii) non-optimal organizational design in attempting to discourage influence actions on senior managers (Inderst *et al.* 2005).

c. *Career focus*. – Local officers are often only working in the region as an intermediate stage in their career. The mobility of branch officers is sought by the parent bank to limit agency problems and influence activities. But it is often demanded by the officers themselves, since all the key positions they can obtain in the bank are located elsewhere. Anyway, the repeated internal mobility of managers means that their chances of a career within the bank, besides their actual remuneration, usually depend on the short-term results produced by the loan office. This may induce local managers to take a cautious attitude towards risky small business loans primarily based on soft, nonverifiable information, while overlending to well-known borrowers (Holmstrom and Ricart-i-Costa, 1986; Palley, 1997; Berger and Udell, 2002).

B. Evidence

There is little yet robust empirical evidence that supports the importance of agency problems and influence costs in banking organizations. Managers of subsidiaries or branches are usually found to conduct only preliminary screening of loan applications by following well-defined standardized rules, while the final decision on loans is left to senior managers at the parent bank (Berger and Udell, 1989; Nakamura, 1994; Keeton, 1995; Liberti 2005). In addition, Ferri (1997) finds that in order to restrain agency costs due to the informational rent of local officers, large national banks reduce the average time their local managers spend in a branch. By contrast, Liberti (2004) finds that empowering local managers increases the effort they devote to screening and monitoring borrowers, and improves the performance of the bank. Liberti, however, does not control for the resources that the parent bank spends on ex-post loan reviewing activities. The latter, as shown by Udell (1989), seem to have a strong positive correlation with the organisational complexity of the bank and the degree of autonomy of local managers.

Berger and DeYoung (2001 and 2002) concentrate on the efficiency costs of agency problems within a multi-bank holding company. The cost and profit efficiency of parent and affiliated banks are positively correlated, and this correlation reduces with an increase in the geographical distance between the two institutions. By contrast, according to Sullivan and Spong (1995) the informational disadvantages of the geographical distance between parent and acquired banks are often outweighed by the advantage of diversification that increases the probability of high performance of the latter (in terms of Roa and Roe). The cost of friction between local officers and senior managers is, instead, confirmed by Klein and Saidenberg (2005) who find that the bank holding company value, as measured by the market-to-book equity ratio, decreases with the diversity of bank subsidiaries in terms of size and lending.

Two other pieces of evidence corroborate the view that, at the bank level, organisational diseconomies have adverse effects on credit availability for some types of borrowers. First, it has been observed that large out-of-market owned and foreign banks have a disadvantage in screening small businesses and allocate less resources to such companies than other banks (Keeton 1995, Cole *et al.* 2002, Carter *et al.* 2004; Alessandrini *et al.* 2005; Berger et al. 2005; Carter and McNulty 2005; Mian 2006). Second, other studies show that consolidations involving large or out-of-state banks lead to a reduction in small business lending, whereas those between two small or in-state banks often have only a temporary negative or even a positive effect on loans to small firms (Keeton 1996; Berger et al. 1998; Cole and Walraven 1998; Peek and Rosengren 1998; Sapienza 2002; Alessandrini *et al.* 2006).

Finally, close to our market-based approach, some researchers have studied the impact of the distance of the banking system from an area on local borrowers and the economy. Avery and Samolyk (2000) find that, among U.S. rural markets, the growth rate of small business loans was lower in markets where, at the beginning of their study period, a high share of small business lending was held by subsequently acquired banks. In urban banking markets, however, this effect is confirmed only for consolidation involving banks operating within the same market (Samolyk and Richardson 2003). Whalen (2000) and Berger, Rosen and Udell (2005), however, find that competition in the local markets is positively correlated with the proportion of deposits in local credit market at large banks and multi-bank holding companies. Working on Italian data, Bonaccorsi and Gobbi (2001) find that in provinces greatly affected by merger activities credit to small firms is lower, whereas the share of bad loans is higher.

Closely related to our paper, Bonaccorsi and Dell'Ariccia (2004) and Collender and Shaffer (2003) build a measure of what we label the functional distance of the banking system from the local economy that takes into account the ownership structure of the local lending offices. All in all, both these papers find that the proportion of the local loan market held by in-market institutions (i.e., the functional proximity of the banking system) has some positive effect on the credit availability at the local level. With regard to the Italian economy, Bonaccorsi and Dell'Ariccia (2004) find that in province *j* the emergence of new firms in industrial sectors characterized by a higher degree of informational opaqueness is positively associated with the share of deposits held by chartered banks in the same province *j*. With regard to the U.S., Collender and Shaffer (2003) study the impact of the functional distance on local economic growth. Their results suggest that the effect of the presence in local markets of out-of-market owned bank offices varies with the characteristics of the local marketplace, as well as the time period analysed. However, in many circumstances the association between local economic growth (above all, long-run economic growth) and bank offices differs significantly with the locus of their ownership.

## 3. Data and variables

### 3.1. *Data*

To test the impact of operational and functional distances on financing constraints for firms, we build up a panel dataset containing information on firms, bank office locations, bank types, credit market, institutional characteristics and macro variables in Italy at the provincial level. The time period considered in the analysis changes with the econometric exercise performed, and ranges from 1995 to 2003. The database relies on three main sources: (1) firm-specific information drawn from three surveys managed by MedioCredito Centrale-Capitalia on small and medium enterprises in 1997, 2000 and 2003 (henceforth, MCC surveys); (2) data on the Italian banking system, credit lines available and used are from the Bank of Italy; (3) basic macroeconomic indicators at the provincial level, from the National Institute of Statistics (ISTAT).

Firm-specific data, instead, comes from well known and widely used surveys on Italian small and medium manufacturing firms.[2] The surveys are managed every three years by MedioCredito Centrale-Capitalia Observatory on SMEs and gather a series of information on firms' structure for a representative sample of firms with more than 11 employees. For our purposes, we use the last three

[2] Among others, the survey on SMEs is used by Benfratello *et al.* (2005) to estimate the effect of local banking development on innovation.

surveys available, since they provide useful information on the bank-firm relationship and on financing constraints, together with balance sheet data for the period 1997-2003[3]. The three surveys together have 12,627 observations[4], but only 526 firms are present in all three datasets, because only a fraction of the sample is kept fixed for the subsequent surveys (rotating panel). The geographical and dimensional distribution of the sample (shown in Table 1, according to the three surveys) highlights: 1) a great concentration of firms in the north of Italy, especially for larger firms, and 2) the dominance of small business, specific to the Italian manufacturing sector.

The second set of data covers the distribution at the provincial level[5], of all Italian bank branches, the composition of banking groups, and the location of bank head offices. Besides, the database includes the interest rates on loans and the ratio between utilized and available credit lines, split in seven categories according to loan size, for each Italian province over the period 1997-2003.

Macroeconomic data at the provincial level cover the same period and concern the value added, population and two indicators on the functioning of the judicial system.

### 3.2. *Measuring distances*

Following the previous literature, we measure the operational proximity (OP) of the banking system from province *j* as the branch density in this province:

(1)
$$OP_j = \frac{\sum_{k_j} Branches_{k_j}}{Population_j} \times 10000$$

where $k_j$ is the number of banks operating in the province *j*.

The functional distance (FD) of the banking system the province *j* is correlated with the ownership and organizational structure of the banks locally operating. In the few attempts to

[3] The data coming from the surveys generally refer only to the year in which the survey is done, even if, for some information (i.e. total sales, workers) the questions cover also the two previous years.
[4] More precisely, the first survey (1997) covers 4,495 firms, the second (2000) 4,680, and the last one (2003) 3,452 (see Table 1).
[5] Italy is divided into 103 provinces, which are grouped into 20 administrative regions. The 20 regions are then usually grouped into five macro areas: (1) North-West: Valle d'Aosta, Piemonte, Lombardia and Liguria; (2) North-East: Veneto, Trentino Alto Adige, Friuli Venezia Giulia and Emilia Romagna (3) Centre: Tuscany, Marche, Umbria and Lazio; (4) South: Abruzzo, Molise, Campania, Puglia, Basilicata and Calabria (5) Islands: Sicily and Sardinia.

consider the ownership structure of the local banking system made in the literature (see above, section 2), FD is roughly computed as the proportion of the local credit market (in terms of branches or deposits) controlled by out-of-market owned banks. Here, the implicit assumption is that functional distance is a dichotomous character that some banks own and others do not.

On the contrary, our assumption is that functional distance can be better understood as a continuous character shared in some measure by all banks. Therefore, we compute FD by weighting the number of branches in the province by a distance indicator that captures the degree of informational asymmetries and the seriousness of organizational diseconomies between the local bank office and the head bank office of the parent bank. Our assumption is that the information asymmetries and communication difficulties within organizations increase with the physical distance between the decisional centres and with the institutional and cultural differences between the loci where they are settled. Moreover, we assume that control of local branches is in the hands of the chartered banks that own them, regardless of their affiliation to a multibank holding company. This is a very restrictive assumption that tends to undervalue the impact of functional distance on financing constraints for firms. Actually parent banks tend to preserve a certain influence on the decisional process of affiliated banks. Since the headquarters of parent banks are in Italy much more geographically concentrated than those of independent chartered banks, considering only the distance within chartered banks greatly reduces the geographical variability of functional distance and underestimates the distance to southern provinces where only few holding groups are located. [6]

Specifically, we consider two indicators of functional distance where the weighting rule of branches is: (1) the kilometric distance between the local branch and the headquarter of the bank that owns it; (2) the absolute difference between the social capital of the province where the branch is located and that of the parent bank. In symbols:

[6] According to the Register of bank and banking groups held by the Bank of Italy, by 2004, 148 chartered banks had their headquarters in one of the southern regions, whereas no banking group had their holding company or parent bank in the these regions. Among the 148 southern banks, 111 were small Credit Cooperatives, 21 were affiliated to Northern-Central banking groups and only 16 were independent, stand-alone banks.

(2) $$FD1_j = \frac{\sum_{k_j} \left[ Branches_{k_j} \times \ln\left(1 + KM_{jz}\right) \right]}{\sum_{k_j} Branches_{k_j}}$$

(3) $$FD2_j = \frac{\sum_{k_j} \left\{ Branches_{k_j} \times \left| SC_j - SC_z \right| \right\}}{\sum_{k_j} Branches_{k_j}}$$

$KM_{jz}$ is the kilometric distance between the province *j* in which the branch is located and the province *z* where the chartered bank that controls the branch is headquartered, with $KM_{jj} = 0$. The kilometric distances across the 103 Italian provinces are calculated with reference to the provincial capitals, thanks to an extension of the ArcView GIS software – Distance Matrix – developed by Jenness (2005). $SC_j$ is the social capital in province *j* and is computed as the average voter turnout at the 21 referenda held in Italy in 1993, 1995 and 2001. This proxy for social capital was introduced by Putnam (1995) and employed in banking literature by Guiso *et al.* (2004).

It may be worth noting the dissimilar impact that the process of banking consolidation and branch opening-closing in the local market have on OP and FDs. While OP varies univocally with the number of branches operating in the local credit market, FD also depends on the type of branches. For example, a bank merger leaving the number of branches in a province unaffected does not have any effect on $OP_j$, but may either reduces or increases $FD_j$ depending on whether the locus of control of the new bank is in a province *z* physically (culturally) closer to or farther from *j* than the two merging institutions. Similarly, also changes in FD1 and FD2 are not perfectly correlated. In fact, the opening (closing) of a branch in province *j* from a bank whose headquarter is in *z* certainly increases (reduces) FD1, whereas FD2 may change in the opposite direction due to a countervailing effect of social capital differential between provinces *j* and *z*.

As we expected, the process of consolidation resulted in an increase of both operational proximity and functional distances of the banking system to Italian provinces (see Table 1). Both OP and FDs show great geographical variability. In particular, as Figure 1 shows, the provincial distribution of distance indicators mirrors the usual Italian geographical divide between northern-central and southern regions with the banking system both operationally and functionally clearly more proximate to the former than to the latter. Recall that the functional distance is computed starting from physical and cultural distances within the chartered banks. Therefore, in some southern and central provinces, like Ancona, Sassari and Palermo, the banking system should emerge much more distant from local communities if some local affiliated banks (like Banca Popolare di Ancona, Banco di Sardegna and Banco di Sicilia) were considered as belonging to their out-of-province holding company. Finally, it is interesting to note that in northern and central provinces FD2 shows lower and more homogeneous relative values than FD1 in consideration of the greater institutional and cultural homogeneity of this part of the country.

### 3.3. *Measuring financing constraints*

Because of the elusiveness of the notion of financing constraints and the lack of established methodology in measuring it, in this paper we follow a robust approach, on the basis of the principle that several consistent clues constitute evidence. Namely, we run three econometric exercises to test the impact of distances on three different indicators of financing constraint. Two indicators are computed at the firm level from survey and balance-sheet data respectively. The third indicator is computed at the market level.

More in detail, for the first exercise, we use the Capitalia surveys on SMEs to define a firm as credit-rationed if it answered yes to the question: "*In [year of the survey] the firm would have desired more credit at the interest rate agreed with the bank?*" (Capitalia, 2003). Hence, our first indicator of financing constraints (RAT) is a dichotomous variable which is equal to 1 if the firm is credit-rationed and zero otherwise. The survey's section on credit rationing is more detailed, since there are two other more questions concerning the firms' availability to pay slightly higher interest rate than the current one and the actual rejection of a loan application. However, since the order and method in which the questions are reported change with the surveys, answers are not comparable across the three datasets and we have decided to concentrate our analysis only on the first question[7]. We realize that the survey question that we use to classify a firm as rationed actually merges quantity with price rationing. However, since we are interested in financing constraints and not in credit quantity rationing *per se*, this is not a drawback for our measure.

Our second strategy to identify the weight of distances on financing constraints is grounded on the large strand of literature which investigates the sensitivity of firms' investment to the cash flow (Fazzari *et al.* 1988; Kaplan and Zingales 1997). As is well known, the idea is that a financially constrained firm will rely on internal financial sources for its investment decisions. Therefore, our second indicator of financing constraints is the estimated marginal impact of cash flow on investment.

The third measure of financing constraint is calculated at the market level as the logarithm of the ratio of credit lines utilized by in-market firms to credit lines made available to them (CRED). This is a widely employed indicator of credit market tightness, in the light of the assumption that firms that use a high proportion of their credit are more likely to be financially constrained.[8]

## 4. Credit Rationing

### 4.1. *The econometric model*

The first measure of financing constraint we investigate is credit rationing (RAT). RAT is a binary variable built on firms surveyed by MCC, that assumes a value of 1 for firms stating a desire for more credit at the prevailing interest rate and 0 otherwise. Our empirical strategy consists in estimating the probability of being rationed as a function of the distance indicators (OP and FDs) and other firm-specific and geographical control variables:

(4) $$\Pr\left(RAT_{ij}\right) = f\left(OP_j, FD1_j, FD2_j, FIRM_{mi}, PROV_{ni}\right)$$

[7] In particular, the problems concern the treating of missing values and the fact that the other two questions are either directed to all firms or exclusively to the ones which answered yes to the first question.

[8] Amongst others, this indicator is employed by Bonaccorsi (2003).

where the subscripts refer to the *i*-th firm and to the *j*-th province. FIRM are *m* firm-specific control variables and PROV are *n* macroeconomic control variables at the provincial level, which should affect the likelihood of being financially constrained.

In our basic regressions, in FIRM we include variables concerning the return on investment (ROI), the degree of indebtedness (DEBT), the propensity to innovate (R&D), the firm size (SIZE) and the bank-firm relationships (BANKS and BANK_PR).[9] All FIRM variables are computed from MCC survey data.

ROI is defined as the gross operating earnings on invested capital, and captures the efficiency of investment, on the ground that less efficient businesses are more likely to be rationed. DEBT is measured by the logarithm of the debt to equity ratio and should increase the probability of being rationed in the credit market. R&D is computed as the share of workers employed in Research and Development departments on the total labour force. Following the literature, we expect that more innovative firms are likely to be credit rationed, either because they are perceived as riskier business by banks, or because they are more informationally opaque. SIZE is expressed by the logarithms of employees. Again, following a common conjecture, we anticipate that smaller firms are more likely to be rationed due to a lack of transparency, higher risk of default and limited access to other financial markets. In the same vein, we test the hypothesis that functional distance constraints are especially weighty for small firms by including in equation (4) the interaction term between FD1 (resp., FD2) and SIZE.

Finally, among the firm-specific controls we include two indicators related to the relationships that firms mantain with banks: the number of banks with which the firm does business (BANKS) and a dummy variable which takes a value of 1 if the firm's main bank is headquartered in the same province and 0 otherwise (BANK_PR). The a priori expectations on both BANKS and BANK_PR are not univocal. The former is a measure of multiple lending. This, in one way, should reduce financing constraints by putting lending banks in competition with each other, but, in another way, could exacerbate financing constraints for both fast developing and distressed firms by lessening the

[9] A detailed the description of all variables and their sources is in Appendix A.

incentives for banks to commit themselves in relational lending and screen borrowers thoroughly. In the same way, relying on a close bank could help to overcome information asymmetries. However, it could also make the firm informationally captured by the local bank with negative effects on access to the credit market. It is worth noting that BANK_PR is only slightly correlated with the functional distance measures (see Table 3). This suggests that the functional proximity of the banking system to the territory and localism are two separate elements. It is true that a province with a banking system formed by only local banks has the lowest FDs (both equal to one). However, it also true that two provinces with equally functionally distant banking systems may show totally different degrees of localism. This is due to the simple fact that FD1 and FD2 are measures based on a continuous character that weighs dissimilarly all the bank offices that operate within the province.

PROV includes control variables for both the characteristics of the banking system and the institutional environment at the provincial level. As regards the credit market, we take into account the degree of market concentration, measured by the Herfindahl-Hirschman Index (HHI) calculated on the number of branches in province *j*, and localism, proxied by the share of branches held by Credit Cooperative Banks (CCB) in the *j*. The ex-ante expectation on the coefficient signs of these variables is uncertain. According to conventional wisdom, higher market concentration should go hand-in-hand with higher loan rates and a lower quantity of credit to borrowers. However, as the recent literature pointed out, market concentration could be beneficial for young and small firms, because of the closer relationships that could be established with banks in a less competitive environment (Petersen and Rajan 1995). In a similar vein, a high proportion of local banks in the credit market (CCB) could increase the credit availability to small local firms by reducing informational and transactional costs, but it might be a proxy for a closed and traditional banking system, unwilling to provide credit to young and riskier firms (Alessandrini and Zazzaro 1999).

As regards the institutional aspects, we consider the efficiency of courts in recovering bad loans measured by the logarithm of the average length (in days) of bankruptcy trials (FAIL) (Jappelli *et al.*

2005; Guiso *et al.* 2004).[10] Moreover, to take into account the unobserved specificity of Italian regions we add geographic dummies either for the five Italian macro regions or for Southern regions (see above, footnote 5), assuming the value of 1 for provinces belonging to each of them and 0 otherwise. Finally, we add time (wave) dummies to control for the differences in the three surveys.

In Table 3 we report the pair-wise correlations between the distance and the other control variables. It is interesting to note the negative and significant correlation between operational proximity and functional distance and the high, but not perfect correlation between FD1 and FD2. With the exception of the pairs CCB-HHI and BANKS-SIZE, the control variables display quite a narrow, although sometimes significant, correlation with each other.

Since we have only three observations in time for RAT and its variability within the firms is very limited, we can look at the determinant of RAT exclusively by using a pooled sample of the three MCC surveys. We first estimate a probit model and then for robustness we also estimate a logit model.

From the original sample of 12,627 observations, we have excluded a number of observations due to inconsistencies or extreme values. In particular, in the trimming process we excluded all firms without the indication of headquarter location and with a value of R&D greater than 100; observations under the first and above the last percentile of ROI, because of very large figures (in both direction) in the tails of the distribution; observations with negative values of DEBT or with values greater than the $99^{th}$ percentile.[11]

4.2. *Results*

A. *Univariate analysis*

The descriptive analysis of the data shows that, on average, 15% of firms included in our sample claim to be rationed. This proportion clearly decreases with firm size, ranging from 17% for firms

[10] The variable is available from ISTAT not at the provincial level, but only for larger Judiciary Districts (Corte d'Appello), each one covering more provinces. Besides, this variable could capture a number of social and institutional unobserved local factors affecting the probability of being financially constrained.

[11] The other variables do not present particular problems. Nonetheless, when we run some robustness checks, adding more control variables, we follow a similar procedure to exclude outliers and impossible observations.

with less than 20 employees to 6.8% for firms with more than 500 employees. In general, while the average number of employees in rationed firms is 40, non-rationed firms have on average 51 employees. This difference is statistically significant (Table 4[12])

Apart from size, the statistics reported in Table 4 show that rationed and not-rationed firms differ in a number of other features. Namely, firms facing credit constraints are on average significantly more indebted, less profitable and more likely linked to a bank located in the same local area. Furthermore, there are significant differences concerning the structural characteristics of local credit markets where credit rationing tends to be a more widespread phenomenon. Indeed,, rationed firms are generally located in provinces where the credit market experiences a lower presence of Credit Cooperative Banks (i.e., has a lower degree of localism[13]) and is more concentrated.

Finally, there are also significant differences also with respect to our key distance variables, since rationed firms are usually located in provinces with a higher branch density and where the functional distances (both kilometric and social) of the banking system are larger. Hence, it emerges from univariate analysis that both the operating and functional distances of the banking system from local communities may seriously impair the availability of credit to firms.

B. *Multivariate analysis*

In this section we illustrate the results of the pooled probit estimation of equation (4). Table 5 reports the marginal effects of the explanatory variables on the probability to be rationed. The first four columns take FD1 as a functional distance indicator and the last four consider FD2. In models 3-4 and 7-8 we introduce interaction term between SIZE and FD1 or FD2 alternatively to assess whether the impact of the functional distance on RAT is greater for small firms. All the models are estimated with and without geographic dummies for the five Italian macro-regions. Finally, to address possible endogeneity problems, the firm-specific control variables are pre-dated to the starting year of the survey: whereas RAT refers to year *t*, R&D, ROI and DEBT refer to *t*-2.

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[12] Recall that SIZE is expressed by logarithm of employees.
[13] The one-tailed test for on CCB is significant at 6% level.

All in all, the results displayed in Table 5 are quite robust across model specifications. With respect to firm-specific characteristics, as expected, we find that larger and more profitable firms are less likely to be constrained (the estimated coefficients of SIZE and ROI are negative and significant), while the more innovative ones encounter more difficulties in accessing bank credit (Guiso 1998). Moreover, the degree of leverage (DEBT) is positively correlated to RAT, showing quite a large marginal effect on the probability of being rationed (+4.8%).

The results concerning bank-firm relationship variables deserve some comments. Interestingly, the sign of coefficients of BANKS and BANK_PR seems to corroborate the hypothesis of contrasting effects of relationship lending on financing constraints. First, the larger is the number of banks with which a firm does business, the higher is the probability that it would have desired to have more credit available (the same result is obtained by Angelini *et al.* 1998). This suggests that multiple lending engenders free riding behaviour or Winner's Curse problems that deter each lending bank from supporting the additional financing needs of the firm. At the same time, however, we find that having the main bank headquartered in the same province raises difficulties in securing adequate amounts of finance. This suggests that relationship loans may be harmful to firms when the lender is a local bank that may informationally capture their customers.

The adverse impact of a banking system greatly controlled by local banks on the probability of being credit-rationed is further confirmed by the positive marginal effect of the proportion of cooperative bank branches in the province (CCB). This finding is apparently in contrast with the empirical evidence provided by Angelini *et al.* (1998). On the basis of a survey question very similar to those we use for RAT, they find that firm members of CCB and dealing only with CCB state they are rationed less frequently than other firms. However, their results are not perfectly comparable with ours since we consider the total weight of CCB in the provincial banking system and not the individual relationship that firms have with cooperative banks.

With regard to market concentration, we find that HHI has an adverse impact on financing constraints, even if its marginal effect is no more significant in specifications including geographic dummies. Concerning the latter, only South and Islands dummies are statistically significant, while the other three geo-dummies are always not significant. In particular, firms located in the southern regions face a probability of being rationed which is around 7% higher than the average; this effect is even greater (ranging between 10% and 11%) for firms sited in Sicily and Sardinia. Finally, having controlled for specific regional fixed effects, the efficiency of courts in recovering bad loans increases the rationing probability. This effect is consistent with the idea that stricter enforcement of credit contracts by courts reduces the screening effort of banks and increases the probability of evaluating borrowers erroneously (Zazzaro 2005).

Coming to our key distance variables, we find that a higher branch density reduces the probability of being rationed, while functional distance increases that probability. The magnitude of the marginal effects of OP and FD1 are pretty similar (compare columns 1-2), while the marginal effect of FD2 is slightly smaller (columns 5-6). Furthermore, all these marginal effects, although still significant, are reduced by the inclusion of geographic dummies, which could capture part of the distance effect. To have an idea of the economic importance of distances for financing constraints, the results imply that an increase in branch density from the first to the third quartile reduces the probability of being rationed by almost 2 percentage points, while passing from the third to the first quartile of the FD1 distribution (an increased functional proximity) reduces the probability of rationing by another 1.6% (column 2). This effect is halved considering FD2 (column 6).

Therefore, as expected, the process of spatial diffusion-concentration of the banking industry in Italy resulting from the large number of bank mergers and acquisitions has had contrasting effect on the availability of credit to firms. To better assess the total impact of these diffusion-concentration trends on financing constraints, we can measure the increase in the probability of observing credit rationing associated with the change observed in distance variables from 1996 to 2003.

According to the estimates reported in Table 5 (columns 2 and 6), for the average firm the opening of new branches and the increase in OP reduces the probability of credit rationing by more than 1%. This positive effect is almost completely offset by the increased functional distance proximity (FD1) during the sample period, which produced an increase in rationing probability of 0.6%. Thus, on aggregate, the estimated probability of RAT decreases from 15.4% in 1996 to 14.9% in 2003. Similar results are obtained considering the model specification with FD2. In this case, the net aggregate effect on RAT is a reduction from 15.8% in 1996 to 15.1% in 2003, whereas a change in FD2 is responsible for a rise in the probability of being rationed from 14.3% to 14.9%.

These results, however, hold only for the average firm in the total sample. If we look exclusively at southern regions, we can observe that the change in the geography of the banking system between 1996 and 2003 left the probability of credit rationing almost unchanged at 18.2%. In this case, the adverse effect of increased functional distance on financing constraints (the rise in FD1 added 1.8% to the probability of credit rationing) is not offset by the positive effect of a higher branch density. Besides, assuming FD2 as a functional distance indicator makes negative the overall effect of the consolidation process on credit availability, since the probability of rationing increased from 19.6% to 19.8% in the south of Italy, notwithstanding a large increase in operational proximity (the number of branches per capita increased by more than 30% in the period considered).

Considering firm size, we can observe that smaller firms are those most affected by increasing functional distance: columns 3-4 and 7-8 of Table 5 show that the adverse effect of FD1 and FD2 diminishes when firm size increases. If we look at the marginal effects of the specification of column 4, we find that the effect of FD1 is 0.015 for a firm with 25 employees, 0.01 for the average firm with 50 workers, and it becomes close to zero for large companies with more than 250 workers (Table 6). This clearly suggests that larger firms do not suffer from the lack of banks' "thinking heads" in their local areas, probably because they both base their borrowing on hard information and can easily have access to the major financial centres. The same decreasing pattern is observable for FD2, even if the marginal effect, in this case, is generally halved.

The consolidation process of the banking industry was therefore particularly harmful for the small firms (for the sake of calculation, here exemplified by firms with 25 employees) located in southern regions, since in this case the negative impact on credit availability of a withdrawal of the decisional centres from the south is not offset by a higher density of bank branches. Indeed, for these firms the estimated probability of being rationed was 20.1 in 1996 and 20.5 in 2003, with FD1 accounting for an increase of more than a percentage point (1.1%). Furthermore, considering FD2, the effect is much stronger, with an aggregate increase in probability of credit rationing between 1996 and 2003 of one percentage point, at 21.8% (functional distance alone added 1.8% to the probability of being rationed). Large companies (exemplified by firms with 250 employees), by contrast, have largely benefited from the concentration-diffusion trends. For these firms, as we stated above, the effect of the change in FD1 has been nil and they have only gained from the greater spread of bank branches across the country, reducing their probability of being rationed from 12.2% in 1996 to 11.3% in 2003.

### 4.3. *Robustness checks*

We have undertaken a number of robustness checks to ascertain the soundness of our findings[14]. In particular, we estimated equation (4) with a pooled logit model and with robust standard errors, without finding any significant difference in the sign and magnitude of coefficients. Besides, the main results on the distance variables are robust across different specifications of the model. In particular, we have estimated models with contemporaneous or one year lagged firm-specific variables (R&D, ROI and DEBT) instead of the initial survey period ones. Moreover, we have dropped some control variables and included additional controls like ROE (whose coefficient is significantly positive), firm age and length of the bank-firm relationship (both not significant).

With respect to the degree of market concentration, we have introduced a quadratic term to seek to capture some non-linearity, but the results are not supportive of that hypothesis. Finally, we used lagged values of the functional distances in order to partially address a problem of endogeneity, finding that our indicators are still significant.

[14] To save space, results and Tables are not reported but are available on request from the authors.

## 5. Investment-cash flow sensitivity

5.1. *The econometric model*

The second econometric exercise we carry out is aimed at testing the impact of distances on the sensitiveness of firm investment to cash flow. In particular, we estimate a dynamic panel investment model in which we include two interaction terms between cash flow and operational proximity and functional distance respectively.

Data on capital stock and cash flow are from firm balance-sheets attached to the MCC surveys. Merging the three surveys, we obtain data over the period 1996-2003 for 526 firms, because of the rotating sample. Furthermore, to get a balanced panel we drop almost 150 firms, so that we end up with a sample of 279 small and medium enterprises, with a total of 2,232 observations (the summary statistics are reported in Table 7).

The dynamic investment model is represented by equation (5), where investment and cash flow are deflated by capital at the beginning of the fiscal year and the subscripts refer to the *i*-th firm, located in province *j* at time *t*:

$$\left(\frac{INV_t}{K_{t-1}}\right)_{ij} = \alpha + \beta_1\left(\frac{INV_{t-1}}{K_{t-2}}\right)_{ij} + \beta_2\left(\frac{CF_t}{K_{t-1}}\right)_{ij} + \beta_3\left(\frac{CF_t}{K_{t-1}}\right)_{ij} \times OP_{jt} + \beta_4\left(\frac{CF_t}{K_{t-1}}\right)_{ij} \times FD_{jt} + \sum_m \delta_m X_{mijt} + \eta_i + \varepsilon_{i,t} \quad (5)$$

*K* is the capital stock, computed as the material and immaterial immobilizations gross of depreciation allowances; *INV* is investment, defined as the variation between time *t* and time *t*-1 of the firm capital stock; *CF* is the cash flow, defined as net income plus depreciation allowances; *X* is a set of *m* control variables.

We expect a financially constrained firm to exhibit a positive correlation between cash flow and investment and consider as a measure of financing constraints the marginal effect of cash flow on investment, $\partial(INV/K)/\partial(CF/K)$. To ascertain whether functional and operational distances have an effect on financing constraints we therefore include two interaction terms ($CF \times OP$ and $CF \times FD$) between distances and cash flow. In this case the sensitivity of investment to cash flow is:

(6) $$\frac{\partial(INV/K)}{\partial(CF/K)} = \beta_2 + \beta_3 FD + \beta_4 OP$$

According to $\beta_3 \gtrless 0$ and $\beta_4 \gtrless 0$ we can therefore say that operational proximity and functional distances increase or reduce financing constraints for firms. Finally, in the basic specification of equation (5) we include time dummies to control for exogenous shocks, the Pavitt industry classification[15] dummies to control for firm specificity, and regional dummies to control for other unobserved local fixed effects.

Since in previous sections we saw that firm size is a critical determinant of credit rationing, as we subsequently divide firms into two sub-samples according to their size to check whether: (H1) the overall investment-cash flow sensitivity is higher for small firms; (H2) the effect of functional distance on $\partial(INV/K)/\partial(CF/K)$ is stronger for small firms than for the large firms.

From a methodological viewpoint, we could estimate equation (5) with the LSDV estimator in order to wash out the firm's specific fixed effects. However, given the dynamic structure of the model and the finite time dimension, the LSDV is proved to be biased and inconsistent, due to the correlation between the lagged variables and the error term (Nickell, 1981). Therefore we control for endogeneity and omitted variable bias using the Generalized Method of Moments (GMM) and, in particular, the System-GMM (Blundell and Bond, 1998), 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).

5.2. *Results*

The results obtained using the System-GMM (Table 8) are consistent with our expectations. In the basic specification of equation (5), which excludes the interaction terms, we find a positive and significant effect of cash flows on current investment (Column 1). Columns 2-7 display the estimation results of our full specification for the pooled sample and for the two sub-samples.

[15] As is well known the Pavitt classification identifies four broad industrial sector: traditional, large scale, specialized, and high technology.

The inclusion of distance measures shows that the marginal effect of cash flows on investment is increasing with FD1 and FD2. In fact, in every specification, we are unable to reject the null hypothesis $\beta_3$>0. Even if the coefficient on CF becomes negative, the overall estimated marginal effect (6) is substantially stable at around 0.4-0.6 and it is increasing with the functional distance. To be more precise, from equation (6) it is easy to derive the threshold value of FD1 beyond which the marginal effect of cash flows on investment becomes positive. In the pooled sample, it is equal to 1.32, which is between the first and the second percentile of the functional distance indicator, while when using FD2 the marginal effect is positive for every value of the distance indicator.[16] This means that marginal effect $\partial(INV/K)/\partial(CF/K)$ is positive in at least 98% of cases and increasing with FDs, providing support for the thesis that the functional distance of the banking system from provinces can be a factor explaining financing constraints of local firms.

It is interesting to note that, unlike in the previous exercise on credit rationing, operational proximity has the same adverse effect on investment-cash flow sensitivity as functional distance. Read together, the opposite effects of OP on RAT and $\partial(INV/K)/\partial(CF/K)$ can be seen as confirmation of the ambiguous effects that the number of banks operating in a region may have on local borrowers, previously found in the literature.

Obviously, a positive impact of functional distance and operational proximity on (6) can be read as strengthening financing constraints only to the extent that the sensitivity of investment to cash flow is a reliable measure of financing constraints. As is well known, this assumption has been challenged by Kaplan and Zingales (1997, 2000) on the basis of the simple theoretical reason that the marginal effect of cash flow on investment is not always monotonically increasing with the degree of financing constraints (which they define as the wedge between the internal and external cost of funds). On empirical grounds, Kaplan and Zingales (1997) find confirmation of this non-monotonicity, showing that the investment of firms which could be classified as financially

[16] We calculate the marginal effect at the average, using the mean of OP. Besides, results do not change using median values.

constrained exhibits significantly lower sensitivity to cash flow than the investment of firms which do not seem to be financially constrained.

In order to address this important criticism, we have to check whether it is reasonable to exclude the possibility that in our sample $\partial(INV/K)/\partial(CF/K)$ is lower for financially more constrained firms. To carry out this test, we estimate equation (5) in the basic specification without the interaction terms discriminating among rationed and non-rationed firms, on the grounds of the variable RAT. Thus, we follow the empirical strategy suggested by Kaplan and Zingales and, even if we cannot use a broader classification, we can distinguish firms into rationed and non-rationed on the basis of their reply to the MCC surveys.[17] The pooled estimates show that the coefficient on CF is 0.49 for rationed firms and 0.40 for non-rationed firms[18]. A stability test rejects the pooled specification, even if the two coefficients on CF for rationed and non-rationed firms are not statistically different. Therefore, we can argue that, in our sample, financially constrained firms do not have significantly lower investment-cash flow sensitivity, and that they exhibit higher point estimates of $\beta_2$, so that we could use $\partial(INV/K)/\partial(CF/K)$ as a sensible proxy for financing constraints.

Once reassured by this finding, the second step is to address the nexus between firm size and financing constraints. We therefore re-estimate both the basic and full specification for two sub-samples of firms: the SMALL sample (including firms with less than 25 employees) and the LARGE sample (including firms with more than 25 employees).

The results obtained from the basic model, without the interaction terms, show that the sensitivity of investment to cash flow is positive and significant for the SMALL sample, while it is not significant (and with a much smaller point estimate) for the LARGE sample.[19]

The results of the full specification, reported in Table 8, point out a significant difference of the variable coefficients across the two sub-samples. In order to test econometrically the significance of

[17] Since we have data on RAT only for the year of the survey, we have to assume that the same condition holds for the entire three-year period, in order to conduct our panel estimates.
[18] For the sake of brevity, estimation results are not fully reported but are available on request from the authors.
[19] Results are not reported but are available on request from the authors.

these differences we perform a test of model stability, similar to the Chow test for structural breaks. We cannot compute the usual F-test implied by the Chow test because it is based on the assumption of normality of the residuals, which is not assumed by the GMM. Nonetheless, we can estimate a pooled model including all regressors multiplied by a dummy for the SMALL and another for the LARGE sample and test for differences across samples in the estimated coefficients. Following this strategy, we can state that the pooled model is rejected in favour of the two sub-samples. Looking separately at small and large firms we can observe that the former exhibits a mean reverting path in investment, while the positive, albeit very small, coefficient on lagged INV is driven by large businesses.

With respect to the variables of interest, the estimated coefficients on CF and the interaction terms (stability test 2) are not equal across small and large firms, and the estimated marginal effect of CF on INV is larger for small firms (0.8 instead of 0.3-0.5), which are more likely to use internal financing because of credit constraints. The threshold of the functional distance indicator beyond which the marginal effect becomes positive are increasing with FD, still supporting the hypothesis that smaller firms are more likely rationed. However, these thresholds still correspond to low values of the distribution of FD1 (between $7^{th}$ and $8^{th}$ percentile) and FD2 (between $5^{th}$ and $6^{th}$ percentile).

Moving to the second and more critical hypothesis H2, our results are mixed. We observe that the contribution of FD1 to the marginal effect of cash flow on investment, measured by $\beta_3$ is not statistically different across the two samples. However, the opposite happens when functional distance is measured in terms of social capital: FD2 has an adverse effect on credit availability which is larger for small than for large firms.

The effect of operational proximity may also differ according to firm size, since it is positive and significant in the SMALL sample and not significant and smaller in the LARGE sample. This difference cannot be rejected, at least at the 6% level, and it suggests that the number of branches located in a province has a larger effect on credit rationing for small than for medium firms.

With respect to the diagnostic, the over-identification test supports the validity of the instrument set at 5% and the Arellano and Bond (1991) autocorrelation tests show the expected values at 5% level of confidence. The dummies are generally not significant, even if the point estimate of the industry dummies means that more specialized and technological firms invest less than traditional ones.

5.2. *Robustness checks*

To validate our findings, we conducted a number of robustness checks. First, we estimate a static specification of equation (5), excluding the autoregressive term, with the within group estimator (LSDV). The results (Table 9) confirm the positive effect of cash flow on investment and also the positive marginal effect of functional distance on $\partial(INV/K)/\partial(CF/K)$. However, controlling for firm-specific invariant effects, we find that operational proximity reduces the marginal impact of cash flow on investment. Moreover, fixed effect estimates only partially validate the GMM findings for the two sub-samples.

Secondly, with respect to the set of control variables, we find that the results are unaffected by the inclusion of regional dummies in the FD2 estimates. Furthermore, our main results do not change controlling for some firm-specific variables, such as the leverage (DEBT) and the growth rate of sales in the previous period (GROWTH), which both have a positive effect on investment.

## 6. Credit lines drawn

6.1. *The econometric model*

The third empirical exercise is carried out at the market level and involves the ratio of credit drawn from available credit lines (CRED). This is a measure of liquidity constraints widely employed in research at the aggregate level, considered as a useful proxy for a credit market in a state of stress.

In particular, we take as dependent variable the logarithm of the ratio of credit lines utilized to credit lines available. We have data at the provincial level, classified in 5 different loan sizes by borrower location over the period 1997-2003, amounting to a total of 721 observations.[20] Given the high persistence shown by credit lines drawn over time, we estimate a dynamic panel model, in which CRED in province *j* at time *t* is a function of its lagged value, operational proximity (OP), functional distance (FD), *n* control variables at the provincial level (PROV), and a set of *m* time and regional dummies (X):

$$\log CRED_{jt} = \alpha + \beta_1 \log CRED_{jt-1} + \beta_2 OP_{jt} + \beta_3 FD_{jt} + + \sum_n \varphi_n PROV_{njt} + \sum_m \delta_m X_{mjt} + \eta_i + \varepsilon_{it} \tag{7}$$

In order to maintain a certain degree of consistency with previous models, we include, among provincial controls (PROV) measures of concentration (HHI) and localism (CCB) in the credit market. Moreover, we include the logarithm of per capita value added (VA) as a measure of local economic development that should capture the average degree of creditworthiness of local borrowers and could also take into account the heterogeneity of the data. In order to take into account time- and local-specific fixed effects we include in (7) time dummies and the dummies for the five Italian macro-regions.

Given the dynamic structure of the model, due to the high path dependence of CRED, we estimate equation (7) using the System-GMM, in order to control also for potential endogeneity of right-hand side variables. We estimate separate models for the five loan size classes. The disaggregation of the dependent variable by size allows us also in this case to test whether distances matter more for small than for large firms.

### 6.2. *Results*

#### A. *Univariate analysis*

In Table 10, we display the time path of CRED across the sample period by loan size. On the whole, the share of credit lines utilized by borrowers at the provincial level did not substantially increase during the seven years considered. This stable trend, however, is the combination of very different

[20] The five loan sizes correspond to: € 75,000-125,000 (CRED_1); € 125,000-250,000 (CRED_2); € 250,000-500,000 (CRED_3); € 500,000-2,500,000 (CRED_4); more than € 2,500,000 (CRED_5).

trends among loan classes. The share of credit lines drawn greatly increased for small loan classes (CRED_1 and CRED_2), while it decreased for the other three classes. With respect to borrowers' location, we observe that borrowers in the provinces of the south have CRED ratios 7% higher than borrowers located in other Italian provinces (an average of 74.3% versus 67.1%, over the period 1997-2003). However, quite surprisingly this difference cannot be found in small loan classes, but in large loan classes.[21]

The correlations between the share of credit lines drawn by borrowers and the operational and functional distance indicators – displayed in Table 11 – indicate a negative and significant correlation between OP and CRED, increasing with loan size, and a positive and statistically significant correlation between FDs and CRED (even if the correlation between FD2 and CRED is lower for small loan sizes).

B. *Multivariate analysis*

From the GMM estimation of equation (7) we find that our model provides statistical evidence of the relationship between functional and operational distances and credit rationing, even if the significance of this relation is limited to small and medium loan classes (CRED_1, CRED_2, CRED_3). Therefore, for the sake of space, in Table 12 we report only results for estimation on these loan classes.

The selected specifications all pass the standard Hansen test of overidentification, suggesting that the lag structure of the instruments is correct. Moreover, as requested, we cannot reject the hypothesis of no first-order autocorrelation, while we can reject that of no second-order autocorrelation[22].

[21] To be precise, the difference in the percentage of credit lines drawn from credit lines available between southern provinces and Italy is for the five loan classes respectively: 0.13 (CRED_1), 0.5 (CRED_2), 2.44 (CRED_3), 5.65 (CRED_4), 9.3 (CRED_5).

[22] For the smallest loan category, the AR(1) is passed only at 8,7% level of significance. This could be due to the specific persistence of the series. In fact, we find that also the second lag of CRED is significant, contrary to the other regressions on different loan sizes (results not shown).

Looking first at the control variables, we find strong evidence of path dependence for CRED, while, contrary to what we expected, the coefficient on per capita value added is often positive and significant. This last result, read together with the lack of significance of geographical dummies, is however consistent with the absence of an aggregate credit shortage for small borrowers in southern provinces, already suggested by the descriptive analysis.

As regards the structural characteristics of the local credit market, we find that the HHI coefficient is positive and usually significant[23], while the share of branches held by credit cooperative banks in the provinces, instead, does not have any effect on CRED.

Moving on to consider distance variables, we find that the OP and FD1 are significant for loans smaller than 500,000 euros (CRED_SME; column 5), while they do not contribute to explain the variability of CRED_4 and CRED_5. In particular, we find that in provinces with a greater branch density the share of available credit lines actually drawn is lower, while a higher functional distance of the banking system is associated with higher shares of credit drawn. However, when the functional distance is measured in terms of social capital (FD2), its influence on CRED_SME is not statistically significant.

Looking at a more detailed classification of CRED_SME according to loan size, we observe that the effect of FD1 vanishes (even if the point estimate is still positive) when the loan size exceeds 250,000 euros, while it is stronger for the smallest loans (€ 75,000-125,000), suggesting that the closeness of the banks' "thinking heads" to the territory is particularly important for small businesses. With respect to the operational proximity of the banking system we find that, apart from the loan class € 125,000-250,000 (for which, nonetheless, it maintains the negative coefficient), it always increases the availability of credit.

6.3. *Robustness Checks*

As in the previous econometric exercises, we conducted a number of robustness checks starting from the basic specifications presented in Table 12. In particular, the main results on the distance

[23] HHI is resulted significant even for CRED_4 and CRED_5 specifications.

variables are robust to changes in control variables. First, we dropped CCB, which is always not significant, without affecting sign, magnitude and statistical significance of the coefficients on OP and FD1 across all loan classes. Then, to replicate the model specification used for RAT, we included FAIL as additional control variables, to check whether judicial efficiency could help explain credit availability at the provincial level (Jappelli *et al.* 2005). The results show that FAIL is always not significant and its inclusion does not affect our main conclusions[24]. Lastly, we also controlled for other geographic fixed effects at the regional level. However, the inclusion of regional dummies does not change the significance of FD1, whose effect is positive for all loans below 250,000 euros.

## 7. Conclusions

According to a commonly-held view, the integration and consolidation processes in the banking industry have reduced the economic distance between financial centres. The waiving of bank regulations, progress in information technology and incessant financial innovation have engendered the geographical diffusion of banking structures and instruments that have greatly increased the operational proximity of banks to local economies. The advantages of this diffusion process for local borrowers lie in the reduction in bank costs, the broadening of financial products and more competitive credit markets.

However, in the opposite direction, the consolidation of the banking industry has also produced the geographical concentration of decisional and strategic centres of banking institutions that has increased the functional distance of the banking system from local communities. Due to the asymmetrical distribution of information within organisations and the cultural differences across communities, functional distance may adversely influence the bank-firm relationships and increase financing constraints for local borrowers.

Such diffusion-concentration trends have been particularly evident in the Italian banking industry. In the research presented here, we assess the effects that operational proximity and

[24] Nonetheless, the standard errors are slightly larger, so that the level of significance of FD1 is reduced to 5-10%, while OP in some specification is no more significant. However, this might be due to a misspecification of the model.

functional distance of the banking system have had on financing constraints and the net impact of their changes over the period 1996-2003 on credit availability at the provincial level.

Because of the difficulties in measuring functional distance and financing constraints, we adopt a robust approach, building two indicators of functional distance and analysing three measures of financing constraints. Specifically, we measure functional distance as the number of bank branches in a province *j* weighted by alternatively: 1) the kilometric distance from the province of control of the bank branch; 2) the difference in social capital between those two provinces. In this way we try to take into account the differences in the economic and cultural environment between the areas where the decisional centres of local bank offices and borrowers are located. Financing constraints are measured by: 1) the proportion of firms claming to be credit rationed; 2) the sensitivity of investment to cash flow; 3) the share of credit drawn from available credit lines. Finally, following the existing literature, we measure the financial proximity of the banking system by the bank branch density at the local level.

Our econometric exercises consistently show that increased functional distance (both in physical and cultural terms) makes financing constraints more binding. Functional distance is positively associated with the probability of firms being rationed, investment-cash flow sensitivity, and ratio of credit lines utilized by borrowers to credit lines make available by banks. These adverse effects are particularly evident for small firms and for firms located in southern Italian provinces, where bank mergers and acquisitions occurring in the 1990s have led to a dramatic increase in the functional distance of the banking system from local economies. Finally, our findings suggest that the negative impact on financing constraints following the actual increased functional distance over the period 1996-2003 has substantially offset (and sometimes exceeded) the beneficial effects of the increased diffusion of bank branches across the Italian provinces occurring during the same period.

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**Table 1**: Geographic and dimensional distribution of the sample

| Geographic distribution | Survey | Number of employees 11-20 | 21-50 | 51-250 | 251-499 | >500 | *Total* |
|---|---|---|---|---|---|---|---|
| North | 1997 | 768 | 1166 | 825 | 224 | 163 | 3146 |
| | 2000 | 1256 | 989 | 540 | 142 | 114 | 3041 |
| | 2003 | 478 | 661 | 901 | 127 | 150 | 2317 |
| | *All surveys* | *2502* | *2816* | *2266* | *493* | *427* | *8504* |
| Centre | 1997 | 231 | 353 | 144 | 25 | 24 | 777 |
| | 2000 | 390 | 425 | 107 | 28 | 15 | 965 |
| | 2003 | 156 | 197 | 212 | 17 | 35 | 617 |
| | *All surveys* | *777* | *975* | *463* | *70* | *74* | *2359* |
| South | 1997 | 162 | 187 | 185 | 24 | 14 | 572 |
| | 2000 | 223 | 324 | 109 | 9 | 9 | 674 |
| | 2003 | 96 | 194 | 194 | 20 | 14 | 518 |
| | *All surveys* | *481* | *705* | *488* | *53* | *37* | *1764* |
| Italy | 1997 | 1161 | 1706 | 1154 | 273 | 201 | 4495 |
| | 2000 | 1869 | 1738 | 756 | 179 | 138 | 4680 |
| | 2003 | 730 | 1052 | 1307 | 164 | 199 | 3452 |
| | *All surveys* | *3760* | *4496* | *3217* | *616* | *538* | *12627* |

Notes: North groups North-West and North-East macro areas; South groups South and Island macro areas.

**Table 2**: Distance indicators: summary statistics

| Distances | OP | | FD1 | | FD2 | |
|---|---|---|---|---|---|---|
| Year | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| 1996 | 4.509 | 1.612 | 2.972 | 1.082 | 4.203 | 3.363 |
| 1997 | 4.656 | 1.677 | 3.035 | 1.094 | 4.307 | 3.380 |
| 1998 | 4.885 | 1.678 | 3.078 | 1.101 | 4.485 | 3.762 |
| 1999 | 5.087 | 1.734 | 3.158 | 1.116 | 4.762 | 4.095 |
| 2000 | 5.267 | 1.789 | 3.213 | 1.121 | 4.913 | 4.186 |
| 2001 | 5.449 | 1.843 | 3.277 | 1.137 | 5.100 | 4.388 |
| 2002 | 5.533 | 1.875 | 3.394 | 1.132 | 5.185 | 4.446 |
| 2003 | 5.538 | 1.904 | 3.451 | 1.151 | 5.702 | 4.206 |

**Table 3**: Pair-wise correlations

| | OP | FD1 | FD2 | BANKS | BANK_PR | SIZE | R&D | ROI | DEBT | CCB | HHI | FAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OP | 1 | | | | | | | | | | | |
| FD1 | -0.447* | 1 | | | | | | | | | | |
| FD2 | -0.543* | 0.662* | 1 | | | | | | | | | |
| BANKS | 0.056* | -0.092* | -0.094* | 1 | | | | | | | | |
| BANK_PR | 0.031* | -0.137* | -0.078* | -0.070* | 1 | | | | | | | |
| SIZE | 0.012 | -0.048* | -0.056* | 0.455* | -0.094* | 1 | | | | | | |
| R&D | 0.021 | -0.020 | -0.037* | 0.053* | -0.009 | 0.105* | 1 | | | | | |
| ROI | 0.086* | -0.101* | -0.104* | -0.072* | -0.003 | -0.021 | 0.005 | 1 | | | | |
| DEBT | -0.001 | 0.001 | 0.008 | 0.005 | -0.007 | -0.010 | 0.010 | -0.016 | 1 | | | |
| CCB | 0.450* | -0.292* | -0.121* | 0.010 | 0.021 | 0.012 | -0.012 | 0.027* | -0.024* | 1 | | |
| HHI | -0.189* | 0.086* | 0.168* | -0.047* | -0.010 | -0.011 | -0.036* | -0.034* | -0.014 | -0.212* | 1 | |
| FAIL | 0.229* | 0.173* | 0.108* | -0.055* | -0.017 | -0.080* | -0.024* | -0.046* | -0.002 | 0.039* | -0.025* | 1 |

Notes: A star * indicates a 5% level of significance

**Table 4**: Credit rationing: Univariate analysis on means

| | RAT=1 | | | RAT=0 | | | t-test |
|---|---|---|---|---|---|---|---|
| | Obs | Mean | Std. Dev. | Obs | Mean | Std. Dev. | |
| SIZE | 1181 | 3.694 | 0.910 | 6793 | 3.923 | 1.068 | 0.001*** |
| R&D | 1181 | 0.753 | 2.677 | 6793 | 0.678 | 2.635 | 0.369 |
| ROI | 1181 | 10.142 | 7.493 | 6793 | 13.173 | 8.579 | 0.000*** |
| DEBT | 1181 | 6.179 | 0.949 | 6793 | 5.757 | 0.977 | 0.000*** |
| BANKS | 1181 | 6.127 | 3.963 | 6793 | 6.194 | 4.494 | 0.631 |
| BANK_PR | 1181 | 0.650 | 0.477 | 6793 | 0.598 | 0.490 | 0.000*** |
| CCB | 1181 | 9.501 | 8.708 | 6793 | 9.918 | 8.527 | 0.122 |
| HHI | 1181 | 0.113 | 0.056 | 6793 | 0.109 | 0.045 | 0.003*** |
| FAIL | 1181 | 7.822 | 0.184 | 6793 | 7.829 | 0.162 | 0.175 |
| OP | 1181 | 5.341 | 1.658 | 6793 | 5.788 | 1.444 | 0.000*** |
| FD1 | 1181 | 2.995 | 0.976 | 6793 | 2.785 | 0.875 | 0.000*** |
| FD2 | 1181 | 3.881 | 3.226 | 6793 | 3.047 | 2.601 | 0.000*** |

Notes: The last column reports the p-values of the t-test of the null hypothesis of equal means across the two samples, against the alternative two-tail hypothesis. A triple star *** indicates a 1% level of significance.

**Table 5**: Credit Rationing: Probit estimation of equation (4).

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| SIZE | -0.024*** | -0.023*** | | | -0.023*** | -0.023*** | | |
| | (0.004) | (0.004) | | | (0.004) | (0.004) | | |
| R&D (-2) | 0.002** | 0.003** | 0.002* | 0.003** | 0.002** | 0.003** | 0.002* | 0.002** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| ROI (-2) | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** | -0.003*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) |
| DEBT (-2) | 0.048*** | 0.050*** | 0.049*** | 0.051*** | 0.049*** | 0.050*** | 0.051*** | 0.053*** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.004) | (0.005) | (0.005) |
| BANKS | 0.002*** | 0.002*** | 0.002** | 0.002** | 0.002*** | 0.002*** | 0.001 | 0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| BANK_PR | 0.029*** | 0.029*** | 0.030*** | 0.029*** | 0.028*** | 0.027*** | 0.030*** | 0.029*** |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| CCB | 0.002*** | 0.001** | 0.002*** | 0.001** | 0.001*** | 0.001* | 0.001*** | 0.001 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.001) |
| HHI | 0.187** | 0.65 | 0.192** | 0.071 | 0.150** | 0.054 | 0.152** | 0.483 |
| | (0.080) | (0.071) | (0.079) | (0.074) | (0.076) | (0.074) | (0.076) | (0.075) |
| FAIL | -0.048 | -0.075** | -0.047 | -0.076** | -0.044 | -0.064* | -0.041 | -0.064* |
| | (0.031) | (0.037) | (0.031) | (0.037) | (0.029) | (0.037) | (0.029) | (0.036) |
| OP | -0.026*** | -0.010* | -0.025*** | -0.010 | -0.021*** | -0.011** | -0.021*** | -0.010* |
| | (0.003) | (0.006) | (0.003) | (0.006) | (0.004) | (0.006) | (0.004) | (0.006) |
| FD1 | 0.016*** | 0.011** | 0.042*** | 0.035*** | | | | |
| | (0.006) | (0.004) | (0.008) | (0.007) | | | | |
| FD1×SIZE | | | -0.007*** | -0.006*** | | | | |
| | | | (0.001) | (0.001) | | | | |
| FD2 | | | | | 0.006*** | 0.004* | 0.018*** | 0.014*** |
| | | | | | (0.001) | (0.002) | (0.001) | (0.005) |
| FD2×SIZE | | | | | | | -0.003*** | -0.003** |
| | | | | | | | (0.000) | (0.001) |
| Pseudo-R2 | 0.068 | 0.071 | 0.067 | 0.070 | 0.069 | 0.071 | 0.066 | 0.068 |
| LR test (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Actual prob. | 0.148 | 0.148 | 0.148 | 0.148 | 0.148 | 0.148 | 0.148 | 0.148 |
| Predicted prob. | 0.131 | 0.131 | 0.132 | 0.131 | 0.131 | 0.131 | 0.132 | 0.132 |
| GEO dummy | No | Yes | No | Yes | No | Yes | No | Yes |
| Obs. | 7974 | 7974 | 7974 | 7974 | 7974 | 7974 | 7974 | 7974 |

Notes: The Table reports the marginal effects (for dummy variables the coefficient is for discrete change from 0 to 1). Three, two and one star (*) means, respectively, a 1%, 5% and 10% level of significance. All regressions are estimated using a probit model and they include time (wave) dummies for the three surveys (not shown for the sake of brevity). The Geographic dummies (when included) refer to the five macro regions. Standard errors (in brackets) are adjusted for cluster at the provincial level, to allow for the intra-group correlation.

**Table 6**: Functional distance and firm size

| | | Marginal effect | Marginal effect |
|---|---|---|---|
| FD | | 0.035*** | 0.014*** |
| | | (0.007) | (0.005) |
| FD×SIZE | | -0.006*** | -0.003*** |
| | | (0.001) | (0.001) |
| Percentiles of SIZE | Number of employees | Aggregate marginal effect of FD1 | Aggregate marginal effect of FD2 |
| 5th percentile | 14 | 0.018 | 0.007 |
| 25th percentile | 21 | 0.016 | 0.006 |
| median | 40 | 0.012 | 0.004 |
| 75th percentile | 89 | 0.007 | 0.002 |
| 95th percentile | 400 | -0.003 | -0.002 |

Notes: Standard errors, in brackets, are adjusted for cluster at provincial level for taking into account the intragroup correlation. Specification in column 4 in Table 5. Time (wave) dummies included.

**Table 7**: Descriptive statistics of the sample

| Variable | Obs | Mean | Std. Dev. |
|---|---|---|---|
| (INV/K) | 2232 | 37.162 | 784.146 |
| (CF/K) | 2232 | 28.800 | 71.829 |
| FD1 | 2232 | 2.724 | 0.804 |
| FD2 | 2232 | 2.541 | 2.094 |
| OD | 2232 | 5.933 | 1.223 |

**Table 8**: One Step System-GMM estimation of equation (5)

| Dependant variable: (INV/K) | All | Pooled | Small | Large | Pooled | Small | Large |
|---|---|---|---|---|---|---|---|
| (INV/K) (-1) | 0.002*** | 0.002*** | -0.124* | 0.002*** | 0.002*** | -0.132** | 0.002*** |
| | (0.000) | (0.000) | (0.064) | (0.000) | (0.000) | (0.060) | (0.000) |
| (CF/K) | 0.421*** | -2.331** | -4.823*** | -2.308** | -1.861* | -4.591*** | -1.860* |
| | (0.120) | (1.086) | (0.939) | (1.175) | (1.033) | (0.818) | (1.102) |
| (CF/K)×FD1 | | 0.459** | 0.504* | 0.562** | | | |
| | | (0.221) | (0.262) | (0.237) | | | |
| (CF/K)×FD2 | | | | | 0.183*** | 0.439*** | 0.174** |
| | | | | | (0.070) | (0.096) | (0.071) |
| (CF/K)×OP | | 0.286** | 0.692*** | 0.209 | 0.317** | 0.711*** | 0.279 |
| | | (0.142) | (0.178) | (0.149) | (0.159) | (0.152) | (0.175) |
| CONSTANT | -34.18*** | 6.055 | 15.62 | -8.317 | 8.985* | 24.16 | -0.487 |
| | (3.944) | (5.074) | (18.32) | (9.941) | (5.053) | (15.95) | (7.052) |
| OBS | 1953 | 1953 | 357 | 1596 | 1953 | 357 | 1596 |
| OIR test | 0.121 | 0.069 | 0.375 | 0.187 | 0.136 | 0.315 | 0.085 |
| AR (1) | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.009 | 0.000 |
| AR (2) | 0.719 | 0.630 | 0.584 | 0.582 | 0.655 | 0.566 | 0.630 |
| F-test (p value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Marginal effect (3) | 0.421 | 0.655 | 0.797 | 0.501 | 0.525 | 0.769 | 0.281 |
| Thresholds of FD | | 1.323 | 1.121 | 1.867 | -0.292 | 0.496 | 1.040 |
| Stability test 1 on (CF/K)×FD | | | | 0.869 | | | 0.027 |
| Stability test 1 on (CF/K)×OP | | | | 0.038 | | | 0.062 |
| Stability test 2 on (CF/K) | | | | 0.000 | | | 0.000 |

Notes: Robust standard errors in brackets. Three, two and one star (*) mean, respectively, a 1%, 5% and 10% level of significance. All regressions include time, geographic (five macro areas) and industry (Pavitt classification) dummies, not shown for the sake of brevity. As instruments, we use lagged values (t-1 and t-2) of (INV/K) (-1) and the lagged value in t-2 for the other variables. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set). Marginal effect is the estimated results of equation (6), calculated at the average values of FD1, FD2 and OP. The thresholds of FD1 and FD2 correspond to the values of FD1 and FD2 which make equation (6) positive. The stability tests refer to the stability of coefficients across the two sub-samples. The test 1 assesses the hypothesis of equality of the coefficients on the interaction term (CF/K)×FD (or (CF/K)×OP) across the two sub-samples (SMALL and LARGE), while test 2 assesses the joint equality of (CF/K), (CF/K)×FD and (CF/K)×OP across the SMALL and LARGE sub-samples. All diagnostic values refer to p-values.

**Table 9**: Fixed effect estimation of the static equation

| Dependant variable: (INV/K) | All | Pooled | Small | Large | Pooled | Small | Large |
|---|---|---|---|---|---|---|---|
| (CF/K) | 8.76* | 40.16*** | -2.08 | 46.27*** | 14.0*** | -2.34 | 18.67*** |
| | (4.98) | (12.20) | (2.14) | (12.25) | (4.65) | (2.28) | (5.97) |
| (CF/K)×FD1 | | 5.66** | 0.38 | 4.25 | | | |
| | | (2.235) | (0.29) | (2.91) | | | |
| (CF/K)×FD2 | | | | | 4.75*** | 0.42** | 4.34*** |
| | | | | | (0.98) | (0.21) | (1.01) |
| (CF/K)×OP | | -7.79*** | 0.316 | -8.02*** | -3.11*** | 0.38 | -3.59*** |
| | | (2.30) | (0.34) | (2.03) | (0.79) | (0.36) | (0.87) |
| CONSTANT | -111.97 | -297.1*** | 39.74** | -326.4*** | -195.1*** | 41.0*** | -233.0*** |
| | (94.10) | (95.9) | (16.69) | (89.3) | (46.9) | (15.9) | (54.8) |
| OBS | 2232 | 2232 | 408 | 1824 | 2232 | 408 | 1824 |
| F-test (p value) | 0.116 | 0.009 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 |
| Overall R2 | 0.258 | 0.538 | 0.217 | 0.617 | 0.636 | 0.216 | 0.678 |

Notes: Robust standard errors in brackets. Three, two and one star (*) mean, respectively, a 1%, 5% and 10% level of significance. All regressions include time dummies, not shown for the sake of brevity.

**Table 10**: CRED by loan size (percentage values)

| Year | Loan size | | | | | |
|---|---|---|---|---|---|---|
| | CRED_1 | CRED_2 | CRED_3 | CRED_4 | CRED_5 | Total |
| 1997 | 80.2 | 77.2 | 74.2 | 72.1 | 66.7 | 69.8 |
| 1998 | 80.1 | 76.6 | 73.2 | 71.0 | 65.1 | 68.5 |
| 1999 | 82.3 | 76.5 | 72.0 | 70.0 | 65.3 | 68.6 |
| 2000 | 84.4 | 77.5 | 71.8 | 70.0 | 66.7 | 69.6 |
| 2001 | 85.8 | 78.3 | 71.5 | 70.0 | 66.5 | 69.9 |
| 2002 | 87.5 | 80.4 | 72.3 | 69.5 | 67.2 | 70.6 |
| 2003 | 88.8 | 81.8 | 73.4 | 69.8 | 65.9 | 70.5 |

Notes: CRED refers to the five loan sizes corresponding to: 75,000-125,000 € (CRED_1); 125,000-250,000 € (CRED_2); 250,000-500,000 € (CRED_3); 500,000-2,500,000 € (CRED_4); more than 2,500,000 € (CRED_5).

**Table 11**: Pair-wise correlations

| | OP | FD1 | FD2 | CRED_1 | CRED_2 | CRED_3 | CRED_4 | CRED_5 |
|---|---|---|---|---|---|---|---|---|
| OP | 1 | | | | | | | |
| FD1 | -0.58 | 1 | | | | | | |
| FD2 | -0.66 | 0.72 | 1 | | | | | |
| CRED_1 | -0.09 | 0.23 | 0.08 | 1 | | | | |
| CRED_2 | -0.13 | 0.21 | 0.08 | 0.79 | 1 | | | |
| CRED_3 | -0.32 | 0.19 | 0.20 | 0.36 | 0.65 | 1 | | |
| CRED_4 | -0.57 | 0.33 | 0.46 | 0.26 | 0.55 | 0.73 | 1 | |
| CRED_5 | -0.45 | 0.22 | 0.38 | 0.25 | 0.33 | 0.40 | 0.59 | 1 |

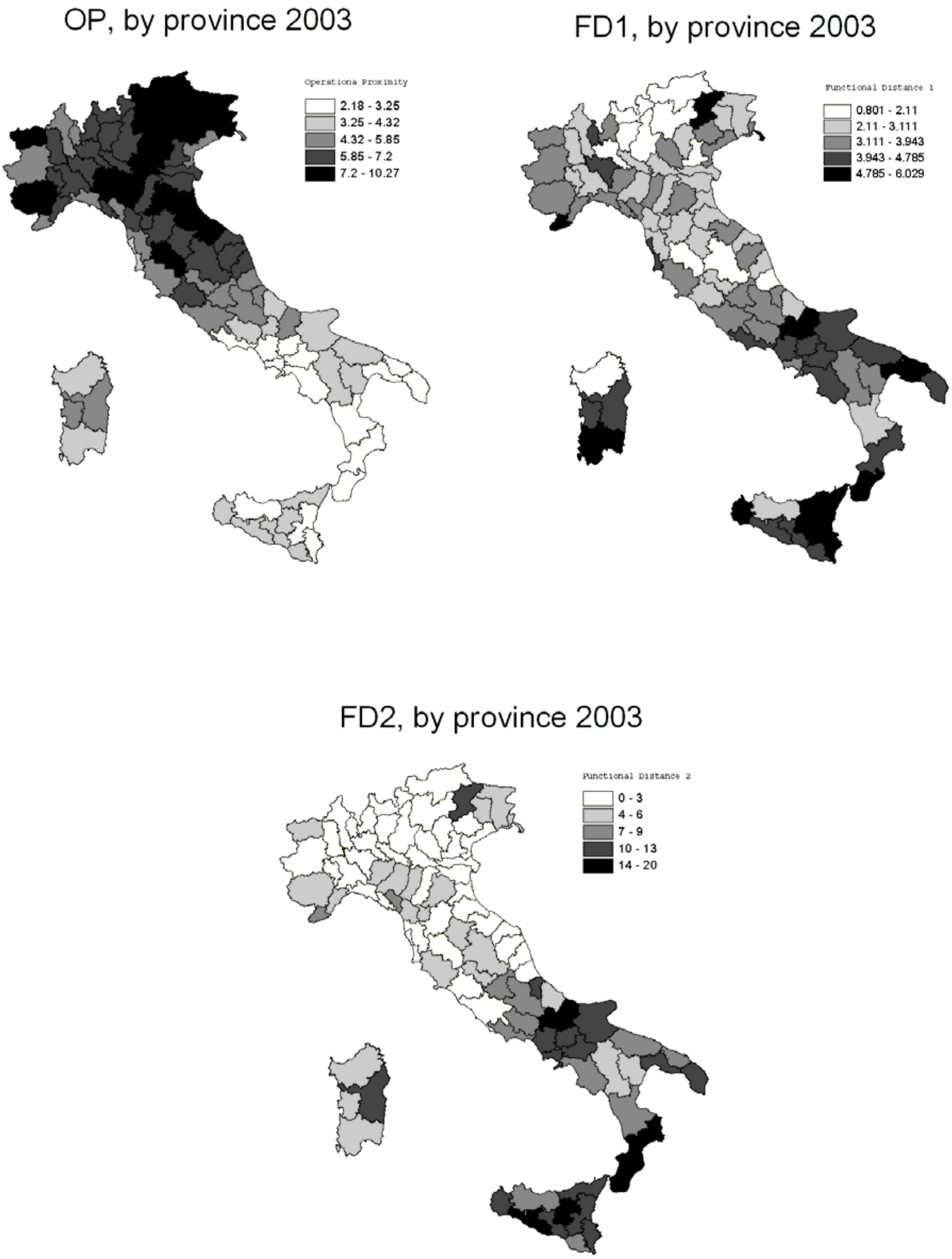
Notes: All correlations are significant at 5% level. CRED refers to the five loan sizes corresponding to: € 75,000-125,000 (CRED_1); € 125,000-250,000 (CRED_2); € 250,000-500,000 (CRED_3); € 500,000-2,500,000 (CRED_4); more than € 2,500,000 (CRED_5).

**Table 12**: One Step System-GMM estimation of equation (7).

| Dependent variable: CRED | Loan Size | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CRED_1 | CRED_2 | CRED_3 | CRED_T | CRED_1 | CRED_2 | CRED_3 | CRED_SME |
| CRED (-1) | 0.677*** | 0.810*** | 0.678*** | 0.784*** | 0.737*** | 0.784*** | 0.635*** | 0.786*** |
| | (0.080) | (0.054) | (0.075) | (0.050) | (0.075) | (0.057) | (0.080) | (0.049) |
| OP | -0.006** | -0.003 | -0.008** | -0.004** | -0.007** | -0.003 | -0.010** | -0.005** |
| | (0.003) | (0.002) | (0.003) | (0.002) | (0.003) | (0.002) | (0.004) | (0.002) |
| FD1 | 0.008** | 0.006** | 0.005 | 0.005** | | | | |
| | (0.004) | (0.003) | (0.004) | (0.002) | | | | |
| FD2 | | | | | 0.0002 | -0.001* | -0.0001 | 0.000 |
| | | | | | (0.001) | (0.000) | (0.001) | (0.000) |
| VA | 0.036 | 0.035** | 0.042 | 0.029* | 0.028 | 0.016 | 0.041 | 0.022 |
| | (0.026) | (0.017) | (0.029) | (0.017) | (0.024) | (0.019) | (0.033) | (0.018) |
| CCB | 0.016 | -0.007 | 0.029 | 0.005 | -0.015 | -0.043 | 0.010 | -0.023 |
| | (0.036) | (0.028) | (0.053) | (0.028) | (0.030) | (0.027) | (0.056) | (0.026) |
| HHI | 0.056** | 0.033 | 0.119*** | 0.052*** | 0.039 | 0.024 | 0.125*** | 0.044** |
| | (0.028) | (0.024) | (0.029) | (0.020) | (0.026) | (0.024) | (0.032) | (0.022) |
| CONSTANT | 1.065*** | 0.467* | 0.961** | 0.649*** | 0.911** | 0.792** | 1.178** | 0.730*** |
| | (0.368) | (0.243) | (0.387) | (0.225) | (0.393) | (0.321) | (0.463) | (0.276) |
| OBS | 618 | 618 | 618 | 618 | 618 | 618 | 618 | 618 |
| OIR test | 0.311 | 0.274 | 0.482 | 0.312 | 0.447 | 0.305 | 0.427 | 0.157 |
| AR (1) | 0.087 | 0.001 | 0.002 | 0.048 | 0.092 | 0.001 | 0.003 | 0.048 |
| AR (2) | 0.133 | 0.357 | 0.909 | 0.656 | 0.132 | 0.345 | 0.855 | 0.329 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: CRED refers to the five loan sizes corresponding to: € 75,000-125,000 (CRED_1); € 125,000-250,000 (CRED_2); € 250,000-500,000 (CRED_3); € 75,000-500,000 (CRED_SME). Robust standard errors in brackets. Three, two and one star (*) means, respectively, a 1%, 5% and 10% level of significance. All regressions include time and geographic (five macro areas) dummies, not shown for the sake of brevity. As instruments, we use lagged values (*t*-1 and *t*-2) of CRED(-1) and all available lagged values from *t*-2 thereafter for the other variables. AR(1) and AR(2) are the Arellano and Bond autocorrelation tests of first and second order (the null is no autocorrelation), the F-test refers to the significance of the regression, and the OIR test is the Hansen test for over-identifying restrictions (the null is the validity of the instrument set). All diagnostic values refer to p-values.

**Figure 1:** Operational proximity and functional distance by province in 2003



**Appendix A: Variable Definition**

**FD1**, by province, is a measure of functional distance, computed as the ratio of branches weighted by the logarithm of 1+ the kilometric distance between the province of the branch and the one where the parent bank is headquartered, over total branches in province j (see Section 3 for details). Source: authors' calculations on Bank of Italy.

**FD2**, by province, is a measure of Functional Distance, computed as the ratio of branches weighted for difference in social capital (measured by the participation rate at referenda) between the province of the branch and the one where the parent bank is headquartered, over total branches in province j (see Section 3 for details). Source: authors' calculations on Bank of Italy and Home Department data.

**OP**, by province, is the indicator of operational proximity, computed as number of banks' branches in province j per 10,000 inhabitants (see Section 3 for details). Source: authors' calculations on Bank of Italy and ISTAT data.

**HHI**, by province, is the Herfindahl-Hirschman Index calculated on the number of branches in province j. Source: authors' calculation on Bank of Italy data.

**CCB**, by province, is the share of branches held by Credit Cooperative Banks on total branches in province j. Source: Bank of Italy.

**FAIL**, by province, is an indicator of judicial efficiency. It measures, by judicial district, the logarithm of the average length, in days, of a bankruptcy trial. Source: Italian National Institute of Statistics (ISTAT).

**VA**, by province, is the logarithm of per capita value added in province j. Source: Authors' calculations on Italian National Institute of Statistics (ISTAT) data.

**CRED**, by province, is the logarithm of the ratio between utilized and available credit lines. CRED is disaggregated according to the five loan sizes corresponding to: 75,000-125,000 € (CRED_1); 125,000-250,000 € (CRED_2); 250,000-500,000 € (CRED_3); 500,000-2,500,000 € (CRED_4); more than 2,500,000 € (CRED_5). Source: Authors' calculations on Bank of Italy data.

**RAT**, by firm, is a dichotomous variable which is equal to one if the firms declare itself to be credit rationed and zero otherwise. Source: MCC Surveys.

**K**, by firm, is the capital stock (at the end of the period), defined material and immaterial immobilizations, gross of depreciation allowances. Source: Balance sheet data in MCC Surveys.

**INV**, by firm, is investment, as variation of capital stock between years t and t-1. Source: Balance sheet data in MCC Surveys.

**CF**, by firm, is cash flows (at the end of the period), defined as net income plus depreciation allowances. Source: Balance sheet data in MCC Surveys.

**ROE**, by firm, is the Return on Equity, computed as gross operational income on net equity. Source: Balance sheet data in MCC Surveys.

**ROI**, by firm, is the Return on Investment:, computed as gross operating earnings on invested capital. Source: Balance sheet data in MCC Surveys.

**DEBT**, by firm, is the measure of leverage, calculated as the logarithm of (1 + Debt-equity ratio). Source: Balance sheet data in MCC Surveys.

**SIZE**, by firm, is the logarithm of the number of workers. Source: MCC Surveys.

**GROWTH**, by firm, is the annual rate of growth of total sales. Source: MCC Surveys data.

**R&D**, by firm, is the ratio of employed in R&D activities on total workers. Source: MCC Surveys data.

**BANKS**, by firm, is the number of banks with which the i-th firm makes business. Source: MCC Surveys.

**BANK_PR**, by firm, is a dummy equal to one if the firm and its main bank are headquartered in the same province, and zero otherwise. Source: MCC Surveys