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Cristina Bernini
University of Bologna, Italy

Paola Brighi
University of Bologna, Italy
The Rimini Centre for Economic Analysis (RCEA), Italy

MODELING THE EFFECTS OF GEOGRAPHICAL EXPANSION STRATEGIES ON THE ITALIAN MINOR BANKS' EFFICIENCY

The Rimini Centre for Economic Analysis
Legal address: Via Angherà, 22 – Head office: Via Patara, 3 - 47900 Rimini (RN) – Italy
www.rcfea.org - secretary@rcfea.org

Modeling the effects of Geographical Expansion Strategies on the Italian Minor Banks' Efficiency

Cristina Bernini
Department of Statistical Sciences
University of Bologna
Via Belle Arti 41, Bologna
e.mail: cristina.bernini@unibo.it

Paola Brighi
Department of Management
University of Bologna
Via Capo di Lucca 34, Bologna
e.mail paola.brighi@unibo.it

Abstract

In the last decades, banking re-organization process has progressively increased centralized hierarchical organizational structures. In several cases, the restructuring activity has involved a geographic expansion of the financial organizations to other municipalities within the home province or into other provinces, any of which may be considerable distances away. Minor banks could have incentive to grow through geographically expansion in the attempt to increase their market power and margins. The aim of the paper is to assess the effect of the geographic expansion on minor banks' efficiency by using appropriate distance measures. Moreover, to evaluate the relevance of the different organizational banking models on bank efficiency, we also control for product diversification and size. Based on an unbalanced panel of Italian banks over the period 2006-2009, we estimate stochastic cost frontier functions for either the minor banks or the whole banking system. Results suggest that geographical dimension measured by the distance between local branches and the headquarter significantly affects cost efficiency, either for the full sample or minor banks with a more incisive impact for the latter ones.

Keywords: geographical distance; product diversification; stochastic frontiers; panel data; local banks.

JEL classification: G21; L11; L25.

1. Introduction and motivation

1.1 What's special about minor banks?

A large stream of the literature have analysed the role of minor banks in the economic system, with particular attention to their special position in the financing SMEs at the local level (Berger et al., 1995, DeYoung et al. 1999, 2004; Cole et al. 2004). With reference to the bank size pattern, several studies have compared the different role of large and small banks on their lending processes. Some authors evidence that minor banks have a comparative advantage in relationship lending operations with small opaque firms (DeYoung et al. 2004). Relationship lending measures the bank–borrower relationship strength, such as relationship length or breadth, as a continuous indicator of the degree to which the relationship lending technology versus a hard technology is effectively applied. In this sense, relationship lending implies the collection of information on the dynamic interactions between borrowers and banks. This information is easily collectable if bank and customers are close each-other, and this is particularly true if the bank is very small and local. "Because relationship lending depends on "soft information" which is difficult to transmit up a bank's hierarchy, this type of lending is better supported by banks with fewer level of management between loan officers and loan decision-makers." (Mudd, 2012) In this respect, minor banks in the market can be considered as a factor that may facilitate relationship lending, especially to small opaque firms, increasing the opportunity for access to finance.

Conversely, some Authors suggest that minor banks have lost their primary role because of the upcoming of credit scoring technologies. At this regard, Berger et al. (2005) underline that the small business credit scoring (SBCS) technologies "allow large banks to expand their small business lending, particularly to relatively risky credits, [...] may put increased competitive pressures on community banks in the long run, since SBCS may be used by banks of any size at any distance, and does not require the traditional local ties of community banks". In summary, SBCS does not require a local presence by the bank.

More recently, Berger and Black (2011) have improved the so-called "current paradigm" based on which banks would follow a dichotomy behaviour in lending: small banks would preferably lend to small firms, while large banks lend primarily to large firms. "Large banks are hypothesized to focus on lending to large, transparent firms using their comparative advantages in lending technologies based primarily on ''hard" quantitative information. [Conversely], "loan officers at small loan officers at small banks have more flexibility to evaluate credit using techniques based primarily on ''soft" qualitative information that is difficult to quantify and communicate by the loan officers – such as personal knowledge about the subjective circumstances of the firm, its owner, and its management." (p. 724). Authors go beyond the "current approach" suggesting that lending technologies are characterized by different nuances of both hard and soft information. They suggest that relationship lending could be more complex, and to identify this type of bank-firm approach it is not enough to focus solely on soft information. One of the main results is that "All lending technologies employ some combination of hard and soft information, but hard and soft technologies are defined by the principal or most critical source of information employed in the screening, underwriting, and monitoring of the credit." (p.726). So for technologies based exclusively on soft information, Authors suggest a more restrictive definition than relationship lending, named "judgment lending", affirming that "lending based primarily on the judgment of a loan officer relying on experience and training, as well as any other available hard and soft information." (p. 725).

Because all technologies are based on both soft and hard information, Authors conclude that for "some hard-information technologies, the comparative advantage of large banks in using the hard-information component may be offset by a comparative advantage of small banks in using the soft-information component. [...] Large banks may have only a slight comparative advantage in obtaining and processing the appraised values, whereas small banks may have a significant advantage in the soft-information component, based on relationships with the borrowing firms or loan officers' knowledge of the market and local business conditions. This implies that large banks may not have comparative advantages in hard technologies with significant soft-information components." (p. 726). Comparing small vs. large banks, Authors finally find that small banks have a comparative advantage in relationship lending overall in the case of credit to large firms. "This suggests that the collection of soft information through relationships has less value for the smallest firms [probably because] small banks may be more likely to use judgment lending to lend to small firms with which they do not have a strong relationship." Judgment lending may be an important soft-information technology that may create a further comparative advantage for small and minor banks.

1.2 Distance and minor banks

Some Authors (see among others Stein, 2002) suggest that minor banks can take advantage in terms of relationship lending because of their simple organizational structure that facilitate the processing and transmitting of soft information; conversely, large banks may be disadvantaged because they are characterized by longer communication channels. That distance plays an important role in defining the relationship between the bank and its borrowers is further developed by several Authors. Among them, Jiménez et al. (2009) investigate the role of "organizational distance, that is, the distance between the location of the top decision-making power of the bank (i.e. its headquarters) and the location of the borrower who receives a loan" on the collateral request when a firm asks for a loan. Authors underline that "Organizational diseconomies in lending imply that organizational distance is sufficient to preserve the informational advantage of local lenders, even after a distant bank opens a branch in the local market. Organizational distance becomes close to physical distance, which has been investigated as an important variable for the workings of credit markets." Their main results suggest that "there exists some segmentation in lending technologies by local and distant banks, and that the informational advantage of the local lender, with respect to the risk of the project to be financed, is relevant in explaining the use of collateral, and, possibly, other terms, for loans granted by local lenders." (p. 236)

In other terms, as highlight by Carling and Lundberg (2005, p. 40) the bank can be assimilated to a church tower that from its outlook it can screen and monitor firms in its proximity. The asymmetric information between the bank and the borrower increases in distance. The distance between the bank headquarter (HQ) and its branches could exacerbate the loan evaluating process, affecting the overall bank efficiency negatively. The rationale is that as the distance between the borrowing firm and the bank loan decision unit increases, the relationship lending weakens and the firm credit evaluation process becomes problematic. The bank borrower's evaluating process becomes more imprecise as the distance between the lender and the borrower increases. In this respect, the bank operating at the local level can have an informational advantage charging higher loan rates to closer firms (hold-up). Further investigations evidence that the distance may also imply spatial credit rationing problems. As Hauswald and Marquez (2006) show, the distance aggravates the information asymmetry problem, implying credit rationing efforts for distant firms.

As for the Italian banking system, Felici and Pagnini (2008) evidence that large banks are more able to cope with distance-related entry costs than small banks, by using hard information. The analysis suggests that banks have become increasingly able to open branches in distant markets, due to the advent of information and communication technologies. In some way the relation between banks and customers may become more effective and efficient, with technological advances facilitating the use of transactional lending technologies, with local banks serving opaque and informational complex borrowers, and national banks, with a smaller branch network than they have today, competing with transactional lending technologies suitable for dealing with more transparent borrowers. Nevertheless, distance continues to play a role: 'Yet the fall in trade costs due to distance brought about by the new technologies does not imply that they are about to disappear. In other words, we do agree with a recent remark by Degryse and Ongena [2004] that "distance dies another day".' (p. 527).

To better investigate the effects of the distance on the bank-borrower relationship a more accurate definition of distance, suggested by Alessandrini et al. (2009), is considered. Authors compute the functional distance as ‘an index that takes account of the ownership structure of the local lending offices. Specifically, [they] calculate functional distance as the ratio of local branches weighted by, alternatively, the physical, economic and socio-cultural distance which separates them from the locus where their own bank is headquartered, to the total number of local branches.’ (p. 263). To this respect, a bank characterized by local branches has the lowest value of the functional distance indicator; otherwise, two banks with equally functionally distance may be characterized by a different intensity of concentration/diffusion of local branches across the territory.

1.2 Geographical features and efficiency

All the above aspects emphasize the role of minor banks as special lenders for firms localized in the territory. Different variables can be used to measure the proximity of bank to the local environment, as bank size and distance between the HQ and local branches. As suggested before, several authors investigate the pro and cons for a bank to be strictly connected to the territory; conversely, only few papers focus on the relative implications in terms of bank cost efficiency. The analysis of bank efficiency has always raised great attention in the academic and professional world, and recently its interest has further increased because of many structural changes and of the recent financial crisis, increasing complexity and competitiveness both at local and global level. Minor attention has been dedicated to the analysis of the impact of bank structure aspects over minor bank efficiency. Many studies focused on the analysis of the efficiency for some categories of banks, as community banks (Feng and Zhang, 2012), saving banks (Carbo et al., 2002) and mutual banks (Battaglia et al., 2010). Some other studies centre on groups of banks classified by size (minor, small and large) and compare efficiency scores basing the analysis on a common production function (see among other Girardone et al., 2004 cf. Akhigbe and McNulty, 2003 and 2005). Differently, other studies investigate the role of size in the inefficiency model. Both approaches suggest that an increase in size is relevant only for smaller banks, and that smaller banks sound to be more efficient than larger ones.

In particular, assuming that different size bank groups (small, medium and large) share the same production technology, Akhigbe and McNulty (2003) find that small banks are more profit efficient than large banks. Authors explore whether several factors related to banking structure, competition and location, as well as the bank's financial ratios, affect small bank efficiency scores. Some key results are reached: i) the efficiency increases with bank size. This result is not coherent with the so called information asymmetry hypothesis, that is the smallest are the banks the better are their loan customers screening with positive effects in terms of greater profit efficiency; ii) the efficiency is greater for banks operating in more concentrated markets; iii) profit efficiency of small banks is negatively affected by the market non-performing loan ratio but it is not influenced by the bank internal non-performing loan ratio. These results are not unequivocally confirmed in the case of other groups of banks, suggesting some degree of heterogeneity among different size banking groups (cf. Akhigbe and McNulty, 2005).

As regards the Italian banking market, Girardone et al. (2004) propose a comparative X-efficiency and economies of scale analysis for different bank groups, classified with respect to size, type and geographical location. The analysis evidences that the highest cost efficiency, either in terms of X-efficiency or economies of scale, is reached by large and medium banks generally located in the northern regions. Among bank categories, the most efficient reveals to be the mutual banks. Economies of scale and local monopoly power could explain this result. A negative relationship between size and inefficiency is found only for very small banks, evidencing the relevant role played by economies of scale within this group. Furthermore, very small banks are characterized by a positive and statistical significant relation between inefficiency and risk (measured by the non-performing loans).

Some authors also investigate the relation between geographic expansion and efficiency, analysing the effect of the distance between the affiliate bank and its lead bank on profit and cost efficiency. Berger and DeYoung (2001) with reference to U.S. commercial banks over the period 1993-1998 find mixed results. “For example, while banks in organizations that expand intro nearby states and regions tend to have higher levels of efficiency, organizational control over affiliate bank efficiency tends to diminish as affiliates move further away from the parent, especially for small bank affiliates. [...] But these distance-related efficiency effects tend to be modest in size, and our results suggest that efficient parent organizations can export their superior skills, policies, and practices to their affiliates and overcome any negative effect of distance” (p. 180). Geographic expansion implies both benefits and costs. Benefits that increase with physical distance are mainly linked to the opportunity of risk diversification on loans, deposits and other financial products. Conversely, costs are connected to the difficult of quantify and transmit information on local borrowers to the distant headquarters. Making relationship loans to local borrowers implies to elaborate knowledge that includes not only hard information on the firm financial status but also soft information about “the firm’s managers, its local economic environment, and tis relationships with customers, suppliers and local competitors. Because much of this information is difficult to quantify and transmit, so that verifying whether local loan performance problems are due to adverse local conditions, poor performance of the borrowers, or lax effort or incompetence of local loan officers become more difficult as distance increases” (p.168).

Following the above streams of research, in the paper we investigate the relationships between some key banking structure model features, as size and distance, and bank cost efficiency. The novelty of the paper relies on the comparison of these effects between minor banks and the whole Italian banking system. Quality and riskiness of bank loans are also considered to control for other sources of bank efficiency heterogeneity. The analysis is carried out on an unbalanced panel of Italian banks over the period 2006-

2009, by using a stochastic frontier approach, in which the cost function and the inefficiency model are simultaneously estimated.

2. The study method

2.1 The model

Evaluating the efficiency of a bank involves a comparison between actual and optimal values. In particular, it is concerned with the comparison between observed outputs and maximum potential outputs obtained from given inputs; or observed inputs and minimum potential inputs to produce a given amount of outputs. It is also possible to define efficiency in terms of behavioural goals, where efficiency is measured by comparing observed and optimal costs and profits, leading to cost and profit efficiencies respectively.

In this paper, for measuring the cost efficiency of Italian banks, we use the SFA approach (Battese and Coelli, 1995). This model incorporates the estimation of cost function and the determinants of efficiency at the same time, by parameterizing the mean of the efficiency term as a function of exogenous variables.

As for the cost function we consider:

(1) $$\ln(TC_{it}) = X_{it} \quad + (V_{it} + U_{it}),$$

where $\ln(TC_{it})$ is the logarithm of total production cost for bank i at time t, X indicates the natural logarithm of input prices and output quantities, is a vector of unknown parameters to be estimated; the V_{it}s are random variables that are assumed to be independent and identically distributed, $N(0;\pm_V{}^2)$. The non-negative random variables, (U_{it}), which account for cost inefficiency, are assumed to be independently distributed, such that U_{it} is the truncation (at zero) of the $N(«_{it};\pm^2)$-distribution, where $«_{it}$ is a function of observable explanatory variables and unknown parameters, as defined below. We choose the truncated normal form because of the hypothesis that the market is competitive, that is, the greater proportion of the enterprises operate 'close' to efficiency. It is assumed that the V_{it}s and U_{it}s are independent random variables.

The parameters of the frontier production function are simultaneously estimated with those of the inefficiency model (β, δ, σ2, σ2v), in which the cost inefficiency effects are specified as a function of other variables:

(2) $$\mu_{it} = \delta_0 + \sum_{m=1}^{M} \delta_m \ln z_{mit}.$$

In the eq. 2 the δs are parameters to be estimated. A positive parameter value of δ_m implies that the mean inefficiency increases as the value of the m-input variable increases.

Maximum-likelihood estimates of the model parameters are obtained using the program, FRONTIER 4.1, written by Coelli (1996). The variance parameters are defined by $\sigma_S^2 = \sigma_V^2 + \sigma^2$ and $\gamma = \sigma^2 / \sigma_S^2$ originally recommended by Battese and Corra (1977). The log-likelihood function of this model is presented in the appendix of Battese and Coelli (1993). When the variance associated with the technical inefficiency effects converges toward zero (i.e. $\sigma^2 \to 0$) then the ratio parameter, γ, approaches zero. When the variance of the random error (σ_V^2) decreases in size, relative to the variance associated with the technical inefficiency effects, the value of γ approaches one.

The cost efficiency of a unit at a given period of time is defined as the ratio of the minimum cost to the observed cost needed to produce a given set of outputs. The technical efficiency of the i-th unit in the year t-th is given by:

(3) $$CE_{it} = \exp(U_{it}) .$$

The cost efficiency of one unit lies between zero and one and is inversely related to the inefficiency effect.

2.2 The data

We analyse an unbalanced panel data of 2,597 banks[1] over the period 2006-2009. Data have been provided by the Italian Banking Association. The coverage of our sample relative to the population of the whole Italian banking system is nearly 90%, and it is quite stable over the analysed period (Table 1).

In order to identify minor banks, we follow the classification provided by the Bank of Italy, which categorizes banks with respect to size and distinguishes between minor, small and large banks. Thresholds are given by Bank of Italy and are based on the average amount of total intermediation assets[2]. Then, minor banks are defined as those with average total intermediation assets lower than 1,3 billions euro; small banks are defined as those with average total intermediation assets included between 1,3 and 9 billions euro; large banks comprise all banks with average total intermediation assets higher than 9 billions euro[3]. Minor banks represent 75% of the total number of banks in our sample, small banks correspond to 18% and large banks is only 7% of the total. In respect to bank total asset, the composition of the sample is simply reversed: the minor group represents only 6% of the entire Italian banking system, small and large bank groups are 14% and 80%, respectively.

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[1] The sample excludes: i) foreign banks; ii) the central institutions for each category of banks; iii) special credit institutions for special purposes.

[2] See Bank of Italy Annual Report, 2009 – Methodological notes: tables a17.6 and a17.7.

[3] The Bank of Italy classifies banks according to five groups: very big (with total average financial intermediation assets higher than 60 billions Euros); big (between 26 and 60 billions Euros); medium (between 9 and 26 billions Euros); small (between 1,3 and 9 billions Euros) and very small (lower than 1,3 billions Euros). Because of the small number of observations in the medium, big and very big samples separately considered, we have grouped them in one group denominated “large banks”.

As a robustness check, we also suggest grouping the Italian banks with respect to the bank's ownership type, distinguishing between mutual, saving & cooperative and other commercial banks. The mutual group is based on the Italian Banking Association classification, the saving group is identified by using the ACRI (Italian Association of Saving Banks) classification, while the other commercial banks is obtained as a residual. In the analysis below, we focus on the group of the mutual banks because: i) they are for a large amount minor banks; ii) they are strictly linked to the local market, being present only at the HQ municipality and in the neighborhoods; iii) due to their mutualistic characteristic along with fiscal benefits, they are more capitalized than other banks.

The mutual banks represent 64% of the total banking system, the saving & cooperative banks correspond to 13%, the other commercial banks to 23%. With respect to the total asset, mutual banks represent 7% of the entire banking system while saving & cooperative group and the other commercial banks are, respectively, 19% and 74%.

Table 1. Sample size and population coverage

Size groups	2006	2007	2008	2009	Total
Large	45	46	46	46	183
	7%	*7%*	*7%*	*7%*	*7%*
Small	110	110	110	110	440
	18%	*17%*	*17%*	*18%*	*18%*
Minor	487	499	501	487	1,974
	75%	*75%*	*76%*	*75%*	*75%*
Juridical groups	**2006**	**2007**	**2008**	**2009**	**Total**
Saving & Cooperative	85	86	88	86	345
	13%	*13%*	*13%*	*13%*	*13%*
Other commercial banks	140	145	146	147	578
	22%	*22%*	*22%*	*23%*	*22%*
Mutual banks	417	424	423	410	1,674
	65%	*65%*	*64%*	*64%*	*64%*
Total unbalanced sample	642	655	657	643	2,597
Total sample over total national system	*89%*	*90%*	*92%*	*91%*	*90%*

In the analysis, data on macro environmental variables, over the period 2006-09, affecting banks efficiency are also used. Information on GDP at the provincial level are provided by Istituto Tagliacarne; ISTAT offers data on the number of provincial default and registered firms. The number of branches (referred to each bank at the municipal level) are taken from the Bank of Italy, as well as a measure of credit risk (defined as the ratio of the flow of new-non-performing loans on the stock of performing loans at the end of the previous period).

2.3 The cost function specification

In the literature, the definition of bank inputs and outputs varies across studies. This study follows the so called value-added approach, originally proposed by Berger and Humphrey (1992). This approach asserts that all liabilities and assets of banks have some output characteristics, rather than categorizing them as either inputs or outputs only[4]. The econometric models are specified for panel data, with both stochastic frontier cost function and inefficiency model. A flexible functional form as the translog production function is used:

$$\begin{aligned}
\ln(c_{it}) = \sim + \sum_{k=1}^{3} {}_{k} \ln q_{kit} + \sum_{p=1}^{3} {}_{p} \ln(p_{pit}) + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} {}_{jk} \ln q_{jit} \ln q_{kit} + \\
\frac{1}{2}\sum_{m=1}^{3}\sum_{p=1}^{3} {}_{mp} \ln(p_{mit}) \ln(p_{pit}) + \sum_{k=1}^{3}\sum_{p}^{3} {}_{kp} \ln q_{kit} \ln p_{pit} + {}_{E} \ln E_{it} + \\
{}_{t} t + {}_{t2} t^{2} + (V_{it} + U_{it}).
\end{aligned} \tag{4}$$

where $\ln c_{it}$ is the natural logarithm of the operative cost of bank i in year t. Accordingly to the value-added approach and following (see among others Akhigbe and McNulty (2003), we consider three outputs, $\ln q_{kit}$ (k=1, 2, 3), that are: total net loans, demand deposits and other earning assets (i.e. non-interest income assets), respectively. $\ln p_{pit}$ (p=1,2,3) is the logarithm

[4] The other two approaches used to define inputs and outputs in banking are: i) the intermediation approach that assumes that banks collect deposits to transform them, using labour and capital, into loans and other assets; ii) the production approach that consider banks as producers of deposit and loans in terms of the number accounts, using labour and capital.

of three price, that are the price for labour, the price of borrowed funds and the price of fixed capital, respectively. We also consider a fixed input E, that is the equity capital defined at the bank level, controlling for differences in equity capital risk across banks. Banks with lower equity ratios are assumed to be more risky, in line with Mester (1996). The cost frontier may also shift over time according to the values of the parameters ${}_{t}$ and ${}_{t2}$.

The conditions for ensuring that the cost function is linearly homogeneous in input price are:

(5) $$\sum_{p=1}^{3} {}_{p} = 1; \quad \sum_{m=1}^{3} {}_{mp} = 0; \quad \sum_{k=1}^{3} {}_{kp} = 0;$$

To meet these homogeneity conditions, eq. (4) is transformed into a normalized function. Specifically, costs and input prices are normalized by the price for labour (p1). Then, the normalized cost function to be estimated is:

(6) $$\ln(c_{it} / p_{1it}) = \sim + \sum_{k=1}^{3} {}_{k} \ln q_{kit} + \sum_{p=1}^{2} {}_{p} \ln(p_{pit} / p_{1it}) + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} {}_{jk} \ln q_{jit} \ln q_{kit} + \frac{1}{2}\sum_{m=1}^{2}\sum_{p=1}^{2} {}_{mp} \ln(p_{mit} / p_{1it}) \ln(p_{pit} / p_{1it}) + \sum_{k=1}^{3}\sum_{p}^{2} {}_{kp} \ln q_{kit} \ln(p_{pit} / p_{1it}) + {}_{E} \ln E_{it} + {}_{t} t + {}_{t2} t^{2} + (V_{it} + U_{it}).$$

Table 2 presents a detailed description of the input and output variables used in estimating the cost functions, for the whole banks sample and the minor and mutual groups.

Table 2. Descriptive statistics of input and output variables

Variable	Minor			Mutual			Total		
	Mean	***Median***	***Std. Dev.***	***Mean***	***Median***	***Std. Dev.***	***Mean***	***Median***	***Std. Dev.***
Cost (Profit) (in thousand €)									
Total cost (cit)	5,934	4,213	125	5,763	4,043	164	46,659	6,389	4,390
Output Quantities (in thousand €)									
Loans (q1it)	173,7 8	114,216	3,807	19 ,194	114,454	6,094	1,621,594	186,638	145,055
Demand deposits (q2it)	120,553	84,037	2,478	132,434	85,739	4,625	1,009,855	122,762	90,978
Other earning assets (q3it)	66,734	45,833	1,624	66,641	44,221	2,308	1,217,314	65,979	190,432
Equity (E)	29,204	20,875	691	30,696	19,643	866	275,178	31,484	38,055
Input prices									
Price of labor (p1it)	51.855	49.707	0.406	50.348	49.323	0.403	53.316	49.920	0.459
Price of funds (p2it)	0.012	0.011	0.000	0.011	0.011	0.000	0.013	0.011	0.000
Price of fixed capital (p3it)	2.480	0.742	0.331	1.105	0.692	0.053	3.349	0.760	0.327

2.4 The cost inefficiency model

We further investigate factors affecting bank efficiency in order to assess the importance of any (in)efficiency determinants. In particular, the main aim of the analysis is to examine whether bank organizational structure – proxy by functional distance, product diversification and size – differently affect bank groups efficiency. In the inefficiency model we also consider risk variables and macro environmental factors, in order to control for bank heterogeneity.

Supposing that internal and environmental economies factors impact on bank efficiency, we propose a novel specification of the inefficiency model in which the means $«_{it}$, associated with the cost inefficiency of bank i at time t, are assumed to be specified as a function of three different sets of variables. The variables of interest are obviously related to business model strategy, depending on the bank branching diffusion degree (HQ-DISTANCE), its product diversification policy (DIV_{REV}) and its size (SIZE). Furthermore, to account for asset quality and the bank micro credit risk conditions, a second group of variables has been included: i) the loan-loss provisions over total net loans (LLP); ii) the traditional non-performing loans over total net loans ratio (NPL). Macro environmental effects are finally controlled by: i) the standard provincial GDP annual growth rate; ii) the provincial firm default rate; and iii) a macro non-performing loans rate.
Then the inefficiency model is specified as follows:

(7)

$$«_{it} = ¢_0 + ¢_{fd} \ln HQ - DISTANCE + ¢_{div} \ln DIV_{REV} + ¢_{size} \ln SIZE + ¢_{llp} \ln LLP + ¢_{npl} \ln NPL + ¢_{gdp} \ln GDP\_RT + ¢_{dr} \ln DEF\_RT + ¢_{npli} \ln NPL\_INDEX.$$

The product diversification index (DIV_{REV}) measures for each bank the degree of diversification policy between traditional and non-interest income activities. Using the standard definition of NET (net interest income) and NII (net non-interest income) and according to Mercieca et al. (2007), we compute the Herfindahl Hirschmann Index (HHI) revenue as follows:

$$HHI_{REV} = \left(\frac{NET}{NET + NII}\right)^2 + \left(\frac{NII}{NET + NII}\right)^2$$

Following Stiroh and Rumble (2006), we define a measure of product and the income diversification index as:

(8) $DIV_{REV} = 1 - HHI_{REV}$.

As suggested by Chiorazzo et al. (2008), under the constraint that NET and NII have to assume positive values, this index varies from 0.0 to 0.5. It will be zero when the bank does not diversify its activity - because either it is strongly concentrated on traditional net interest income or highly non-interest income – and equals 0.5 when it is completely diversified. The income diversification index equals 0.313 in the whole sample, but it is lower in the minor and mutual groups (0.294 and 0.292, respectively) (Table 3). These preliminary results suggest a less aggressive business diversification strategy in the case of minor banks.

Table 3. Descriptive statistics of the inefficiency variables

Variable	Minor			Mutual			Total		
	Mean	***Median***	***Std. Dev.***	***Mean***	***Median***	***Std. Dev.***	***Mean***	***Median***	***Std. Dev.***
Banking business model									
Functional distance (HQ-DISTANCE)	1.675	1.753	0.022	1.625	1.742	0.019	2.083	2.009	0.025
Product diversification (DIV_{REV})	0.294	0.298	0.002	0.292	0.294	0.002	0.313	0.317	0.002
Total assets (in thousand €) (SIZE)	249,763	177,321	4,912	272,993	171,964	8,426	2, 77,222	280,074	317,832
Micro risk condi ions									
Loan loss provisions/Total net loans (LLP)	0.005	0.004	0.017	0.005	0.003	0.016	0.005	0.004	0.015
Non performing loans/Total net loans (NPL)	0.019	0.012	0.001	0.018	0.013	0.001	0.018	0.012	0.001
Macro environmental conditions									
GDP growth rate (GDP)	99.335	99.179	0.064	99.355	99.179	0.071	99.191	99.092	0.055
Firm default rate (DEF_RT)	2.536	2.160	0.040	2.370	2.110	0.042	2.602	2.190	0.033
Macro NPL (NPL_ INDEX)	25.488	1.000	0.925	26.481	1.000	1.030	23.530	1.000	0.753

A novel measure of the functional distance (HQ-DISTANCE) between bank branches and its headquarter (HQ) is proposed. Our indicator is similar to the F-DISTANCE measure suggested by Alessandrini et al. (2009). Differently from the Authors, we construct the indicator for the i-bank at the municipal level, as follows:

$$(9)\ HQ-DISTANCE_i = \frac{\sum_{z_b=1}^{B_i}[Branches_{iz_b} \times \ln(1+D_{iz_b})]}{\sum_{z_b=1}^{B_i} Branches_{z_b}},$$

where $z_b = 1, ..., \mathrm{B_i}$ are the municipalities where the i-bank has branches, with i:1,..,I. $D_{iz_b} = \sqrt{(X_{z_b} - X_{HQ_i})^2 + (Y_{z_b} - Y_{HQ_i})^2}$ is the Euclidean distance between the municipality z_b where the branch is located and the municipality where the HQ of the i-bank is located (HQ_i). The HQ-DISTANCE is calculated in respect to municipalities where at least one branch is present, that is for almost 5,900 Italian municipalities[5].

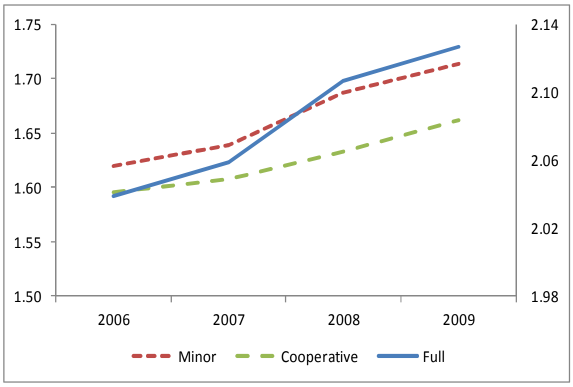
Statistics reported in Table 4 show that the average functional distance of the Italian banking system is 40 kilometers, being different between the bank groups. Mutual and minor banks are mainly concentrated in the territory: the mean distance between the HQ and branches is respectively 10 and 17 kilometers. As expected, mutual and minor banks are characterized by a high proximity between the HQ and local branches, and this is particularly true for the regions where the mutual banking system is more developed (i.e. Trentino-Alto Adige, Emilia-Romagna, Marche, Veneto and Toscana). Another interesting feature regards the dynamics of the HQ-DISTANCE in respect to the bank groups. As for the whole sample of banks, the distance augments of 4.3% over the analyzed period of time, exhibiting a decreasing average growth rate (0.9% between 2008 and 2009). Minor banks show the highest increase in HQ-DISTANCE: the total growth rate equals 5.81%. Conversely, the boost in the HQ-distance is slightly less

[5] The total number of municipalities in Italy is 8,094, but in 2009 only 5,929 municipalities host at least one branch (5,926 in 2008, 5924 in 2007 and 5,926 in 2006).

evident for the mutual group in the first part of the analyzed period of time, becoming consistent in the last years (1.8% between 2008 and 2009).

Table 4. Dynamics of the HQ-DISTANCE

	Full	Minor	Mutual
2006	2.04	1.62	1.60
2007	2.06	1.64	1.61
2008	2.11	1.69	1.63
2009	2.13	1.71	1.66
Total growth rate	4.30%	5.81%	4.15%

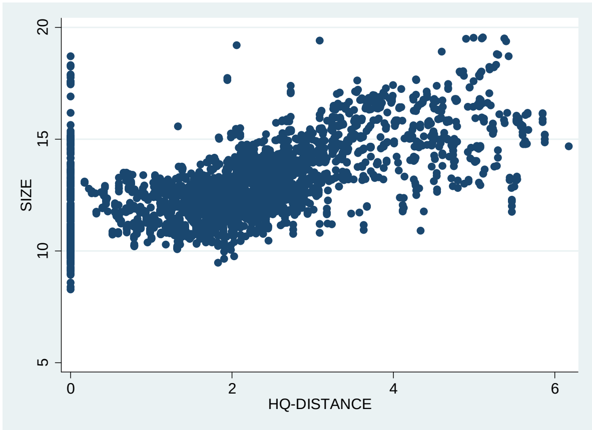


These preliminary results suggest that minor banks have been involved in a process of geographical expansion to other municipalities within their home province or in other neighborhood provinces. In the following, we investigate the effects produced by this policy on the cost efficiency.

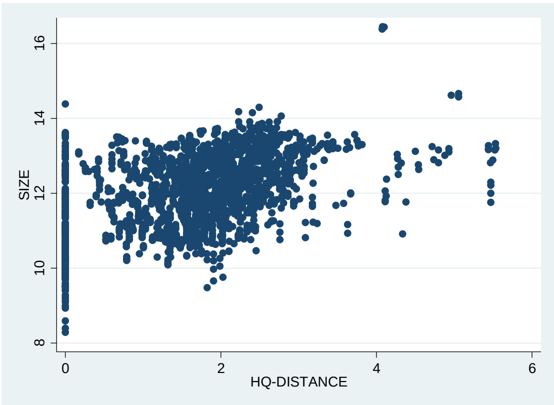
The bank organizational structure is also controlled by using a measure of bank size (SIZE) - that is the natural logarithm of total asset. Minor and mutual banks are very similar in terms of size that is nearly ten times lower than that of the full sample. For this reason a positive correlation between distance and the size of the bank is expected. The scatter plots of the size and distance for the different bank groups (Figure 1) confirm this relationship, being higher for the whole sample of bank (the correlation equals 0.663) in respect to mutual and minor banks (the correlation is 0.548 and 0.499, respectively).

Figure 1. The relationship between Size and HQ-Distance

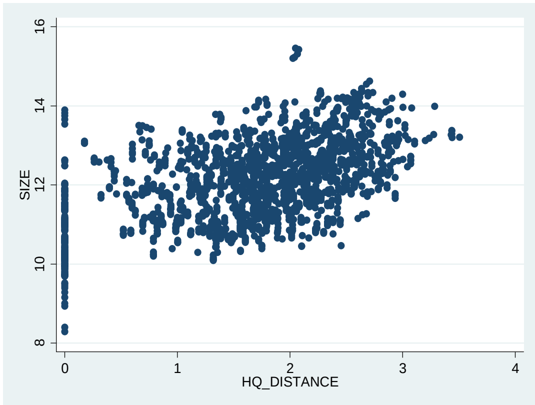
Full sample



Minor



Mutual



Different bank organizational models imply different credit risk policies and the economic distress, causing credit quality depreciation over the investigated period, suggest including some asset risk measures in the inefficiency models. Then, the LLP index – as a proxy for the ex-ante credit risk – is computed for each bank as the ratio between the flow of loan-loss provisions over the stock of net loans.[6] Moreover, the NPL variable, measured as the ratio between the stock of the non-performing loans over total net loans ratio, is a backward-looking measure and may be used as a proxy for the ex-post credit risk (Fiordelisi et al., 2011).

[6] For further details on the loan loss provisions computation according to IAS 39 see IASB (2009).

In the previous literature on bank efficiency the credit risk has been studied by simply considering its effect on the inefficiency equation (cf. among others Akhigbe A., McNulty J.E., 2003 and 2005; Girardone et al., 2004). However, recent studies focusing on credit risk and its effects on efficiency have examined the causality of the relationship between efficiency and credit risk via capital, by using simultaneous equation models (Altunbas et al., 2007) and the Granger causality approach (Fiordelisi et al., 2011). In our study we deviate from these approaches because our aim is to evaluate the direct effect of credit risk on bank inefficiency without considering possible causality with capital. For this reason we omit from our models the capital and the loan growth rate being highly correlated with the risk.

Finally, as macro indicators, we suggest using the annual growth rate of GDP (GDP_RT) and the ratio between default firms and registered firms (DEF_RT). These macro indicators are calculated in respect to the i-bank, weighting the indicator at the province level with the ratio of branches in the province in respect to the total amount of branches of the i-bank. The procedure allows to take into account of the different impact that each macro-indicator has on the bank, in respect to the presence of that bank in that province. Among the group of environmental variable, we also include the ratio between non-performing loans and total net loans (NPL_INDEX) that, using a threshold value of macro risk of the 6 per cent, is defined as follows[7]:

$$\mathrm{NPL\_INDEX_i} = \frac{\sum_j \frac{\mathrm{branches}_{ij}}{\mathrm{branches_i}} * \left(\frac{\mathrm{npl}}{\mathrm{loans}}\right)_j}{\sum_j \mathrm{p_{ij}}},$$

[7] We use a threshold value of 6 per cent, following the definition proposed by the Interbank Deposit Protection Fund. The choice is also supported by some empirical evidences. Over the period 2006-09, the median value of NPL over total net loans has been of 4.9%, evidencing a substantial stability over time.

where $\left(\frac{npl}{loans}\right)_j = \begin{cases} \left(\frac{npl}{loans}\right)_j & \text{if greater than } 6\% \\ 0 & \text{otherwise} \end{cases}$ and

$$p_{ij} = \begin{cases} 1 & \text{if bank}_i \text{ is present in province j} \\ 0 & \text{otherwise} \end{cases}.$$

The rationale is that the provincial macro-risk conditions may differently impact on banks efficiency. We expect that macro-risk influences more severely local banks, which haven't the opportunity to diversify their risk across the national territory. Conversely, large banks, supported by their branch network can benefit of greater diversification benefits.

3. Results

In order to control for heterogeneity of the banking system, stochastic frontier functions and inefficiency models are estimated for either the whole banks or the minor group; as a robustness check we also provide estimates for the mutual banks. As main drivers of inefficiency, we consider the impact of business structure variables, using micro financials ratio and macro environmental factors as controlling variables in the inefficiency models.

Model estimates confirm a relevant heterogeneity between bank groups with respect to either cost frontier or inefficiency determinants (Table 5). With respect to the banking business model, we find a negative and significant relationship between HQ-DISTANCE and efficiency. in particular, distance appears to be an important determinant of inefficiency for the minor and mutual banks. Because of their organizational structure model minor and mutual banks are characterized by strict relationship with the territorial operational units and with the customers. Given this characteristic, as the distance between bank branches and its HQ augments the cost efficiency reduces more than in the whole sample. Then, the increase in the distance between the local HQ and its branches has revealed to be inefficient for banks whose core business is strictly linked to the local territory. The strategy to enlarge the activity far from the local head-quarter should be considered with cautions by minor banks, because it may produce a reduction in their cost efficiency.

Conversely, diversified business strategies produce different results among minor and mutual banks. In literature, the effect of financial diversification on bank performance has been largely investigated, without a general consensus. Our results appear partially coherent with Chiorazzo et al. (2008). Authors show "limits to diversification gains as banks get larger" while "small banks with very small non-interest income shares experience financial performance gains from increasing non-interest income". As DIV_{REV} rises, the bank becomes more diversified and less concentrated. The benefit of diversification outweigh the cost of NII volatility increasing efficiency, only in the case of minor banks. In all other cases the opposite results – even if with different nuances in the whole and mutual groups – hold, coherently with Mercieca et al. (2007) and Lozano-Vivas and Paiouras (2010). The effect of income diversification is in fact strongly negative (increasing efficiency) only for minor banks. As for mutual banks, even if an increase in the diversification implies more inefficiency, the effect is quite marginal.

Furthermore, to better investigate the effects of banking business organization structure on the inefficiency we also control for the SIZE effect. Our results are coherent with some previous studies (see among others Akhigbe and McNulty, 2003 and Girardone et al., 2004), suggesting that economies of scale and efficiency gains mainly hold for minor banks. Our results evidence that increasing bank size improves efficiency in the case of minor and mutual banks, while the effect on the whole banking system is negligible.

Table 5. Inefficiency model Estimates

Variable	Minor		Mutual		Full sample	
Banking business model						
HQ-DISTANCE	0.223	*	0.137	*	0.088	*
DIV_{REV}	-1.402	*	0.098	*	0.168	**
SIZE	-0.423	*	-0.239	*	0.051	*
Micro risk conditions						
LLP	0.205	*	0.028	*	-0.078	*
NPL	0.375	*	0.037	*	0.078	*
Environmental macro conditions						
GDP	-5.025	*	-0.410		-0.239	
DEF_RT	1.419	*	0.157	*	0.319	*
NPL_INDEX	0.042	*	0.017	*	0.024	*
CE_group	0.780		0.820		0.720	
CE_pool	0.810		0.820		0.720	
LL	-177.910		322.500		-904.700	

p-value: * 0.05; ** 0.10.

Note: LR tests strongly reject the null hypothesis of a single frontier for the Italian banking system. The LR test of the one sided error for the null hypothesis of no technical efficiency is also strongly rejected for all the models.

As regards to micro risk conditions, model estimates reveal that, as expected, the NPL variable has a negative impact on efficiency, being the effect higher for the minor banks. Results also reveal a positive effects of LLP on bank efficiency in the case of the whole sample. Conversely, minor and mutual banks show a positive response of efficiency to LLP: the effect is positive and significative. A prudential credit risk policy realized by the ex-ante provision of funds to face future risk could imply a cost efficiency increase: “prevention is better than cure”. This result is however simply reversed in the case of minor and mutual banks, for which benefits of prudential credit policy can produce more costs than benefits, with a negative effect in terms of more inefficiency. In the case of the whole sample, the result may be strongly influenced by the more efficient prudential credit risk policy faced by the larger banks. It’s well known that large banks have developed efficient credit risk management divisions. Conversely, minor and mutual banks have not always developed internally the credit risk function, suffering of more costs in organizing credit risk prudential policies.

Finally, the main effects of environmental macro conditions on efficiency are controlled for. The per-capita value added growth rate (GDP) produces, as expected, a positive effect on banking efficiency even if its intensity is not homogenous among the different bank groups. The macro risk variables produce a negative effect on bank efficiency. Firm default rate (DEF_RT) is the most important determinant of efficiency in the minor and mutual banks groups; the macro credit risk (NPL_INDEX) also negatively affects cost efficiency but with minor intensity.

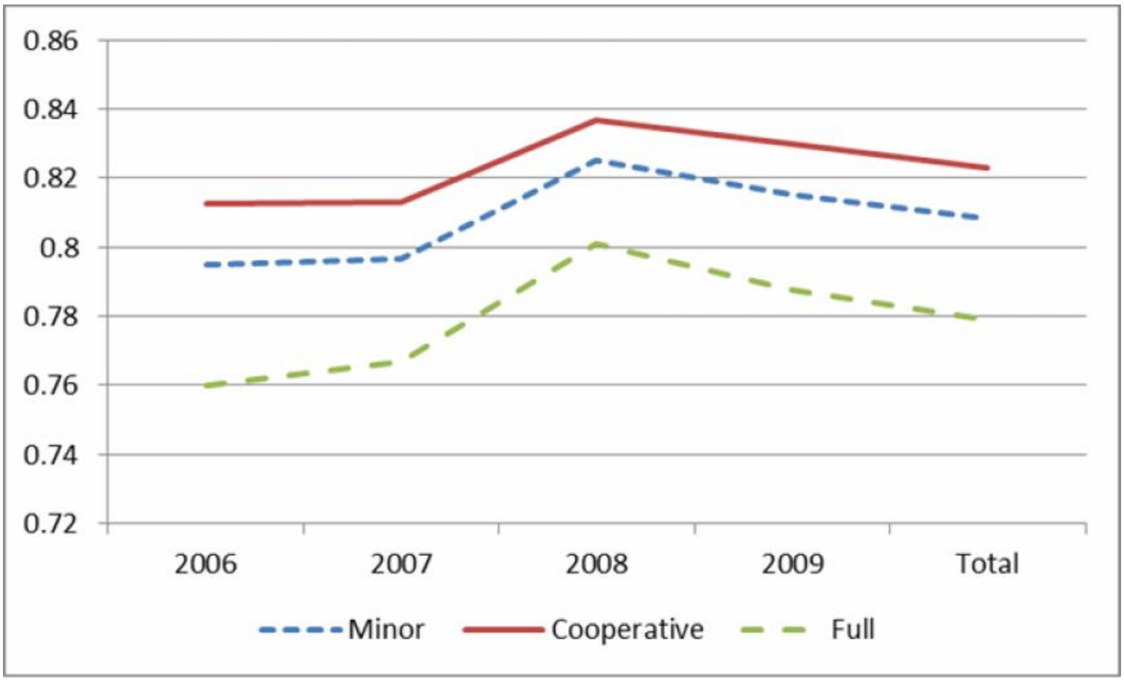
Model estimates are also used to investigate whether exists some difference in the cost efficiency among bank groups and whether cost efficiency changes over time. To answer to these issues, we suggest using the CE values obtained by the model estimated on the full sample. To perform more straightforward comparisons, we compute the efficiency scores from a translog stochastic frontier model without the (in)efficiency model, enabling the comparison of cost efficiency over time and among groups. Therefore, cost efficiency scores, representing the relative distance from the frontier cost realized by the best practice bank, are computed by equation (6).

The average CE value over the sample period and across the full bank sample is 0.72, indicating that if banks are able to eliminate these inefficiencies, total costs could reduced by 28%. The most efficient banks all over the period appear to be the mutual ones, with an average score of 0.82.

The average efficiency per year, calculated for the full sample of bank, increases until 2008, passing from 0.76 in 2006 to 0.80 in 2008, and then it decreases in 2009 to 0.79 (Figure 2). As expected, the recent financial crisis determines a generalized cost efficiency reduction for all the Italian banks in 2008 and 2009. However some differences emerge in respect to the different groups considered. The minor and mutual banks loss only 1.20%

and 0.83% respectively, because they may better react to the recent Lehman Brothers' crack.

Figure 2. Cost efficiency dynamics



Note: Kruskal-Wallis tests reject the null hypothesis of equality of the median efficiencies either between groups or over time for each group.

4. Conclusions

In this paper we investigate the cost efficiency of the Italian banking system with the aim to analyse the extent to which the distance between the head-quarter and local branches and product diversification affect bank efficiency and whether the effect is different between the minor and the whole Italian banks sample. Using a stochastic frontier approach a strong heterogeneity within the Italian banking system is detected with respect to either the level of efficiency reached by the different groups or the determinants of cost efficiency.

The analysis of the cost efficiency evidences that bank groups characterized by an organizational local structure (minor and mutual banks) are more efficient than the full sample. Some authors - Altunbas et al. (2001) and Girardone et al. (2004) - suggest that mutual banks may exploit a lower cost of funds than other banks types due, for example, to their (possible) local monopolies. For the same reason, they may exploit more advantageous condition on the interest rate applied on net loans, even if they could be less competitive on the other earning assets. Furthermore, because of a special jurisdiction, they may exploit a less severe fiscal regime; moreover, a large part of their profits are used to increase capital reserves, implying a higher degree of capitalization. As the capital is an input of the production function a different degree of capitalization can explain a different efficiency among different bank type groups.

The analysis also evidences that minor and mutual banks exhibit a lower efficiency reduction due to the recent financial crisis than the Italian banking system. The average efficiency per year, calculated for the whole sample, shows a positive dynamics until 2008, and then it decreases. As expected, the recent crisis has determined a generalized cost efficiency reduction for all the Italian bank groups. The minor and mutual banks appear to better react to the financial crisis: thank to their traditional business model, strongly linked to local economy, these banks better response to the financial losses generated by the downturn in the international markets.

As for inefficiency determinants, the analysis results confirm the importance of the distance in determining bank efficiency. As the distance increases the efficiency decreases. According to the information asymmetry theory, an organizational structure with close interaction between the HQ unit and the peripheral operational units better disentangle asymmetric information problems between lender and borrower increasing bank efficiency. Coherently with previous evidence, an increase in bank size implies a positive effect on cost efficiency only in the case of minor and mutual banks.

Finally, the income diversification has a positive role in affecting cost efficiency of only the minor banks. A more diversified business strategy implies that the bank become less concentrated. The benefit of diversification outweighs the cost of non-interest income volatility, increasing efficiency. In all other cases the opposite results – even if with different nuances in the whole and mutual groups – hold. The influence of some credit risk factors on cost efficiency are also investigated. We distinguished between micro and macro risk conditions. An increase in the credit risk implies a generalized decrease in efficiency. Moreover, an increase in the loan-loss provision entails a better prudential credit risk policy with positive effects in terms of increased efficiency.

Empirical findings presented in this paper also evidence that heterogeneity among banks exists in terms of either organizational models or technological sets, suggesting that the effects of distance and income diversification on efficiency may be different in respect to bank groups. Therefore, different bank groups, constructed by considering size and category, should be studied in the future to reveal a more complete picture of the effects of distance and business models on the efficiency of the Italian banking system. Furthermore, the availability of a longer period of investigation may allow to better investigate the influence that the recent financial shocks have on bank production processes and efficiency.

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