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Risk and Regulation:
The Efficiency of Italian Cooperative Banks

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Abstract
In this paper we analyse the determination of cost efficiency in a sample of Italian small banks located in different geographical areas and including two great institutional categories: cooperative banks (CB's) and other banks. We highlight the effect of environmental factors (asset quality, local GDP per capita) on banks' performance, and provide novel evidence in favour of the "bad luck" hypothesis suggested by Berger and De Young (Journal of Banking and Finance, 1997). Local GDP per capita strongly affects the territorial differentials for technical efficiency, especially for CB's. This can be easily rationalised, as current regulations hamper CB's vis-à-vis other banks in their capability to diversify territorially. Our estimates provide us with a tentative quantitative measure of the costs of missing diversification, ranging between 2 and 7 percentage points. Correspondingly, our evidence suggests that there is potentially strong endogeneity in some currently available bank performance indicators.

JEL classification:D24, G21, L89

Keywords: Cooperative banks, Cost efficiency, Local shocks, Territorial diversification.

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1. Introduction

The fundamental importance of the financial sector for the economic and social development of a given area has long been recognised in the literature, and has recently become one of the leading themes of the growth literature (Rajan and Zingales, 1998; Guiso et al., 2004). Within this literature, a theme that has been somewhat neglected concerns the efficiency of bank institutions (see however Hasan et al., 2009, as well as the references included there, Lucchetti et al., 2001, in particular). Yet, already Cameron et al. (1967) had forcefully stressed the key role of bank efficiency in the finance-growth nexus. This suggests that providing novel evidence about territorial bank efficiency differentials in a country characterised by strong economic heterogeneity as Italy could be of some general interest. This is precisely what we endeavour in this paper along the following lines.

In the literature concerned with the determination of bank efficiency the themes of regulation and proprietary forms have always enjoyed a prominent status among (Berger and Humphrey, 1997; Berger and Mester, 1997). These themes have almost invariably been taken in account without explicit allowance for changes in the socio-economic environment of banks. The latter are, on the other hand, intimately connected with the theme of risk management within the productive process of banks (Hughes and Mester, 1993; Berger and De Young, 1997). In this paper we bring together these two strands of the banking literature, within a frontier efficiency analysis of Italian small banks. As a matter of fact, we focus on Italian cooperative banks (CB's), whose regulatory structure is particularly suited to the analysis of the interaction between regulation and risk. Other Italian small banks will mainly be considered for purposes of comparison. We believe that our analysis may be of relevance, not only because European cooperative banks have recently spurred considerable policy interest (see, for instance, Fonteyne, 2007, who also highlights the important role of Italian CB's), but also because we produce some quantitative estimates of the impact of (territorial) risk diversification upon bank efficiency. Estimates of this kind are not yet widely available (see however Hughes et al., 1996, 1999; and Deng et al., 2007), and are to the best of our knowledge wholly missing for European banks.

Our analysis consists of the following steps. Section 2 examines the production process of banks, considering some traditional ways to incorporate risk and socio-economic environment in it. In Section 3 we introduce the reader to some features of Italian CB's and, more generally, of the Italian economy, which provide the backbone of our empirical set-up. Section 4 describes the latter. We argue that the regulatory structure of Italian CB's, as well as the utilisation of relatively novel, territorially very disaggregated, information about economic activity, makes it possible to obtain some innovative evidence about the impact of risk and diversification upon bank efficiency. We also briefly describe our data sources and empirical methods. Our key findings are set out in Section 5. Some concluding remarks close the paper, taking stock of our evidence and proposing avenues for future research.

2. The production process of banks: background and recent extensions

As can be gathered from some classic accounts (European Union, 1977; Niehans, 1978; Fama, 1980), banks are a typical example of multi-output activities. These activities include: (i) asset management, (ii) foreign currency management (iii) provision of export credit, (iv) issue of various securities (checks, payment cards, etc.), (v) asset safekeeping, (vi) support for various kinds of financial transactions (buying and selling government securities, bonds, shares, mutual investment funds). This multi-faceted nature finds a counterpart in the variety of approaches utilised to describe the production process of banks (Van Hoose, 2010).

In the "asset" approach (Sealey and Lindley, 1997), akin to the "intermediation" approach, the bank is mainly a financial intermediary, which uses deposits to fund loans and other types of financial assets in order to encourage customers to invest. For this reason, deposits are included in the vector of inputs, thus differing from the "value added", also called "production", approach (Goldschmidt, 1981). According to the latter, the primary task of lending institutions is to provide services related to both loans and deposits using labour and capital as inputs. The superiority of one approach over the other is still the matter of some discussion. Combining the "asset" and "value added" approaches, we obtain the "modified production" or "profit/revenue" approach (Berger and Humphrey, 1991). This approach captures the dual role of banking operations, considering the price of deposits to be an input, whilst the volume of deposits is an output. In this specification, banks are assumed provided intermediation and loan services as well as payment, liquidity, and safekeeping services at the same time. The three approaches are compared in Table 1.

The "asset" approach has maintained some ascendancy within the literature, especially when focusing on the role of banking efficiency for economic development (Lucchetti et al., 2001; Hasan et al., 2009), and it will be the approach chosen in the following empirical analysis. At any rate, the awareness has grown that in order to measure accurately bank efficiency, allowance must be made for environmental factors beyond the control of bank managers, as well as for the role of risk aversion. The correct measurement of bank efficiency hence requires the analysis to include not only the inputs and outputs enumerated in Table 1, but also indicators of environment and risk-aversion.

It is well known that efficiency measurement involving banks from different territories ought to make allowance for differences in the socio-economic and institutional environment beyond the control of bank managers. There are various analyses of bank efficiency across US states (see Lozano–Vivas et al., 2002, p.2). Dietsch and Lozano-Vivas (2000) and Lozano-Vivas et al. (2002) analyse the impact of other environmental factors beyond the control of bank managers,

Table 1 - Value Added, Asset and Modified Production Approaches: The Production Set

Approaches	**Outputs**	**Inputs**
Value Added Approach (Goldschmidt, 1981)	Customer Deposits Customer Loans Securities (bank loans, Treasury bills and similar securities, bonds and other debt minus bonds and debt securities held by banks and other financial institutions) Other Services (Fees and other operating incomes)	Physical Capital Labour
Asset Approach (Sealey and Lindley, 1997)	Customer Loans Securities (bank loans, Treasury bills and similar securities, bonds and other debt minus bonds and debt securities held by banks and other financial institutions) Other Services (Fees and other operating incomes)	Physical Capital Labour Funds (customer deposits, bank debts, bonds, certificates of deposit and other securities)[2]
Modified Production Approach (Berger and Humphrey, 1991)	Customer Loans Customer Deposits Securities (bank loans, Treasury bills and similar securities, bonds and other debt minus bonds and debt securities held by banks and other financial institutions) Other Services (Fees and other operating incomes)	Physical Capital Labour Funds (customer deposits, bank debts, bonds, certificates of deposit and other securities)

notably the degree of concentration (measured by the Herfindahl-Hirschman index), population density, GDP per capita, in a European cross-country set-up. It can be easily argued that similar indicators are needed in order to take into account territorial differences in the socio-economic environment even within a given European country, if the latter is characterised by marked

[2] Sometimes free capital, the difference between equity and fixed assets, is also included in the input vector because it constitutes an additional source of resources, over and above the collection of funds (see Destefanis, 2001)

heterogeneity. However, more seldom, if at all (a very recent exception is Hasan et al., 2009), these factors have been utilised in works dealing with within-country comparisons for European countries.

A key indicator varying along with the socio-economic environment is risk. Banks can be mainly hit by credit risk, which relates to the management of subjective uncertainty and, in many cases, depends on the discretion of managers, who may not behave in the bank's interest. According to Berger and De Young (1997), the existence of risky assets entails additional "monitoring" and "screening" costs that banks must meet in order to assess them. Hence, changes in economic environment may bring about deteriorations in the banks' performances (the "bad luck" hypothesis), but also poor risk management may bring about a higher insolvency risk (the "bad management" hypothesis).

A popular indicator of credit risk is the ratio between bad and total loans. This indicator is related to the probability of bank failure. If banks do not bear any credit risk it is close to zero, and it approaches unity if financial intermediaries incur in a higher percentage of outstanding claims. Clearly, however, this indicator is linked to both the "bad luck" and "bad management" mechanisms. Indeed, Berger and De Young (1997) resort to a time-series analyses in order to disentangle the two different links between it and banks' efficiency. A related point, made by Berger and De Young themselves, is that it could be interesting to analyse the "bad luck" hypothesis relying on indicators of credit risk that are exogenous for a given bank. To the best of our knowledge, this attempt has never been carried out in the literature.

In any case, if bank managers are not risk-neutral, their degree of risk-aversion is likely to be reflected in their choices about the production set. The bank's behavioural response to risk is measured by an index of capitalisation, very often the relationship between equity and total assets (Hughes and Mester, 1993; Mester, 1996). This index approximates to one if banks are highly capitalized. In this case, the banks can cope with possible risks without incurring danger of default. A similar situation arises when banks are subject to more intense merger and acquisition processes.

Another fundamental point concerning risk management is risk diversification. Broadly speaking, diversification can occur across income sources, industries or geographical areas (Rossi et al., 2009). Focusing on territorial diversification, Hughes et al. (1996, 1999) find that territorial diversification is positively correlated with bank efficiency in the US. In particular, interstate bank diversification has improved bank efficiency in the US after the passage of the Riegle-Neal Interstate Banking and Banking Efficiency Act in 1994. Also for the US, Deng et al. (2007), measuring territorial diversification through various indexes of deposit dispersion, find that diversification has a favourable impact upon the risk-return profile of bank holding companies.[3] Again, there seems to be room in literature for further evidence on this point, especially if coming from small European banks.

Summing up, we believe this short survey highlights the need for novel European-based evidence on the impact of territorial diversification on bank efficiency and risk-return profile. This evidence should rely on disaggregated indicators of socio-economic environment, likely to capture hitherto neglected heterogeneity and to allow a sharper test of the "bad luck" hypothesis (being exogenous for a given bank). This is our endeavour in the present study. We analyse efficiency for a sample of small Italian banks, modelling differences in risk-preferences through an index of capitalisation and allowing for differences in the socio-economic environment

[3] These findings are related to the huge block of literature relating to the impact of M&A on bank efficiency, a point also made in Bos and Kolari (2005), who, considering the potential gains from geographic expansion for large European and US banks, concluded that profit efficiency gains were obtainable from cross-Atlantic bank mergers.

through GDP per capita indicators computed at a finer level of territorial disaggregation than hitherto utilised in the literature (this level approximately entails a population close to a local bank customers' pool). In order to shed light on the impact of territorial diversification on bank efficiency and risk-return profile, we chiefly compare the performance of cooperative and traditional small banks across Italian regions. As will be presently clarified, we exploit here the fact that CB's follow different rules from other banks as far as diversification is concerned.

3. Italian cooperative banks: main features and environment

In Italy there are nowadays approximately 430 CB's with more than 3600's branches (about 11% of the total of all branches) and shares of 6.6 and 8.3% over, respectively, total loans and deposits. Italian CB's have an important role in the financing of households, artisans and small businesses, and are characterised by small size, self-governance, a very local attitude, and the principle of mutuality (internal: the activity is mainly biased in favour of associates; external: there important activities aimed at supporting the moral, cultural and economic development of the local community).

The strengths of CB's are the deep understanding of local economies (which reduces the typical problems of asymmetric information existing in the credit market) and the network externalities associated with their mutual aid system (see Angelini et al., 1998). However, recently, deregulation and technological progress have increased the contestability of local credit markets, requiring CB's to improve their performance. As is also shown by Table 2, CB's face relatively low profit margins, high costs, and restricted income sources.

It must be said that there exists for Italian CB's a so-called *principle of prevalence*, requiring that more than 50% of assets are either detained by members or in risk-free assets, according to the criteria established by the Financial Regulator. Furthermore, as far as profit distribution is concerned, the Testo Unico Bancario, 1993, requires that CB's must:

1. devote at least 70% of annual net profits to legal reserve;

2. pay a share of annual net profits to mutual funds for the promotion and development of cooperation in an amount equal to 3%;

3. devote to purposes of charity or mutual aid, the remaining share of profits.

Table 2 - Selected Bank Performance Indicators (in %, 2002-04 average)

	Banking system	***Banche popolari***	**CB's**
Non-performing loans/total loans	6.6	5.5	6.5
Bad debts/total loans	4.6	3.7	3.0
Net interest income / total assets	2.2	2.5	3.2
Gross income / total assets	3.5	3.8	4.1
Share of non-interest income in total income	38.2	35.8	21.8
Operating expenses / Gross income	59.4	59.4	67.8
Loan losses / total assets	0.48	0.44	0.25
Return on equity	7.9	7.6	6.7
Solvency ratio	11.4	10.1	17.8

Source: Fonteyne (2007)

Because of these regulations, the possibility to compare CB's with other bans profit-efficiency wise must be seriously doubted. On the other hand, comparing their cost, and especially their technical, efficiency with that of other banks seems much more appropriate. Although generally the banking objective function is to maximize profits by choosing an optimal combination of inputs for maximum output, the same is not true for CB's (Fonteyne, 2007). However, also the latter are likely to aim for cost minimisation by choosing the mix of inputs corresponding to the lowest cost, because they need to meet a survival requirement (Pestieau and Tulkens, 1993).

There is a further point, crucial for present purposes. CB's can provide loans only within a given area, the so-called area of territorial competence, (*area di competenza territoriale)*. The territorial competence (jurisdiction) of the CB's is determined by the Supervisory Instructions of the Bank of Italy and must be specified in their statute. It includes the municipalities in which the bank has its head office, branches and the surrounding areas, so that there must be territorial contiguity between these areas. Only in very special cases can CB's open branches in non-contiguous municipalities.

In Table 3 we highlight some consequences of this state of affairs. CB's have less branches than other small banks (as defined by the Bank of Italy), and the mean distance between their head office and a given branch is smaller.

Table 3 - Number of branches and head office-branches mean distance, various bank types, years 2006-2008.

Percentiles	CB's Number of branches	Other Small Banks Number of branches	CB's Head office-branches Mean distance	Other Small Banks Head office-branches Mean distance
5%	1	1	0	0
25%	2	7	3.81	16.44
50%	4	29	7.40	34.51
75%	8	63	12.50	110.34
95%	18	144	26.26	317.95

Source: own calculations on BilBank 2000 data

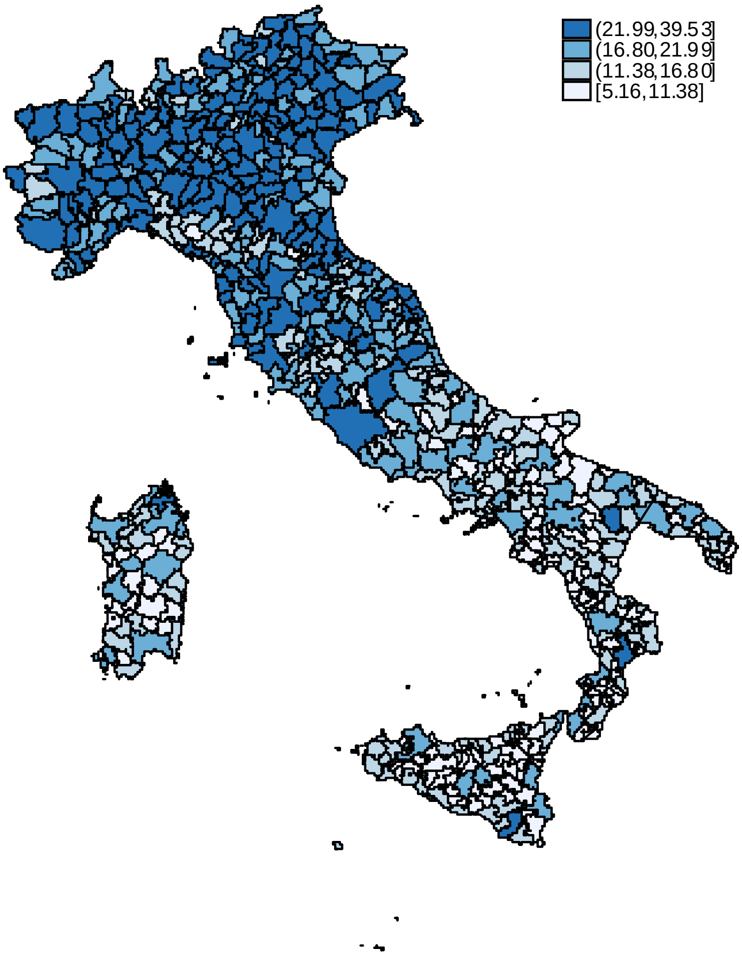
Sticking to the area of territorial competence greatly hampers any move to territorial diversification on the part of CB's and is likely to make them very sensitive to local shocks. In this paper we rely on this institutional difference between CB's and other banks in order to provide some measures of the cost of missing diversification. To do so, however, we must have some quantitative indicators of local shocks at an appropriate territorial level.

A very important analytical category for territorial economic analyses in Italy is the *Sistema locale del lavoro*, SLL). This is a group of municipalities (akin to the UK's Travel-to-Work-Areas) adjacent to each other geographically and statistically comparable, characterised by common commuting flows of the working population. They are an analytical tool appropriate to the investigation of socio-economic structure at a fairly disaggregated territorial level. The identification of 686 SLL's made by ISTAT (the Italian Statistical Office) in some recent research (ISTAT, 2005) has highlighted remarkable differences in economic performance across the Italian territory. For purposes of comparison note that there are nowadays in Italy 110 *province* (the NUTS3-type classification) and 20 *regioni* (the NUTS2-type classification).

Figure 3.1 depicts the economic performance of the SLL's in 2006. We believe that Fig. 3.1, relying on GDP per capita, very aptly describes the strong economic differences across Italy. Roughly speaking, the darker the area, the better the performance.

Interestingly, not only the well-known North-South divide, but also some finer territorial differences, show up. This suggests that SLL-level indicators provide a much more accurate representation of the socio-economic environment than the usually adopted provincial (NUTS3) or regional (NUTS2) indicators. However, it could be rightfully asked what is the precise relevance of SLL-level statistical information for local banks. We immediately stress that there is no precise correspondence between a SLL and the area of territorial competence of a CB. However, especially for the smaller CB's, there is a close correspondence between the SLL's population and the bank customers' pool (calculated as the sum of populations from municipalities where the bank has a branch). This correspondence is shown in Table 4, that also highlights how the population of the closest territorial divide (the *provincia*) is usually much larger than the CB customers' pool. Also note that the customers' pool of other small banks, unhampered by territorial regulations about loan provision, is even larger.

Fig. 1 - The Italian SLL's (sistemi locali del lavoro). GDP per capita – Year 2006



Source: GDP is constructed by updating the SLL data from ISTAT with the 2006 data from the Bureau Van Dijck's AIDA dataset. Population is from the ISTAT SLL data-set. GDP per capita is in thousands of euros.

Table 4 - Population and customers' pools for various territorial divides and bank types, years 2006-2008

Percentiles	SLL population	*Provincia* (NUTS3) population	CB's customers'pool	Other Small Banks customers'pool
5%	6,978	141,195	4,485	54,147
25%	13,718	231,330	19,129	694,700
50%	34,276	369,427	74,373	2,547,677
75%	79,595	580,676	250,342	7,109,032
95%	268,503	1,239,808	1,225,440	28,417,586

Source: own calculations on ISTAT and BilBank 2000 data

We conclude that SLL-level data are likely to provide useful information on the local shocks relevant for CB's, potentially yielding novel evidence about the "bad luck" hypothesis and the importance of territorial diversification.

4. The empirical set-up

We believe the asset approach has maintained some ascendancy within the literature, especially when focusing on the role of banking efficiency for economic development (Lucchetti et al., 2001; Hasan et al., 2009). We subsequently adopt it in the following empirical analysis, and define our output and input vectors accordingly.

The vector of outputs is composed as follows: *customer loans*, *securities* (loans to banks, Treasury bills and similar securities, bonds and other debt less bonds and debt securities held by banks and other financial institutions), *other services* (commission income and other operating income). The vector of inputs consists of the following items: *number of branches*, *number of workers*, and *fundraising*: total liabilities to customers, amounts owed to banks and debt securities (bonds, certificates of deposit and other securities). In order to measure cost efficiency, we also need a cost vector, which is composed as follows: (i) *labour cost*, the ratio between personnel costs (wages and salaries, social charges, pensions and the like) and the number of employees, (ii) *cost of physical capital*, the ratio of other administrative expenses, value adjustments to tangible and intangible assets and other operating expenses to the number of branches and (iii) *cost of financial capital*, the ratio of interest expense and similar charges and commission expenses on total debt.

Let us now turn to the more specific part of our analysis. Traditionally enough, we model differences in risk-preferences through an index of capitalisation (equity, equal to capital plus reserves – without adding profits or losses -, over total assets). As an indicator of socio-economic differences we take the SLL-level GDP per capita. As previously argued, this indicator is likely to capture hitherto neglected heterogeneity. Yet it can be reasonably supposed to be exogenous for small banks, allowing an appropriate test of the "bad luck" hypothesis. For each bank, we include in the production set the GDP per capita of the SLL where the bank's head office is located. As also been said above, the impact of diversification is chiefly assessed by comparing the performance of cooperative and traditional small banks across Italian regions. The impact of SLL-level shocks, the "bad luck effect", is expected to be stronger for CB's, because they have less scope for territorial diversification out of this area. We can also readily provide a robustness check for this expected nexus: we include in the production set, along with the SLL-level GDP per capita, the mean distance between a bank's head office and its branches (a measure akin to the diversification indicators constructed by Deng et al., 2007). Taking this structural indicator into account should reduce the differential "bad luck effect" across bank types, as a fundamental aspect of diversification should then be controlled for.

Finally, in order to provide evidence about the impact of territorial diversification on the risk-return profile, we also estimate a production set including a measure of asset quality, which is inversely related with credit risk. A popular indicator of asset quality is constructed as one minus the ratio between bad and total loans (more precisely, as the ratio between "adjustments and recoveries of loans and provisions for guarantees and commitments" and total loans). The ratio between bad and total loans has been used in many works (Berger and De Young, 1997; Fiordelisi et al., 2011). We do not include non-performing loans in it because they represent a milder form of risk, possibly biasing the measurement of credit risk.[4]

Our key a priori expectation is that local GDP per capita affect CB's efficiency (and risk-return profile) much more than the other banks' outcomes, due to CB's stricter localisation rules. In principle local shocks ought to affect the relationship between bank inputs and outputs for given input prices, so that the differential "bad luck effect" should be stronger for technical than for allocative efficiency. Given this interest in decomposing efficiency in a multi-output production set, we estimate efficiency using the DEA (variable-returns to scale) nonparametric method (Farrell, 1957; Banker et al., 1984). DEA, like other non-parametric approaches, is very sensitive to the presence of outliers, which may bias estimates. To circumvent these problems, we applied the bootstrapping method suggested in Hall and Simar (2002). Also, we searched and eliminated all the outliers in the dataset using the super-efficiency and rho - Tørgensen's concepts (Tørgensen et al, 1996).

Efficiency scores are measured in three different models, summarised in Table 5: a baseline asset-approach model (also including capitalisation), the baseline model plus GDP per capita, and the baseline model plus GDP per capita and the distance measure. Evidence about the risk-return profile is obtained going through these three models again with the asset quality indicator in the production set. Capitalisation and asset quality (one minus the ratio between bad and total loans) are included in the production set as outputs, because they can be both thought as good outcomes whose realisation uses up bank resources. On the other hand GDP per capita is

4 See Fiordelisi et al. (2011) for further details on credit risk indicators.

included in the production set as a fixed (non-discretionary) input, and distance, being to some extent a choice variable and a feature of the bank branches, is modelled as an ordinary input. In estimating our DEA models, we relied on two packages based on the freeware R (FEAR 1.13, Benchmarking 0.18).

Given our interest in CB's and local shocks, and the eminently comparative nature of frontier analysis, our sample relates to essentially local banks. It is made up by Italian banks classified by the Bank of Italy as a small (funds below 9 billion euro). We use data compiled from the database "BilBank 2000 - Analysis of bank balance sheets" distributed by ABI (the Italian Banking Association) for the 2006-2008 period.

Table 5 - The Empirical Models: The Production Set

Models	# 1	# 2	# 3
INPUTS	Physical Capital Labour Funds	"# 1" + SLL- level GDP per capita, (non-discretionary input)	"# 1" + SLL- level GDP per capita, (non-discretionary input) + Mean Distance (discretionary input)
OUTPUTS	Customer Loans Securities Other Services Capitalisation	"# 1"	"# 1"

NB: When assessing the risk-return profile, asset quality is included in all the three models as an output.

This sample includes all CB's and most of the former savings and *popular* (*popolari*) banks. Table 6 (in the Appendix) provides some background information about the sample by geographical location and bank type. The balance-sheet information in this database allows calculation of measures for our inputs and outputs, as well as for asset quality and capitalisation. The GDP per capita of the head-office's SLL is constructed by updating the SLL value added data from ISTAT through the 2006-2008 data from the Bureau Van Dijck's AIDA dataset.

Population is from the ISTAT SLL data-set. The mean distance between a bank head office and a given branch is taken from the Bank of Italy's database of branches. It is the availability for this variable that fundamentally drives our sample choice. Descriptive statistics about all these variables are provided in Tables 7 and 8 (also in the Appendix).

5. The empirical evidence

We applied DEA to the three versions of the asset approach, without and with the asset quality indicator, year by year, considering two different groupings of banks. The first grouping is simply given by all the banks in our sample, and it will be referred to as One Sample. Then, because of the important regulatory differences between CB's and other banks, it could be thought that a sharp distinction should be drawn between these two bank types. Estimates are then carried out for the two subsets separately, and we refer to these estimates as to those belonging to Two Samples. Our main a priori expectation is that CB's are much more affected by the "bad luck effect" than the other banks, due to their strict localisation rules. This impact should also be stronger when considering technical efficiency, as local shocks ought to affect the relationship between bank inputs and outputs for given input prices. The estimates reported in Table 9 (in the Appendix) support this expectation to a large extent. In order to make results more understandable, we only report mean efficiency scores from Italy's four territorial partitions (North-West, North-East, Centre, South). When comparing efficiency scores from Models #1, #2 and #3, it clearly appears that local shocks, such as proxied by SLL-level GDP per capita, affect technical efficiency differentials, especially for CB's. No great difference exists on the other hand between Models #2 and #3. If we control for the mean distance between a bank head office and a given branch, the "bad luck effect" greatly diminishes.

All in all, the “bad luck effect” comes out most clearly comparing Models #1 and #2, and considering banks located in the South, for One Sample. This can be easily rationalised. If we consider Two Samples, banks are not differentiated by their capability to absorb local shocks through territorial diversification. Hence, the impact of local shocks ought to be relatively weaker than in One Sample. In the latter, the technical efficiency of CB’s gains between 2 and 7 percentage points in Model # 3, providing a quantitative measure of the costs of missing diversification. No large gain of this kind appears to exist for the other banks. Also, no clear pattern emerges across Models #1, #2 and #3 for allocative efficiency. The pattern of cost efficiency across models is decisively driven by technical efficiency, as was also expected. Note finally that the inclusion of the asset quality proxy makes no sizable difference to the estimates. Provided we believe that risk is adequately measured by our proxy, the above illustrated evidence then implies that territorial diversification has a significant impact on the risk-return profile of Italian small banks.

In Table 10 of the Appendix, we give to our analysis a more formal twist. We consider the efficiency scores year by year, and apply to them the test for the equality of means suggested in Kittelsen (1999). Should this test be significant (we give in Table 10 its p-values), the differences between respectively Models #1 and #2, and Models #2 and #3, would be statistically significant. The results from Table 10 are overwhelmingly aligned with the previous considerations. In One Sample, the technical and cost efficiency scores are significantly higher in Model # 2 than in Model #1 for the CB’s only. The difference between CB’s and Other Banks partially fades away in Two Samples, but the significance tests always show lower p-values for the CB’s. Once again no strongly consistent pattern shows up for allocative efficiency. This also explains why Models #2 and #3 are almost never significantly different. All in all, there is rather convincing evidence that a larger territorial spread among a bank’s branches reduces significantly the impact of local GDP per capita on cost efficiency.

As we will discuss below, this evidence can be refined in various ways. However, we believe that these results show that modelling "environmental" variables at the SLL-level reduces to a great deal differences in technical and cost efficiency among Northern and Southern Italian banks. Analytically, this could point to a potentially strong endogeneity of previously available bank performance indicators. From a more practical standpoint, there appears to be some reasons to ease the localisation constraints for CB's.

6. Concluding remarks

In this paper we have analysed the cost efficiency differentials among Italian small banks located in different geographical locations and belonging to two great institutional categories: CB’s and other banks. We have applied DEA throughout the 2006-2008 period, highlighting the effect of some environmental and institutional factors on banks' performance. The evidence shows that that local shocks, proxied by SLL-level GDP per capita, affect technical efficiency differentials, especially for CB’s. This can be easily rationalised, as current regulations hamper CB’s vis-à-vis other banks in their capability to diversify territorially. Our estimates provide us with a tentative quantitative measure of the costs of missing diversification, ranging between 2 and 7 percentage points. On the other hand our evidence suggests that there is potentially strong endogeneity in some currently available bank performance indicators.

We are fully aware that there are various ways in which our evidence could be made much more robust. Perhaps most prominently, the return-risk profile of banks should be evaluated in the light of more sophisticated proxies than our simple measure relying on the ratio between bad and total loans In future work we plan to include our measure of local shocks in a panel analysis of bank efficiency, risk, and capitalisation, also allowing for lagged relationships, as in Fiordelisi et al. (2011) or in Rossi et al. (2009). In order to do so, our sample should be extended through time.

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Appendix

Table 6 - Sample by bank types and areas

Year	**2006**	**2007**	**2007**
CB's	429	437	422
Other Banks	179	204	216
ALL	608	641	638
Geogr. location			
North – West CB's	82	83	80
North – East CB's	158	160	158
Centre CB's	90	91	86
South CB's	99	103	98
North – West Other Banks	43	45	48
North – East Other Banks	61	68	71
Centre Other Banks	47	57	62
South Other Banks	28	34	35

Source: own calculations on BilBank 2000 data

Table 7 - Production and Costs: Some Descriptive Statistics, years 2006-2008.

ALL SAMPLE	**Loans**	**Securitie s**	**Other Services**	**Funds**	**Workers**	**Branche s**	**Phys. Cap. Cost**	**Fin. Cap. Cost**	**Labour Cost**
Mean	660,202	291279	18789	831699	196	23	0.029842	900.589	68.60
st. dev.	1198322	737977	49892	1460213	334	42	0.017417	6,070.122	16.14
Min	22	2810	5	1594	3	1	0.004378	8	9.73
Max	8808730	8767580	608546	9157992	2471	727	0.313573	176910	213.75
CB's (mean values)									
North-West	183,537.5	73459.22	3336.985	220969.2	74	10	0.0366172	364.5561	56.3551
North-East	134,558.3	60986.43	2095.631	166734	51	7	0.037272	390.7106	57.24301
Centre	116,429.3	72112.01	2234.488	170309.1	56	6	0.0358567	451.15	55.29879
South	38,795.43	43718.11	824.2861	73897.55	25	4	0.0351298	367.4843	56.56504
Total	117,433	61370.09	2055.504	155504.3	50	7	0.0363564	391.6745	56.53395
Other Banks (mean values)									
North-West	1070078	476200.2	33274.49	7,488,347	499	47	0.036865	1223.601	57.38187
North-East	1025914	835781.4	61077.01	9,964,507	515	43	0.0471912	6279.818	65.91323
Centre	929979.1	577952	40867.89	8,891,967	488	46	0.0391703	2742.779	59.28032
South	684018.9	479397	19783.29	2,571,438	432	40	0.0382668	862.296	52.88012
Total	946197.7	615112.1	41383.01	7,885,528	488	44	0.0409286	3125.571	59.68412

Source: own calculations on BilBank 2000 data, money values in thousands of euros.

Table 8 - Environmental factors, mean values by area and bank type, years 2006-2008

	Equity/ Asset Ratio		**Asset Quality**		**GDP per capita**		**Head office-branches Mean distance**	
AREA	**CB's**	**Other Banks**	**CB's**	**Other Banks**	**CB's**	**Other Banks**	**CB's**	**Other Banks**
North-West	0.1307	0.1445	0.9742	0.9752	25.15	26.73	14.53	63.74
North-East	0.1510	0.1443	0.9639	0.9785	25.04	30.84	7.92	99.92
Centre	0.1252	0.1383	0.9526	0.9593	21.32	19.99	9.13	66.87
South	0.1396	0.1458	0.9241	0.9441	15.49	17.39	17.01	75.16
Total	0.1394	0.1430	0.9541	0.9661	22.08	24.76	11.55	78.539

Source: own calculations on BilBank 2000 data

Table 9 - The Mean Efficiency Scores

CB's, One sample, model without Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,7196	0,8565	0,6158	0,7339	0,8588	0,6298	0,7517	0,8406	0,6317
North-East	0,7649	0,8897	0,6800	0,7824	0,8917	0,6973	0,8037	0,8695	0,6986
Centre	0,6694	0,8739	0,5844	0,6993	0,8682	0,6068	0,7115	0,8547	0,6080
South	0,6452	0,8155	0,5263	0,7268	0,8164	0,5933	0,7342	0,8078	0,5931

CB's, One sample, model with Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,7336	0,8497	0,6229	0,7477	0,8521	0,6367	0,7637	0,8358	0,6382
North-East	0,7790	0,8870	0,6906	0,7957	0,8909	0,7086	0,8178	0,8683	0,7101
Centre	0,6710	0,8731	0,5853	0,7016	0,8683	0,6088	0,7141	0,8545	0,6101
South	0,6452	0,8160	0,5266	0,7310	0,8198	0,5992	0,7390	0,8106	0,5991

Other banks, One sample, model without Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8108	0,8242	0,6688	0,8171	0,8252	0,6749	0,8427	0,8018	0,6762
North-East	0,8611	0,8192	0,7057	0,8694	0,8248	0,7174	0,8809	0,8138	0,7173
Centre	0,7645	0,7695	0,5885	0,7919	0,7674	0,6084	0,8065	0,7531	0,6081
South	0,7605	0,7585	0,5767	0,8081	0,7569	0,6117	0,8140	0,7519	0,6122

Other Banks, One sample, model with Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8176	0,8224	0,6729	0,8242	0,8251	0,6805	0,8509	0,8006	0,6818
North-East	0,8864	0,8407	0,7458	0,8929	0,8466	0,7565	0,9037	0,8367	0,7566
Centre	0,7794	0,7680	0,5992	0,8054	0,7695	0,6204	0,8193	0,7564	0,6206
South	0,7687	0,7558	0,5809	0,8140	0,7586	0,6176	0,8196	0,7538	0,6180

(continue)

CB's, Two samples, model without Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8235	0,9450	0,7782	0,8266	0,9462	0,7822	0,8339	0,9378	0,7821
North-East	0,8480	0,9482	0,8041	0,8548	0,9518	0,8136	0,8702	0,9356	0,8142
Centre	0,8135	0,9463	0,7698	0,8210	0,9482	0,7785	0,8263	0,9421	0,7784
South	0,8333	0,9084	0,7571	0,8701	0,9167	0,7977	0,8718	0,9134	0,7964

CB's, Two samples, model with Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8384	0,9452	0,7925	0,8418	0,9469	0,7971	0,8479	0,9398	0,7969
North-East	0,8612	0,9504	0,8185	0,8684	0,9545	0,8290	0,8820	0,9404	0,8294
Centre	0,8168	0,9483	0,7746	0,8255	0,9506	0,7847	0,8307	0,9446	0,7847
South	0,8346	0,9118	0,7612	0,8743	0,9218	0,8060	0,8765	0,9181	0,8047

Other banks, Two samples, model without Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8443	0,7950	0,6713	0,8536	0,7945	0,6784	0,8815	0,7711	0,6800
North-East	0,8813	0,8023	0,7071	0,8899	0,8081	0,7193	0,9013	0,7982	0,7197
Centre	0,8078	0,7309	0,5902	0,8373	0,7391	0,6191	0,8506	0,7274	0,6190
South	0,7888	0,7388	0,5826	0,8426	0,7595	0,6398	0,8468	0,7557	0,6399

Other Banks, Two samples, model with Asset Quality Indicator, 2006-2008 Averages

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
North-West	0,8494	0,7979	0,6777	0,8643	0,8031	0,6945	0,8881	0,7899	0,6933
North-East	0,9050	0,8266	0,7485	0,9147	0,8406	0,7697	0,9194	0,8317	0,7651
Centre	0,8197	0,7333	0,6013	0,8494	0,7547	0,6415	0,8534	0,7428	0,6340
South	0,7941	0,7398	0,5873	0,8470	0,7710	0,6531	0,8498	0,7619	0,6474

Table 10 - The Mean Efficiency Scores, Annual Values and Some Tests

CB's, One sample, model without Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.7249	0.8140	0.5931	0.7535	0.8226	0.6227	0.7626	0.8145	0.6233
2007	0.6918	0.8878	0.6161	0.7229	0.8914	0.6469	0.7456	0.8664	0.6482
2008	0.7092	0.8866	0.6274	0.7526	0.8750	0.6591	0.7673	0.8588	0.6592

	Model # 2 vs Model # 1			Model # 3 vs Model # 2		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.0006	0.0936	0.0011	0.1535	0.1072	0.4766
2007	0.0003	0.2444	0.0006	0.0064	0.0000	0.4468
2008	0.0000	0.0083	0.0001	0.0426	0.0008	0.4954

CB's, One sample, model with Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.7295	0.8117	0.5950	0.7602	0.8226	0.6283	0.7704	0.8134	0.6289
2007	0.7005	0.8865	0.6230	0.7329	0.8905	0.6554	0.7548	0.8666	0.6565
2008	0.7206	0.8831	0.6351	0.7629	0.8737	0.6673	0.7777	0.8575	0.6673

	Model # 2 vs Model # 1			Model # 3 vs Model # 2		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.0004	0.0496	0.0004	0.1330	0.0832	0.4788
2007	0.0004	0.2169	0.0006	0.0104	0.0000	0.4541
2008	0.0000	0.0246	0.0001	0.0460	0.0009	0.4968

Other Bank, One sample, model without Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.7956	0.7380	0.5959	0.8100	0.7423	0.6099	0.8245	0.7298	0.6103
2007	0.7962	0.8371	0.6700	0.8177	0.8338	0.6864	0.8370	0.8150	0.6872
2008	0.8282	0.8154	0.6782	0.8509	0.8183	0.7006	0.8612	0.8083	0.7007

	Model # 2 vs Model # 1			Model # 3 vs Model # 2		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.1580	0.3798	0.2404	0.1525	0.1924	0.4922
2007	0.0648	0.3794	0.1687	0.0778	0.0472	0.4828
2008	0.0340	0.3961	0.0782	0.1944	0.1887	0.4959

Other Banks, One sample, model with Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.8043	0.7449	0.6095	0.8207	0.7511	0.6269	0.8350	0.7390	0.6273
2007	0.8134	0.8405	0.6885	0.8316	0.8413	0.7056	0.8515	0.8225	0.7063
2008	0.8487	0.8229	0.7022	0.8686	0.8262	0.7226	0.8780	0.8172	0.7224

	Model # 2 vs Model # 1			Model # 3 vs Model # 2		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.1233	0.3391	0.2040	0.1525	0.2155	0.4922
2007	0.0993	0.4713	0.1698	0.0698	0.0538	0.4847
2008	0.0499	0.3936	0.1131	0.2047	0.2327	0.4972

(continue)

CB's, Two samples, model without Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.8259	0.9263	0.7657	0.8421	0.9316	0.7849	0.8494	0.9232	0.7843
2007	0.8293	0.9464	0.7852	0.8401	0.9477	0.7967	0.8495	0.9372	0.7962
2008	0.8430	0.9411	0.7937	0.8557	0.9462	0.8102	0.8647	0.9363	0.8097
				Model # 2 vs Model # 1			Model # 3 vs Model # 2		
				Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006				0.0186	0.1265	0.0121	0.1706	0.0356	0.4726
2007				0.0779	0.3403	0.0750	0.1120	0.0009	0.4752
2008				0.0457	0.0652	0.0194	0.1159	0.0023	0.4784

CB's, Two samples, model with Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.8318	0.9284	0.7732	0.8497	0.9353	0.7954	0.8564	0.9275	0.7948
2007	0.8386	0.9469	0.7947	0.8507	0.9488	0.8079	0.8589	0.9395	0.8074
2008	0.8540	0.9446	0.8075	0.8671	0.9499	0.8245	0.8754	0.9409	0.8241
				Model # 2 vs Model # 1			Model # 3 vs Model # 2		
				Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006				0.0122	0.0728	0.0062	0.1975	0.0509	0.4739
2007				0.0602	0.2801	0.0550	0.1436	0.0033	0.4761
2008				0.0417	0.0626	0.0192	0.1369	0.0055	0.4797

Other Banks, Two samples, model without Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.8371	0.7044	0.6003	0.8555	0.7208	0.6279	0.8680	0.7112	0.6282
2007	0.8220	0.8124	0.6743	0.8503	0.8072	0.6940	0.8708	0.7894	0.6951
2008	0.8537	0.7953	0.6841	0.8725	0.8061	0.7091	0.8831	0.7961	0.7089
				Model # 2 vs Model # 1			Model # 3 vs Model # 2		
				Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006				0.0575	0.1424	0.0896	0.1374	0.2741	0.4936
2007				0.0095	0.3196	0.1250	0.0327	0.0614	0.4768
2008				0.0385	0.1637	0.0559	0.1513	0.1904	0.4948

Other Banks, Two samples, model with Asset Quality Indicator

	Model # 1			Model # 2			Model # 3		
	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006	0.8431	0.7168	0.6166	0.8635	0.7348	0.6473	0.8756	0.7255	0.6477
2007	0.8362	0.8195	0.6931	0.8596	0.8206	0.7144	0.8680	0.8253	0.7257
2008	0.8733	0.8046	0.7089	0.8994	0.8359	0.7583	0.8979	0.8078	0.7320
				Model # 2 vs Model # 1			Model # 3 vs Model # 2		
				Tech.	Alloc.	Cost	Tech.	Alloc.	Cost
2006				0.0413	0.1382	0.0813	0.1431	0.2936	0.4926
2007				0.0262	0.4643	0.1191	0.2293	0.3469	0.2698
2008				0.0040	0.0044	0.0014	0.4352	0.0105	0.0565