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Abstract Italy has experienced a restructuring and consolidation process in the banking industry since the 1990s' that is expected to foster efficiency and competition. Despite the reforms, a peculiarity of the industry is the persistence of small mutual-cooperative banks (BCCs) active in narrowed markets. The scope of this paper is to evaluate the level and the dynamics of BCC efficiency compared with other bank-types and to analyze its main determinants over the period 2006-2011. Efficiency is firstly estimated with stochastic frontiers and then used as dependent variable in fixed and random effects models that have been run to regress BCC efficiency against individual and environmental factors. The latter are meant to gauge the structure of the provincial banking market, that is to say the reference market of BCCs. Results show that BCCs perform better than other banks, even though efficiency has decreased over time, owing to the effect of the current crisis. Furthermore, BCC efficiency increases with market concentration and demand density and decreases as bank branches increase in local markets. This holds whatever the frontier (cost or profit). Finally, local development negatively affects (only) cost efficiency, while BCCs gain in generating profits when systemic credit risk increases.

JEL codes: G21, C13, D22, O16, P13
Keywords: Mutual-cooperative banks; local markets; stochastic frontiers; efficiency determinants

Contents

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1. Introduction

The Italian banking industry has observed very strong deregulation and consolidation processes over the last two decades, like many other countries. The major reforms go back to the 1990s' when the 1990 Amato-Carli Act, the EU Directive II and the 1993 Consolidated Act entered into force and were motivated by the attempt to increase consolidation and market competition. An interesting deregulation reform was the relaxing of geographic constraints, allowing banks to open branches throughout the country. The implied fact is a territorial diversity in bank organization and an increase in competition in even very narrowed local markets.[1]

The outcome of the overall process of reforms can be documented from different perspectives. For instance, the number of banks has reduced drastically over time: there were 1037 in 1993 and 693 in 2013. At the same time, the increase in bank-branches has been remarkable (there were 22133 in 1993 and 32106 in 2013). A fast "bankarization" of the territory took place: the proportion of municipalities with at least one bank branch increased from 46.43% to 74.23% over the 1993-2014 period. As far as ownership is concerned, Italy experienced a transformation from public-owned banks to private banks with the result that nowadays the banking system comprises only private cooperatives and joint stock companies (Ltd.). A clear cut-off signal of the reform comes from the market concentration: as consolidation proceeds through a massive number of Mergers and Acquisitions (M&A), the market shares of the top-5 banking-groups acting as leaders increased from 36% in 1996, to 50% in 2000 and 64% to in 2013. In brief, the current market configuration is with (a) several big banks operating throughout the country - among which the largest act as big players even in international markets, (b) a growing number of medium-sized cooperative banks organized mostly in the form of "Popolari" Banks and (c) the network of small mutual-cooperative banks (Banche di Credito Cooperativo, henceforth BCCs).

These facts clearly suggest that the current Italian banking sector has changed profoundly. However, one of its most interesting peculiarities is the permanence of a plethora of BCCs which coexist with all the other entities that regularly tend to become bigger and bigger and expand their activities in every segment of the national market. Thus, BCC survival appears to be threatened by two main forces. Firstly, in the new market a crucial role is played by complex financial conglomerates, which force the disappearance of small entities. In a world of big-banks, small credit institutions are expected to disappear. Secondly, BCCs historically operated in narrow isolated local markets, which, now, are no longer protected because the regulatory barriers to geographic expansion have been removed. If local markets become contestable, then it is expected that BCCs will lose their quasi-monopoly power which, in the past, assured a certain degree of profitability. However, it is worth pointing out that a radical transformation also regarded BCCs. A signal of this is their reduction in number: at the end of 2013 there were 385 (411 in 2011), while in the early 90s' there were 700. These figures indicate that the restructuring of the credit market has not ruled out the BCCs, which have embarked on a process of M&A to increase their size. However, the consolidation process in the network of cooperative-mutual organizations occurred involving mostly BCCs, with the result that the number of BCC branches even doubled in ten years, moving from 2226 in 1993 to 4454 in 2013. In relative terms, in 2013 BCC branches made up 14% of total national branches, which is a value 4 percentage points higher than that of 1993. This process surely reinforces BCCs territorial vocation, which tends to expand their relative role and participation in small markets. In other words, data

[1] The process of institutional reforms has been regulated by several norms, such as, for instance, the 2002 budget law, the 262/2005 law and the 353/2006 Legislative Decree. Details on these reforms are in Giannola (2009), Messori et al. (2003) and Silipo (2009).

indicate that BCCs reacted to the national restructuring process by re-organizing their network through within-group M&A and thus increasing their presence in local markets.

Based on these arguments, it becomes meaningful to investigate BCC performance, given that they operate within a national banking industry, which, now, is much more concentrated and consolidated than in the past. In order to address its main research question, this article combines two strands of the literature, one focusing on the evaluation of bank efficiency, the other investigating the determinants of efficiency.

Despite the huge literature on bank efficiency - see, among many others, the exhaustive surveys by Berger and Humphrey (1997) and Fethi and Pasourias (2010) - few papers have focused on Italy (Battaglia et al. 2010; Dongili et al. 2008; Fontani and Vitali 2007; Giannola et al. 1997; Giannola and Scarfiglieri 1998; Girardone et al. 2004). In this regard, the evidence is mixed, but three main conclusions can be drawn from these studies. Larger Italian banks attain lower efficiency levels than small banks. Bank efficiency is higher in the North of Italy than in the South. Interestingly for the purpose of this paper, a common result from many papers is that Italian mutual-cooperatives perform better than other banks in controlling costs.[2] This outcome is often explained by the competitive advantages that BCCs have over big-banks in terms, for example, of (a) the use of soft instead of hard-information, (b) lean rather than complex organization and (c) because of the short operational distance between banks and customers (see, i.e., Alessandrini et al. 2009; Berger et al. 2005; Carnevali 2005).

With regards to the theme of "what" explains bank efficiency, it is noteworthy that there is no clear widely-shared theory, but much is left to empirics. This helps to explain why the results are contrasting and often not comparable, as - at best - model specifications differ from one study to another, reflecting the paper-specific aim. For instance, much research regards the relationship between efficiency and market concentration, socio-economic external conditions, banking structure, and access to banking services (Battaglia et al. 2010; Bos and Kool 2006: Dietsch and Lozano-Vivas 2000; Girardone et al. 2004). While part of this literature will be reviewed in the set-up of our model (see Hughes and Mester (2008) for a comprehensive survey on this topic), here, it is important to say that the main focus of this paper, after controlling for the role of BCC specific factors, is the effect on BCC performance exerted by environmental factors. In this sense, the paper by Battaglia et al. (2010) is comparable with our work, as it focuses on the efficiency of BCCs over the 2000-2005 period. They estimate stochastic frontiers by referring only to the sample of BCCs and thus proposing 'within-the-group' differences rather than providing efficiency scores retrieved from the estimations of national banking frontiers. As the authors argue, their method allows them to "…avoid estimation bias in efficiency scores to strong heterogeneity in the sample" (Battaglia et al. 2010:1366). At this point of the discussion, it is also worth mentioning that Battaglia et al (2010) calculate the external variables at regional level. On one hand, their main results suggest that cost or profit efficiency is insensitive to non-performing loans and regional GDP per capita; on the other hand, cost efficiency decreases with high spatial concentration of the local banking industry and increases with the number of branches.

With respect to the related literature, our paper is innovative in several ways. The first distinguishing feature refers to the empirical setting we propose. In the first step, cost and profit efficiency scores are estimated within the Stochastic Frontier Approach (SFA) by following the specification proposed by Battese and Coelli (1995)[3] and, above all, considering all Italian banks.

[2] This result is found in Ayadi et al. (2009), Battaglia et al. (2010), Giannola et al. (1997), Giannola and Scarfiglieri (1998), Girardone et al. (2004), Giordano and Lopes (2006), Giordano and Lopes (2012), Fontani and Vitali (2007), Dongili et al. (2008) and Turati (2004).

[3] The choice of considering both dimensions of efficiency (cost and profit) overcomes the limits arising from analysing only one of them. Indeed, profit efficiency only gauges performance properly if banks' objectives

Differently from Battaglia et al. (2010), our estimations of BCC individual performances control for what happens in the national banking system. In other words, BCCs are analyzed within the overall industry, with the result of preserving the comparability of efficiency across different groups of banks. This allows discernment "within" and "between" group differences.[4] In the second step of the analysis, the BCC efficiency scores are regressed against a set of individual and external variables that can exert an effect on BCC performance. In this regard, the main interest is to evaluate the effect of local banking conditions that are measured through several determinants defined at provincial level. This introduces the second important contribution of the study, which regards the choice to consider the province (NUTS3) as the reference geographical area of BCCs. An analysis based on larger territories, for example regions, could suffer from aggregation bias, as it is plausible to think that the greater the proximity of BCCs to markets the more precise will be the investigation of the individual efficiency-environment nexus. Briefly, the choice to focus on BCCs and limiting the territory of interest to provincial level allows a better understanding of the role of local market conditions on individual performance, which remains the main scope of this research. This is why BCCs are the only category of banks operating in spatially-bounded markets, acting as single market entities. From an empirical point-of-view and differently from the case of big-banks, the required statistical information to be analyzed comes from the BCCs balance-sheet, the contents of which are reliable from the point of view of a territorial study. Indeed, the accounting-data incorporate the environmental effects, as they are the result of the financial relationship between BCCs and the "residents".[5] Therefore, the research-question on "whether and how" the BCC efficiency is determined by environmental factors becomes intriguing because it sheds some light on the relationship between the effects of the restructuring process of the entire Italian industry and the performance of the financial entities operating in local markets. Another aspect of interest is related to the period under scrutiny, which covers the years between 2006 and 2011. This was a period of severe instability in financial markets which has not been deeply studied in terms of the effects on the efficiency of Italian mutual-cooperative banks (the exception is Barra et al 2014). The present paper contributes to fill this gap firstly by updating the analysis of the level and the dynamics of BCC performance compared with others and secondly by modeling time as a determinant of BCCs efficiency.

The paper is organized as follows: Section 2 reports some stylized facts on the banking industry; Section 3 describes the method used to estimate banking efficiency and reports the frontier estimations; Section 4 discusses the estimated efficiency scores of BCCs compared to other bank-types; Sections 5 focuses on the determinants of BCC performance; finally, Section 6 concludes.

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are restricted to profit maximisation. However, banks tend to minimise costs. According to some authors profit efficiency is superior to cost efficiency "for evaluating the overall performance of the firm" (Berger and Humphrey 1997; Berger and Mester 1997; Fitzpatrick and McQuinn 2005). This view is intuitively based on the fact that profit derives from the maximisation of a function which depends on revenues and costs. It must be also said that profit efficiency requires not only technical efficiency and both input and output allocative efficiency (as does the cost efficiency), but also an appropriate scale. Thus, banks cannot be profit efficient if they are scale inefficient (Berger and Mester 1997). While profits maximisation is not the ultimate scope of mutual-cooperative banks, the above arguments hold even for this bank-type as their competitive advantages over big-banks may translate to higher profitability (see, i.e. Ayadi et al 2009; Iannotta et al. 2007).

[4] As Bos and Kool (2006) argue, studies which do not take into account differences between bank-type yield inappropriate conclusions about bank performance. On the contrary, by using a wide sample of banks allows net efficiency measures to predict how BCCs are ranked under the assumption that banks operate in an equivalent environment.

[5] The relationship between individual efficiency and external determinants might be evaluated at branch level, whatever the bank-type. However, data at branch level are not available in Italy - as well as in many other countries - because they are classified as sensitive-statistics.

2. Local banking markets in Italy: some facts

As our main scope is to explain BCC efficiency by distinguishing between environmental and individual factors, this section documents some of recent developments that have occurred in local Italian markets. The discussion is conducted at provincial level (NUTS3), which is the geographical disaggregation mostly closer to the operating scale of mutual-cooperative banks. Throughout the paper, reference is made to the period 2006-2011 because of the greater reliability of the micro-data.[6]

An important effect of the restructuring reform is the spatial diffusion of financial services. Several proxies can be used as an indicator of this. For instance, the number of branch banks in each province is, on average, 328 over the 2006-2011 period. The maximum (2141 branches) is observed in Milan, while Ogliastra is the province with the lowest number (26) of bank branches. Another useful index is the bank branches by square kilometer, which measures the density by province. The density is considerably different across provinces [it varies from 0.2 (Crotone) to 12.9 (Milan) in 2006-2011, appendix table A1], although it is stable over time (Figure 1.a). Another valuable indicator is the ratio "Bank Branches/Municipalities" per province, which was, on average, more than 5 in 2006-2011 and ranges from more than 20 branches per municipality in the provinces of Trieste and Prato to less than one branch in the provinces of Isernia, Oristano and Vibo Valentia (table A1). Along this line of reasoning, further evidence comes from the concentration of provincial markets. Figure 1.b reports the Hirschman-Herfindahl index calculated using the number of branches per bank (HH1) in every province by year. Table A1 displays the average over the period 2006-2011. What emerges is that the concentration is quite time invariant (fig. 1.b), but huge differences across provinces still persist. For instance, the average of HH1 over the years 2006-2011 was 0.12 (table A1). The index HH1 ranges from the highest values (higher than 0.5) in the provinces of Nuoro and Oristano to the lowest (0.036) which is observed for Trento. It is low (less than 0.1) in many other provinces. Higher average market concentration has been revealed when considering total bank assets (HH2).[7] In this case, the average value of HH2 is 0.36 (three times higher than the average of HH1) varying from 0.23 (Parma) and 0.59 (Como). Importantly, when using HH2 an increasing market concentration is observed over time (Figure 1.c). Finally, there has been a relevant increase of big-bank participation in the periphery. The top-3 national banks - as revealed by the total assets averaged over 2010-2011 - owned 21% of bank branches operating in every Italian province. The 3 largest banks own more than 40% of bank branches in the province of Aosta, Siena and Turin. On the contrary, in Bolzano, Macerata, Pesaro-Urbino Pescara, Teramo, Chieti, Crotone, Matera, Potenza, Nuoro and Oristano the presence of the largest 3 banks is modest, as they own less than 10% of branches operating in those provinces. The role of big-banks in local markets is more apparent when looking at their total assets shares. The top-3 banks absorbed (on average) 73% of total assets at provincial level in 2006-2011. The territorial distribution of this market share shows a minimum of 51% in Benevento and a maximum in Siena

[6] Two different data-aggregations are needed for addressing the issues we pose. The first concerns data at bank level, while the second regards the geographical aggregation we refer to. Data on individual bank are from the Italian Banking Association (ABI). When considering the provincial level (NUTS3) we use different data sources (Bank of Italy, Italian Institute of Statistics, Istituto Tagliacarne). The period under scrutiny covers the years 2006-2011. This is why the implementation of International Accounting Standards (IAS) occurred in 2005 and banks balance sheets before-and-after IAS are not comparable.

[7] Data needed to calculate HH2 is the value of total assets by the i-*th* bank in every province j (TAij). Because this information is not freely available in Italy, as well as in many other countries, we proceed through this calculation: $TA_{ij}=TA_i*b_{ij}$, where TAi is the balance-sheet amount of Total Asset (TA) of the i-th bank and bij is the proportion of branches of bank i in province j (bij=BBij/BBj). This procedure is proposed by Carbò Valverde et al. (2003).

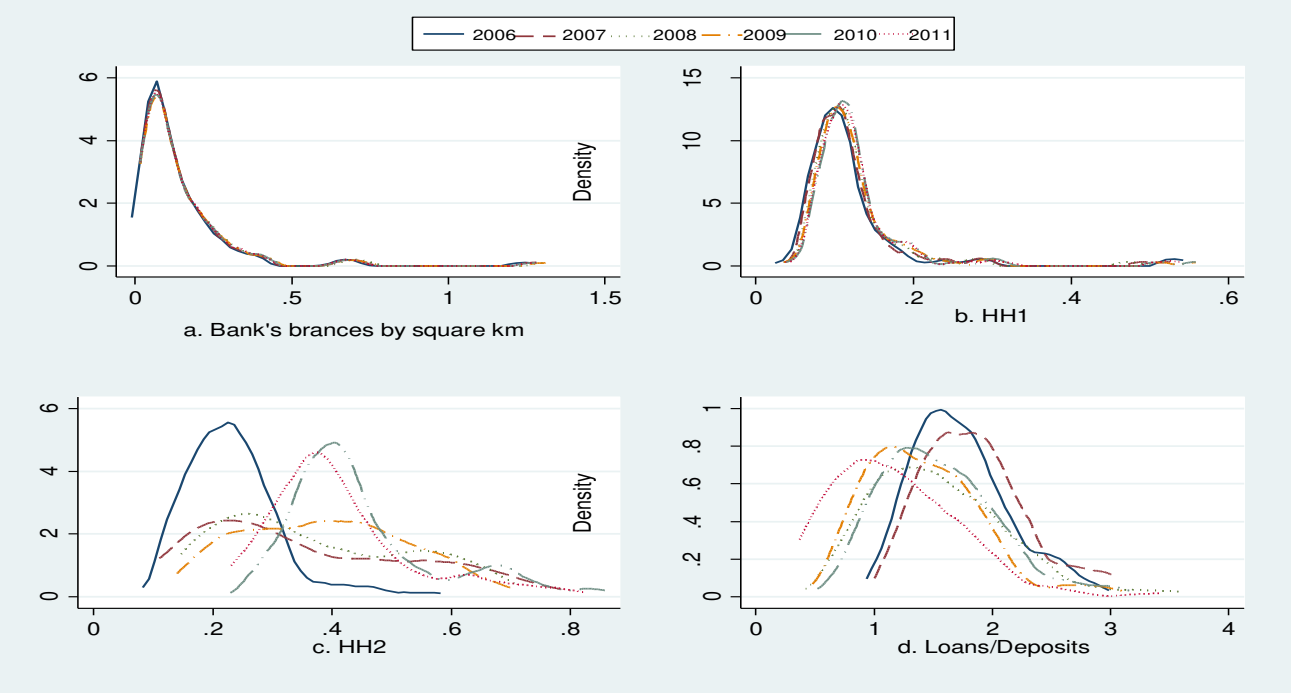
(more than 90%). It is worth pointing out that in 22 out of 103 Italian provinces, the top-3 national banks absorb more than 80% of local total assets (table 1).[8]

Another issue concerns the traditional function of banks, namely the transformation of deposits into loans. The Bank of Italy provides the required data taking into account the residence/location of customers and depositors. Appendix table A1 and Figure 1.d summarize this information. High values of this ratio mean that the provincial banking sector is issuing out more of its deposits in loans at provincial level, which, in turn, means it releases more income. Over 2006-2011 the ratio Loans/Deposits is on average 1.55. On the one hand, the highest value (3) results in Milan. Again, calculations show that in several provinces (Ancona, Bergamo, Bolzano, Florence, Lucca, Modena, Prato, Reggio Emilia, Ravenna, Rimini, Siena and Vicenza) the banking industry provides a number of loans to residents which is more than double deposits from the same area. On the other hand, Aosta, Trieste, Avellino, Benevento, Brindisi, Reggio Calabria, Vibo Valentia, Agrigento, Caltanisetta, Nuoro and Oristano are the provinces in which loans are smaller than deposits. It is interesting to point out that the distribution of Loans/Deposits ratio reproduces the North-South dualism of the Italian economy, being high in the Northern provinces and low (except Aosta and Trieste) in Southern provinces. A related issue to offering funds is that loans are not always repaid. In Italy, bad performing loans are 6.38% of total loans over 2006-2011, with a different incidence across provinces. In some provinces (Milan, Sondrio and Siena), bad-loans are low (less than 2%), while they are very high (more than 10% of total loans) in Avellino, Benevento, Caserta, Crotone, Caltanissetta, Enna, Frosinone, Isernia, Latina, Nuoro, Potenza, Reggio di Calabria, Taranto, Vibo Valentia and with a peak of 18.44% in Matera. Finally, there is also great heterogeneity when looking at the credit provided by banks. This result from the loans-to-GDP ratio which ranges from the high values observed in Milan (3.45), Siena (2.50) and Florence (1.84) to the lowest values (less than 50% of provincial Value Added) registered in Oristano, Enna, Vibo Valentia, Reggio Calabria, Isernia, Brindisi, Benevento, Rieti and Frosinone (table A1)

From the above discussion one learns that the local banking market conditions are still extremely heterogeneous across Italian provinces. This market heterogeneity further motivates the understanding of the nexus between the local determinants and BCC efficiency.

[8] Alessandria, Aosta, Como, Imperia, Mantova, Milan, Novara, Pavia, Torino, Belluno, Arezzo, Grosseto, Massa, Siena, Lecce, Agrigento, Caltanissetta, Enna, Messina, Ragusa, Siracusa, Trapani.

Figure 1 Bank density, market concentration and Loans/Deposits by province (2006-2011)



Source: elaborations on data from Bank of Italy and ISTAT.
(b) HH1=Hirschman-Herfindahl index based on the number of branches per bank by province
(c) HH2=Hirschman-Herfindahl index based on the total assets per bank by province

3 Modeling the stochastic frontiers of banks

3.1 The method

The econometric analysis is carried out in two steps. Firstly, we consider a very large sample of Italian banks and obtain cost and profit efficiency scores by estimating stochastic frontiers using the specification proposed by Battese and Coelli (1995). To this end, the main equations (cost or profit frontiers) are based on a 3-inputs-3-outputs model, while the inefficiency equation only controls for bank type (BCC, Popolari and Ltd.) and location effects. This procedure has two advantages. On the one hand, referring to a national banking frontier ensures that results are comparable, in the sense that BCC performance is relative to the rest of the industry; on the other hand, the estimated efficiency scores are net of any institutional and geographical effect. In the second step of the analysis, BCC efficiency obtained in the first step is used as dependent variable of efficiency equations aimed at evaluating the effect of individual and local factors on BCC performance. This paragraph briefly presents the methodology used to estimate bank frontiers, while the econometric specification of the BCC efficiency equation is discussed later (*cfr* § 5).

The frontiers are estimated by employing the SFA, that allows banks to be distant from the frontier also owing to randomness (Aigner et al. 1977; Meeusen and van de Broek 1977). In this, SFA differs from the Data Envelopment Analysis (DEA) which supposes that the distance from the frontier is entirely due to inefficiency. Again, SFA assigns a distribution to the stochastic component of the model and, thus, allows inference to be made. Inference, however, is not specific to SFA because of advances in bootstrapping in the DEA procedure (Simar and Wilson 2000). A further advantage of SFA derives from the specification of Battese and Coelli (1995), which allows a cleaner efficiency

measure to be obtained comparing it with the model where one firstly estimates inefficiency using a frontier and, secondly, uses the estimated efficiency-score as the dependent variable in subsequent regression (Greene 1993). As shown by Lensink and Meesters (2014) and Wang and Schmidt (2002), the standard two-step approach suffers from the fact that the inefficiency is assumed to be identically and independently distributed in the main frontier equation, while it is determined by other variables in the inefficiency equation.[9]

The following function F_c (.) indicates the cost of producing an output y given a price w, whereas F_p (.) states the profit obtainable from producing y at input price w.

$$Cost_{it} = F_c(y,w)\, e^{v_c} e^{u_c} \qquad [1]$$

$$\text{Profit}_{it} = F_p(y,w)\, e^{v_p} e^{-u_p} \qquad [2]$$

Eq. [2] is an alternative profit function since it depends on inputs and outputs, whereas actual profits depend on the prices of output. It uses the same variables as the cost function, implying that output-prices are free to vary (Huizinga et al., 2001). Exhaustive discussions on alternative *versus* traditional profit efficiency are in Berger and Mester (1997) and Vander-Vennet (2002).

From eq. [1] the efficiency can be expressed as the ratio of the minimum cost of a potentially efficient bank to the cost actually observed:

$$CE = \frac{F_c(y,w)e^{v_c}}{F_c(y,w)e^{v_c}e^{u_c}} = e^{-u_c} \qquad [3]$$

Similarly, profit efficiency is the ratio of the observed banks profit to the maximum level of profit achievable in the case of full efficiency

$$PE = \frac{F_p(y,w)e^{v_p}e^{-u_p}}{F_p(y,w)e^{v_p}} = e^{-u_p} \qquad [4]$$

We use the Translog function to model the frontiers. It satisfies the assumptions of non-negativity, concavity and linear homogeneity (Kumbhakar and Lovell 2000). After taking into account the constraint of homogeneity[10] in relation to input-prices ($\sum_n \omega_n = 1$), the cost frontier in the log-linear form (w_r is the price of deposits) is:

[9] Following Battese and Coelli (1995) allows us to address the issues brought up by Lensink and Meesters (2014) and Wang and Schmidt (2002). Phrased differently, we use a variant of the SFA traditional two-step approach, as in the first step we basically exploit all the advantages provided by the stochastic frontiers specification proposed by Battese and Coelli (1995), while the common use of two-step procedure refers to Battese and Coelli (1992).

[10] Using a translog, linear homogeneity also requires standard symmetry ($\beta_{js} = \beta_{sj}$ and $\omega_{nq} = \omega_{qn}$) and linear restrictions of the cost (or profit) function ($\sum_n \omega_{nq} = 0$ and $\sum_n \alpha_{nj} = 0$).

$$\log\left(\frac{Cost}{w_r}\right) = \beta_0 + \sum_j \beta_j \log y_j + \sum_n \omega_n \log \frac{w_n}{w_r} + \\ + \frac{1}{2}\left[\sum_j \sum_s \beta_{js} \log y_j \log y_s + \sum_n \sum_q \omega_{nq} \log \frac{w_n}{w_r} \log \frac{w_q}{w_r}\right] + \\ + \sum_n \sum_j \alpha_{nj} \log \frac{w_n}{w_r} \log y_j + u + v \qquad [5]$$

where *Cost* is total bank costs; y_j represents the *j-th* output, with j=1,2,3; w_n is the cost of the *n-th* input, with n=1,2,3; α, β and ω are the parameters to be estimated; u is the inefficiency; v is the random error.

With regard to profits, the right-hand side replicates the cost function, while the dependent variable is bank profit, expressed as $\log\left(\frac{Profit}{w_r}\right)$. As in Berger and Mester (1997), Bonin et al. (2005), Fitzpatrick and McQuinn (2005), Huizinga et al. (2001) and Maudos *et al.* (2002), profits are transformed by adding the absolute value of minimum profit plus one to actual profits. This ensures that $\log(Profit) = \log\left[\pi + \left|\pi^{\min}\right| + 1\right]$ is defined in $[0, +\infty)$.

Finally, we assume that v_{it} is normally distributed with mean zero and u_{it} is distributed as a truncated normal. Again, v_{it} and u_{it} are independently and identically distributed:

$v_{it} \sim iidN(0, \sigma_v^2)$ [6]

$u_{it} \sim N^+(\boldsymbol{z'\eta}, \sigma_u^2)$ [7]

where $z'\eta$ is the linear predictor of inefficiency.[11] The econometric specification of the inefficiency component is:

$$u_{it} = \eta_1 z_{ltd} + \eta_2 z_{pop} + \eta_3 z_{centre} + \eta_4 z_{south} + e_{it} \qquad [8]$$

where Z_{ltd} and Z_{pop} are two dummy variables equal to unity if the i-th bank belongs to the group of Ltd. or Popolari, respectively (the base group comprises the BCC), whereas Z_{centre} and Z_{south} are equal to unity if the headquarter of the i-th bank is in the Centre or in the South of Italy (the base group is formed by banks located in the North of the country). These dummy variables guarantee that the efficiency scores are net of any geographical and institutional fixed effect. Moreover, e_{it} is the erratic component. Finally, efficiency is time-variant, ensuring a change in relative ranking among banks. In other words, this accommodates the case where an initially inefficient bank becomes more efficient over time.

[11] As in many other recent papers in the banking efficiency literature (see, i.e., Battaglia *et al*. 2010; Giordano and Lopes 2008; Lensink and Mester 2012) the assumptions on v_{it} and u_{it} are those originally proposed by Battese and Coelli (1995), also because modeling other "possible correlated structures of the technical inefficiency effects and the random errors in the frontier" (Battese and Coelli 1995:327) goes beyond the scope of this work.

3.2 Frontier estimations: a brief comment

The data source used to estimate the efficiency is ABI (Italian Banking Association), which comprises the balance sheets of 96% Italian banks. All individual bank variables are extracted used to estimate the 3-inputs-3-outputs frontier models (eq. [5]). Appendix table A2 displays the variables used in defining the frontiers, which were modeled by referring to the intermediation approach (Sealey and Lindley 1977). Appendix table A3 reports the summary statistics. Regressions were performed through the simultaneous estimation of eq. [5] and [8] and were run by using more than 3700 bank-observations. Results from estimating the cost and the profit frontiers are in table 1.

After observing that the coefficients of the Translog frontiers are almost all significant,[12] the first meaningful result regards gamma, which is the ratio of the variance of the inefficiency to the variance of the composite error. The estimated gamma parameter is always high, indicating that inefficiency significantly contributes to determine the distance from the frontier. This evidence is confirmed by the Likelihood Ratio test, which verifies the correct model specification of an SFA. It considers the H_o that all the parameters in eq. [8] are equal to zero: if this hypothesis is accepted, then the OLS estimates will be consistent because the composite error comprises only randomness. Results indicate that the LR is 47.814 and 1664.7 in cost and profit frontiers respectively and, therefore, H_o is rejected at 1% (table 1).

With regards the results related to eq.[8], it is also important to underline that the dummy variable Z_{Ltd} has a positive sign, implying that the average level of efficiency (cost or profit) is higher for BCCs than for Ltd., while the sign of Z_{pop} coefficient is positive in the cost function (implying that BCCs obtain higher cost efficiency levels than Popolari) and negative in the profit frontier (meaning that BBCs achieve lower profit efficiency levels than Popolari). Passing to explain the geographical effect, banks with their main office in the Centre of Italy obtain lower inefficiency levels than banks of Northern Italy (for both cost and profit aspects), while some territorial differences exist as far as profit is concerned, as northern banks register profit efficiency lower than southern banks.

[12] We implement an LR test to verify the correctness of the Cobb-Douglas *versus* the Translog. Under H_0 there is the more parsimonious model, which is always rejected at 1%.

Table 1 Banking Frontiers in Italy. Translog estimates in 2006-2011

	Cost	Profit
β_0	-3.713***	9.803***
β_1 (*Loans*)	0.729***	0.159***
β_2 (*Commission Income*)	-0.241***	-0.245***
β_3 (*Securities*)	0.442***	0.096 .
ω_1 (*Labor Cost/Cost of Deposits*)	1.128***	1.093***
ω_2 (*Cost of capital/Cost of Deposits*)	0.344***	0.168 .
β_{11}	0.092***	0.006**
β_{12}	-0.100***	-0.023***
β_{13}	-0.086***	0.025***
β_{22}	0.056***	0.002
β_{23}	-0.004	-0.014 .
β_{33}	0.047***	0.014**
ω_{11}	-0.025 .	0.015
ω_{12}	-0.095***	-0.107***
ω_{22}	0.122***	0.082***
α_{11}	-0.060***	-0.030***
α_{12}	0.084***	0.055***
α_{13}	-0.030***	-0.044***
α_{21}	0.068***	0.035***
α_{22}	-0.065***	-0.043***
α_{23}	0.008	0.031***
Z_{LtD}	0.092***	0.096**
Z_{Pop}	0.157***	-0.372***
Z_{centre}	-0.127***	-0.385***
Z_{south}	0.032	-0.675***
σ^2	0.064***	0.169***
$\gamma = \frac{\sigma_u^2}{\sigma^2}$	0.323***	0.901***
Log-likelihood	229.414	188.918
LR test	47.814***	1664.7***
	(14.33)+	(14.33)+

Significance levels: '***' = 0.01; '**' = 0.001; '*' = 0.05; '.' = 0.1; ' ' = 1.
+ 1% LR critical value as in Kodde and Palm (1986)
Source: see table 1

4. The estimated efficiency scores: BCCs *versus* other bank-types

This section focuses on the estimated efficiency scores retrieved from the estimations of cost and profit frontiers. The analysis aims to understand better BCC performance compared to the other banks. In this, the advantage of having considered the entire sample of banks in the estimations of national frontiers is exploited. A brief investigation is conducted into what extent BCC efficiency differs from the rest of the sample and this discussion is complemented by calculating some balance-sheet ratios.[13]

The average estimated values of cost and profit efficiencies and of balance-sheets ratios by bank-type are summarized in table 2.[14] Data indicates that mutual-cooperative banks dominated the industry, as they amount to on average 63% of the sample. Moreover, it emerges that bank size ranges from 7,029M euro in 2006 to 7,884M euro in 2011. In this respect, mutual-cooperative entities are very small compared to the others. Their size is, on average, 286M Euro, which is about thirty times smaller than the average size of other banks (7,884M Euro). Data also suggest that BCCs activities are not diversified. This holds either in terms of income diversification (the ratio is, on average, 0.23 for BCC, 0.36 for others) or loans diversification (0.33 versus 0.38). The ability to transform Deposits into Loans is lower for BCCs than others (on average 1.49 versus 2.48). Interestingly, the ratio Equity/Total Assets of BCCs is significantly lower than that observed for the other two bank groups: on average, it is 0.015 for BCCs and 0.098 for others. This implies that BCC show a higher financial dependence than others, regardless of assets risk unlike the regulatory capital ratios.

While table 2 highlights the existence of marked differences in banking behavior, further interesting evidence comes form a deep-analysis of efficiency scores. Indeed, BCCs result to perform better than other banks whatever the frontier. On average, cost efficiency is 0.90 for BCCs and 0.87 for other banks. This implies that, in order to be full efficient, BCCs should reduce the inputs of only 10% offering the same banking services (or similarly they should increase outputs of 10% with the same inputs). This proportion is 13% for the counterpart. Moreover, on average, BCCs earned 85% of their potential profits: a 15% recovery of profitability would have been possible without increasing inputs. This estimated performance is better than that obtain for the other banks, which record a profit efficiency of 79%, that is six percentage points less than BCC profitability. In brief, Italian BCCs perform better than other banks either when they control costs or generate profits. As can be seen from table 3, this evidence holds even year-by-year: the average level of cost efficiency is 83% for BCCs and 75% for the others in 2006, declines up to 2008 and shows a slight even irregular recovery in the two subsequent years. In 2011, the distance in terms of cost efficiency, between BCCs and the counterpart is less than 9% percentage points. There are similar gaps (although less marked than costs) when considering annual profit efficiency: the distance is 6 percentage points in 2006 and 7.7 percentage points at the end of the period, in 2011. These time-changes highlight two stylized-fact. On one hand, it is a fact that BCCs and the other banks gain more in controlling costs than in generating profits. In other words, over the period under scrutiny Italian banks register high efficiency in saving costs. On the other hand, BCCs always perform better than the other banks, in the sense that BCCs make better use of inputs and outputs than any other group.

The difference found in the average values is confirmed when considering the entire distributions of cost and profit efficiency. Figure 2 considers all the bank-year-observations and reveals a substantial heterogeneity between and within bank-groups. First of all, it is interesting to

[13] The balance-sheet ratios are (a) the income diversification defined as [Income Commissions /(Income Commissions+Net Interests Income)]; the loans diversification expressed as (1-Loans/Total Assets); the Loans/Deposits ratio and the Equity/Total Assets ratio.

[14] The initial number with positive values of total assets is 686 in 2006, 692 in 2007, 689 in 2008, 686 in 2009, 648 in 2010 and 631 in 2011.

point out that the density functions of cost efficiency differ from those of profit, whatever the bank: cost efficiency is less dispersed than profit efficiency: standard deviations are 0.0247 and 0.0493 respectively. This is evident from figure 2. Again, the median cost efficiency is 0.9002, whereas it is 0.8562 for profits. Finally, for 1% of banks, cost efficiency ranges from 0.7486 and 0.8227, whereas the upper value of profit efficiency is 0.7057 for 1% of banks (these data are available upon request).

Table 2 Comparing BCC's and other banks performance Over the 2006-2011 period. Bank size, efficiency scores and some balance-sheet ratios, by year

	Mutual Cooperative Banks						
	2006	2007	2008	2009	2010	2011	2006-2011
Income Diversification	0.25452	0.20855	0.17811	0.24047	0.24748	0.23898	0.22814
Loans Diversification	0.34658	0.33555	0.32512	0.32714	0.30569	0.31187	0.32567
Loans/Deposits	1.29296	1.35194	1.42448	1.38888	1.41727	2.07432	1.48684
Equity/Total Assets	0.01712	0.01850	0.01594	0.01229	0.01551	0.01263	0.01539
Cost Efficiency	0.90653	0.89640	0.89382	0.89726	0.89541	0.90531	0.89904
Profit Efficiency	0.86040	0.85782	0.82451	0.85179	0.85468	0.85087	0.84972
Size*	241	257	278	301	318	328	286
# of BCCs**	431	436	428	414	406	404	2519
	Other Banks						
	2006	2007	2008	2009	2010	2011	2006-2011
Income Diversification	0.42092	0.29260	0.23903	0.39408	0.42302	0.40802	0.36323
Loans Diversification	0.40031	0.38062	0.38410	0.39782	0.34836	0.35499	0.37861
Loans/Deposits	2.53152	2.34515	2.39291	1.97645	2.61914	3.08037	2.47589
Equity/Total Assets	0.09150	0.09214	0.09916	0.10927	0.09836	0.09916	0.09837
Cost Efficiency	0.87392	0.86392	0.85452	0.86599	0.86703	0.87342	0.86611
Profit Efficiency	0.80845	0.77537	0.76168	0.78693	0.81755	0.77418	0.78601
Size*	7,029	7,621	8,132	7,784	7,811	8,621	7,884
# of other banks**	255	257	261	272	242	227	1514

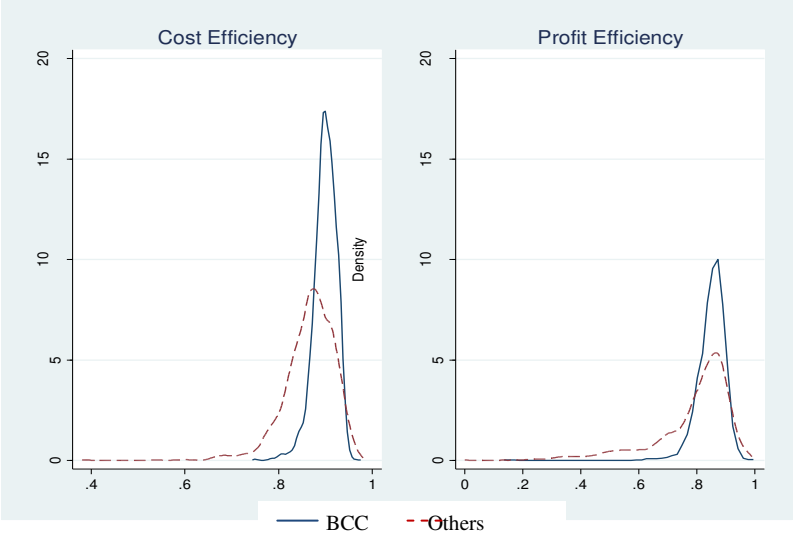
Note:

* Average value of total assets, expressed as the ratio between the total assets and the number of banks of each group. Constant values in M of euro - NIC Index Istat, base year = 1995.

** The number of banks changes year-by-year because (i) the dataset does not comprise the balance-sheet of some minor and small banks in 2010 and 2011; (ii) some banks have ceased to operate; (iii) few banks were involved in a very limited number of M&A.

Source: see Figure 1

Figure 2 Distribution of cost and profit efficiency of Italian banks over the 2006-2011 period. BCC versus Other Banks



5 The determinants of BCC efficiency

The results discussed so far indicate that the Italian banking sector is still highly heterogeneous across provinces and that the BCCs perform better than others in terms of cost and profit efficiency. This paragraph combines these two outcomes and aims at evaluating the role of provincial market conditions on BCCs performance. The sub-section 5.1 presents the efficiency equations using once cost efficiency, once profit efficiency as dependent variable. The subsections 5.2 and 5.3 focus on the impact exerted by individual and territorial factors respectively.

51 The efficiency equation

The efficiency scores range from zero to unity. Thus a Tobit model would be appropriate to estimate an efficiency equation, as made by others (Casu and Molyneux 2003; Gillen and Lall 1997; Huang and Fu 2013; Jimborean and Brack 2010; Shao and Lin 2001). However, Tobit models perform well only if upper and lower bounds come from non-observability, thereby implying that the variability in the range [0;1] does not support itself the use of a Tobit model. Indeed, when no zero and unity observations of the dependent variable are in the sample results from Tobit models overlap those obtained from standard OLS (Maddala 1991; McDonald 2009). Based on this, the following transformation is adopted: CE^{TRANS}=ln(CE/(1-CE) and PE^{TRANS}=ln(PE/(1-PE) where CE and PE are the cost and profit efficiency scores of BCCs that were retrieved from the joint-estimations of eq. [5] and [8] made in the first step of the analysis. Therefore, the efficiency equation is specified as follows:

$$CE^{TRANS}_{it} = \omega_0 + \omega_1 X^{I}_{it} + \omega_2 X^{E}_{it} + e_{it} \qquad [9]$$

where CE^{TRANS}_{it} is the transformed cost efficiency of the i-*th* BCC at time t. X^I and X^E comprise, respectively, a set of individual and environmental variables meant to exert an effect on BCC performance. Finally, e_{it} is a random disturbance. When estimating the profit efficiency equation, PE^{TRANS}_{it} replicates CE^{TRANS}_{it} in eq. [9].

With regard to the right-hand side variables of eq. [9], it is worth noticing that the efficiency determinants defined at bank level are related to the capital structure, size and diversification of BCCs activities, while the variables at provincial level are meant to gauge the relationship between efficiency and market concentration, spatial diffusion of banking services, density of demand, credit risk and the role of economic development of each province.

The empirical strategy followed to estimate eq. [9] is to apply random effects and fixed effects models and to control for endogeneity by considering the Hausman-Taylor specification. Table 3 displays the results. The first three columns of data report the estimates obtained when considering the equation of cost efficiency. In more detail, column 1 presents the estimates from a random effects model, column 2 refers to results from fixed effects model, while column 3 shows the Hausman-Taylor estimates. Columns 3-6 replicate for profit efficiency.

Before presenting the results regarding the role played by each efficiency determinant, it is important to provide some diagnostics on the estimated model. The choice of the best performing model deserves comment. To this end we consider two tests. The Hausman test is conducted to assess the appropriateness of random or fixed effects models. Failure to reject Ho indicates that the random specification is valid. Results are in favor of fixed effect specification, whatever the BCC efficiency equation (cost or profit). Furthermore, the Hausman-Taylor specification is compared with the fixed effects model. In the Hausman-Taylor specifications, all variables at bank level are treated as endogenous, while environmental variables are assumed to be exogenous.[15] Even in this case, the test supports the fixed effect model, given that the difference in estimated coefficients are not statistically different. This implies that bank-level variables may be treated as exogenous. Before discussing the role of individual and local banking determinants, it is remarkable to highlight that the coefficient of Time is always negative, thereby implying that during the years of the current crisis the BCCs register significant efficiency losses. It is a result to be better investigated, as made by Barra et al. (2014).

5.2 The role of individual factors

This section presents the estimates obtained when analyzing the effect on efficiency exerted by BCCs individual characteristics. The first relevant issue regards the efficiency-size nexus. While much research documents that efficiency is directly related to size, there is no consensus on the sign of the effect. Some authors show that the effect is positive (Andries 2011; Drake 2001), whereas others find a negative effect (Pilloff 1996). In our setting, SIZE is measured by the total assets of each BCC.[16] It emerges that cost efficiency tends to increase with size. This indicates that economies of scale are at work: following Hauner (2005) it appears that dimension affects the costs of inputs, even in the case of BCCs. At the opposite extreme, a contrasting force against dimension comes from BCCs profits, which decrease as size increases. Since BCCs do not tend to maximize profits, their tendency to become "relatively" bigger ought to be monitored and evaluated only from the perspective of cost saving.

[15] BCC individual endogenous variables are instrumented by the difference between the primary variables and their time-averaged values, when all the variables are time varying. The endogenous time invariant variables are instrumented by the temporal mean of the time varying exogenous variables (Hausman and Taylor, 1981). The hypothesis of exogeneity of provincial variables is based on the fact that BCCs are very small entities and hence their behavior has no effect on local market equilibrium.

[16] It is important to say that the size-efficiency nexus may not be the same whatever the size, because nonlinear effects can arise (Andries 2011; Berger and Mester 1997). To this end, we have augmented the basic equation with $SIZE^2$ and, alternatively, with the logarithm of SIZE. In both cases, estimations are not significant, implying that there is no-linearity (results are available upon request).

There are some reasons to consider as relevant the diversification of activities for BCCs efficiency. It is argued that income from traditional bank activities suffers lower volatility than other financial uses and then the higher the share of risky activities the lower the exposure to systematic risk (Vallascas and Keases 2012). However, it is not certain that the higher betas coming from diversification compensate the costs for diversifying the sources of income (Baele et al. 2007; Wagner 2010). This means that there is no expectation on the link between income diversification and BCC efficiency. In this paper, diversification is measured as income diversification and loans diversification (see table 2). Results from income diversification suggest that the business model matters in influencing BCCs efficiency. The analysis shows that income diversification significantly affects efficiency, whatever the frontier. The estimated coefficients result to be positive in cost and profit regressions, implying that Italian BCCs would gain from diversifying their business other than intermediation within the income statement (income diversification). With regard to loan diversification the effect remains positive on profit efficiency, and reverses on cost efficiency. From this, it appears that BCCs would save costs by offering traditional services (loans) to their member-customers, while they obtain profit-benefits as their investment portfolio is unbalanced in favor of non-traditional lending activities (loans diversification).

Another aspect that the study addresses is the relationship between efficiency and the capital structure. Indeed, the financial capital is related to exposure to risk in a sense that the more indebted a bank the higher the risk of failure that arises in situations of systemic crisis (Acharya and Viswanathan 2011). In other words, less equity implies higher risk taken and greater leverage which results in higher borrowing costs. Again, a high level of leverage directly affects funding costs, since paid interests imply less profitability for the bank in the income statement (Berger and Mester 1997). From these arguments, it is reasonable to assume that more leveraged BCCs face high funding costs and then low efficiency scores. In our regressions the capital structure is proxied by the ratio Equity/Total Assets, which ranges from 0 (highly leveraged BCC) to 1 (financial independence). From an empirical point of view, the equity-to-total assets ratio is found to effect negatively on cost efficiency, while the relationship is positive for profit efficiency. On the costs side, this means that an increased amount of capital, for instance as requirements of regulation, can act as a binding restriction and thus is perceived by BCCs as a cost. Furthermore, the evidence also confirms that the most indebted BCCs register high financial cost and thus low cost-efficiency.

5.3 The role of environmental factors

Turning back to the specific objective of the paper, it is worth discussing the empirics about how the provincial market conditions effect BCC performance. The discussion begins with market concentration, which enters into regressions to gauge the effect of consolidation process observed in banking markets. It is measured using the Herfindahl Index and Total Assets (HH2) in each province, as defined and discussed in section 2. This is an issue addressed in many works (Casu and Girardone 2009; Dongili et al. 2008; Fontani and Vitali 2007) aimed at verifying whether a higher industry concentration influences bank efficiency. The uncertainty of the outcome is due to the fact that, on the one hand, the operations of consolidation have resulted in an increase in size with an eye to probable and expected increases in efficiency levels. On the other hand, high concentration can cause an increase in banks market power and, therefore, a reduction of banks efficiency (Turati 2008). It appears that local banking concentration is positively related to BCCs efficiency. It is a robust evidence, provided that it holds in cost and profit frontiers, suggesting that BCCs operating in provinces with more concentrated banking markets show higher efficiency. This is consistent with the efficient structure hypothesis (Berger 1995; Goldberg and Rai 1996). Phrased differently, in local concentrated banking markets, each BCC is induced to be more and more efficient, exploiting

economies of scales and thus acquiring stronger market positions in their narrowed reference markets. This explains and motivates the sign on the estimated parameter: in provinces with high market concentration there would be a dominance of efficient BCCs. Arguments that increased market concentration leads to efficiency improvements are also provided by Demirgüç-Kunt and Levine (2001) and Casu and Girardone (2009).

Regarding the spatial access to banking services, it is reasonable to argue that banking efficiency in local market can also be affected by the branching that has occurred in Italy over the last 20 years, after the removal of barriers to expand banking activities. In more detail, it can be expected that the higher the number of branches the less BCC efficiency. This is why a large number of branches exerts negative effects of individual efficiency because the operating costs to provide banking services increase. Moreover, local markets with a high number of branches (in terms of spatial dimension) would suffer from over-dimensioning which acts against efficiency. However, the sign may be different, as the big-bank participation in small markets can be positive due to the increases in the capital brought by big banks, the expertise brought in risk management and increases in competition (Delis and Papanikolaou 2009; Hannan and Prager 2009). This phenomenon is measured province-by-province with the number of bank branch by square kilometer (*cfr* figure 1.a). Results are in line with the expectation against branching as the estimated parameter of Branch Density is always negative. This means that Italian BCCs suffer from the huge branch opening process occurring throughout the country. As said before in the Introduction even BCCs have contributed to the branching by restructuring their network and then augmenting their role in every province. The estimated negative sign might be due to the fact that the presence of many bank branches in local markets forces individual BCC to invest increasing amount of resources for serving more customers (other than members), whose expectations is to increase the benefits from loans and deposits at better advantageous conditions than those applied by other banks. Other things being fixed, the increased number of bank branches in local markets and the BCCs strategies act against their costs and profits.

Another issue that the study addresses regards the effect on efficiency due to demand effects. The hypothesis is that BCCs that operate in markets with a lower density of demand face higher expenses to find customers asking for banking services (Fries and Taci 2005). Thus, the higher the density demand, the higher will be the banking efficiency levels. These effects are gauged by the demand density expressed as total deposits by square kilometer. From estimations it emerges that BCCs cost and profit efficiency is positively related to demand density, whatever the method used to estimate eq. [9]. The evidence supports the hypothesis: BCCs working in provinces with high level of deposits face, *ceteris paribus*, lower costs and gain higher profits in mobilizing deposits and making loans.

In order to gauge the effects of systemic market risk on individual efficiency, in eq. [9] is inserted the variable Credit Quality, expressed as the bad loans to total loans. It is calculated by taking into account the localization of customer in every province. Here, the question is: do BCCs gain or lose from operating in local markets with poor credit-quality? It is likely that BCCs operating in risky markets are exposed to potential efficiency losses caused by higher costs of screening and monitoring activities. Results differ according to the type of efficiency we refer to. On the one hand, individual cost efficiency is not related to the local financial markets riskiness. This might be due to the fact that BCCs save costs from the nature of the relationship with their member-customers. These relationships are long-dated and based on the use of soft-information and protect BCCs from market riskiness. On the other side, the risk of local markets positively affects profit efficiency: BCCs charge higher interest rates in order to compensate for covering anticipated and unanticipated credit risk. This is in line with this expectation (Kasman et al. 2010). Bearing in mind that the study covers a crisis-period with a large number of episodes of credit crunch, the highly risky customers, rationed by other banks,

borrow from BCCs. In order to receive credit, they are willing to pay higher rates of interest, with net gains for BCC profits. In such a case, the origins of BCC benefits might be the market failures and a potential monopoly power in the restricted markets in which they operate. This view is aligned to Gutiérrez (2008), but contrasts with Coccorese (2009).

Finally, it is reasonable to assume that the level of local economic development is an important factor of bank performances, because it affects numerous factors related to the demand and supply of banking services (mainly deposits and loans). To this end, the income per capita (Y/POP) is used as measure of development. It is excepted that provinces with higher Y/POP are assumed to have a banking system operating in a mature environment and resulting in more competitive interest rates and profit margins. They can also exert more financial activity. Results are mixed. No significant evidence comes from profits regressions, while a negative relationship is found between cost efficiency and economic development. Evidence from cost efficiency is consistent with the view according to which the higher the development of an area the higher the operating and financial costs BCCs would incur in offering services (Dietsch and Lozano-Vivas 2000).

Table 3 The determinants of BCCs' efficiency. Estimations from RE, FE and HT models (2006-2011)

	Dep. Var.: BCCs' Cost Efficiency			Dep. Var.: BCCs' Profit Efficiency		
	Fixed Effect Model	Random Effect Model	Hausman Taylor	Fixed Effect Model	Random Effect Model	Hausman Taylor
Intercept	17.731 **	7.599	19.579 **	24.491 *	50.375 ***	41.444 ***
BCCs Individual Level						
Size						
Total Assets	0.262 ***	-0.097 **	0.225 ***	-0.248 *	0.039	-0.250 **
Diversification						
Loans	-0.218 ***	-0.304 ***	-0.191 **	0.735 ***	0.603 ***	0.707 ***
Income	1.657 ***	1.553 ***	1.629 ***	0.565 ***	0.793 ***	0.677 ***
Capital Structure						
Equity/Total Assets	-1.961 ***	-1.509 ***	-1.936 ***	1.366 ***	0.634 **	1.234 ***
Provincal Level						
Market concentration	0.069 **	0.045 **	0.066 **	0.130 **	0.110 **	0.126 **
Credit quality	-0.243	-0.255	-0.149	0.959 **	1.506 ***	1.355 ***
Demand density	0.001 **	0.001 ***	0.001 ***	0.001 *	0.001	0.001 *
Branches density	-84.140 *	-48.634 ***	-63.571 ***	-516.053 ***	-33.022	-74.186 **
GDP per capita	-0.008 **	-0.007 *	-0.007 **	-0.003	-0.001	-0.002
Time	-0.008 **	-0.003	-0.009 **	-0.011	-0.024 ***	-0.020 **
Obs	2133	2133	2133	2133	2133	2133
F-Fisher (p-value)	90.64 (0.000)			23.46 (0.000)		
Wald (p-value)		872.81 (0.000)	962.28 (0.000)		232.06 (0.000)	257.56 (0.000)
Hausman test (p-value)	-	79.25 (0.000)	2.65 (0.915)	-	46.90 (0.000)	18.68 (0.009)

Legend: * p<.1; ** p<.05; *** p<.001.
Source: see table 1.
P-values are in brackets.

5. Conclusions

This paper provides an empirical analysis of cost and profit efficiency of the Italian banking industry over the period 2006-2011, which is a time crisis. The central theme is, however, the efficiency of BCCs, which, despite the sectorial reforms, remain important players in local markets. This issue is addressed from two different perspectives, one focusing on the analysis that generates the bank efficiency, one investigating the role of individual and local market-specific factors affecting BCC efficiency. Results are threefold.

Firstly, from stochastic frontier estimations, it is found that BCCs perform, on average, better than other banks (commercial and "popolari") whatever the frontier. In brief, BCCs could use 20% less input in order to offer the same level of banking services, while cost inefficiency of other banks is 28%. As for profits, a 15% recovery of BCC profitability would have been possible without increasing inputs (the profit efficiency of the other banks is 6% less than BCC profitability). This evidence supports the viability of BCCs in local markets. In same way, our results complement the work by Fiordelisi and Mare (2013) who demonstrate, for the period 1997-2009, that the probability of BCC survival increases with efficiency (either in terms of costs saving or profits maximization).

The most important contribution of the article concerns the analysis based on the use of the estimated efficiency scores as dependent variables in efficiency equations. This part of the work aims at investigating the association of BCC efficiency with individual and local banking market characteristics. In this respect, the second evidence is that BCC cost efficiency seems to be inversely correlated with the individual financial independence and the loans diversification, while the contrary holds regarding income diversification and size. Profits regressions highlight the positive effect of diversification (loans and income) and of the equity/total assets ratio. Importantly, the profits of Italian BCCs are negatively affected by individual size.

Thirdly, from the estimates linking BCC performance and the environmental variables several points stand out. Over the period 2006-2011, the study emphasizes the positive relationship between efficiency and market concentration. Other robust insights come from the demand density and the branch density, which positively and negatively affect cost and profit efficiency respectively. The evidence from credit quality indicates that BCCs cost efficiency appears not to be related to the riskiness of local banking markets, while the opposite holds for BCC profits. This outcome can be interpreted as the effect of potential higher interests rates that BCCs charge to "marginal" borrowers when these are rationed by other banks.

While the paper is not centered on the evaluation of deregulation, the result that high concentration in local market induce BCCs to be more efficient, should be considered as an implication of reforms. In this sense a virtuous-circle seems to be at work: market concentration in the periphery makes BCC in those markets be more efficient and then viable. This is in line with the intentions of regulators, as the scope to maintain market efficiency is an expected result of market consolidation. At the same time, BCC viability preserves the small market to be served. However, the negative effect of branching on BCC efficiency acts against the full effectiveness of reforms, as the impressive branch opening is seen as a threat for efficiency and thus BCCs survival.

To sum up, both individual behavior and local market conditions play a role in influencing BCC performance. This evidence is robust to the method used in estimating the efficiency equations. However, a limitation of the study is that it does not deal with the discernment of different sources of heterogeneity in individual BCC efficiency. Provided that local banking markets differ from each other and that embeddedness in the territory is part of the business-model of small banks, an extension of this analysis should provide a quantitative measure on "how much" location and individual factors explain BCCs heterogeneity. In other words, it would be valuable for academics and policy making to know how much of the difference in BCCs performance can be attributed to individual heterogeneity

and how much of this difference reflects local market conditions. Addressing this issue goes beyond the scope of this paper and is left for future work.

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Table A1 Structure and behavior of Italian banking industry at provincial level over the years 2006-2011

	Market Concentration				Bank Density				
	HH1 Bank Branches	HH2 Total Assets	Q3 Market Shares Bank Branches	Q5 Market Shares Bank Branches	Branches by square Km	Branches per Municipality	Financial Development (Loans/Value Added)	Loans/Deposits	Bad Loans
Agrigento	0.112	0.398	0.319	0.326	0.0005	3.880	0.540	0.973	9.026
Alessandria	0.099	0.434	0.261	0.272	0.0009	1.598	0.973	1.615	6.724
Ancona	0.075	0.287	0.134	0.134	0.0019	7.947	1.387	2.181	5.401
Aosta	0.174	0.545	0.506	0.516	0.0003	1.313	0.617	0.896	4.734
Arezzo	0.117	0.358	0.270	0.275	0.0007	6.432	1.077	1.822	5.791
Ascoli Piceno	0.082	0.306	0.105	0.105	0.0013	3.543	1.088	1.696	6.154
Asti	0.229	0.511	0.223	0.235	0.0011	1.357	0.963	1.610	4.191
Avellino	0.122	0.293	0.103	0.109	0.0005	1.155	0.530	0.947	11.471
Bari	0.076	0.305	0.188	0.189	0.0011	12.167	0.908	1.322	7.775
Belluno	0.146	0.535	0.366	0.369	0.0005	2.876	0.688	1.468	4.274
Benevento	0.104	0.313	0.116	0.148	0.0005	1.201	0.427	0.880	13.341
Bergamo	0.086	0.469	0.220	0.220	0.0027	3.096	1.547	2.307	2.484
Biella	0.195	0.325	0.117	0.135	0.0015	1.622	1.204	1.881	5.672
Bologna	0.068	0.318	0.222	0.231	0.0023	14.926	1.421	1.730	3.092
Bolzano	0.073	0.236	0.030	0.030	0.0006	3.579	1.439	2.125	2.519
Brescia	0.064	0.354	0.186	0.188	0.0020	4.595	1.627	2.565	3.073
Brindisi	0.096	0.336	0.190	0.190	0.0007	6.158	0.479	0.928	8.891
Cagliari	0.241	0.437	0.165	0.165	0.0004	2.342	0.747	1.202	8.348
Caltanissetta	0.114	0.385	0.309	0.319	0.0005	4.538	0.526	0.931	10.012
Campobasso	0.108	0.388	0.208	0.217	0.0004	1.310	0.673	1.215	9.174
Caserta	0.141	0.293	0.159	0.162	0.0008	2.016	0.523	1.086	10.374
Catania	0.110	0.332	0.257	0.279	0.0010	6.325	0.789	1.340	7.256
Catanzaro	0.089	0.323	0.198	0.198	0.0004	1.321	0.571	1.164	8.028
Chieti	0.135	0.357	0.089	0.089	0.0007	1.729	0.832	1.435	5.801
Como	0.096	0.593	0.295	0.295	0.0029	2.377	1.023	1.600	3.224
Cosenza	0.102	0.305	0.116	0.117	0.0003	1.319	0.526	1.180	9.862
Cremona	0.073	0.481	0.197	0.234	0.0016	2.507	1.105	1.947	3.848
Crotone	0.149	0.270	0.084	0.084	0.0002	1.389	0.591	1.228	13.598
Cuneo	0.092	0.398	0.178	0.188	0.0008	2.069	0.988	1.639	2.673
Enna	0.142	0.434	0.327	0.332	0.0003	3.358	0.458	1.027	10.796
Ferrara	0.140	0.322	0.191	0.192	0.0009	9.354	0.765	1.348	8.871

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Firenze	0.083	0.267	0.232	0.239	0.0020	16.440	1.846	2.595	2.427
Foggia	0.081	0.256	0.142	0.144	0.0003	3.951	0.758	1.236	8.432
Forlì-Cesena	0.079	0.365	0.161	0.163	0.0015	11.700	1.363	1.935	3.641
Frosinone	0.109	0.425	0.251	0.253	0.0006	2.234	0.487	1.209	13.363
Genova	0.122	0.333	0.273	0.298	0.0029	7.866	0.977	1.279	3.548
Gorizia	0.102	0.384	0.157	0.157	0.0023	4.353	0.813	1.372	6.174
Grosseto	0.135	0.493	0.361	0.371	0.0003	5.595	0.887	1.716	4.743
Imperia	0.113	0.478	0.281	0.294	0.0010	1.806	0.688	1.295	4.796
Isernia	0.118	0.339	0.198	0.208	0.0002	0.663	0.495	1.255	16.860
La Spezia	0.194	0.370	0.151	0.166	0.0016	4.281	0.770	1.334	5.217
L'Aquila	0.122	0.332	0.134	0.134	0.0003	1.435	0.755	1.156	7.323
Latina	0.106	0.337	0.299	0.301	0.0008	5.677	0.510	1.084	11.972
Lecce	0.109	0.358	0.271	0.271	0.0009	2.730	0.608	1.190	7.079
Lecco	0.093	0.472	0.226	0.228	0.0029	2.620	1.042	1.534	3.812
Livorno	0.119	0.318	0.273	0.307	0.0017	10.425	0.960	1.940	3.188
Lodi	0.113	0.505	0.233	0.273	0.0020	2.607	1.326	1.969	2.666
Lucca	0.104	0.273	0.209	0.247	0.0015	7.819	1.234	2.024	4.796
Macerata	0.111	0.247	0.089	0.089	0.0009	4.222	1.133	1.619	5.186
Mantova	0.121	0.331	0.383	0.392	0.0014	4.816	1.266	2.538	3.003
Massa	0.129	0.296	0.223	0.239	0.0010	6.539	0.929	1.548	5.570
Matera	0.126	0.244	0.088	0.088	0.0002	2.747	0.628	1.074	18.449
Messina	0.110	0.347	0.329	0.345	0.0007	2.167	0.586	1.196	8.923
Milano	0.071	0.463	0.335	0.342	0.0129	13.471	3.454	3.046	1.270
Modena	0.097	0.316	0.226	0.251	0.0019	10.645	1.312	2.144	3.764
Napoli	0.121	0.268	0.186	0.191	0.0070	8.984	0.813	1.113	6.946
Novara	0.122	0.445	0.295	0.335	0.0016	2.422	0.925	1.405	5.618
Nuoro	0.537	0.418	0.076	0.076	0.0002	1.336	0.544	0.932	11.901
Oristano	0.504	0.372	0.089	0.089	0.0003	0.924	0.475	0.957	9.091
Padova	0.099	0.312	0.146	0.153	0.0030	6.196	1.284	1.878	3.979
Palermo	0.117	0.365	0.257	0.265	0.0008	5.114	0.676	1.061	7.616
Parma	0.112	0.229	0.158	0.167	0.0010	7.819	1.328	1.610	4.226
Pavia	0.097	0.513	0.304	0.321	0.0011	1.767	0.758	1.211	5.614
Perugia	0.075	0.320	0.232	0.234	0.0007	7.446	1.086	1.780	5.657
Pesaro e Urbino	0.087	0.287	0.092	0.092	0.0012	5.364	1.242	1.870	5.314
Pescara	0.085	0.309	0.097	0.097	0.0014	3.779	1.232	1.777	5.414
Piacenza	0.125	0.230	0.135	0.142	0.0009	4.580	1.080	1.567	3.992
Pisa	0.087	0.270	0.170	0.192	0.0011	7.577	0.963	1.698	4.563

(to be continued)

(continued)

Pistoia	0.107	0.303	0.153	0.160	0.0020	8.758	1.136	1.911	5.888
Pordenone	0.107	0.382	0.157	0.161	0.0010	4.415	0.935	1.709	4.846
Potenza	0.094	0.238	0.082	0.085	0.0003	1.663	0.521	1.139	14.869
Prato	0.098	0.299	0.222	0.229	0.0039	20.119	1.450	2.132	5.383
Ragusa	0.168	0.410	0.276	0.283	0.0008	10.236	0.892	1.613	8.134
Ravenna	0.097	0.387	0.217	0.222	0.0018	18.639	1.284	2.116	2.386
Reggio di Calabria	0.144	0.358	0.260	0.261	0.0004	1.436	0.426	0.970	12.377
Reggio nell'Emilia	0.103	0.278	0.220	0.241	0.0018	9.056	1.381	2.031	3.525
Rieti	0.169	0.387	0.159	0.159	0.0003	1.155	0.485	1.042	5.853
Rimini	0.079	0.369	0.128	0.130	0.0034	11.462	1.435	2.143	4.104
Roma	0.072	0.341	0.278	0.282	0.0038	16.953	1.579	1.501	4.342
Rovigo	0.126	0.362	0.121	0.124	0.0010	3.663	0.852	1.583	6.362
Salerno	0.075	0.310	0.177	0.179	0.0008	2.368	0.648	1.141	8.833
Sassari	0.290	0.400	0.138	0.139	0.0003	2.310	0.964	1.739	8.169
Savona	0.114	0.486	0.205	0.230	0.0012	2.727	0.885	1.566	3.990
Siena	0.174	0.569	0.424	0.425	0.0006	6.134	2.501	2.843	1.639
Siracusa	0.123	0.352	0.317	0.326	0.0006	6.056	0.661	1.303	9.105
Sondrio	0.293	0.442	0.116	0.116	0.0004	1.618	1.352	1.983	1.430
Taranto	0.094	0.342	0.270	0.270	0.0007	6.080	0.555	1.053	10.156
Teramo	0.157	0.345	0.074	0.074	0.0010	3.957	0.961	1.496	7.485
Terni	0.112	0.389	0.167	0.176	0.0006	4.040	0.797	1.425	6.087
Torino	0.134	0.487	0.499	0.505	0.0017	3.611	0.935	1.219	3.315
Trapani	0.110	0.412	0.334	0.340	0.0007	7.188	0.736	1.466	9.948
Trento	0.036	0.506	0.131	0.137	0.0009	2.521	1.428	1.996	2.199
Treviso	0.074	0.383	0.208	0.215	0.0027	6.954	1.419	1.924	3.615
Trieste	0.126	0.457	0.327	0.330	0.0067	23.778	0.847	0.729	2.556
Udine	0.079	0.409	0.150	0.152	0.0010	3.490	1.276	1.919	2.470
Varese	0.089	0.473	0.250	0.258	0.0040	3.421	0.869	1.438	4.495
Venezia	0.095	0.306	0.168	0.183	0.0021	11.864	0.919	1.665	3.450
Verbano-Cusio-Ossola	0.175	0.437	0.230	0.268	0.0004	1.158	0.836	1.499	6.284
Vercelli	0.193	0.423	0.195	0.231	0.0006	1.564	0.666	1.253	5.503
Verona	0.101	0.343	0.236	0.272	0.0023	7.420	1.416	1.865	2.882
Vibo Valentia	0.148	0.286	0.111	0.111	0.0004	0.813	0.392	0.948	12.642
Vicenza	0.084	0.392	0.225	0.235	0.0024	5.455	1.293	2.208	4.236
Viterbo	0.102	0.330	0.146	0.146	0.0006	3.422	0.717	1.408	6.032
Italy	0.125	0.368	0.208	0.217	0.0014	5.291	0.968	1.548	6.381

Source: own computation on data from Bank of Italy

Table A2 Definition of the variables included in the cost and profit functions

Variables	Name	Description
y_1	Loans	Loans to customers. It includes current accounts, repurchase agreements, mortgages, credit cards, personal loans and salary-backed loans, transactions relating to financial leasing and factoring, business loans, structured debt securities and other securities
y_2	Commission Income	Revenues arising from non-traditional loans and deposits of banks. It includes incomes from trading of financial instruments and currencies, custody and administration of securities, business consulting, management of insurance products, collection and payment services, collection services.
y_3	Securities	Sum of loans to other banks, equities and bonds
x_1	Labor	Number of employees
x_2	Capital	Gross Banking Product, expressed as the sum of loans, direct and indirect funding.
x_3	Deposits	Debts to customers
w_1	Labor cost	Ratio of the personnel expenses to the number of employees
w_2	Cost of capital	Ratio of the other expenses (commission expenses, operating costs, depreciation of fixed assets, the administrative costs that do not relate to personnel expenses and the interest expenses that do not relate to those calculated on deposits) to the Gross Banking Product
w_3	Cost of deposits	Ratio of the interest expenses to the debts to customers
Costs (*y, w*)	Total costs	$w_1x_1 + w_2x_2 + w_3x_3$ = Administrative expenses + Depreciation of fixed assets + Interest expenses + Operating costs + Commission expenses
Profits (*y, w*)	Total profits	$\log(Profit) = \log\left[\pi + \left\|\pi^{\min}\right\| + 1\right]$

Table A3 Average values of input and output (2006-2011)
(constant values in M of euro - NIC Index Istat, base year = 1995)

Variables	Obs.	Mean	S.D.	Min	Max
Cost	3766	161456.60	856024	378.2148	20100000
Π	3766	10226.17	108520	-1040415	4395613
Profit	3766	1050642	108520	1	5436029
y_1 = loans to customers	3766	1712072	8435175	1.45	182000000
y_2 = commission income	3766	27212.08	133176	0.72	2880022
y_3 = securities	3766	716470.30	5922604	206.47	154000000
w_1 = labor cost	3758	53.14	20.50	7.12	712.77
w_2 = cost of capital	3766	0.0595	1.0283	0.000048	44.81
w_3 = cost of deposits	3741	0.0135	0.0344	0.000008	1.25

Source: see table 1