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A PROFIT ELASTICITY APPROACH TO MEASURE BANKING COMPETITTION IN ITALIAN CREDIT MARKETS

by Michele Benvenuti[*] and Silvia Del Prete[**]

Abstract

As in other industries, competition in banking is potentially beneficial to efficiency and social welfare. Unfortunately, the task of measuring such competition is not straightforward: according to the empirical literature, traditional metrics to measure competition may fail because they do not correctly account for entry barriers, product substitutability, or the concentration and reallocation of market shares among banks. In this study we explore new measurements of competition, based on the Profit Elasticity, which can limit previous drawbacks, in order to assess the significant changes in the Italian banking market over the last two decades (1994-2013), when the most serious crisis occurred. We focus on competition dynamics over time, across bank clusters and geographical areas. Our main findings suggest that deregulation and M&A activity increased the extent of competition, while the financial turmoil reduced it, in line with other international evidence. Moreover, mutual banks faced relatively less competitive local markets, mostly owing to the informational barriers that they can impose on non-local intermediaries, and banking competition is heterogeneous across Italian macro-regions.

JEL Classification: G21, L16, R11.
Keywords: banking competition, financial crisis, local credit markets.

Contents

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1 Introduction and motivation[1]

Competition in the banking system is beneficial to gain efficiency and to protect customers. However, due to its considerable role in the economy, the banking sector is somewhat special and strictly regulated with respect to other industries, in order to prevent inefficiency and systematic risks due to market failures.[2]

Correctly measuring competition over time, especially in last decades under the confounding effects stemming from the crisis and other shocks, is a very difficult task. This is why, in order to prevent measuring errors, theory and metrics significantly improved along different approaches. In the empirical literature, approaches to measure banking competition can be classified into structural and non-structural ones. Moving from the traditional view that market concentration is an effective proxy of competition, more recent researches go beyond and use firm-level indicators based on measures of profitability. In this paper we focus on a profit elasticity measure with respect to marginal cost, belonging to the new industrial organization framework and able to overcome the limitations of previous competition measures.

The main aim of this paper is to provide an updated picture of the evolution of banking competition in the Italian credit sector during the period 1994-2013, in which many of the factors affecting competition and market power, such as regulation reforms, financial innovations, M&As and above all a relevant crisis, took place. In doing so, we adopt a state-of-the-art metrics, the Profit Elasticity (PE) indicator provided by Boone (2008). The Italian banking industry is an interesting case to explore because it has been involved in an extended deregulation process in the early 1990s with the adoption of the Second Banking Directive and the New Banking Law (L. 385/1993). Afterward, a large wave of M&As occurred, resulting in a rise in market concentration but not in a clear *a priori* effect on the degree of competition. Moreover, in recent years, the financial turmoil affected bank risk and profitability, with some concerns on the sustainability of the traditional retail bank business model.

The measure of competition in the Italian credit market is a relatively unexplored issue. To the best of our knowledge, among few others (Coccorese, 2009; Coccorese and Pellecchia, 2013), there are two main papers that directly investigate this topic: Angelini and Cetorelli (2003), who provide evidence on competition mainly for the 1980s and 1990s by using the Lerner Index, and De Bonis et al. (2018), who use a simplified version of the PE indicator to measure banking competition and to account for different cycles during more than 120

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[2]It is important to notice that the banking sector should be competitive and efficient, but also stable at the same time, in order to mitigate risks and instability, as a result of moral hazard problems, associated with *too-big-to-fail* institutions and *domino-effects*. Therefore, also with the aim of facing the competition-stability trade-off, the correct measurement of banking competition becomes a very critical issue.

years.[3]

Differently from their approach, in this paper we use an extended version of the Boone's metrics in order to measure competition and its evolution in the Italian credit market over two more recent decades (1994-2013). To this end, we focus on different dimensions of competition dynamics: a) over time, to assess the effects on competition by changes in concentration, also caused by the crisis; b) across bank clusters, as Italian banking system is largely diversified in terms of bank characteristics; c) across local markets, as Italy is a heterogeneous country, with the main macro-regions differing in the levels of economic and financial development.

Our main findings suggest that deregulation and M&A activity increased the extent of competition, while the financial turmoil reduced it. When we focus on different groups of intermediaries, we find that mutual banks faced relatively less competitive local markets, maybe due to the informational entry barriers they can impose. Italian macro-regions exhibited heterogeneity in competitive levels; however, this differential (positive) effect for mutual banks remains robust in the main Italian geographical areas.

The rest of the paper is organized as follows. Section 2 summarizes the evolution of the empirical literature on measures of competition, mainly focusing on the theoretical framework of the PE indicator and on previous findings on banking competitiveness. Section 3 describes data and variables used to build the Boone indicator; furthermore, it also presents the econometric setup to estimate marginal costs and then the Profit Elasticity approach, showing first stylized facts on the evolution of costs and profitability. Section 4 reports and discusses the main empirical evidence of our analysis on the two decades under examination, with a special focus on the crisis period, mutual local intermediaries and the main Italian geographical areas. Finally, Section 5 concludes and highlights some policy implications.

2 Literature review: metrics and evidence

2.1 Theory and metrics of competition

The measurement of the level and dynamics of competition in the banking markets has been widely debated in the literature. Generally, there is no consensus about a leading index to be used as a proxy for competition. There exists a large number of different approaches, which can be classified into two groups: structural and non-structural ones. In turn, these approaches may rely either on market power or on efficiency indicators. The former moves from the idea that competition is related to the ability to control the market, while the latter infers competition from the capability of a bank to set a price with respect to the cost frontier.

Structural methods assume "structure-conduct-performance" (SCP) to be the underlying paradigm: a stable, casual relationship is stated between the structure of the industry, firm conduct, and their performance. It entails the idea that markets with fewer, larger firms are less competitive because firms are more likely to engage in collusive behaviour. As a result, competition is negatively correlated to measures of concentration, such as the share of

[3]See also De Bonis et al. (2014) for more details on data and on the empirical analysis.

assets held by the n largest players, or the Herfindahl-Hirschman Index (HHI).[4] However, concentration measures may fail in predicting competition because of market contestability: that is, the behaviour of a firm in a contestable market is influenced by the threat of entry and exit. Firms are pressured to behave competitively in an industry with low barriers to entry for new competitors and with easy exit conditions for unprofitable ones, even if the market is concentrated.

Non-structural approaches draw insights from the "New empirical industrial organization" framework, which introduces the concept of contestable markets with potential entrants. These indicators move from specific assumptions on the behaviour of banks and generally use micro data. These include the Panzar-Rosse H-statistic, the Lerner index, and the Profit Elasticity (PE) indicator, the most recent contribution in the literature, which is going to be adopted in this paper.

The H-statistic captures the elasticity of bank interest revenues to input prices;[5] higher values are associated with a more competitive market. The H-statistic will be equal to 1 under perfect competition (because of an elastic demand function) and 0 in the case of a monopoly. The Lerner index (or price cost margin, PCM) is based on markups, i.e. the difference between output prices and marginal costs (relative to prices).[6] The basic idea is that the higher the index, the lower the competition, since in less competitive markets firms are able to set prices well above marginal costs. It ranges from 0, the case of perfect competition, to 1, in the hypothesis of monopoly.

The PE indicator captures adjustments in the intensity of competition due to a change in entry barriers, product substitutability, interactions among firms, and, broadly speaking, to exogenous factors causing a shock (including a financial turmoil). Boone (2008) shows that competition increases either when the products offered by different firms become closer substitutes and/or firms interact more aggressively, or when entry costs decline. Under those conditions, the performance (measured by profits) of more efficient firms improves.[7] The

[4]According to this approach, banking concentration can be approximated by the concentration ratio, as the share of assets held by the largest banks (typically three or five), or by the HHI, calculated as the sum of the squared market share of each bank in the system. The HHI accounts for the market share of all banks in the banking system and assigns a larger weight to the biggest banks. Instead, concentration ratios completely ignore the smaller banks in the system. The concentration ratio varies between nearly 0 and 100. The HHI has values up to 10,000. If there is only a single bank that has 100 percent of the market share, the HHI would be 10,000. If there were a large number of market participants, with each bank having a market share of almost 0 percent, the HHI would be close to 1/n.

[5]The H-statistic is calculated in two steps. First, running a regression of the log of gross total revenues (or the log of interest revenues) on log measures of banks' input prices. Second, adding the estimated coefficients for each input price. Input prices include the price of deposits (commonly measured as the ratio of interest expenses to total deposits), the price of personnel (as captured by the ratio of personnel expenses to assets), and the price of equipment and fixed capital (approximated by the ratio of other operating and administrative expenses to total assets).

[6]Prices are generally calculated as total bank revenues over total assets, whereas marginal costs are obtained from an estimated translog cost function with respect to outputs.

[7]Boone (2008) proposes a new way to measure the evolution of competition, the so-called Relative Profit Difference (RPD), which theoretically measures changes in the intensity of competition due to several factors. Boone et al. (2013) show that the elasticity of profits to marginal cost, labeled as the Profit Elasticity (PE) indicator, which can be estimated through a regression of profits on marginal costs (both in log terms), is closely related to the RPD. For a rigorous demonstration of this relation between RPD and PE, see for all Xu, van Rixtel

idea behind Boone's indicator is that more efficient firms (those with lower marginal costs) get higher profits (or gain market shares) and that this effect is stronger when competition is higher. As a result, it is expected that a negative elasticity between cost efficiency, i.e. marginal costs, and net profits will be found; the more intense the competition, the higher (in absolute terms) this estimated elasticity.

Why is PE measure to be preferred to other non-structural indicators? There are three advantages of Boone's approach over the price-cost margin (Lerner index), which until recently was the method most often employed to study market power in banking. First, the price-cost margin is criticized for not being able to capture the degree of product substitutability (Vives, 2008). Second, the theoretical foundation of the price-cost margin as a measure of competition is not robust. In fact, numerous studies present models where higher competition leads to higher price-cost margins (for a review, see Boone, 2008). Finally, and presumably most important, the Lerner index may be thought of as measuring not only bank competition, but also the strength of the profit maximizing incentives of banks (Delis, 2012). On the one hand, especially in developing and transition countries, many banks may often have incentives that diverge widely from pure profit maximization and, subsequently, they are rather inefficient. On the other hand, in the process of liberalization, an increase in the profit maximizing behaviour of banks will be reflected in a higher Lerner index, which is not necessarily associated with higher market power. Under the theoretical framework of Boone's indicator, both the changing of a bank's objectives (i.e. more focus on profits, efficiency and substitutability of products instead of pricing) and of the competitors' focus are an integral part of the model and its solution. Compared to the Lerner index, the key here is that competitors' behaviour also changes, i.e. they become more (less) aggressive as competition increases (decreases), and profits can take into account those changes. Therefore, an increase (decrease) in the absolute value of the PE indicator is clearly and purely associated with higher (lower) competition.

Moreover, according to Boone et al. (2013) and focusing on the theoretical foundation of different metrics of competition, the PE indicator performs better than both the Lerner index and the H-statistic because it encompasses the *reallocation effect*, while the others do not, especially in more concentrated markets. Indeed, when competition increases, less efficient firms will exit the market, moving their shares to more efficient ones. So, measuring competition by a Lerner index on the surviving (more efficient) firms, characterized by a greater price cost margin, may actually produce a higher aggregate value, which incorrectly signals a decrease in the intensity of competition when it actually increases. By contrast, the PE indicator is consistent with the fact that an efficient bank may exploit its advantage not only by increasing profit margins, but also by enlarging its market share.[8] As a result, according to Boone et al. (2013), both the H-statistic and the Lerner index are not monotone functions of competition and could fail to correctly measure the extent of competitiveness, and its dynamic over time, under the reallocation effect, which is more severe in more concentrated markets and along the business cycle.

and van Leuvensteijn (2013).

[8]This is why, in some papers the elasticity of marginal cost is calculated using as outcome measures of market share, instead of (or jointly with) net profits; see, among the others, De Bonis et al., 2018.

However, it is important to notice that there exist some drawbacks of the Boone indicator and this is why it is still not widely accepted in the literature and several recent papers use it only as a robustness check.[9] Following, among the others, Schiersch and Schmidt (2010), the Profit Elasticity metrics could mainly be affected by firm size or by the multi-product nature of some activities, and consequently by the difficulty of correctly defining a market or a product. In other terms, some criticisms may arise in the estimation of the Boone indicator when certain given conditions postulated by Boone are not assured, such as that firms operate in a market with relatively homogenous goods and that they act in a level playing field, which ensures that changes in competition affect firms directly and not indirectly through changes in that playing field (as in the case of cartels). On the one hand, the more precisely we can capture a market, the less other factors influence the outcome and the better the subsequent competition estimates should be. On the other hand, related to firm size, the most efficient firm must become the biggest firm in terms of market share and consequently, due to its efficiency level, it also must make the greatest profit.

The Italian banking industry is a strictly regulated sector in order to assure a level playing field among banks. Moreover, it seems broadly acceptable that the loan market could be considered a market with a fairly homogeneous product and that, according to the banking size, the largest banks are generally also the most efficient ones in the period under observation. Therefore, we are confident that the theoretical assumptions of the Boone metrics should be valid for Italian banks and that the PE, we are going to implement in the followings, should perform well in measuring the extent of competition in Italian credit markets.

2.2 Empirical evidence for Italy and other countries

To the best of our knowledge, very few papers have addressed the measurement of banking competition in Italy. In a pre-crisis period, Coccorese (2009) analyzed a group of Italian single-branch banks operating as monopolists in small local areas (municipalities) and strongly rejected the hypothesis of pure monopoly pricing, principally by reason of the nearby competition. Moreover, Coccorese and Pellecchia (2013) assess the impact of multimarket contact of banks on their market power and support the idea that firms which have a greater amount of contact are more likely to collude. A more comprehensive analysis based on cost-margin measures for Italy is provided by Angelini and Cetorelli (2003), using the Lerner index calculated on bank-level balance sheet data. They found that the degree of competition remained relatively unchanged until 1992 and increased substantially thereafter, while there was no evidence that banks involved in M&As resulted in gaining market power. Their overall results are consistent with the hypothesis that the deregulation process, which brought to the adoption in 1993 of the Second Banking Directive, significantly affected banking competition.

In a more recent contribution by De Bonis et al. (2018) a very long-run study (over a period of 125 years) is conducted on the evolution of banking competition in the Italian credit market using the PE indicator by Boone. By estimating the annual (negative) elasticity of profit (or market shares) to costs, they argue that competition was relatively high between 1890 and the mid-1920s,

[9] See, for example, Delis et al. (2016); Davidson et al. (2014); Degl'Innocenti et al. (2018).

in a sort of *free-banking* framework. Two banking laws, in 1926 and 1936, introduced significant barriers to entry, producing a decrease in competition until the 1950s (the *financial repression* period); subsequently, the indicator became more stable until the 1970s. A new rise in competition started in the 1980s, during the *deregulation* period, reaching a peak in the mid-1990s. Between the second half of the 1990s and the first years of the new millennium competition decreased again; such decrease came to a halt in years following the financial turmoil and afterward competition stabilized. Therefore, their findings on the degree of competition establish the existence of a *yo-yo* pattern linked to regulatory changes.

Indeed, to analyze such an extraordinary long time-span data limitations arose. Our paper, focusing on a more limited period, tries to overcome all these shortcomings. On the very long-run De Bonis et al. (2018) have to simplify the estimation of the Boone indicator, due to lack of data. First, they are not able to estimate bank marginal costs by using Translog Costs Function and they use average costs, assuming on the whole period constant returns of scale and lower fixed costs in the banking sector. Second, they restrict the analysis on commercial banks, excluding all mutual small banks for which there are not sufficient data on the entire period. Finally, instead of net profits, as suggested by the Boone indicator, they use as alternative measure of bank performance the market share, obtaining more robust estimates of the negative elasticity.

Taking a look worldwide, van Leuvensteijn et al. (2011) were the first economists who applied the Boone indicator to the banking industry. They measure competition on the lending markets in the five major EU countries as well as, for comparison, the UK, the US and Japan. Their main findings indicate that the US had the most competitive loan market, whereas overall loan markets in Germany and Spain were among the best competitive in the EU, while in Italy competition declined significantly over time.

Other empirical evidence, available across banking sectors worldwide, suggests that financial innovations, the quality of institutions, economic development and business cycles are highly correlated with the extent of competition. Among the others, Delis (2012) found that financial liberalization policies reduced the market power of banks in developed countries with advanced politico-institutional milieus, as he found for Italy. Therefore, a certain level of consolidated institutions is a precondition for the success of reforms aimed at enhancing competition and efficiency of banking markets. Clerides et al. (2015) show that competitive conditions in banking have deteriorated on average during the period 1997-2006. This trend has an halt until 2008, while in 2009 and 2010 market power again increases (as found for Italy, too). Thus, they provide evidence that competitive conditions are correlated with financial stability. Furthermore, for the OECD countries the results of the Lerner-type indices and the method by Boone provide conflicting findings. Similarly, Xu et al. (2013) find that the PE indicator performs better in measuring competition than the Lerner index, signaling that competitive conditions actually increased in the last decade in the Chinese banking sector, in line with the process of financial reform.

As briefly summarized in the following scheme, evidence worldwide (and for Italy, too) is ambiguous on the evolution of banking competition, especially in more recent years with many changes in the financial and economic framework. Therefore, in order to shed some more light on this issue, by using high quality

balance sheet data for Italian banks, we firstly estimate at bank-year level for the period 1994-2013 marginal costs by using a Translog Cost Function (TCF), to implement subsequently the PE indicator, measuring the elasticity of the bank net profit at changes in marginal costs, as suggested by Boone (2008) and Boone et al. (2013).

3 Data and econometric setup

3.1 Data

Our dataset collects balance sheet information on all Italian banks for the period 1994-2013 from Supervisory reports and additional data (headquarters' location, branches, etc.) from the Bank of Italy's Census of banks. Figure 1 provides a schematic overview on the number of banks potentially used in the analysis, after having cleaned from banks with relevant missing data in costs, revenues and assets, as well as from special intermediaries or local branches of foreign banks. It is important to notice that the sample of banks effectively used in the estimation of marginal costs shows a little - but not stringent - increase over time in missing data. Indeed, in the computation of costs we do not include very specialized institutions (e.g. investment banks, internet banks, etc.), more relevant in last years, which exhibit a unique balance sheet structure, in terms of costs, revenues and assets. Finally, in our analysis we use non-consolidated balance sheets; so, the decreasing number of banks over time in our panel is correlated with the increasing M&A activity during the period under examination.

Table 1 summarizes the composition of the dataset, in terms of number of banks and their branches. After the implementation of the Second Banking Coordination Directive in 1993, banks were classified into three categories: "banche SpA" (commercial banks as limited-companies), "banche popolari" (commercial banks as medium-sized cooperative banks) and "banche di credito cooperativo" (small-sized mutual banks). For the purpose of this analysis the first two categories are pooled together, since they have more similar size and business model, while small local mutual banks are considered separately, since they are subject to a special regulation, which limits their territorial activity and their profit maximization, as well as the earning distribution. Therefore, in the econometric analysis we will deal with two groups of intermediaries: commercial banks (CBs, hereafter) versus mutual banks (MBs).

Table 1 also shows the number or branches and some structural indicators computed on the basis of the network of branches. Even if M&As and concentration do not explain competition *per se*, they may provide useful insights on the topic. Figure 2 shows the overall trend on the two phenomena that are strictly correlated. The Italian banking system has been affected by two main waves of M&As: one between the late 1990s and the early 2000s and one starting with, and motivated by, the financial turmoil, in order to deal with the weakened conditions of some intermediaries. The Bank of Italy liberalized the opening of branches in March 1990 and their number continued to grow reaching a peak in 2009; afterwords commercial banks started to shrink their network because of efficiency reasons. The structure of the market evolved in connection with the banking consolidation process: the Herfindahl-Hirshmann

Empirical evidence on banking competition

Author(s)	County	Period	Data&Metrics	Main findings
Angelini & Cetorelli (2003)	Italy	1984-1997	Banks' balance sheets - Lerner Index	Regulatory reforms and deregulation increase competition, while large-scale M&As have no significant impact.
De Bonis et al. (2018)	Italy	1890-2014	Banks' balance sheets - Profit Elasticity Index (profits/market share)	They detected a yo-yo pattern linked to regulatory changes: with liberalization in 1920s competition increased; that trend reversed at the end of the 1930s, because of the restrictive regulation introduced after the Great Depression; following deregulation process in the 1980s, competition increased again and stabilized during the recent crisis.
Coccorese (2009)	Italy	1988-2005	Banks' balance sheets (single-branches) - NEIO estimation techniques	The paper analyzes the conduct of a group of Italian single-branch banks operating as monopolists in small local areas (municipalities); both tests strongly reject the hypothesis of pure monopoly pricing, and in duo-polistic markets the conduct of single-branch banks is virtually competitive.
Coccorese & Pellecchia (2013)	Italy	1997-2009	Bank data aggregated at regional level - margin between price and marginal cost	Results show that multimarket contact is positively and significantly correlated to the market power index, and is also connected to both home and non-home market concentration.
Clerides et al. (2015)	148 countries (including Italy)	1997-2010	Banks' balance sheets - Lerner Index & Profit Elasticity Index (profits)	All indicators show that competitive conditions deteriorated on average during the period 1997-2006; this trend had an halt until 2008, while in 2009 and 2010 market power again increases (as for Italy). Non-OECD countries, with high or low-income, have less competitive banking sectors than middle-income countries.
Delis (2012)	84 countries (including Italy)	1987-2005	Banks' balance sheets - Profit Elasticity Index (profits)	Financial liberalization policies reduced banks' market power in developed countries (in Italy, too); banking competition did not improve at the same pace in countries with weaker institutions and lower level of economic development.
van Leuvensteijn et al. (2011)	France, Germany, Italy, the Netherlands, Spain, UK, US and Japan	1992-2004	Banks' balance sheets - Profit Elasticity Index (market share)	Over the period 1994-2004 the US had the most competitive loan market, whereas overall loan markets in Germany and Spain were among the best competitive in the EU. The Netherlands occupied a more intermediate position, whereas in Italy competition declined significantly over time. The French, Japanese and UK loan markets were generally less competitive.
Xu et al. (2013)	China	1996-2008	Banks' balance sheets - Lerner Index/Profit Elasticity Index (profit)	Competition actually increased in the last decade in the Chinese banking sector, in line with the process of financial reform.

Index, calculated on bank branches, and other structural indicators (the market share of the 3 or 5 largest banks; see Table 1) show an increase in concentration in connection with both M&A waves. In the SCP framework this would be interpreted as a decrease in competition, while this could not be the case.

3.2 Cost function

To measure competition using the elasticity of net profit to marginal costs we need to obtain a measure of marginal costs for Italian banks. Thus, the first step in the calculation of the PE indicator is the estimation of the marginal cost. A standard solution in the literature is to adopt a Translog Cost Function (TCF).[10]

Since mutual and commercial banks are two very different groups of intermediaries, with very different aims in terms of profit maximization and cost structure due to different regulations regimes, we estimate a cost function both for the banking system as a whole and for the two main clusters of banks (CBs and MBs). For bank i (belonging to cluster h, commercial vs mutual banks) and year t, the TCF looks like:

$$ln\ c_{it}^{h} = \alpha_0 + \sum_{t=1}^{T-1} \gamma_t^h d_t + \sum_{j=1}^{K} \delta_j^h ln\ x_{ijt} + \sum_{j=1}^{K}\sum_{k=1}^{K} \epsilon_{jk}^h ln\ x_{ijt}\ ln\ x_{ikt} + \sum_{j=1}^{N} \omega_j^h n_{ijt} + v_{it} \tag{1}$$

where c_{it} is the overall cost, d_t are year dummies (to capture breaks due to technological change), x_{ijt} are K variables including K_1 outputs and K_2 input prices (squared and cross-products between these K variables are included, too), n_{ijt} are control variables and v_{it} is an error term. Any variable is measured as the log-level. Since estimated coefficients from TCFs for mutual versus other banks are statistically different (see Table 9 in the Appendix), we then use those different coefficients to estimate more effective marginal costs at bank-level for the two groups of banks, in order to employ those costs in the subsequent estimate of the PE indicator.

TCFs are appropriate for multi-product firms, such as banks. Following the literature on the subject, we use three different outputs: the outstanding amount of loans, the outstanding amount of securities, and the income from services. Furthermore, we consider three input factors: labour (proxied by the wage rate, i.e. the share of labour costs divided by total assets), finance (as the price of funding), and external inputs (proxied by the ratio of other expenses to total assets). Finally, we include into the estimation the *equity ratio* as a control variable, to take into account differences in loan portfolio risk across banks (van Leuvensteijn et al., 2011).

Before the estimation of the TCF we drop from the sample very specialized intermediaries (e.g. investment or internet banks), which exhibited a unique balance sheet structure, in terms of costs, revenues and assets. The size of the estimation sample is not affected by missing data, as presented by the Figure

[10] It assumes that the technology of a bank can be described by one multi-product production function. Under proper conditions, a dual cost function can be derived from such a production function, using output levels and factor prices as arguments. A TCF is a second-order Taylor expansion around the mean of a generic dual cost function with all variables appearing as logarithms. It is a flexible functional form that has proven to be an effective tool.

1, where we show that dropped observations are very few during the 20 years of our econometric analysis.

Descriptive statistics of these variables are reported in Table 2. Focusing on outputs, over the whole period Italian banks in our sample exhibited on average a share of loans to total assets close to 50 percent and an incidence of securities to total assets greater than 20 percent, while the ratio of service revenues to total income margin was around 16 percent. Concerning inputs, the share of total costs to total assets was on average 5.3 percent: the mean interest rate paid by banks on liabilities (deposits and bonds) was on average 3.7 percent, while the mean incidence of personal costs and other costs to total assets were both close to 1.5 percent.

The TCF is estimated by a constrained OLS, taking into account two constraints. The first stems from cost exhaustion, reflecting the fact that the sum of cost shares should equal unity (and implying that the value of the three input prices is equal to total costs). The second refers to linear homogeneity in input prices, i.e. the three linear input price elasticities must add up to one, whereas the squared and cross-products of all explanatory variables must add up to zero. The estimation of the TCF over the period 1994-2013, for the Italian banking system as a whole and for CBs and MBs separately, is reported in the Appendix.

3.3 The Profit Elasticity

The following step is to use the TCF estimated coefficients to compute marginal cost mc_{it}, for each combination of bank i, belonging to the group h (mutual or commercial bank) and year t, by differentiating the total costs with respect to the selected output (loans, in this paper). Given the multi-product nature of banks, one could worry that this choice would not be properly adequate, neglecting other possible sources of costs and profits (as other financial services). However, especially in the period under analysis, Italian banks exhibited more loan-oriented business models to respect to other countries, with a prominent contribution to margins and profits stemming from lending than from other services.[11]

Then, the PE indicator can be estimated for bank i at time t by running a regression of profit on this estimated marginal cost (the latter calculated for CBs and MBs, separately), as follows:

$$ln(\pi_{it}) = \alpha_i + \alpha_t + \beta\ ln(mc_{it}) + \sum_{j=1}^{J} \delta_j x_{ijt} + \epsilon_{it} \tag{2}$$

where $ln(\pi_{it})$ is the log level of a given bank i net profit at time t, α_i and α_t are respectively bank fixed effects and time fixed effects (year dummies), the β coefficient on the $ln(mc_{it})$ represents the elasticity of profit to costs and is the core variable we are interested in, x_{ijt} is a vector of J bank-year control variables; finally, ϵ_{it} is an usual error random term.

There are different econometric techniques to estimate this equation: mainly OLS, bank random or fixed effects. We follow Boone et al. (2013) and we estimate the coefficient of the marginal cost relative to earnings by using a

[11] Descriptive evidence supports this empirical choice, since on average half of the total assets of Italian banks are represented by loans (see Table 2).

panel model controlling for bank fixed effects, in order to take into account all possible unobservable idiosyncratic factors (organizational skills, banking history, management capability, etc.). Since profit could be negative, the log transformation could determine a truncated data set and induce some bias in the estimates of the PE. In order to avoid this, some papers (Clerides et al., 2015; De Bonis et al., 2018) use the transformation suggested by Bos and Koetter (2011), which implies that the log of profits is set to zero if profits (π_{it}) are negative and a control variable ξ_{it} is added to the model, where ξ_{it} is equal to $ln(-\pi_{it})$ if profits are negative or zero otherwise. In order to tackle this possible concern, we will present in the followings estimation of the PE indicator with this correction, as a robustness check.[12] In addition, in the same vein, we use as dependent variable of the PE equation a gross measure of bank profit (instead of net earnings), less affected by negative values, to contain missing data in the log transformation.

In the PE equation, since marginal costs determine profits and *viceversa*, in order to tackle the possible endogeneity due to reverse causality, we insert costs and other bank controls with one-year lag relative to profit measures. To this end, some researchers propose IV estimations of the PE function, using as instruments for marginal cost lagged values of the same variable. Nevertheless, since 2SLS estimates with instrumental variables are generally less efficient, we prefer to run OLS estimates controlling for bank fixed effects of the reduced form of the PE equation, where we insert directly the one-year lag of the marginal cost. However, we check our baseline findings using 2SLS models with bank fixed effects, instrumenting marginal cost with its one- (and two-) year lag, and the estimation of the PE indicator remains mostly unchanged, in magnitude and in statistical significance.[13]

We also include year dummies to control for the cycle through years, especially the impact of the two subsequent crises, occurred in the last part of our estimation period (e.g. the 2008-09 Great Global Financial crisis, in the aftermath of the Lehman's collapse, and the 2011 Sovereign Debt crisis).

Some descriptive evidence on our main control variables (the vector x_{ijt} in the PE equation), we use in some estimates and which are exogenous with respect to competition, is reported in Table 3, both for the whole period under examination and for the crisis years. The equity ratio, measured by capital and reserves to total assets, was for the median bank close to 10 percent (11.3 on average). The share of bad loans to total loans was on average around 6 percent, while the mean cost-to-income ratio was of almost 70 percent during the last two decades. In the sub-period characterized by the crisis bank performance

[12] In our panel of banks, less than 10 per cent of the observations are lost for negative profits; so, in order to run robustness checks of our estimations, we have applied this transformation and re-estimated the PE indicator with this new transformed profits and our baseline findings are robust to this correction. However, as suggested in other studies (Delis, 2012), which do not apply this correction, we believe that this correction could induce more bias in the estimates than improvements: it implies to add to the data marginal firms or banks for which accounting competition on the basis of a profit elasticity indicator (as the PE) does not make sense by definition, because these are inefficient firms that are going to exit the market. This is why we prefer to present estimates without that transformation, after having checked for their robustness.

[13] Results on the PE are robust to this alternative estimation technique also in splitting samples in pre- and post-crisis periods, for mutual banks and geographical areas. Moreover, in unreported regressions on the whole period, our evidence is robust to alternative tests with the technique suggested by Arellano and Bond.

indicators were generally worse than in the previous one.

Some stylized facts on the decline of marginal costs and profitability over the last 20 years for Italian banks are presented in Figure 3. Descriptive evidence on the marginal costs estimated by the TFCs, distinguishing between CBs and MBs, suggests that these costs were on average decreasing over time, especially since the beginning of the last decade. Moreover, profitability (measured by the return on equity, e.g. ROE) exhibited over the 20 years under examination a very similar downward trend with respect to marginal costs, but with a more intense fall in the aftermath of the Lehman's collapse during the first Great Recession.

4 Results

4.1 Competition and dynamics over time

Results from our baseline estimation on the whole period are reported in Table 4 (column 1), including both bank and year fixed effects. As expected the coefficient of marginal costs relative to net profit is negative and highly statistically significant, suggesting that competition was effective in the Italian banking sector during the period analyzed, as underlined by Angelini and Cetorelli (2003) for the first part of the 1990s, when their analysis ends. In our baseline estimates the coefficient on marginal cost is equal to -0.757, that is that an increase by 1 percent in marginal costs determines a reduction in net profit by 0.76 percent over the whole period.

This finding on competition is confirmed when we control for other bank-level characteristics (see column 2). In particular, we firstly control for bank size (as the lagged log of total assets) in order to avoid some criticisms in the PE estimation (see section 2.1). Secondly, since in the second part of the last decade, in the aftermath of the Lehman's collapse, bank riskiness and capital requirements became crucial constraints on bank profitability, we insert in our model lagged measures of bank portfolio riskiness and the equity asset ratio. The β on marginal costs remains negative and strongly significant, with a very similar magnitude relative to the basic estimate (-0.7), even if a bit lower probably due to the partial crowding-out effect of riskiness in explaining profitability in the long-run. In columns (3)-(5) we implement some robustness, changing or correcting the dependent variable in the PE equation. First, we apply the Bos Koetter correction to net profit to tackle the bias due to negative net earnings in the dependent variable and we obtain again a robust estimate of PE, with a magnitude only a bit lower than the baseline model (-0.6, column 3). Second, in column (4) we use as dependent variable the log of ROE instead of a value of net profit; the idea is that using an index of net profitability, scaled by equity, could be more accurate in taking account bank size and controls for some drawbacks in the PE estimations. Also with this test our estimate is statistically significant with a coefficient very similar to the basic estimate. Third, in column (5) we use as dependent variable the log of the gross income in order to contain the occurrences of negative net profit in the log transformation and increase the estimation sample. The estimated coefficient on marginal cost is again highly significant; however, its magnitude is lower than the baseline estimate (-0.4) and this is probably due to the fact that the gross income does not

incorporate provisions and losses on bank loans, which are relevant in evaluating the proper profitability of the lending activity. So, in our view, this is not the more appropriate margin to connect to marginal costs of loans, as done in our exercise. Finally, in column (6) we run a robustness check on the econometric technique, estimating the baseline model with bank control (column 2) by using 2SLS and instrumenting marginal cost with its one-year lag; baseline results are robust also to this check and the estimated coefficient is again very similar in magnitude and significance to the basic model.

In order to better appreciate the timing of competition during the 20 years under analysis, we have distinguished three different sub-periods, as follows: 1) the "era of the implementation of the new Banking Law", including the years between 1994 and 1999; 2) the "era of the great bank M&As", including the years between 2000 and 2006; 3) the "era of the two great crises", including the years between 2007 and 2013. Results are shown in Table 5, columns (1)-(3), controlling for bank and year fixed effects as in the baseline model.

As already argued by Angelini and Cetorelli (2003) and De Bonis et al. (2018), competition was effective in the second half of 1990s and was substantially enhanced by the deregulation process introduced with the new Banking Law. While the concentration of the banking industry increased, boosted by strategic M&As among the larger Italian banks, the contestability of the credit markets simultaneously augmented, as suggested by the higher competition in the first part of the last decade. From the first to the second sub-periods the PE increased in absolute value (moving from 0.451 to 0.732). On the contrary, the global financial crisis, in the second part of the last decade, lowered the competition process among banks; in this new "era", characterized by economic and financial adverse conditions, profitability was constrained by the general turmoil and containing costs and losses became mandatory but extremely difficult. Since we control for the cycle by using year dummies, we are confident that the estimated coefficient on marginal costs in the PE equation is an actual measure of a lower competition during the crisis.[14] Finally, in order to better appreciate differences in competition over time, in the last column of Table 5 we run a unique regression using interaction terms between marginal costs and time dummies identifying the 3 sub-periods. As expected, the interaction term for the period 2000-06 is negative and significant, suggesting an increase in competition in the first half of 2000s, while the interaction term for the crisis period (2007-13) is positive and significant, indicating a decrease in competition in correspondence with the deterioration of the business cycle.

In these sub-periods (especially at the end of 1990s, as well as during the crisis) we get some different results on the dynamics of banking competition with respect to the evidence provided by De Bonis et al. (2018). They find[15] that competition declined at the end of 1990s and at the beginning of the subsequent decade, in contrast with the effect of the liberalization and deregulation, and stabilized subsequently and during the crisis period. They

[14] The basic observation that competition increased before the crisis does not necessarily suggest that greater competition in itself spurred the crisis. Recent studies argued that the problem was mainly in missing incentives for adequate risk-monitoring, and in lax supervision (Kirkpatrik, 2009). Indeed, the run-up to the crisis was characterized by an increase in market power (see, among others, Anginer, Demirgüç-Kunt, and Zhu, 2012).

[15] "We acknowledge that, in the 125 years of our sample, the five years from 1996 to 2000 are the most puzzling: competition declined notwithstanding the previous years' liberalizations", see De Bonis et al. (2018), p. 141.

explain this counter-intuitive result with: a) the fact that the growth of branch network came to an halt in those years, after a relevant increase; b) a positive trend of bank profitability in those years may have reduced managers' incentives to pursue aggressive policies; c) banks may have aimed at other business activities, such as asset management instead of traditional lending activity, as they observe when they compare results with PE obtained by profit or market share on loans.

It is important to notice that the last 20 years have been characterized by many discontinuities: in regulation, in lending technology, in the business cycle, with the Great Recession and the subsequent Sovereign Debt Crisis. In this context, we believe that the hypothesis of using average costs instead of (estimated) marginal costs is too restrictive, in order to properly capture these discontinuities which imply no constant revenues of scales. So, even if we interpret our results with some caution, we believe that estimating the PE indicator using marginal costs and considering the net profit as outcome can lead to a better estimation of the Boone indicator over time, more in line with the expectations. In fact, with a very similar approach to those implemented in this paper, Delis (2012), using the Boone indicator, finds for Italy an increase in banking competition during the first half of 2000s, in line with our results. In economic terms, the increasing importance of fixed and structure costs in banking activities could have determined M&As among banks with the main aim to gain economies of scale and scope, favoring competition in terms of efficiency, as suggested by our estimates of the Boone indicator, in spite of the increase in market concentration in 2002-03, signaled by the HHI and C3-C5 ratios calculated on bank branches (see Table 1). Moreover, the increase in competition in the first-half of 2000s maybe be also related to lagged effects of deregulation and liberalization introduced with the new banking law in 1993, since deregulation takes time to become fully effective.

For the crisis period, De Bonis et al. (2018) found a stabilization in the level of competition, after the previous period of decline. They interpret this puzzling evidence with the fact that data have not again incorporated sufficient information to well evaluate the impact of the crisis in the dynamic of competition. On the contrary, our results suggest that the financial turmoil and the Great Recession, in the aftermath of the Lehman's collapse, increased bank market power and lowered the level of competition, showing a correlation with the business cycle, too, as proved by the empirical literature. Thus, our result on the crisis period is in line with the evidence provided for Italy by Clerides et al. (2015), who estimated a PE indicator decreasing in absolute value during the 2008-09 years of the crisis, signaling an increase in bank market power.[16]

[16]In unreported regressions, we add to the PE estimates a dummy crisis (equal to 1 for the years since 2008) and its interaction with the log of marginal cost, in order to capture differential effects in the more recent sub-period, characterized by the the two crises, and to run robustness checks of the PE estimated during the pre- and post-crisis period presented in Table 5. Controlling for bank fixed effects, the PE indicator overall is negative and significant, while the interaction between the log of marginal costs and the dummy crisis is positive and significant, suggesting that during a turmoil the banking competition is hampered and reduced by the general downturn, stemming from the adverse business cycle.

4.2 Competition across local banks and local credit markets

Going beyond the general evolution of competition during time, in this section we devote a special focus to understanding whether, by using the PE metrics, there could be different extents in banking competition across different local credit markets. While we previously focused on the entire Italian banking market, bank competition may be analyzed also on a territorial perspective, since the regional divide between the North and the South is a persistent feature of the Italian economy.[17]

Since we use a panel of banks, we can approximate differences in banking competition across markets by using either: a) different characteristics between local and non-local banks; or b) differences among their geographical headquarters' location or operation with their branch network.

In line with the literature on local intermediaries (see, among the others, Demma, 2015, and Stefani et al., 2016), we consider as *local* exclusively those intermediaries that exert the banking activity as mutual banks and that operate in their local credit markets to support the development of the economy where they are headquartered. To this end, we interacted the log of marginal cost with a dummy variable identifying the *status* of mutual banks (MBs). Indeed, the special nature of these banks makes these intermediaries quite different relative to traditional ones, in terms of governance, regulation and pursuit of profit maximization.[18] Differential effects in competition among groups of banks, distinguishing mutual banks *versus* commercial ones, are reported in Table 6. The elasticity of profit to marginal costs remains negative and statistically significant (with a higher estimated coefficient; see column 2); however, the general negative effect was partially offset by the impact on elasticity valid only for mutual banks: the estimated coefficient on the interaction term was positive and equal to 0.673. This finding suggests that in the local credit markets where these mutual intermediaries operate the competition was on average effective to a lower extent, maybe due to the fact that these banks benefit from their informational advantage in relationship lending, stemming from their more focused network of branches on the local credit markets. Moreover, this finding is robust to adding more control variables at bank level to the model, as shown in column (3).

To disentangle credit markets along the main geographical areas, we have considered the location of the bank headquarters and built four dummies that equal 1 in case of bank location in each of the four Italian macro-areas (North-West, North-East, Centre, South and Islands), and zero otherwise (respectively, *duhqNW*, *duhqNE*, *duhqCE*, *duhqSH*). In order to appreciate

[17] According to the literature, the banking system in Northern Italy has been traditionally more competitive than the Southern one (Cotula et al., 1996). Looking at the Herfindahl index for loans in the regional markets, historically concentration was higher in the South than in the North, while in more recent years concentration decreased especially in Southern Italy (Piselli and Vercelli, 2016); in 2010 concentration was quite homogeneous across the entire country (De Bonis et al., 2018).

[18] *Banche popolari* are Italian cooperative banks that are not subject to the same limitations in terms of territorial activities and profit maximization set for the mutual banks. So, even with a cooperative legal institutional form, Italian popular banks are more similar in size and business models to commercial banks as limited companies. This is why we pool popular banks together with commercial ones and we estimate also distinct marginal costs for the two groups of banks (commercial versus mutual), using differentiated TCFs.

differences in competition along geographical areas, we have interacted the marginal cost with each of the area dummies and we have added interaction terms to the model in the PE equation. Results are reported in Table 7. Columns (1)-(4) present differential effects for each areas separately to respect to the others: findings on the interaction terms are significant and positive only for the Noth-East, suggesting less competitive conditions in this market. In column (5) we run a unique regression using as benchmark area the North-East and we find that in all other areas there are more competitive credit markets (the interactions terms in NW, CE and SH are negative and significant). Finally, in the last column, we add to the model also the interaction with the dummy mutual bank and we find that the differential (positive) effect, found previously for these local intermediaries, remains robust in the main four geographical areas where banks are headquartered.

However, even if headquarters' location is a classical proxy in the banking literature to identify geographical credit markets, it is important to notice that it cannot take into account the real degree of activity of each intermediary in the different areas. This is particularly the case of the larger banks, which are obviously located with their headquarters in a given area but could operate in any of the four Italian macro-regions. Therefore, in order to better identify credit markets along the main geographical areas, we have used an alternative proxy to allocate banks in the different macro-areas on the basis of their market shares.

In particular, we have calculated the market share of branches of each bank in our sample at the end of each year, distinguishing the four Italian macro-areas, and we have built four dummies (one for every of the four macro-areas, e.g. *dubranchNW*, *dubranchNE*, *dubranchCE*, *dubranchSH*) that equal 1 if a given bank has a market share of branches in a given area greater than the 25th percentile of the yearly distribution of the bank branches' market share of intermediaries that actually operate in that area, and zero otherwise.[19] By this way, we end up with a set of four dummies measuring the relevant activity of each bank in every of the four macro-regional credit markets, going beyond the headquarters' location. Moreover, this approach allows us to have the majority of the local banks assigned to the area where they are headquartered and they effectively operate (or with a relevant activity in no areas, in case of a share of branches lesser than the 25th percentile in the area where they are located). At the same time, larger banks may have more than one of the dummies equal to 1, signaling that they have a relevant activity in terms of branch network in all the different geographical areas, and, furthermore, their relevant operational market share can vary during time.

In line with the previous analysis we adopt the same estimation strategy, by interacting marginal costs with the four territorial dummies calculated according

[19]Since we have a panel of banks, we have built the share of the branches that each bank i has at time t in the four Italian macro areas compared to its total branches. The dummy *area* for bank i, at time t, in the macroarea a is 1 if the bank i,t has a share higher than the 25-percentile of the annual distribution of the shares of all "rival" banks that actually operate in the considered area. MBs generally have all branches in the area of reference and therefore have shares equal to 100 percent (and dummy *area* equal to 1 in a single geographical area, except for marginal cases of dummy 0). Since small local banks could have lower branch market shares (and could be not assigned to any areas), we have run some sensitivity analysis of this cut-off, using less restrictive percentile (p-20, p-15) of the yearly distribution of the bank branches' market share, and our results are confirmed.

to the geographical distribution of the bank branch network, to better appreciate differences in the extent of competition across regional credit markets within the same panel of banks.

The main results of this exercise are reported in Table 8. Over the entire period, the elasticity of marginal cost to net profit is negative and highly significant in all of the four Italian macro-regional credit markets (columns (1)-(4)), but the interaction terms of the marginal costs with the branch dummies are generally not statistically significant, with the exception of the South (only at 10 percent). Furthermore, the general negative elasticity of marginal cost to net profit was partially offset by the impact on profit elasticity found for mutual banks in any of the regional credit markets. Therefore, in all areas these mutual intermediaries are able to operate in more 'protected' markets, using their informational advantage, stemming from relationship lending with small and opaque customers, as entry barriers on specific clusters of clients.

Focusing the attention on the last column, where all the regional markets are considered together (with the North-East as benchmark area), we find evidence that confirms previous geographical results using the headquarters' location (Table 7), with more competitive conditions in North-West, Centre and South to respect to North-Eastern regions. Moreover, the positive differential effect on the level of competition for mutual local banks holds, in magnitude and in significance, as found previously (see Table 6). Indeed, since mutual banks are mainly headquartered in North-East (especially in Trentino), with their branch networks also concentrated in that area, it is more likely that North-Eastern credit markets are less competitive than elsewhere, probably due to the prominent role of these special banks with a local network of branches and able to impose informational barriers to enter those markets.

5 Conclusions

Competition in banking system is potentially beneficial to efficiency in order to protect customers, as in other economic sectors. However, its measurement is a very critical issue. Furthermore, the recent economic and financial crisis induced many (large and small) banks to reduce their traditional branch networks, in order to contain operational costs and gain profitability. These phenomena presumably had a significant impact on local credit markets' structure and competitiveness.

In this study we explore new measurements of competition, based on the Profit Elasticity approach (Boone, 2008), in order to assess significant changes in the Italian banking system over two decades (1994-2013), including the crisis period. To this end, we build a very rich dataset on Italian banks' balance sheet statements, reporting detailed information on costs, revenues and bank profits, combined with Bank of Italy's Census of banks, recording information on branch network, institutional form, governance regime, headquarters' location, and so on. Moreover, the detailed information during time and at regional-level, mainly referring to branches' localization, allows us to devote a special focus to investigate if the Great Recession, occurred after the Lehman's collapse, enhanced or exacerbated the competition process and to disentangle if there were significant differences in competition for local banks or local credit markets

in the main geographical areas.

According to our main results, the Profit Elasticity index was negative and statistically significant for Italian banks, along the 20 years under examination, signaling that less efficient banks in terms of marginal costs were negatively affected by a higher decline in their net profits. Considering different sub-periods, competition deteriorated with the business cycle and became to a halt during the Global Financial crisis and the Sovereign Debt crisis, relative to the pre-crisis period, especially between the end of 1990s and the beginning of 2000s. Distinguishing between commercial banks and local mutual banks, competition was less effective for the latter, presumably due to the fact that the special nature of these intermediaries - in terms of objective and profit maximization - makes them less reactive to reduce their costs of structure, and their informational advantage in relationship lending could generate some entry barriers in their local credit markets. Moreover, Italian macro-regions exhibited heterogeneity in competitive levels: in particular, Northeastern regions, where are located many mutual banks, seem to have a bit less competitive credit markets than elsewhere.

Thus, deregulation aimed to boost bank competition has been effective during booms, even in period of increased concentration in the market, as at the beginning of 2000s, while in crisis periods the competition process has been hampered by the adverse business cycle, which reduced profit elasticity to marginal cost. Furthermore, local banks seem able to take advantage from their relationship lending and to generate entry informational barriers in local credit markets that partially offset competition, mainly in those areas where they exert a prominent role. In this respect, the recent Italian reform on mutual banks (in force since 2019), with the aim to create more capitalized and efficient mutual banks by some mutual banking groups, could attenuate differences in competition between local and non-local intermediaries.

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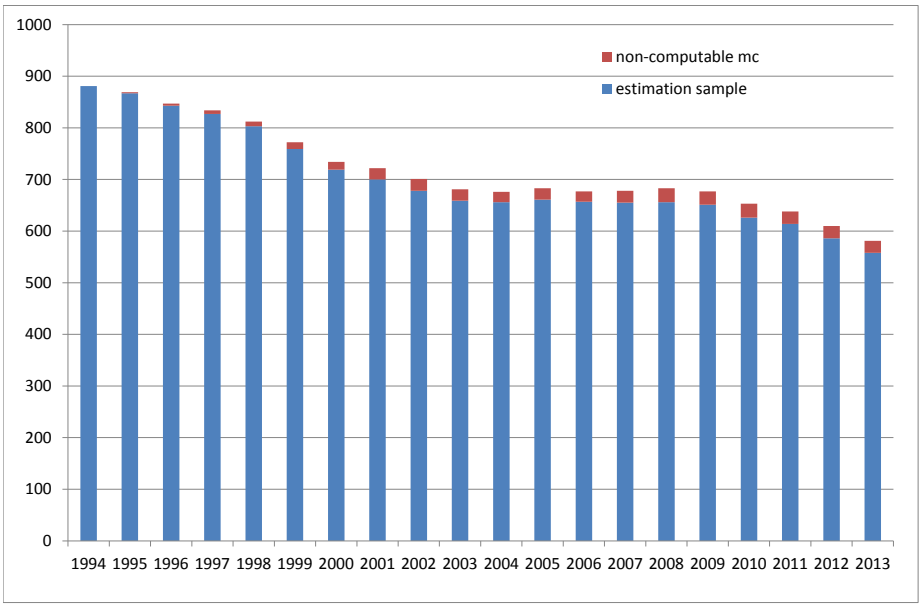
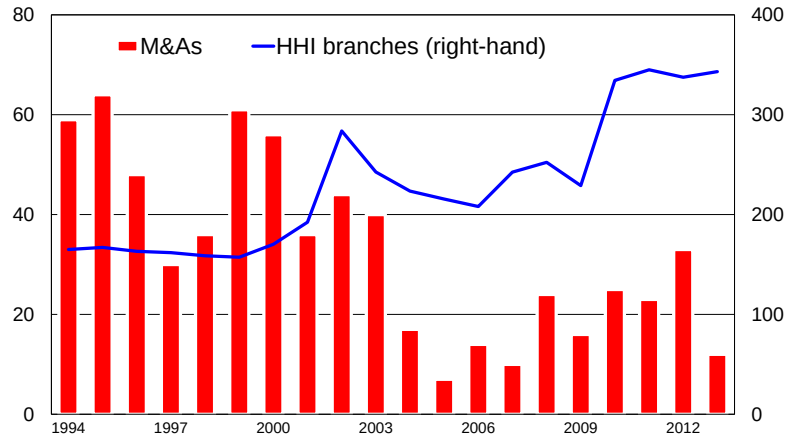
Figures and tables

Figure 1: **The sample of Italian banks over time: 1994-2013**



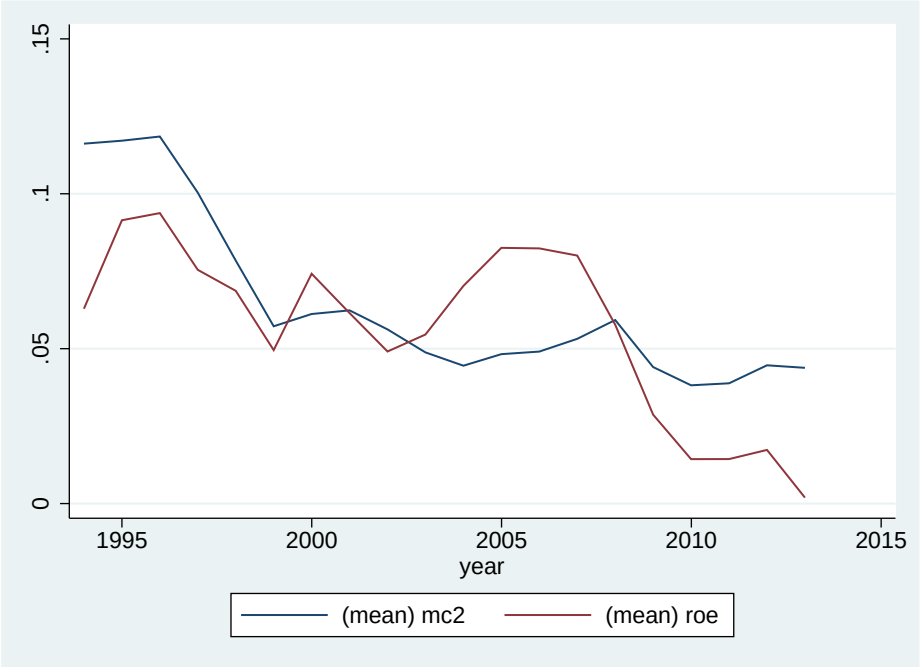
Source: authors' elaborations on Bank of Italy's data (1994-2013). The figure reports the number of banks per year used in the estimation of the TCF, as in equation (1) (the blue bar), to respect with the universe of Italian banks (the red bar).

Figure 2: **M&As and concentration**



Source: authors' elaborations on Bank of Italy's data (1994-2013). The figure reports the number of bank M&As per year (left hand-side) and the HHI per year calculated on bank branches.

Figure 3: **The evolution of bank marginal cost and profitability over time: 1994-2013**



Source: authors' elaborations on Bank of Italy's data (1994-2013). The figure reports the average value by year of the estimated marginal cost and of the Return on Equity (ROE), as a measure of profitability.

Table 1: **The Italian credit market: structure**

		Banks			Branches				
Years		CBs	MBs		CBs	MBs	HHI	C3	C5
1994	907	265	642	22,258	20,009	2,249	165.0	14.1	21.0
1995	911	293	618	23,322	20,945	2,377	167.1	14.1	20.8
1996	879	288	591	24,305	21,776	2,529	163.2	13.8	20.2
1997	873	290	583	25,156	22,497	2,659	161.9	13.3	19.5
1998	854	291	563	26,170	23,397	2,773	158.8	12.8	18.9
1999	811	280	531	27,043	24,181	2,862	157.3	12.4	18.6
2000	777	278	499	28,083	25,130	2,953	170.3	13.9	20.5
2001	763	289	474	29,150	26,107	3,043	192.4	16.5	23.0
2002	744	283	461	29,804	26,613	3,191	283.8	24.1	31.7
2003	716	271	445	30,224	26,903	3,321	242.6	20.6	27.9
2004	713	274	439	30,815	27,350	3,465	223.6	19.4	26.6
2005	717	278	439	31,392	27,787	3,605	215.5	19.0	26.2
2006	718	282	436	32,209	28,456	3,753	208.1	18.4	25.6
2007	727	287	440	33,071	29,148	3,923	242.5	21.3	27.7
2008	715	283	432	33,942	29,819	4,123	252.4	23.0	29.9
2009	706	285	421	33,728	29,480	4,248	229.1	21.6	28.1
2010	685	270	415	33,340	28,967	4,373	334.4	27.4	32.2
2011	661	250	411	33,249	28,817	4,432	345.0	26.9	34.6
2012	628	234	394	32,549	28,104	4,445	337.6	26.2	34.0
2013	604	219	385	31,500	27,052	4,448	343.2	26.2	34.3

Source: authors' elaborations on Bank of Italy's Census of banks and Supervisory Reports (1994-2013). Notes: figures do include commercial and cooperative banks (pooled together as CBs) and mutual banks (MBs); do not include branches of foreign banks and special institutions. HHI is the Herfindahl-Hirschmann index computed on the market shares of branches (x 10,000). C3 and C5 are the percentage market shares of the largest 3 or 5 banks, respectively.

Table 2: **Outputs, inputs and controls in the TCF**

VARIABLES	Mean	Median	Std dev.
Total costs / total assets	5.30	4.58	2.55
Loans / total assets	49.27	48.89	16.80
Securities / total assets	22.26	21.22	12.77
Service revenues / gross income	16.12	12.78	20.40
Funding rate	3.71	2.69	2.75
Labour costs / total assets	1.49	1.39	1.02
Other costs / total assets	1.48	1.32	1.28
Equity / total assets	11.33	10.15	6.59

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: indicators are reported in percentages if not diversely specified.

Table 3: **Banks characteristics and the PE estimation**

VARIABLES	Mean	Median	Std dev.
1994-2013			
Return on assets (ROA)	0.75	0.84	1.74
Return on equity (ROE)	5.84	6.01	10.96
Profit before taxes (log)	14.71	14.50	1.83
Net profit (log)	14.33	14.20	1.82
Marginal cost (CBs *versus* MBs)	6.03	5.20	40.50
Riskbank (bad loans on total loans)	6.24	3.80	7.37
Equity ratio (equity on total assets)	11.33	10.15	6.59
Cost-to-income ratio (operating costs on gross income)	70.62	67.68	63.04
Liabilities / total loans	187.53	145.48	607.20
Liquid ratio (cash on total assets)	20.46	18.82	17.59
2007-2013			
Return on assets (ROA)	0.35	0.51	1.90
Return on equity (ROE)	3.15	3.16	8.47
Profit before taxes (log)	14.96	14.75	1.75
Net profit (log)	14.54	14.38	1.81
Marginal cost (CBs *versus* MBs)	4.59	4.00	5.45
Riskbank (bad loans on total loans)	5.24	3.93	4.69
Equity ratio (equity on total assets)	12.14	11.01	6.75
Cost-to-income ratio (operating costs on gross income)	73.25	68.53	64.75
Liabilities / total loans	159.37	123.13	229.28
Liquid ratio (cash on total assets)	3.41	0.62	8.74

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013).
Notes: indicators are reported in percentages if not diversely specified.

Table 4: **Profit Elasticity Index for Italian banks (1994-2013)**

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	basic	controls	corBK	roe	Gprofit	2SLS
$ln(marginalcost)_{bt-1}$	-0.757***	-0.699***	-0.587***	-0.746***	-0.377***	
	(0.117)	(0.102)	(0.099)	(0.107)	(0.060)	
$ln(marginalcost)_{bt}$						-0.854***
						(0.108)
$riskbank_{bt-1}$		-2.980***	-2.225***	-2.813***	-1.980***	-2.891***
		(0.444)	(0.411)	(0.435)	(0.224)	(0.432)
$equity\_asset_{bt-1}$		-1.150*	0.505	-7.024***	-0.360	-1.392**
		(0.690)	(0.631)	(0.824)	(0.389)	(0.681)
$ln(asset)_{bt-1}$		0.599***	0.604***	-0.245***	0.915***	0.606***
		(0.069)	(0.067)	(0.074)	(0.043)	(0.065)
$corr\_BK_{bt}$			-0.928***			
			(0.004)			
Dummy year	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Constant	11.648***	-0.017	0.103	-0.549	-3.873***	
	(0.392)	(1.550)	(1.491)	(1.686)	(0.930)	
Observations	11,754	11,471	12,392	11,471	12,148	11,393
R^2	0.857	0.865	0.970	0.551	0.962	0.222
adjr2	0.844	0.852	0.967	0.507	0.959	0.152
clusters	1,009	985	1,035	985	1,011	915

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: Columns (1)-(5) report OLS estimates of equation (2) with bank fixed effects and year dummies, while column (6) reports 2SLS estimate with bank and year fixed effects. Standard errors are clustered at bank level. The dependent variable is the log of net earnings (profits) of bank b in year t, with the exception of columns (4) and (5) where the dependent variable is, respectively, ROE and a gross margin. In column (3) we apply the Bos Koetter correction for negative profit and we add to the model the variable $corr\_BK_{bt}$. The explanatory variables are: $ln(marginal\_cost)_{bt-1}$ (bank b's log of marginal cost at time $t-1$); $riskbank_{bt-1}$ (share of non performing loans on total loans at time $t-1$); $equity\_ratio_{bt-1}$ (share of capital and reserves on total assets at time $t-1$); $ln(asset)_{bt-1}$ (log of total assets at time $t-1$). The estimations do not include banks for which the estimated marginal costs, obtained from the *Translog Cost Function (TCF)*, were negative (less than the 1st percentile of the distribution on the overall period). *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 5: **Profit Elasticity Index for Italian banks, by sub-periods**

VARIABLES	(1) Y_1994-99	(2) Y_2000-06	(3) Y_2007-13	(4) Y_1994-2013
$ln(marginalcost)_{bt-1}$	-0.451**	-0.732***	-0.520***	-0.170***
	(0.186)	(0.182)	(0.188)	(0.049)
$ln(marginalcost) \times dy0006_{bt-1}$				-0.774***
				(0.118)
$ln(marginalcost) \times dy0713_{bt-1}$				0.231**
				(0.104)
$dy0006_{t-1}$				-2.105***
				(0.355)
$dy0713_{t-1}$				0.693**
				(0.322)
Dummy year	YES	YES	YES	NO
Bank FE	YES	YES	YES	YES
Constant	12.684***	12.705***	12.490***	13.827***
	(0.486)	(0.582)	(0.625)	(0.124)
Observations	3,765	4,373	3,616	11,754
R^2	0.908	0.926	0.860	0.843
adjr2	0.879	0.910	0.828	0.829
clusters	877	757	672	1,009

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: Columns (1)-(4) report OLS estimates of equation (2) with bank fixed effects and year dummies or dummy for time period (interacted with marginal costs). Standard errors (in parenthesis) are clustered at bank level. The dependent variable is the log of net earnings (profits) of bank b in year t. The main explanatory variable is: $ln(marginal\_cost)_{bt-1}$ (bank b's log of marginal cost at time $t-1$). The estimations do not include banks for which the estimated marginal costs, obtained from the *Translog Cost Function (TCF)*, were negative (less than the 1st percentile of the distribution on the overall period). *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 6: **Profit Elasticity Index for Italian banks: differential effects for MBs**

VARIABLES	(1) PE_basic	(2) PE_MBs	(3) PE_MBs_controls
$ln(marginalcost)_{bt-1}$	-0.757***	-0.912***	-0.892***
	(0.117)	(0.117)	(0.100)
$ln(marginalcost)_{bt-1} \times dummy\_MB$		0.673***	0.720***
		(0.064)	(0.061)
$riskbank_{bt-1}$			-3.051***
			(0.401)
$equity\_asset_{bt-1}$			-0.329
			(0.650)
$ln(asset)_{bt-1}$			0.690***
			(0.063)
Dummy year	YES	YES	YES
Bank FE	YES	YES	YES
Constant	11.648***	12.717***	-0.900
	(0.392)	(0.380)	(1.390)
Observations	11,754	11,754	11,471
R^2	0.857	0.862	0.870
adjr2	0.844	0.849	0.858
clusters	1,009	1009	985

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: Columns (1)-(3) report OLS estimates of equation (2) with bank fixed effects and year dummies. Standard errors (in parenthesis) are clustered the bank level. The dependent variable is the log of net earnings (profits) of bank b in year t. The explanatory variables are: $ln(marginal\_cost)_{bt-1}$ (bank b's log of marginal cost at time $t-1$); the interaction of the marginal cost with a dummy_MB, which is equal to 1 if the bank is a mutual bank. In column (3) are included in the model the same bank-level controls as in the baseline (capital, risk and size). The estimations do not include banks for which the estimated marginal costs, obtained from the *Translog Cost Function (TCF)*, were negative (less than the 1st percentile of the distribution on the overall period). *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 7: **Profit Elasticity Index for Italian banks: differential effects by areas and MBs**

VARIABLES	(1) PE_NW	(2) PE_NE	(3) PE_CE	(4) PE_SH	(5) AllAreas	(6) Area&MBs
$ln(mc)_{bt-1}$	-0.686***	-0.807***	-0.718***	-0.725***	-0.494***	-0.749***
	(0.110)	(0.118)	(0.122)	(0.115)	(0.117)	(0.121)
$ln(mc) \times duhqNW_{bt-1}$	-0.214**				-0.365***	-0.186**
	(0.089)				(0.093)	(0.084)
$duhqNW_{bt-1}$	-0.247				-0.797**	-0.155
	(0.443)				(0.406)	(0.346)
$ln(mc) \times duhqNE_{bt-1}$		0.302***				
		(0.057)				
$duhqNE_{bt-1}$		0.695*				
		(0.393)				
$ln(mc) \times duhqCE_{bt-1}$			-0.114		-0.286***	-0.148**
			(0.071)		(0.073)	(0.070)
$duhqCE_{bt-1}$			-0.397		-0.837**	-0.299
			(0.327)		(0.422)	(0.359)
$ln(mc) \times duhqSH_{bt-1}$				-0.082	-0.257***	-0.229***
				(0.076)	(0.079)	(0.075)
$duhqSH_{bt-1}$				-0.698	-0.909	-0.281
				(1.095)	(1.082)	(1.094)
$ln(mc) \times du\_MB_{bt-1}$						0.643***
						(0.064)
Dummy year	YES	YES	YES	YES	YES	YES
Bank FE	YES	YES	YES	YES	YES	YES
Constant	11.809***	11.628***	11.792***	11.866***	12.462***	12.973***
	(0.382)	(0.412)	(0.408)	(0.472)	(0.517)	(0.506)
Observations	11,682	11,682	11,682	11,682	11,682	11,682
R^2	0.857	0.858	0.857	0.857	0.858	0.862
adjr2	0.844	0.845	0.844	0.844	0.845	0.849
clusters	997	997	997	997	997	997

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: the four geographical areas and dummies are identified considering bank headquarters' location. Columns (1)-(6) report OLS estimates of equation (2) with bank fixed effects and year dummies. Standard errors (in parenthesis) are clustered at bank level. The dependent variable is the log of net earnings (profits) of bank b in year t. The explanatory variables are: $ln(marginal\_cost)_{bt-1}$ (bank b's log of marginal cost at time $t-1$); the interaction of marginal cost with a dummy_MB, which is equal to 1 if the bank is a mutual bank. The estimations do not include banks for which the estimated marginal costs, obtained from the *Translog Cost Function (TCF)*, were negative (less than the 1st percentile of the distribution on the overall period). *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 8: **Profit Elasticity Index for Italian banks: differential effects across local banks and credit markets**

VARIABLES		(1) North-West	(2) North-East	(3) Centre	(4) South	(5) All Areas
$ln(marginalcost)_{bt-1}$		-0.898***	-0.895***	-0.868***	-0.877***	-0.739***
		(0.115)	(0.120)	(0.121)	(0.119)	(0.121)
$ln(marginalcost)$ $dummy\_MB_{bt-1}$	×	0.667***	0.634***	0.655***	0.682***	0.635***
		(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
$ln(marginalcost)$ $du\_branchNW_{bt-1}$	×	-0.053				-0.157*
		(0.083)				(0.085)
$du\_branchNW_{bt-1}$		-0.313				-0.564
		(0.364)				(0.369)
$ln(marginalcost)$ $du\_branchNE_{bt-1}$	×		0.020			
			(0.122)			
$du\_branchNE_{bt-1}$			-0.131			
			(0.384)			
$ln(marginalcost)$ $du\_branchCE_{bt-1}$	×			-0.086		-0.174**
				(0.068)		(0.070)
$du\_branchCE_{bt-1}$				-0.051		-0.311
				(0.266)		(0.268)
$ln(marginalcost)$ $du\_branchSH_{bt-1}$	×				-0.277*	-0.358**
					(0.158)	(0.158)
$du\_branchSH_{bt-1}$					-0.720	-0.908*
					(0.475)	(0.474)
Constant		12.773***	12.757***	12.768***	12.817***	13.097***
		(0.381)	(0.390)	(0.385)	(0.388)	(0.390)
Dummy year		YES	YES	YES	YES	YES
Bank FE		YES	YES	YES	YES	YES
Observations		11,754	11,754	11,754	11,754	11,754
R^2		0.862	0.862	0.862	0.862	0.862
adjr2		0.849	0.849	0.849	0.849	0.849
clusters		1,009	1,009	1,009	1,009	1,009

Source: authors' elaborations on Bank of Italy's Supervisory Reports (1994-2013). Notes: Columns (1)-(5) report OLS estimates of equation (2) with bank fixed effects and year dummies. Standard errors (in parenthesis) are clustered at bank level. See footnote of Table 6 for more details. Banks are considered with a relevant activity in a given area according to their share of branches (if the share of their branches is higher than the first quartile value of the yearly-distribution of the share of bank branches in each area; we build four dummies (*dummy branch* NW, NE, CE and South) equal to 1 according to the previous geographical criteria). *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Appendix

Table 9: **Translog Cost Function**

	(1)		(2)		(3)	
Variables	all banks		CBs		MBs	
Outputs						
$ln(loans)$	-0.253**	(0.105)	-0.254**	(0.128)	-0.238*	(0.153)
$ln(loans)^2$	0.084***	(0.006)	0.075***	(0.006)	0.084***	(0.008)
$ln(securities)$	0.305***	(0.061)	0.261***	(0.062)	0.151**	(0.075)
$ln(securities)^2$	0.016***	(0.002)	0.013***	(0.002)	0.081***	(0.005)
$ln(other\ services)$	0.385***	(0.095)	0.245**	(0.116)	0.343***	(0.116)
$ln(other\ services)^2$	0.046***	(0.005)	0.045***	(0.006)	0.015***	(0.004)
Input prices						
$ln(wage)$	0.493***	(0.123)	0.335*	(0.185)	1.068***	(0.230)
$ln(wage)^2$	0.096***	(0.014)	0.089***	(0.016)	0.145***	(0.032)
$ln(fundrate)$	0.231**	(0.096)	0.222*	(0.119)	-0.397***	(0.131)
$ln(fundrate)^2$	0.070***	(0.008)	0.062***	(0.009)	0.072***	(0.012)
$ln(other\ costs)$	0.276*	(0.154)	0.444**	(0.216)	0.329	(0.242)
$ln(other\ costs)^2$	0.077***	(0.025)	0.069**	(0.030)	0.175***	(0.043)
Control variables						
$ln(equity/assets)$	0.335***	(0.052)	0.145**	(0.065)	-0.197***	(0.055)
$ln(equity/assets)^2$	0.076***	(0.011)	0.041***	(0.013)	-0.024**	(0.012)
$Constant$	9.124***	(0.616)	10.751***	(0.820)	9.796***	(0.894)
$Cross\ products$	YES		YES		YES	
$Year\ dummies$	YES		YES		YES	
Obs	14,056		4,585		9,471	
$F-test$	31125.42***		6810.89***		26975.42***	

Source: authors' elaborations on Bank of Italy's Supervisory Reports. Notes: estimated coefficients over the years 1994-2013 on bank outputs and inputs, using a TCF as in equation (1) reported in the text, for the whole sample of Italian banks (column (1)), and separately for commercial banks (column (2)) versus mutual banks (columns (3)). We employ estimated coefficients in columns (2) and (3) to obtain distinct marginal costs for the two clusters of banks (commercial vs mutual intermediaries) to use in the estimation of the PE indicator, as in equation (2) in the text. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

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