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Competition Among Dominant Firms in Concentrated Markets: Evidence from the Italian Banking Industry

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ABSTRACT

Conventional models of the industrial organisation theory usually state that in concentrated industries firms have significant market power, and that competition can be easily reduced if the leading firms collude. However, recent theoretical analyses show that strong concentration does not necessarily prevent competition among firms. In this paper we consider the Italian banking industry, where the eight largest firms operate at a national level, manage about a half of total loans, and have a notably larger dimension than the other competitors. We estimate a structural model – formed by a demand equation, a cost equation and a price-cost margin equation, the latter containing a behavioural parameter – to assess the market conduct of the largest banks for the period 1988-2000. Our finding is that, in spite of their noteworthy size and significant market share, in these years the largest banks have been characterised by a more competitive conduct than the Cournot outcome: this is in line with the results of the latest literature of the field, for which in the banking industry there is often no conflict between competition and concentration.

KEYWORDS: Banking; Competition; Market structure

JEL CLASSIFICATION: G21, L10

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1. Introduction

In the past two decades, European banking markets have been subjected to structural changes, which were caused by modifications occurred in the external environment especially as a consequence of the increasing monetary and financial integration. The gradual liberalisation of capital flows and the prospect of a common market have undoubtedly influenced the policy of the domestic banks, also concerned about the competitive pressure from foreign rivals. This has pushed banks to search for more efficient organisational solutions, greater variety of the offered services and stronger exploitation of scale economies. The last of these phenomena has taken place thanks to the increasing consolidation. It generally consisted in the acquisition (either partial or total) of ownership of national or foreign credit institutions as well as in making agreements with other banks, and has led to a fall in the number of banks.

It is crucial to assess whether such modifications have had an impact on the degree of competition characterising the banking industry, because of the potential for monopoly power that the consolidation process could produce. Actually, when compared with the beginning of the last decade, the main Italian credit institutions now enjoy both a larger size and a higher proportion of deposits and loans.

This paper aims to evaluate the degree of competition of the eight Italian largest banks (the only operating throughout the whole country, and also involved in many mergers and acquisitions) during the period from 1988 to 2000. In this way, we are able to evaluate their average conduct, and thus shed light on the possibility that few large and important banks could use their dimension and market leadership to act as colluding oligopolists, therefore gaining all the advantages linked to the ongoing consolidation at the expense of customers.

The next section gives a brief picture of the structural evolution of the Italian banking industry over the recent years, together with a survey of the most commonly used empirical approaches for investigating the presence of competition in banking markets. Section 3 is devoted to the theoretical description of the conjectural variation model that we use to assess the level of competition among the Italian largest banks. Section 4 describes the sample characteristics and discusses the estimation results. Some conclusions are given in the last section.

2. The recent evolution of the Italian banking market

Over the last fifteen years, a profound process of consolidation occurred in the Italian banking industry, which gave rise to significant transformations, both economic and organisational. The above phenomenon is common to all the European banking markets, and derives from the phenomenon of "disintermediation" (the weakened role of banks as financial intermediaries[1]), the integration process and the related opening of the domestic financial markets, and the adoption of the single currency.

In this context, commercial banks have been forced to search for scale and scope economies, with the aim of increasing their efficiency. In Italy, a significant signal of these changes is that from 1988 to 2000 the number of commercial banks dropped from 1100 to 841 (a 24% decrease). Moreover, in the decade 1990-2000 there were 356 mergers or acquisitions. Simultaneously, the elimination of the authorisation to open additional branches (adopted in 1990 in order to promote the increase in competition in local markets, often characterised by a high degree of concentration) led to an increase of the number of branches: in the period 1988-2000 they passed from 15363 to 28175 (a 83% increase). As a result, in each province (an administrative area comprising a bigger town or city and several little neighbouring towns) in 2000 there were on average 31 operating

[1] For some details concerning the Italian context, see BRUNI (1982), VICARELLI (1982) and COCCORESE (1998b).

banks (20 in 1980); in the same year, 80% of the population could choose among 3 banks, up from 58% in 1980[2].

The belief of the Central Bank of Italy is that in the national banking industry (characterised by a prevalence of small-scale banks) there is room for exploiting wide scale economies, without prejudice to the market niches of local little banks. At the same time, mergers and acquisitions are considered as a beneficial solution compared to the closure of inefficient banks, since their exit is expected to involve economic and social costs.

In spite of the outlined changes, commercial banks have been able to maintain their outstanding role in the Italian economy and particularly in the national financial system. Actually, the reduction in the number of banks has been balanced by a remarkable increase in the number of branches, so that nowadays the Italian banking system has still the control, either directly or indirectly, of a substantial part of national savings.

Nevertheless, such changes have also amplified the concern that the reorganisation may have adverse consequences on competition as a result of the bigger market power gained by leading banks through mergers. This is especially true when there is a small number of banks with significant dimension and market share: bigger and fewer banks can find it easier to collude, charge higher rates on loans, pay less interest on deposits and charge higher fees for the offered services[3].

Accordingly, the current process of structural consolidation, related to the aspiration of an improvement in efficiency to face the enhanced competition, has cast doubts on the possibility that a competitive conduct is still possible in the banking industry. This fear derives from the structure-conduct-performance (SCP) paradigm, where the degree of competition in a market is a direct function of the number of firms and an inverse function of the average market share[4]. So, a higher concentration (fewer and larger firms) is likely to give rise to an anticompetitive conduct. The above theoretical framework is surely coherent, but the occurrence of certain conditions can lead to alternative results. One example is given by contestability, which emerges when there are no sunk costs and the hit-and-run behaviour by potential firms is possible[5]. With free entry and exit, a monopolist will prevent competition by setting fairly competitive prices: in this case, contestability ensures competitive behaviour irrespective of the number of active firms[6]. In addition, in some markets high concentration and profits might derive from the higher efficiency of firms rather than from substantial market power.

The previous point emphasises the significant role that an empirical investigation could play in assessing the degree of competition in an industry. The economic literature offers various techniques for exploring this question[7]. The traditional approach examines the relationship between structure (proxied mainly through the Herfindahl index) and return (in terms of either profitability or price), since – according to the SCP paradigm – a positive link could imply imperfect competition[8]. With reference to the banking industry, influential papers employing this methodology are those by Berger and Hannan (1989), Rhoades (1995), and Hannan (1997). A difficulty with this approach is that it is not possible to find a clear benchmark for competitive returns; furthermore, the empirical evidence for the existence of a relationship between concentration and market power is mixed.

Another method consists in a comparative-statics analysis where the identification of market power is obtained through an index (the H-statistic) calculated as the sum of the elasticities of the

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[2] See FAZIO (2000), p. 23*.

[3] For a discussion on concentration, competition and efficiency in the European banking markets, see MOLYNEUX (1999).

[4] These linkages, first formalised by MASON (1939), were developed by BAIN (1951). See also STIGLER (1964) and SCHERER (1970).

[5] The main reference for this theory is the book by BAUMOL, PANZAR and WILLIG (1982).

[6] COCCORESE (1995) discusses the possibility that the Italian banking market exhibits characteristics of contestability.

[7] See CETORELLI (1999) for an overview of the methodologies used in the analysis of competition in the banking industry.

[8] A comprehensive survey on these and related topics is given by GILBERT (1984).

reduced-form revenue with respect to all the factor prices[9]. In the latest years, this technique has been applied to the banking industry by Shaffer (1982), Nathan and Neave (1989), Molyneux *et al.* (1994), Coccorese (1998a, 2001), Bikker and Groeneveld (1998), De Bandt and Davis (2000), and Bikker and Haaf (2000).

A third possibility is the estimation of a simultaneous-equation model, where a parameter representing the behaviour of firms (and therefore the degree of their market power) is included. It can be interpreted as a conjectural variation coefficient[10], or as the deviation of the perceived marginal revenue schedule of a firm in the industry from the demand schedule[11]. Empirical implementations of this technique within a banking context have been performed by Shaffer (1989, 1993), Berg and Kim (1994), Shaffer and DiSalvo (1994), Coccorese (1998b), and Angelini and Cetorelli (2000). The advantage of this approach is the direct analysis of the firms' conduct (rather than the overall market structure), thus avoiding indirect (and sometimes ambiguous) inferences about market power through indicators of concentration. The main limitation is the need of detailed information on costs and demand[12].

Our study conforms to the last approach. It tries to verify whether the assertion that "there is a great deal of market power, in the sense of price-cost margins, in some concentrated industries"[13] is applicable to the banking industry. We consider the Italian context, where only eight banks can be considered as "national", meaning that their reference market is the whole country, while the other banks generally have a much more limited area of business. As a matter of fact, the data show that local banking markets are mainly oligopolies, where the most powerful firms are small-size banks. It has been calculated that in more than half of the Italian provinces only two banks account for half of the deposits, while in another third of provinces only three are necessary[14].

The local forms of oligopoly can be explained by considering the possibility that, due to the presence of asymmetric information between lenders (banks) and borrowers (customers), some assets could not be recovered entirely, and hence are sunk costs. Particularly, a bank loan represents a sunk cost depending on its category. For example, if a bank wants to leave the market, assets like government bonds, interbank loans and credits to large-size firms may not be regarded as sunk costs, since the whole market knows the debtor's degree of solvency. In contrast, the credits linked to a guarantee as well as the specific loans (especially if they have been given to small firms) can be considered as sunk costs to a much larger extent, because they imply a personal relationship between creditor and debtor whose specificity hinders its transfer to other credit institutions, who do not know the exact associated degree of risk. We can conclude that there is strong competition between banks for the loans to large firms due to the absence of sunk costs, while on the other hand the information asymmetries, and related costs of exit, persuade a bank operating in a local market – no matter its size – to reduce its competitive pressure on the other rivals, or even to come to a collusive agreement with them[15].

In this picture, the role of the largest (i.e. national) banks needs to be established. It is believable that they are able to exercise competitive pressures also in local concentrated markets because of their dimension and the resulting possibility of enjoying scale economies, which could balance the lack of territorial roots and information about the local clientele. Moreover, the significant proportion of managed deposits and loans could induce them to cooperative agreements in order to better exploit their dominant position and act as leaders. Finally, in the last years they have been characterised by an outstanding consolidation trend (mergers and acquisitions) that has allowed them to gain access to local markets too.

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[9] See ROSSE and PANZAR (1977), and PANZAR and ROSSE (1987).
[10] See IWATA (1974), APPELBAUM (1979, 1982), ROBERTS (1984), ROLLER and SICKLER (2000).
[11] See BRESNAHAN (1982), LAU (1982), ALEXANDER (1988).
[12] See CETORELLI (1999), p. 6-7.
[13] See BRESNAHAN (1989), p. 1052.
[14] See PADOA-SCHIOPPA (1995), p. 55*-56*.
[15] Starting from these issues, DI BATTISTA and GRILLO (1988) use the theory of contestability to analyse the role and extent of competition in Italian banking industry. On the same argument, see also COCCORESE (1998a), p. 185-186.

Tables 1 and 2 help to depict a thorough picture of the structural characteristics and the evolution of the Italian banking market, with reference both to its global structure and to the situation of the largest banks.

3. A conjectural variation model of competition

In the following analysis, we focus on the largest banks only, treating them as the only firms in the market. This assumption is approximately correct considering the above description of the Italian banking industry. In spite of the many banks operating at a local level, the "national" market is an oligopoly where only the eight main banks can compete: they can exploit scale economies and rely on a good and established reputation, also secured by their dimension that avoids the thread of new entries. Competition among these banks takes place especially on the demand for loans coming from the largest national producers. At the same time, in local credit markets (i.e. in the various limited geographical areas) they must also face the fierce competition from the little banks. Data display this situation: as Table 2 points out, the eight banks under consideration manage about half of loans. Nonetheless, the role of the other banks is still potentially important, and the largest banks' behavioural parameter we are going to estimate can detect it.

We use a price-setting model, thus assuming product differentiation between firms as well as price competition. The hypothesis is that for every bank the demand for loans depends on its own price, the price of rivals and other exogenous factors, particularly national income and bank size.

Each bank is supposed to face the following demand function:

$$q_{it} = q_{it}(p_{it}, p_{jt}, D_{it}), \qquad i = 1, \ldots, N \tag{1}$$

where q_{it} is the quantity demanded, p_{it} is the price charged by bank *i*, p_{jt} is an index of the competitors' prices, D_{it} is a vector of exogenous factors which affect demand, and *N* is the number of banks here considered (therefore, eight).

For each bank, we will use a weighted average price of the other seven banks as a proxy of the opponents' price. In this way, we treat the market for loans as a duopolistic market, where each firm faces a single rival whose dimension is the average dimension of the seven remaining banks, and therefore the demand for each firm depends only on the average price of this group of firms[16]. In addition, we consider only one output (i.e. loans): in spite of the multi-product nature of banks, this assumption seems widely acceptable given that credit intermediation is still the predominant activity of commercial banks.

We expect that the own-price elasticity of demand is negative, while its magnitude reflects whether consumers regard the loans of the considered banks as poor or good substitutes. We also expect that the own-price elasticity is larger than the cross-price elasticity, if we admit that banks are able to soften price competition by providing other fringe services.

It seems important to take into account the reaction of customers through the evaluation of the elasticity coefficients: the possibility of exploiting some market power would surely force banks toward an increase in loan rates, but in this case a high demand elasticity would also remarkably reduce the demand for loans as a consequence of the price increase. Therefore, banks will not be able to use entirely their market power, and there will be also the possibility that some of them lower prices in order to increase their market share at expense of others. In the latter case, an increase in competition will result.

The cost function is assumed to be affected by the quantity of output q_{it} as well as the price ω_{it} of input factors:

[16] See also ROLLER and SICKLES (2000), p. 849.

$$C_{it} = C_{it}\left(q_{it}(\cdot), \omega_{it}\right). \tag{2}$$

Omitting the time subscript for notational convenience, we can write the profit function of each bank in the following way:

$$\pi_i = q_i(\cdot)\, p_i - C_i\left(q_i(\cdot), \omega_i\right). \tag{3}$$

The maximisation program implies that

$$\frac{\partial \pi_i}{\partial p_i} = q_i + \left(p_i - MC_i(\cdot)\right)\left(\frac{\partial q_i}{\partial p_i} + \frac{\partial q_i}{\partial p_j}\frac{\partial p_j}{\partial p_i}\right) = 0, \tag{4}$$

where $MC_i(\cdot) = \dfrac{\partial C_i}{\partial q_i}$ is the marginal cost function. Rearranging the above expression, the first-order condition for bank *i* can be written as:

$$\frac{p_i - MC_i}{p_i} = -\frac{1}{\varepsilon_{ii} + \lambda \varepsilon_{ij}\dfrac{p_i}{p_j}}. \tag{5}$$

Here $\varepsilon_{ii} = \dfrac{\partial q_i}{\partial p_i}\dfrac{p_i}{q_i}$ and $\varepsilon_{ij} = \dfrac{\partial q_i}{\partial p_j}\dfrac{p_j}{q_i}$ are the own-price elasticity and the cross-price elasticity of demand, respectively, and $\lambda = \dfrac{\partial p_j}{\partial p_i}$ is the conjectural variation parameter of firm *i*. If identified, this conjectural derivative expresses the degree of coordination of banks. A positive value of λ indicates that a firm expects the rivals to match its price, thus cooperating in holding revenues at a profitable level. Perfectly collusive behaviour is characterised by a unit value of λ. When $\lambda = 0$, the behaviour is coherent with a Cournot-Nash equilibrium in prices, because each firm does not consider rivals' choices when setting its price (and it does not react to changes in the other firms' behaviour). Finally, a negative conjectural derivative means that a firm contemplating a price increase expects its rivals to react in a competitive fashion by reducing their prices[17]. Perfect competition implies that $\lambda = -\infty$, what changes expression (5) in the well-known competitive equilibrium condition $p = MC$.

The conjectural variation index λ is identified in the system formed by equations (1), (2) and (5). With reference to costs, we consider a translog function, which is common in the analysis of banking markets since this functional form can deal with both scale and scope economies in the multiproduct firms[18]. Given *m* generic inputs and one output, firm *i*'s total cost function is therefore:

$$\ln C_i = \beta_0 + b_0 \ln q_i + \frac{b_1}{2}(\ln q_i)^2 + \sum_{r=1}^{m} \beta_r \ln \omega_{ri} + \ln q_i \sum_{r=1}^{m} b_{r+1} \ln \omega_{ri} +$$

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[17] See MARTIN (1993), p. 25.

[18] The translog function was first proposed by CHRISTENSEN *et al.* (1971), and then extended to the multiproduct context by BROWN *et al.* (1979). Among the several applications to banking industry, we recall the studies by GILLIGAN *et al.* (1982) and MESTER (1987). Specific studies on Italian depository institutions are those by COSSUTTA *et al.* (1988), BALDINI and LANDI (1990) and CONIGLIANI *et al.* (1991).

$$+\frac{1}{2}\sum_{r=1}^{m}\sum_{s=1}^{m}\beta_{m+r+s-1}\ln\omega_{ri}\ln\omega_{si}\ . \tag{2a}$$

Such a cost function implies the following marginal cost function:

$$MC_i=\frac{\partial C_i}{\partial q_i}=AC_i\left(b_0+b_1\ln q_i+\sum_{r=1}^{m}b_{r+1}\ln\omega_{ri}\right), \tag{7}$$

where AC_i is the average cost and ω_{ri} are the prices of input factors (r = 1, ..., m). In our analysis we assume the intermediation model of a bank[19], where deposits are considered an intermediate input in the production of loans, in conjunction with other factors.

The market demand function, corresponding to (1), is postulated to be as follows:

$$\ln q_i=a_0+a_1\ln p_i+a_2\ln p_j+a_3\ln Y+a_4\ln BR_i+\varepsilon_i\ , \tag{1a}$$

where q_i and p_i are the quantity and the price of the output of bank i, respectively, p_j is the calculated average value expressing the price of all the other banks, Y is national income (a measure of economic activity), BR_i is the number of branches of each bank (a variable that tries to capture the network size effect of the firm on its own demand), and ε_i is an error term.

Concerning the translog cost function, we will use two alternative specifications: a two-factor function (deposits and labour), and a three-factor function (deposits, labour and physical capital). It will assume the following form:

$$\ln C_i=\beta_0+b_0\ln q_i+\frac{b_1}{2}(\ln q_i)^2+\sum_{r=1}^{3}\beta_r\ln\omega_{ri}+\ln q_i\sum_{r=1}^{3}b_{r+1}\ln\omega_{ri}+$$
$$+\sum_{r=1}^{3}\beta_{r+3}(\ln\omega_{ri})^2+\beta_7\ln\omega_{1i}\ln\omega_{2i}+\beta_8\ln\omega_{1i}\ln\omega_{3i}+\beta_9\ln\omega_{2i}\ln\omega_{3i}+\varphi_i\ , \tag{2b}$$

where φ_i is an error term.

It is not possible to predict the sign of the coefficients of the variables in the translog cost equation, but there are some conditions that are generally imposed on the coefficients of such a cost function[20]. The above formulation makes possible to avoid the test for symmetry[21]. Linear homogeneity in input prices would imply that $\sum_{r=1}^{3}\beta_r=1$, $\sum_{r=1}^{3}b_{r+1}=0$ and $\sum_{r=1}^{6}\beta_{r+3}=0$. However, we will not impose any initial restriction[22].

Given the above translog specification of the cost function, and substituting (7) in (5), simple manipulations yield:

[19] See KLEIN (1971) and SEALEY and LINDLEY (1977) for details about this model, which has been used in several banking cost studies.
[20] See for example BERGER *et al.* (1987).
[21] Symmetry in the coefficients of produced goods is ruled out by the fact that we consider only one output (loans). Symmetry in the coefficients of input prices would be necessary if we estimate different parameters both for $\ln\varpi_r\ln\varpi_s$ and $\ln\varpi_s\ln\varpi_r$, (r = 1,...,m; s = 1,...,m), like in (2a), rather than only one coefficient for each pair of multiplications, as we do by using the function (2b).
[22] We tested for linear homogeneity after performing the regressions: in all models, a chi-square test did not reject any of the three restrictions at the 5% level.

$$p_i = AC_i\left(b_0 + b_1 \ln q_i + \sum_{r=1}^{3} b_{r+1} \ln \omega_{ri}\right) - \frac{1}{\frac{a_1}{p_i} + \lambda \frac{a_2}{p_j}} + \phi_i \,, \tag{5a}$$

where ϕ_i is an error term.

Hence, the system to be estimated (labelled as Model 1) is formed by equations (1a), (2b) and (5a). If the market conduct parameter λ can be identified through this estimation, it describes the degree of coordination in our price-setting game context. Actually, this index reflects the average behaviour of the banks considered: therefore, the presence of a collusive (competitive) behaviour should give rise to positive (negative) values of λ.

Given the nature of our dataset, it seems appropriate to estimate also an alternative model, which tries to capture firm-specific and time effects. For this purpose, we propose another system (Model 2), composed by the following three equations:

$$\ln q_i = a_1 \ln p_i + a_2 \ln p_j + a_3 \ln Y + a_4 \ln BR_i + (a_5 t + a_6 t^2) + \sum_{k=1}^{8} a_{k+6} BD_k + \varepsilon_i \tag{1b}$$

$$\begin{aligned}\ln C_i = {} & b_0 \ln q_i + \frac{b_1}{2}(\ln q_i)^2 + \sum_{r=1}^{3} \beta_r \ln \omega_{ri} + \ln q_i \sum_{r=1}^{3} b_{r+1} \ln \omega_{ri} + \sum_{r=1}^{3} \beta_{r+3} (\ln \omega_{ri})^2 + \\ & + \beta_7 \ln \omega_{1i} \ln \omega_{2i} + \beta_8 \ln \omega_{1i} \ln \omega_{3i} + \beta_9 \ln \omega_{2i} \ln \omega_{3i} + (\beta_{10} t + \beta_{11} t^2) + \sum_{k=1}^{8} \beta_{k+11} BD_k + \varphi_i\end{aligned} \tag{2c}$$

$$p_i = AC_i\left(b_0 + b_1 \ln q_i + \sum_{r=1}^{3} b_{r+1} \ln \omega_{ri}\right) - \frac{1}{\frac{a_1}{p_i} + \left(\sum_{k=1}^{8} \lambda_k BD_k\right)\frac{a_2}{p_j}} + (\gamma_1 t + \gamma_2 t^2) + \phi_i \tag{5b}$$

To account for the economic expansion occurred in the period under exam, a quadratic time trend has been added in all equations. Furthermore, in the demand and cost equations[23] the intercept term has been substituted by bank-specific dummy intercepts (*BD*). Finally, in the price-cost margin equation we estimate separate conjectural indexes λ_k for each of the eight banks.

Other models have been estimated with the purpose of isolating the effects due either to time or firms' specificity. Model 3 is the same as Model 2, but with a common index λ. Model 4 contains the dummy variables BD_k and λ_k, without the time trend. The same happens in Model 5, but here again we estimate a common derivative λ instead of specific indexes for each bank. In Model 6 we consider the time trend as well as different λ_k's, but omit the *BD* variables. Lastly, Model 7 is similar to Model 6, with the exception of the behavioural parameter, which is estimated as a single common coefficient.

[23] In analogy with the previous model, we did not impose any restriction on the coefficients of the new cost equation, and we have tested for linear homogeneity in input prices. Again, in all estimations a chi-square test did not reject this hypothesis at the 5% level.

4. Data and estimation

The sample considers the period 1988-2000, and for each year data have been collected for the eight nationwided banks. Hence, it consists of 104 observations for each regression. Appendix A reports the list of the banks analysed as well as a description of the data used for the estimation.

In the demand equations (1), the quantity of output for each bank, q_i, is measured by the value of loans and the price of output for that bank, p_i, is given by the interest rate earned on loans, which is calculated as the ratio between interest revenue and total loans. The coefficient of p_i is expected to be negative, thus conforming to a downward-sloping demand curve. An analogous procedure is followed for the calculation of p_j: accordingly, the price of the rivals is still computed as an average interest rate on loans (given by the ratio between the interest revenue of all the "other" banks and their loans). Its coefficient is expected to be positive if loans are substitutable across banks. National income Y is measured by the Gross Domestic Product, and is expected to have a positive influence on the level of banking services demand. Finally, the coefficient of BR_i should be also positive as long as the number of branches represents a good proxy of the banks' network size effect over the loan demand.

As already stated, the inputs considered here are deposits, labour and (in an alternative formulation of the cost function) physical capital. For a correct specification of λ, we must assume that banks are input price-takers. This is probably true for labour and physical capital, since for these inputs banks compete with other firms for their acquisition. With reference to deposits, the assumption would be also correct if the deposit interest rates were not under banks' control: this is probably what happened in the period examined here, mainly because of the fierce competition coming from government bonds as well as from smaller banks[24].

In equations (2) and (5), the price of deposits, ω_{1i}, is measured as the average interest rate on deposits (computed as the ratio between interest expenses and deposits), and the price of labour, ω_{2i}, is calculated as the ratio between total labour costs and the number of employees. In the estimation that includes the price of physical capital, ω_{3i}, it is measured as the value of all net operating costs different from those related to deposits and labour, divided by the funds under management, a ratio that represents a good proxy for the unit cost of capital[25]. Lastly, the average cost AC_i is calculated as the ratio between total costs and loans.

All variables (in euro) are expressed in 1995 values and were deflated by the Gross Domestic Product deflator. Summary statistics of the data and the list with the names of the variables are shown in Appendix B. Systems are estimated simultaneously through non-linear three-stage least squares. Tables 3a and 3b display the estimation results. In these tables we do not report the values of the firm-specific dummy variables, but we provide the Wald statistics for the null hypotheses that they are jointly zero and that they are equal to a common value: the above tests are always rejected at the 5% level.

Let us first consider the two-factor system specification, formed by equations (1a)-(2b)-(5a). The results are shown in Table 3a. In the demand equation the coefficients of p_i and p_j have the expected sign (negative and positive, respectively), and are both statistically significant, mostly at the 1% level. Therefore, the empirical evidence confirms a downward-sloping demand function as well as a positive cross-price elasticity for loans. The estimated value of both the coefficients of p_i and p_j drops when the bank-specific dummies BD are included: particularly, without these coefficients the demand for loans appears to be elastic, given that we reject the hypothesis that $a_1 \leq |1|$, while the insertion of the BD's makes it inelastic. The cross-price elasticity is always smaller than the absolute own-price elasticity, confirming our expectations that loans are more sensitive to variation in p_i rather than in p_j. However, the difference between the two values is not high, and this fact

[24] See SHAFFER (1993) and COCCORESE (1998b).

[25] GILLIGAN and SMIRLOCK (1984) and other authors hold that the price of the physical capital can be considered as constant across the samples. SHAFFER (1993) argues that this is more realistic in a cross section than in a time series.

could be a first indicator of a considerable level of competition among the banks. A larger gap between the coefficient of p_i and p_j occurs only in Models 6 and 7.

The variable Y has a positive and statistically significant coefficient only when both the *BD* dummies and the time trend are included in the equations: in this situation, since the estimated coefficient is greater than 4, we expect a remarkable growth in the demand for loans as long as the economy is characterised by an expansion (measured through the real GDP). The coefficient of BR_i is positive and significant, meaning that a wider branch network allows a larger increase in the demand for loans of bank i. In terms of magnitude, it is larger in those models that take account of the bank-specific dummies *BD*. When significant, the effect of time on loans consists in a fall in their demand.

In the cost equation, the estimated coefficients show that banks are operating where average costs lie above marginal costs, that is, in a region of economies of scale. This finding parallels the results of previous studies on cost banking functions and suggests that new entries in the “national” market, if possible, are unattractive because of the presence of a notable size effect (already captured by the coefficient of BR_i in the demand equation). For this equation, the quadratic time trend is highly significant in all regressions, and captures a cost reduction in the most recent years.

The value of the “average” conjectural parameter λ is negative and significant (Models 1, 3 and 5). Its value ranges from -0.4182 to -2.7925 and -3.1203, according to whether we skip both the *BD* dummies and the time trend, include the *BD*’s only, or include both. These values are significantly different (at 5% level) from +1 and 0. The only striking deviation is in Model 7, where the value of λ (even though small in size) is positive and significant. As a consequence, for three of four models with common λ, we are able to reject the hypothesis that in the Italian banking industry there is evidence of monopoly power or coordination between banks. Furthermore, banks’ behaviour appears to be more competitive than in a Cournot-Nash equilibrium in prices. Therefore, the results show that in Italy the banking market is characterised by a certain degree of competition, although imperfect. This conjecture agrees with the results of other studies that investigate the market power of the credit institutions within the Italian banking industry in the same years. Actually, some of them have shown that monopolistic competition is the best description of the local banking market[26].

The above comments remain true also when considering the results of the models with firm-specific conjectural indexes. Even if there is a relaxing in their significance when passing from models with a one common λ to the corresponding models with individual λ_k’s, we always observe a remarkable increase in the estimated values. In any case, they are always significant at least at the 10% level, and their average value is significantly different from +1 and 0 at least at 10% level (with the exception of Model 6, where none of them is significantly different from zero). Again, we reject the joint collusion hypothesis among banks; in contrast, their behaviour seems to be more competitive than the Cournot outcome.

Hence, even though no threat of possible entrants should exist (given the existence of scale economies), the estimated degree of competition, usually lying between the perfectly competitive and the Cournot values, indicates a fairly competitive pattern of behaviour. This can be deducted also by calculating the mark-up over marginal costs in equation (5a). For example, in Model 1 it is equal to 40.6%, and in Model 5 to 33.1%: considering that the Cournot-Nash behaviour ($\lambda = 0$) implies a mark-up of 57% and 123.5%, respectively (and the cartel hypothesis much higher), pricing in the considered banking market appears rather competitive. Our results seem therefore to support the policy of the Central Bank of Italy, that has cautiously favoured a tendency to

[26] See COCCORESE (1998a), BIKKER and HAAF (2000) and DE BANDT and DAVIS (2000). In the first of these studies, the monopolistic competition outcome is explained as a compromise between local monopolies or oligopolies from little banks and the competitive pressure coming from large banks operating at a national level. COCCORESE (2001) finds evidence of a relationship between the local economic performance and the degree of competition among banks: they appear to behave as perfectly competitive firms where local macroeconomic data show lower unemployment rates, greater per capita GDP and lower market loan rates.

concentration in the Italian banking industry during the last years (in accordance with the Antitrust Authority), also when it involves large banks.

It is worth to note that we never reject the hypothesis that the eight λ_k's are equal to the same value. This supports the view that the estimation with only one conjectural variation derivative (representing the average conduct of banks) is trustfully acceptable as well. We also observe that the absolute value of the estimated own-price elasticity is larger when the estimated λ's or λ_k's are of smaller magnitude. According to this result, in our assumed model of product differentiation (where banks are supposed to act as monopolists in their market niches), when firms are operating where their demand is perceived to be elastic the equilibrium ensures them some market power, which is detected by a lower estimate of λ.

Finally, the estimated time trend for the third equation is always significant and shows us a fall in the price-cost margin during the considered years. For example, in Model 3 we note that the average mark-up over marginal costs is equal to 20.5%. Along with equation (5b), we can decompose this value in two parts: the first is related to the behavioural parameter λ, amounting to 32.3% (very close to 33.1% estimated for Model 5); the second reproduces the time effect, being equal to -11.8%. Hence, the introduction of the time trend provokes a 37% fall in the mark-up value, and can be interpreted as an additional signal of increased competition among banks.

The three-factor specification models, formed by equations (1b)-(2c)-(5b), generally confirm the above results and comments (see Table 3b). Particularly, the addition of the price of capital does not have notable effects on the estimates of the demand coefficients and the conjectural derivative (where all coefficients keep their sign and magnitude), nor on the *R*-square of the three equations. We notice that the significance of the various λ's increases slightly; with reference to the firm-specific behavioural parameters, their average is significantly different from +1 and 0 at the 5% level in two of three models. We can therefore conclude that the introduction of the capital input does not add much explanatory power to the estimation.

5. Conclusion

Conventional models in industrial organisation (particularly those following the SCP paradigm) state that in concentrated industries active firms can count on a significant market power, and competition can be reduced if they exercise some form of market collusion. In contrast, recent theoretical analyses show that strong concentration processes do not necessarily prevent competition among firms.

This paper has relied on a non-linear simultaneous-equation model for the period 1988-2000 (formed by a demand equation, a cost equation and a price-cost margin equation) in order to identify the degree of competitiveness characterising the eight Italian largest banks, the only which operate nationwide and have a noteworthy size and a significant market share. The results strongly reject the hypothesis of collusion or coordination among them, and are consistent with a more competitive conduct than the Cournot outcome.

Given the special features of the banking industry (asymmetric information, personal relationships between banks and customers, reputation), it seems that the degree of competition is considerable. Our findings are in line with the results of the recent literature in this field as well as with those of other studies on Italian data, and contradict the conclusions of the SCP approach, for which the tendency to concentration in a market is to be considered with concern for its anti-competitive consequences. Quite to contrary, our empirical evidence shows that in the Italian banking industry there is no conflict between competition and concentration.

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Appendix A – Data description

The panel of this study is composed by the eight largest Italian banks: Banco di Napoli, Banca Nazionale del Lavoro, Banca di Roma, Cassa di Risparmio delle Province Lombarde, Banca Commerciale Italiana, Credito Italiano, Monte dei Paschi di Siena, Istituto Bancario San Paolo di Torino. They are regarded as "largest" also in the statistics of Banca d'Italia (the Central Bank of Italy).
The dataset is derived from the annual balance sheets of each bank as well as from statistical reports of Banca d'Italia and Istat (Italian Statistical Institute). It considers annual data from 1988 through 2000. All values have been expressed in real terms (1995 values) by using the GDP deflator.
The following variables have been used for the regression analysis.

- *GDP*: gross domestic product (source: Istat)
- *Loans*: short-term and long-term loans (source: Banca d'Italia and balance sheets)
- *Deposits*: include savings deposits, certificates of deposit and bonds issued by banks (source: Banca d'Italia and balance sheets)
- *Loan revenue*: interest accrued on the whole loans portfolio (source: balance sheets)
- *Deposit cost*: interest paid on deposit liabilities (source: balance sheets)
- *Wage cost*: direct and indirect staff costs (source: balance sheets)
- *Capital costs*: net operating costs different from interest and staff costs (source: balance sheets)
- *Funds under management*: include customer deposits, interbank deposits, shareholders' equity and reserves (source: balance sheets)
- *Branches*: number of local offices with operational capabilities (source: Banca d'Italia and balance sheets)
- *Employees*: number of bank staff members of all status (source: balance sheets)

Appendix B – Sample descriptive statistics and list of variables

Variable	Mean	S. D.	Min	Max	Median
GDP	911947.2	53924.5	826059.0	1012802	896830.0
Loans	32402.3	12174.4	13057.1	77875.5	30985.7
Deposits	33932.7	11236.8	15589.5	75390.4	31492.6
Loan revenue	4968.3	1606.9	1410.3	10647.7	4764.1
Deposit cost	3529.8	1319.0	769.4	8395.3	3261.4
Wage cost	932.5	204.6	516.2	1401.0	895.6
Capital cost	565.9	202.7	226.1	1376.9	539.6
Funds under management	59925.2	17256.9	24518.9	120410.6	58777.2
Branches (*)	753.6	261.3	381	1398	688.0
Employees (*)	16363.6	4045.5	10427	26766	15364.0
p_i *(**)*	0.1621	0.0448	0.0734	0.2754	0.1713
p_j *(**)*	0.1588	0.0389	0.0856	0.2076	0.1656
ω_{1i} *(**)*	0.1074	0.0345	0.0380	0.1860	0.1060
ω_{2i} *(***)*	57.69	6.38	44.31	74.40	56.46
ω_{3i} *(***)*	772.8	204.8	409.5	1483.8	790.2

All variables are expressed in millions of 1995 euro, except:
(*) Number of units
(**) Ratios
(***) Thousands of 1995 euro

Variable		
q_i	=	loans
p_i	=	interest revenue / total loans
p_j	=	interest revenue / total loans (for the group of the other banks)
Y	=	Gross Domestic Product
BR_i	=	number of branches
ω_{1i}	=	interest expenses / total deposits
ω_{2i}	=	labour cost / number of employees
ω_{3i}	=	other operating costs / funds under management

Table 1 – The Italian banking system: descriptive data

Year	Loans	Deposits	Loan revenue	Deposit cost	Banks (number)	Branches (number)
1988	423896	639986	53068	51947	1100	15363
1989	479284	681025	60047	55482	1085	15577
1990	515000	714349	63956	56395	1064	17721
1991	547954	744953	67419	56223	1043	19080
1992	586972	774512	80415	62858	1025	20784
1993	589788	821124	75281	61755	992	22004
1994	573709	801208	64421	50050	965	23000
1995	562697	786548	70737	50503	976	24040
1996	543902	790971	67208	49084	938	24421
1997	567300	729362	57698	39846	935	25251
1998	586666	701381	50369	30177	922	26255
1999	632551	688510	41463	20140	877	27132
2000	704766	679891	47726	23227	841	28175

All variables are expressed in millions of 1995 euro (unless otherwise indicated)

Source: Banca d'Italia and Istat

Table 2 – The Italian eight largest banks: grouped descriptive data

Year	Loans	Deposits	Loan revenue	Deposit cost	Labour cost	Net operating cost	Branches (number)	Employees (number)	Deposit share (% of total deposits)	Loan share (% of total loans)
1988	181039	226222	34798	24902	6740	2627	3630	123865	35.35	42.71
1989	205534	235427	40656	30213	6674	3018	3711	118623	34.57	42.88
1990	222097	234045	42238	31585	6688	3174	3974	122817	32.76	43.13
1991	235879	253862	45355	33516	7600	3827	5058	133213	34.08	43.05
1992	244849	251371	49656	36362	7855	4134	5570	131939	32.46	41.71
1993	255692	275823	47020	34325	8209	4715	6192	137707	33.59	43.35
1994	265508	289895	41625	29564	8302	4774	6523	137336	36.18	46.28
1995	281972	296537	46613	34373	8171	5180	6837	140726	37.70	50.11
1996	257868	284069	40542	29370	8111	5126	6825	133877	35.91	47.41
1997	271223	286864	35369	24640	7726	5844	7238	134129	39.33	47.81
1998	291460	289118	32406	21391	7091	5144	7377	130263	41.22	49.68
1999	309722	294084	26948	16082	6791	5063	7471	126729	42.71	48.96
2000	347000	311681	33480	20779	7024	6232	7971	130588	45.84	49.24

All variables are expressed in millions of 1995 euro (unless otherwise indicated)

Source: Banca d'Italia and individual balance sheets

Table 3a – System estimation results for the two-factor specification

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
DEMAND EQUATION (dependent variable: $\ln q_i$*)*								
$\ln p_i$	a_1	-1.7542*** (-8.79)	-0.7741*** (-4.85)	-0.8966*** (-5.63)	-0.6691*** (-4.08)	-0.8096*** (-4.98)	-2.1326*** (-11.36)	-2.1723*** (-11.95)
$\ln p_j$	a_2	1.6591*** (6.01)	0.5196** (2.11)	0.6896*** (2.75)	0.5656*** (2.81)	0.7771*** (3.82)	1.5829*** (4.17)	1.6422*** (4.63)
$\ln Y$	a_3	0.3830 (0.35)	4.1094** (2.53)	4.2151** (2.52)	-0.6260 (-0.89)	-0.3084 (-0.43)	3.4710 (1.23)	3.5470 (1.38)
$\ln BR_i$	a_4	0.3996*** (4.16)	0.6990*** (8.96)	0.7014*** (8.82)	0.6331*** (9.01)	0.6373*** (8.84)	0.4290*** (3.99)	0.3809*** (3.85)
t	a_5	-	-0.0608** (-2.33)	-0.0640** (-2.42)	-	-	0.0063 (0.15)	0.0351 (0.86)
t^2	a_6	-	-0.0019 (-0.86)	-0.0016 (-0.71)	-	-	-0.0062 (-1.60)	-0.0078** (-2.16)
Intercept	a_0	6.5444 (0.30)	-	-	-	-	-57.8524 (-0.99)	-59.1743 (-1.12)
Adj. R^2		0.5177	0.8315	0.8319	0.8192	0.8216	0.4920	0.4790
COST EQUATION (dependent variable: $\ln C_i$*)*								
$\ln q_i$	b_0	-0.3171 (-0.60)	-0.7021 (-1.05)	0.0002 (0.01)	0.4830 (1.02)	0.9184** (2.13)	-1.8236** (-2.44)	-3.8059*** (-5.81)
$(\ln q_i)^2$	b_1	0.0471** (2.07)	0.0742** (2.43)	0.0224 (0.87)	0.0298 (1.23)	-0.0236 (-1.21)	0.1267*** (3.49)	0.2265*** (7.23)
$\ln \omega_{1i}$	β_1	2.1088 (1.28)	0.8697 (0.56)	2.1413 (1.32)	0.6369 (0.38)	1.5405 (0.89)	1.4581 (0.97)	1.9962 (1.34)
$\ln \omega_{2i}$	β_2	-3.6536 (-0.57)	-8.2651 (-1.41)	-8.1269 (-1.32)	-6.9399 (-1.15)	-8.4922 (-1.40)	-2.6283 (-0.43)	-3.2969 (-0.56)
$(\ln q_i)(\ln \omega_{1i})$	b_2	0.0442 (1.49)	0.0677 (1.58)	-0.0189 (-0.42)	0.0837*** (3.55)	0.0284 (1.20)	-0.0207 (-0.44)	-0.0531 (-1.23)
$(\ln q_i)(\ln \omega_{2i})$	b_3	0.0483 (0.68)	0.0804 (0.79)	0.0747 (0.98)	-0.0309 (-0.37)	0.0520 (0.90)	0.0552 (0.54)	0.0944 (1.32)
$(\ln \omega_{1i})^2$	β_4	-0.2175*** (-2.93)	-0.1361** (-2.13)	-0.1352** (-2.04)	-0.1708** (-2.37)	-0.1761** (-2.37)	-0.1452** (-2.35)	-0.1627** (-2.55)
$(\ln \omega_{2i})^2$	β_5	0.1547 (0.21)	0.7360 (1.07)	0.6962 (0.98)	0.7828 (1.14)	0.8004 (1.13)	0.1128 (0.17)	0.1043 (0.16)
$(\ln \omega_{1i})(\ln \omega_{2i})$	β_7	-0.8348** (-2.28)	-0.5795* (-1.70)	-0.5277 (-1.49)	-0.5640 (-1.46)	-0.5607 (-1.41)	-0.3718 (-1.19)	-0.3847 (-1.19)
t	β_{10}	-	0.0435*** (3.60)	0.0481*** (3.85)	-	-	0.0563*** (4.34)	0.0658*** (4.99)
t^2	β_{11}	-	-0.0049*** (-5.17)	-0.0052*** (-5.37)	-	-	-0.0058*** (-5.70)	-0.0063*** (-6.07)
Intercept	β_0	22.7375 (1.53)	-	-	-	-	32.7572** (2.16)	52.0940*** (3.64)
Adj. R^2		0.8784	0.9308	0.9263	0.9041	0.9003	0.9054	0.9023

t-statistics for the parameter estimates in parentheses (*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)

Table 3a – System estimation results for the two-factor specification (continued)

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
PRICE-COST MARGIN EQUATION (dependent variable: p_i)								
Common conj.der.	λ	-0.4182** (-2.15)	-	-3.1203** (-2.16)	-	-2.7925*** (-2.68)	-	0.2701*** (2.87)
Bank 1's c.d.	λ_1	-	-5.1181* (-1.80)	-	-4.8176** (-2.25)	-	-0.0522 (-0.29)	-
Bank 2's c.d.	λ_2	-	-5.4620* (-1.79)	-	-5.3534** (-2.20)	-	-0.0439 (-0.28)	-
Bank 3's c.d.	λ_3	-	-5.3892* (-1.80)	-	-5.3295** (-2.23)	-	-0.0637 (-0.37)	-
Bank 4's c.d.	λ_4	-	-4.1153* (-1.84)	-	-3.8178** (-2.25)	-	0.0420 (0.29)	-
Bank 5's c.d.	λ_5	-	-4.9979* (-1.81)	-	-4.8477** (-2.24)	-	-0.0174 (-0.12)	-
Bank 6's c.d.	λ_6	-	-3.8768* (-1.80)	-	-4.0192** (-2.25)	-	0.0651 (0.50)	-
Bank 7's c.d.	λ_7	-	-3.8212* (-1.82)	-	-3.5988** (-2.25)	-	0.0582 (0.46)	-
Bank 8's c.d.	λ_8	-	-5.1596* (-1.82)	-	-4.6153** (-2.23)	-	-0.0280 (-0.19)	-
t	γ_1	-	-0.0042*** (-2.89)	-0.0030* (-1.69)	-	-	-0.0051*** (-3.62)	-0.0092*** (-5.55)
t^2	γ_2	-	0.0003** (2.58)	0.0002 (1.23)	-	-	0.0003*** (2.80)	0.0006*** (4.32)
Adj. R^2		0.9790	0.9819	0.9798	0.9806	0.9784	0.9873	0.9602

t-statistics for the parameter estimates in parentheses (*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)

Wald statistics for bank-specific dummy variables (chi-square test)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
DEMAND EQUATION (dependent variable: $\ln q_i$*)*							
$H_0 : a_7 = a_8 = ... = a_{14} = 0$	-	226.63***	217.90***	211.78***	203.52***	-	-
$H_0 : a_7 = a_8 = ... = a_{14}$	-	223.70***	215.04***	210.90***	203.42***	-	-
COST EQUATION (dependent variable: $\ln C_i$)							
$H_0 : \beta_{12} = \beta_{13} = ... = \beta_{19} = 0$	-	38.18***	38.03***	34.66***	34.94***	-	-
$H_0 : \beta_{12} = \beta_{13} = ... = \beta_{19}$	-	36.29***	36.42***	33.15***	32.98***	-	-
PRICE-COST MARGIN EQUATION (dependent variable: p_i)							
$H_0 : (\lambda_1 + \lambda_2 + ... + \lambda_8)/8 = 0$	-	3.37*	-	5.17**	-	0.01	-
$H_0 : \lambda_1 = \lambda_2 = ... = \lambda_8$	-	2.77	-	3.90	-	3.40	-

(*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)

Table 3b – System estimation results for the three-factor specification

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
DEMAND EQUATION (dependent variable: lnq_i*)*								
lnp_i	a_1	-1.8054*** (-9.04)	-0.8547*** (-5.36)	-0.9928*** (-6.25)	-0.7144*** (-4.35)	-0.9572*** (-5.96)	-2.1539*** (-10.94)	-2.1748*** (-11.22)
lnp_j	a_2	1.8126*** (6.47)	0.5831** (2.36)	0.7288*** (2.90)	0.6520*** (3.21)	0.9180*** (4.54)	1.5738*** (4.16)	1.5271*** (4.16)
ln$Y$	a_3	1.0368 (0.93)	4.2810*** (2.63)	4.2831** (2.56)	-0.2505 (-0.36)	-0.2392 (-0.33)	3.9761 (1.43)	3.9175 (1.49)
lnBR_i	a_4	0.4040*** (4.20)	0.6845*** (8.76)	0.6810*** (8.57)	0.6130*** (8.78)	0.6181*** (8.54)	0.4187*** (3.96)	0.3864*** (3.83)
t	a_5		-0.0592** (-2.26)	-0.0590** (-2.23)	-	-	0.0027 (0.06)	0.0259 (0.62)
t^2	a_6	-	-0.0022 (-1.00)	-0.0022 (-0.98)	-	-	-0.0066* (-1.72)	-0.0082** (-2.23)
Intercept	a_0	-6.7802 (-0.30)	-	-	-	-	-68.2109 (-1.19)	-66.9796 (-1.23)
Adj. R^2		0.5175	0.8318	0.8306	0.8210	0.8215	0.4888	0.4800
COST EQUATION (dependent variable: lnC_i)								
lnq_i	b_0	-0.3747 (-0.73)	-0.6130 (-0.93)	0.1311 (0.24)	-0.1770 (-0.35)	0.8227* (1.91)	-0.9100 (-1.40)	-2.0978*** (-3.73)
(lnq_i)^2	b_1	0.0286 (1.31)	0.0563* (1.80)	0.0076 (0.28)	0.0353 (1.54)	-0.0360* (-1.96)	0.0688** (2.14)	0.1371*** (4.80)
lnω_{1i}	β_1	2.1697 (1.09)	0.9712 (0.54)	2.2051 (1.19)	1.9118 (0.93)	2.7883 (1.32)	0.4496 (0.29)	0.9287 (0.60)
lnω_{2i}	β_2	-6.9697 (-0.89)	-13.4079* (-1.93)	-13.1765* (-1.88)	-14.6930* (-1.91)	-16.6530** (-2.13)	-6.4626 (-1.06)	-6.4596 (-1.06)
lnω_{3i}	β_3	-0.1734 (-0.08)	1.5871 (0.86)	0.8937 (0.46)	2.5953 (1.30)	1.7611 (0.85)	-0.8235 (-0.49)	-1.1177 (-0.65)
(lnq_i)(lnω_{1i})	b_2	0.0201 (0.66)	0.0684 (1.63)	-0.0195 (-0.47)	0.0587** (2.45)	0.0092 (0.38)	0.0087 (0.21)	-0.0265 (-0.70)
(lnq_i)(lnω_{2i})	b_3	0.0528 (0.78)	0.0658 (0.66)	0.0672 (0.94)	0.0053 (0.07)	0.0542 (0.98)	0.0769 (0.85)	0.0923 (1.48)
(lnq_i)(lnω_{3i})	b_4	-0.0657** (-2.27)	-0.0644* (-1.85)	-0.0369 (-0.99)	-0.0747*** (-3.30)	-0.0481** (-1.99)	-0.0317 (-1.05)	0.0033 (0.12)
(lnω_{1i})^2	β_4	-0.1982** (-2.34)	-0.0940 (-1.45)	-0.0961 (-1.42)	-0.1281* (-1.67)	-0.1304 (-1.64)	-0.1322** (-2.13)	-0.1423** (-2.20)
(lnω_{2i})^2	β_5	0.6711 (0.81)	1.2625* (1.80)	1.2398* (1.70)	1.5455* (1.92)	1.6862** (2.02)	0.5794 (0.95)	0.5322 (0.84)
(lnω_{3i})^2	β_6	-0.0741 (-0.65)	-0.0595 (-0.63)	-0.0789 (-0.80)	0.0060 (0.06)	-0.0318 (-0.30)	-0.1232 (-1.39)	-0.1021 (-1.11)
(lnω_{1i})(lnω_{2i})	β_7	-0.7478* (-1.76)	-0.5523 (-1.49)	-0.5085 (-1.31)	-0.5286 (-1.21)	-0.5449 (-1.20)	-0.3684 (-1.16)	-0.3401 (-1.04)
(lnω_{1i})(lnω_{3i})	β_8	-0.0254 (-0.17)	0.0040 (0.03)	-0.0114 (-0.09)	0.1601 (1.09)	0.1567 (1.04)	-0.1180 (-1.06)	-0.1100 (-0.95)
(lnω_{2i})(lnω_{3i})	β_9	0.1561 (0.46)	-0.1973 (-0.72)	-0.1950 (-0.68)	-0.1965 (-0.62)	-0.1895 (-0.58)	0.0461 (0.18)	0.0172 (0.07)
t	β_{10}	-	0.0099 (0.67)	0.0155 (1.00)	-	-	0.0148 (1.05)	0.0282** (1.98)
t^2	β_{11}	-	-0.0033*** (-3.16)	-0.0038*** (-3.49)	-	-	-0.0039*** (-3.85)	-0.0047*** (-4.53)
Intercept	β_0	29.7677 (1.47)	-	-	-	-	29.3784* (1.76)	39.7251** (2.45)
Adj. R^2		0.8762	0.9386	0.9343	0.9062	0.9025	0.9259	0.9221

t-statistics for the parameter estimates in parentheses (*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)

Table 3b – System estimation results for the three-factor specification (continued)

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
PRICE-COST MARGIN EQUATION (dependent variable: p_i)								
Common conj.der.	λ	-0.3692** (-2.13)	-	-3.4578** (-2.15)	-	-1.9234*** (-2.85)	-	-0.0363 (-0.25)
Bank 1's c.d.	λ_1	-	-6.1562* (-1.90)	-	-3.9559** (-2.47)	-	-0.6755* (-1.74)	-
Bank 2's c.d.	λ_2	-	-6.4810* (-1.86)	-	-4.2601** (-2.42)	-	-0.5775* (-1.79)	-
Bank 3's c.d.	λ_3	-	-6.5862* (-1.87)	-	-4.3818** (-2.45)	-	-0.6321* (-1.75)	-
Bank 4's c.d.	λ_4	-	-4.6797** (-2.00)	-	-3.3822** (-2.48)	-	-0.3646 (-1.43)	-
Bank 5's c.d.	λ_5	-	-5.6881* (-1.93)	-	-3.7613** (-2.46)	-	-0.5332* (-1.79)	-
Bank 6's c.d.	λ_6	-	-4.5345* (-1.93)	-	-3.2228** (-2.46)	-	-0.3449 (-1.38)	-
Bank 7's c.d.	λ_7	-	-4.0619** (-1.99)	-	-2.7469** (-2.47)	-	-0.3826 (-1.57)	-
Bank 8's c.d.	λ_8	-	-6.0764* (-1.92)	-	-4.0033** (-2.45)	-	-0.5079* (-1.75)	-
t	γ_1	-	-0.0021 (-1.20)	-0.0019 (-0.94)	-	-	-0.0035** (-2.24)	-0.0069*** (-4.32)
t^2	γ_2	-	0.0002 (1.24)	0.0001 (0.65)	-	-	0.0002* (1.97)	0.0004*** (3.54)
Adj. R^2		0.9852	0.9841	0.9818	0.9823	0.9822	0.9900	0.9781

t-statistics for the parameter estimates in parentheses (*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)

Wald statistics for bank-specific dummy variables (chi-square test)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
DEMAND EQUATION (dependent variable: $\ln q_i$)							
$H_0 : a_7 = a_8 = ... = a_{14} = 0$	-	220.73***	211.07***	207.86***	192.84***	-	-
$H_0 : a_7 = a_8 = ... = a_{14}$	-	217.42***	208.00***	207.68***	192.78***	-	-
COST EQUATION (dependent variable: $\ln C_i$)							
$H_0 : \beta_{12} = \beta_{13} = ... = \beta_{19} = 0$	-	18.99**	16.81**	37.17***	35.76***	-	-
$H_0 : \beta_{12} = \beta_{13} = ... = \beta_{19}$	-	16.40**	15.28**	34.11***	33.78***	-	-
PRICE-COST MARGIN EQUATION (dependent variable: p_i)							
$H_0 : (\lambda_1 + \lambda_2 + ... + \lambda_8)/8 = 0$	-	3.86**	-	6.26**	-	3.20*	-
$H_0 : \lambda_1 = \lambda_2 = ... = \lambda_8$	-	2.72	-	4.87	-	4.67	-

(*** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level)