ThE Papers 05/01

Departamento de Teoría e Historia Económica

Universidad de Granada

New evidence of scope economies among lending, deposit-taking, loan commitments and mutual fund activities

Santiago Carbó[1] Valverde & Francisco Rodríguez Fernández

Universidad de Granada

[1] *Corresponding author:* Santiago Carbó Valverde, Departamento de Teoría e Historia Económica, Universidad de Granada. Campus Cartuja s/n, E-18071, GRANADA (SPAIN); Phone: +34 958 243717; Fax : +34 958 249995 ; e-mail: scarbo@ugr.es

Abstract

      Financial innovation and technology affect bank cost, revenue and profits. Most of the previous empirical studies have not found significant cost, profit or revenue scope economies or output pair complementarities either between traditional and non-traditional banking products or between traditional activities themselves. We study scope economies and output pair complementarities in a 'broad banking' environment: the Spanish banking sector. The results indicate that after including off-balance sheet business in the output mix, cost and profit scope economies rise and are statistically significant. Besides, consumer valuation of financial services is only detected when the off-balance sheet business is added to the output definition.

Running title: New evidence of scope economies among…

Key words: banking, scope economies, off-balance sheet.
JEL classification: G21, L11

1. Introduction

Financial innovation is affecting bank cost, revenue and profit scope economies and output pair complementarities. There are some previous studies for the US banking industry, most of which have not found significant complementarities either between traditional banking products (loans and deposits) or between those traditional activities and off-balance sheet business (Clark, 1988; Pulley and Braunstein 1992; Mester, 1992; Pulley and Humphrey, 1993; Jagtiani et al., 1995; Humphrey and Pulley, 1997; or Rogers, 1998). The main contribution of this paper is to show the extent to which these results are conditioned by the use of traditional output mix definitions that do not properly account for innovations in banking production function, informational complementarities or technological improvements.

Previous studies have dealt with output definition problems and methodological issues separately but, to our knowledge, not simultaneously. Moreover, there is a lack of studies that measure output complementarities in countries where banks have been traditionally permitted to offer a broad range of financial products. In this study, we aim to test how output innovation and product mix definition may, at least partially, explain the existence of cost, revenue or profit scope economies in the banking sector, as the standard theoretical models of the banking firm show. To test these hypotheses we estimate cost, profit and revenue scope economies and specific output pair complementarities in Spanish banking using a composite cost function and including various on and off-balance sheet output measures. Specifically, loan commitments and mutual fund distribution activities are considered along with traditional lending, deposit-taking and securities activities.

The Spanish banking system is a good laboratory since –unlike the US before the Gramm-Leach-Bliley Act of 1999- banks have been allowed to offer all sorts of financial products and engage in all kinds of financial businesses for, at least, two decades. Of course, the specialization patterns differ across banks. Nevertheless, even if many banks do not act exactly as universal banks, a broad banking environment exists from the regulatory point of view. In the case of the profit and revenue function, we need to consider the underlying market in which banks operate in Spain. For this reason, we identify the market structure (using the Rosse-Panzar H-statistic) and study changes in market power (Lerner Index) over time (hypothesis 1). Both tests are undertaken employing traditional and non-traditional output mixes. Once the underlying market structure is identified, the choice between standard and alternative profit and revenue functions will be better justified.

The estimation of cost and profit scope economies permits us to assess how off-balance sheet business may increase the informational and customer relationship properties of banking (hypothesis 2) and generate cross-selling advantages (hypothesis 3). Additionally, the revenue side will provide an estimate of the valuation of 'broad banking' by customers (hypothesis 4). Our main results suggest that cost, profit and revenue scope economies exist in the Spanish banking industry although some of these advantages only come to light when including off-balance sheet activities in the output mix. Interestingly, both cost and profit scope economies co-exist in a less than competitive environment.

The paper is divided in five sections. In section 2, we survey the main institutional and empirical background with regard to the effects of regulatory treatment of broad banking on bank costs and profits. Next, section 3 contains the methodological background and discussions of the hypotheses of this research. Section 4 analyses various issues with regard to the data and the empirical approach of the paper. Section 5 presents the main results. The paper ends with a brief summary of the conclusions and their policy implications.

2. Institutional and empirical background

2.1. The broadening of banking services: the Spanish case

Bank regulation varies both across countries and over time. Although liberalization has been a dominating trend in international banking during the last two decades, there have been significant differences across countries in the development of financial market and/or intermediaries activities depending upon, *inter alia*, historical experience and institutional legal factors.

In the US, regulation has traditionally prevented banks from engaging in activities such as portfolio management, mutual or pension fund distribution, insurance or industrial participations both directly and through subsidiaries. However, the Gramm-Leach-Bliley Act allows US banks to diversify their portfolio with equity management, mutual fund distribution and other financial activities (Scholtens 1999; Barth et al., 2000). The European tradition is different. Many European banks have enjoyed these 'broad banking' advantages much earlier than the US (Barth et. al, 2000). Mixing banking with securities activities was generally unrestricted or permitted in the EU-15 and only few restrictions applied to insurance activities and ownership of commercial banks and non-financial firms[1].

The Spanish case is relevant in this context, since Spanish banks have controlled over 90% of the growing 'disintermediated' financial flows during the late 1980s and the 1990s with a high growth of capital market investments, loan commitments and mutual funds management, as the main example of the expansion of broad banking (Figure 1). In particular, mutual funds assets managed by banks rose by 176,5% (in real terms) during 1993-1999, while loan commitments grew at 89,5% (in real terms) during the same period. Broad banking is also reflected upon on-balance sheet business, as shown by the evolution of securities, equity and industrial participations growing by 35% (in real terms) during 1993-1999. The market share of mutual fund assets held by banks in Spain has been 90-92% during 1993-1999, while this market share has been significantly lower in other countries such as the US. It should be noted that disintemediation and off-balance sheet expansion has been compatible with growth of traditional business since consumer loans and deposits have experienced also a significant growth (62,1% and 19,7%, respectively, in real terms).

><<<<<<<<<<<<<INSERT FIGURE 1 HERE<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

2.2. Cost, revenue and profit issues

Standard models of the banking firm assume the existence of complementarities between deposit taking and loan supply, since they are viewed as two sides of the same liquidity demand function although the volume, origin and operative characteristics of both activities are different (Kashyap et al., 1999). The introduction of innovations beyond traditional banking –such as off-balance sheet business- may also produce benefits. Firstly, some off-balance sheet activities represent a technological expansion of lending, as loan commitments -lines of credit, credit cards- which expand the scope of the customer relationship and its informational properties (Berger and Udell, 1995; Das and Nanda, 1999; Degryse and Van Caseele, 2000). Therefore, loan commitments may be seen as an informational extension of traditional lending, although some bank customers could also reduce their demand of traditional lending as they increase the number of loan commitments. Secondly, there are some other non-traditional and fee-earning activities more directly related with portfolio management and financial markets operations -such as portfolio management and mutual or pension fund distribution- that are expected to reduce risk (Gallo et al., 1996), increase scale economies and produce cross-selling benefits (Kane, 1995 and Golter, 1996).

However, the empirical evidence has not supported these theoretical expectations either between on and off-balance sheet activities or even between traditional activities themselves. The majority of studies are applied to US banks. On the cost side, most of the empirical studies have shown the existence of scope economies for balance sheet activities (including deposits as an output) although they are generally small both globally and among output pairs (Clark, 1988; Pulley and Braunstein 1992; Pulley and Humphrey, 1993; Noulas et al., 1993; Ferrier et al., 1993). The few studies analyzing the profit side have also found small profit scope economies among balance sheet outputs although they were found to be significantly different from zero (Humphrey and Pulley, 1997; and Rogers, 1998).

As for the few studies analyzing cost and profit economies of scope including off-balance sheet business, the evidence is mixed. Mester (1992) does not find complementarities between loans and off-balance sheet securitization while Rogers (1998) finds significant but small complementarities between traditional output and 'new financial services'. Complementarities also appear when a wide range of off-balance sheet activities is considered jointly (including derivatives, collateral and loan commitments) although they vanish as bank size increases (Jagtiani et al., 1995; Jagtiani and Khantavit, 1996; Clark and Siems, 2002). Finally, Rime and Stiroh (2003) examine efficiency at Swiss banks using a distribution free approach, finding that off-balance sheet business introduce both cost and profit inefficiencies compared to a narrow (traditional) definition of output mix.

3. Methodological background and hypotheses.

3.1. Issues regarding market competition

First of all, competitive assumptions are needed to evaluate the robustness of the choice of the scope economy functions. Additionally, it is interesting to analyze how changes in output mix may alter market power and market competition since the coexistence of cost and profit (revenue) economies of scope is only possible in a less that competitive environment, as shown above. Therefore, hypothesis 1 is defined as:

- *Hypothesis 1*: The introduction of new off-balance sheet activities in the bank output mix (such as loan commitments or mutual fund distribution) will alter market power although likely associated changes in market competition need to be assessed. It is expected that changes in the output mix associated with a higher proportion of off-balance sheet business will increase market power since competition in these activities is not as intense as it in traditional activities such as lending or deposit-taking. Moreover, non-

traditional activities may result in pricing strategies (such as price bundling), where banks seek to

compensate a decreasing growth rate of interest revenue with an increase in non-interest revenue by

charging higher prices in non-traditional business. Therefore, testing hypothesis 1 will be relevant for

three main reasons: (1) changes in market power with output innovations may alter the interpretation of

scope economies estimations; (2) competitive assumptions will determine the use of an standard or an

alternative profit and revenue functions; (3) the coexistence of cost and revenue complementarities (if

any) will only be possible if perfect competition does not hold, as noted by Berger et al. (1996).

3.2. A multioutput framework: direct and indirect function approaches

Global scope economies (*GCSE*) are defined as the percentage change in costs (profits or revenues)

when banking services are offered jointly as opposed as when each service is offered separately (Mester,

1987). When defining the cost function (*TC*), the standard approach consists of variable costs depending on

input prices, variable output quantities and given input and output quantities (Berger and Mester, 1997):

$$TC = TC(w, y, z) \tag{1}$$

where *w* is a vector of variable input prices; *y* is a vector of variable input quantities; and *z* is a vector of given

netputs[2], included to show the effects of given netputs on costs due to their complementary or substitution

relationships with variable netputs[3]. The definition of global scope economies compares complete specialization

with a joint production of financial services. However, as noted by Pulley and Braunstein (1992) and Berger et

al. (1996) complete specialization does not seem to be a realistic view of bank production and it could be more

appropriate to consider banks as 'quasi-specialized' institutions. Quasi-specialization does not only reflect a

bank producing the same proportion of all outputs jointly (which would be the standard definition of scope

economies) but also allows to account for banks having different specialization levels. Then, the quasi-

specialized cost scope economies (QCSE) as:

$$QCSE = [TC\{1 - (m-1) \in\} \ Q_1, \in Q_2, ..., \in Q_{n+m}; \overline{r}) + TC(\in Q_1, \ \{1 - (m-1) \in\} Q_2, ..., \in Q_{n+m}; \overline{r})$$
$$+ ... + TC(\in Q_1, \in Q_2, \ ..., \{1 - (m-1) \in\} Q_{n+m}; \ \overline{r}) - TC(\ Q_1, \ Q_2, ..., Q_{n+m}; \overline{r})] \ / \ TC(\ Q_1, \ Q_2, ..., Q_{n+m}; \overline{r}) \tag{2}$$

where *m* is the number of outputs (Q_i, *i=1,…,m*) and $\in$ is the proportion on non-specialized outputs produced,

so that when $\in = 0$ expression (2) turns into *GCSE*. When $\in > 0$ we obtain different measures of subadditivity in

costs capturing scope economies for a given output mix ranging from complete diversification ($\in = 0$) to

different levels of specialization (higher values of $\in$). Therefore, QCSE is an empirical subadditivity measure since we are able to estimate scope economies with simultaneous changes in scale and product mix. Institution size becomes a very relevant issue at this point since specialization and subadditivity change with bank output level. Output mix strategies vary significantly with bank size. Moreover, these strategies could change significantly if the off-balance sheet business is significant -as it is in a broad banking environment- and is taken into account when comparing different degrees of specialization and subadditivity as is the case in this study.

Profit scope economies are also important, specifically when including off-balance sheet output, where they are expected to be larger than cost advantages (Kane, 1995; Golter, 1996; Rogers, 1998). The definition of profit scope economies will depend upon some important assumptions regarding the maximization and pricing behavior of bank firms. First of all, the standard indirect profit function approach assumes perfect competition in bank markets, where banks are price-takers in both input and output markets (Humphrey and Pulley, 1997; and Berger and Mester, 1997). Under this approach, there will be a given vector of on and off-balance sheet outputs (y), a vector of inputs (x) and also a vector of netputs $Q = (y, -x) = (Q_1,\ldots, Q_{n+m}, -x_1, \ldots, -x_n)$. The standard profit function is defined as $\pi = P'Q$, where P is a vector of output prices (p) and input prices (r) so that P=(p,r)' = $(p_1,\ldots,p_{n+m},r_1,\ldots,r_n)'$. In a competitive environment, prices are exogenous. However, the perfect competition hypothesis does not seem to be plausible in most banking markets, where a certain degree of market power is observed (Humphrey and Pulley, 1997).). As noted by Berger et al. (1996) and Humphrey and Pulley (1997) banks are known to have some control over the level of output prices charged so that output price exogeneity does not apply to many banking products. In particular, two thirds of banking profits (revenues) are associated with services where price-setting was expected. A benefit of the alternative profit function is that it permits the use of a more accurately measured metric-output quantity (y) for improved local identification of revenues, and hence profits. Therefore, an alternative indirect function is employed here, where firms maximize profits for a given vector of output quantities (y) and input prices (r) choosing output prices (p):

$$\underset{p,\,x}{Max}\ \pi\ =\ P'Q\ =\ (p,r)(y,\ -x)'\quad s.t.\quad g(p,y,r)\ =\ 0$$
$$h(y,x)\ =\ 0$$

(3)

when $g(p,y,r,z)$ is a bank's pricing opportunity set for given values of y and r in the transformation function. This reflects the bank's assessment of its competitive position as well as its assessment of the willingness of customers to pay the prices the bank wishes to charge. The function g(.) also reflects any conjectural variations

incorporated in pricing rules the bank may follow, such as differentially marking up the cost of funds; hence, the inclusion of input prices. The Lagrangian yields the optimal choice of output prices ($p = p[y,r,z]$) and input quantities ($x=x[y,r]$), and the alternative indirect profit function is defined as[4]:

$$\pi \;=\; P'Q \;=\; [p(y,r),r][y, \; -x(y,r)]' \;=\; \pi(y,r) \tag{4}$$

Following (2), the 'quasi –specialized' (*QPSE*) profit scope economies function can be defined as:

$$QPSE \;=\; [\{\pi(\,Q_1,\,Q_2,...,Q_{n+m};\overline{r}\,) - \pi(1-(m-1)\in\}Q_1,\in Q_2,...,\in Q_{n+m};\overline{r}\,)$$
$$- \pi(\in Q_1,\,\{1-(m-1)\in\}Q_2,...,\in Q_{n+m};\overline{r}\,) - ... - \pi(\in Q_1,\in Q_2,\,...,\{1-(m-1)\in\}Q_{n+m};\,\overline{r}\,)] \;/\; \pi(\,Q_1,\,Q_2,...,Q_{n+m};\overline{r}\,) \tag{5}$$

Both cost and profit scope economies will be estimated under the above competitive assumptions[5]. In any event, output mix needs to be assessed both globally and between (on and off-balance sheet) output pairs since many scope economy (diseconomy) relationships between certain outputs can not be assessed separately within the global scope economy definition. Therefore, output pair complementarities are also defined both for costs (*CSC*) and profits (*PSC*) as:

$$CSC = (-)\frac{\delta^2 C\;(Q_1,\,Q_2,\,...,\,Q_{n+m};\,P_1,\,...,\,P_K)}{\delta Q_i \delta Q_j}\;; \quad \forall\, i \neq j \qquad i,j = 1,...,n+m; \tag{6}$$

and

$$PSC = \frac{\delta^2 \pi\;(Q_1,\,Q_2,\,...,\,Q_{n+m};\,P_1,\,...,\,P_K)}{\delta Q_i \delta Q_j}\;; \quad \forall\, i \neq j \qquad i,j = 1,...,n+m; \tag{7}$$

where *CSC* (*PSC*) is defined as the change in marginal cost (profit) of producing output *i* relative to changes in output *j*, so that when *CSC>0* (*PSC*>0), there are complementarities in costs (profits) of producing jointly outputs *i* and *j*.

Within this theoretical framework, we aim to test the two following hypotheses:

- *Hypothesis 2*: In a broad banking environment, expected cost and profit complementarities between traditional activities (eg. loan supply and deposit-taking) will increase significantly when their extended informational and technological properties beyond the balance sheet (lines of credit, loan commitments) are included in the output mix definition.

Expected complementarities in traditional banking (i.e. Kashyap et al., 1999) were not found in most of the previous empirical studies. It is possible that complementarities between activities such as lending and deposit-taking will only be detected if the associated customer relationships are specified. This relationship is

essentially intertemporal. Activities such as loan commitments may proxy the length of these intertemporal relationships. Therefore, we will expect scope economies to increase when relating loan commitments to products such as loans or deposits.

- *Hypothesis 3*: Cross-selling cost and profit scope economies or diseconomies between on and off-balance sheet outputs (not necessarily related to lending activities) may differ substantially depending on output mix definition. As noted by Stiroh (2000), a substantial portion of revenue from fee and service activities and off-balance sheet items like lines of credit or loan commitments are now important activities that are growing over time and are mainly concentrated in the largest institutions. Therefore, failure to account for them may lead to incorrect conclusions. The existence of cross-selling advantages between deposits and mutual funds can be expected since both products can be held (for diversification purposes) by the same customer within the same branch. However, deposits and mutual funds may also be seen as substitutes and, in this case, cross-selling advantages will not be accomplished (Kane, 1995).

3.2. Cost and profit scope economies and the one-stop banking hypothesis

A fourth hypothesis arises by looking at the revenue side of bank activities. This is the following:

- *Hypothesis 4:* Consumer's valuation of broad banking services (one-stop banking hypothesis) will only come into light when including traditional and non-traditional activities jointly in the output mix. This will be the expected result since the current structure of banking services is wider and more complex. Bank customers demand a wider range of products beyond (and along with) loans and deposits and they only value lending and deposit-taking activities if banks offer them additional services (such as debit or credit cards, mutual funds or securities underwriting).

Hypothesis 4 requires some additional assumptions to evaluate consumer valuation of broad banking properly. Under certain conditions, revenue scope economies will illustrate synergies in the joint consumption of financial services (one-stop banking hypothesis). For banks to obtain greater revenues in the joint production of financial services, output prices have to vary with different output mixes (Berger, et al., 1996). Revenue economies of scope would exist in a competitive environment only if: (1) consumers are willing to pay a premium for jointly provided financial services; and (2) there are cost diseconomies of scope. If there were no

cost justification for charging higher prices for services provided jointly, competition among banks would eliminate the revenue synergies, even if consumers valued jointness. Therefore, the coexistence of cost and revenue scope economies will be only possible in a less than perfectly competitive environment. Potential reductions in transaction and searching costs for customer may incentive banks to supply a wide range of services.

Under the same assumptions in [4], an alternative indirect revenue function (R) is also defined to analyze complementarities in consumption. The revenue problem seeks to maximize the revenue function:

$$\underset{p}{Max}\ R\ =\ p'y \quad \text{s.t.} \quad g(p,y,r) = 0 \tag{8}$$

and the Lagrangian yields the revenue maximizing prices as functions of y and r:

$$R\ =\ p'y\ =\ p(y,r)'y\ =\ R\ (y,r) \tag{9}$$

and the 'quasi-specialized' revenue economies of scope (QRSE) and revenue complementarities (RSC) are defined similarly to profits as in (5) and (7).

4. Data and empirical approach.

4.1. Data and variable definition

Cost, profit and revenue scope economies and complementarities[6] are estimated for a large sample of Spanish banks over 1993-1999 using semi-annual data. This period covers the larger expansion of 'broad banking' in Spain with two main features: (1) a very high growth of mutual funds managed by banks as the main example of 're-conducted disintermediation' and (2) a simultaneous significant growth of loan products both on an off-balance sheet (ie. loan commitments). The sample includes 38 commercial and savings banks summing up to 531 semi-annual observations during 1993-1999 and accounting for 75-80% of the total assets of the Spanish banking industry[7].

In order to estimate scope economies and cost complementarities in a 'broad banking' environment, data on costs, profits, revenues, output quantities and input prices is required. The variables employed in the empirical approach are defined as follows:

- **TC**: total costs, as the sum of all interest and operating costs, including the underlying operating costs of deposits, staff and physical capital costs.
- **PF**: profit before taxes.

- **TR**: total revenue, including interest and non-interest income.

- **LN**: Loan portfolio, including customer and interbank loans.

- **DP**: sight and term deposits.

- **OE**: other earning assets different from loans, including securities, shares and industrial participations.

- **LC**: loan commitments, including lines of credit and other off-balance sheet loan commitments (credit cards).

- **MF**: mutual fund off-balance sheet' assets.

- **DC**: price of deposits as the ratio 'interest expenses to short-term funding' (including customer and interbank deposits and short-term equity debt).

- **SC**: average labor cost per manhour.

- **KC**: an approximation to the unit cost of physical capital including the opportunity cost of equity capital or reserves. As noted by Hughes et al. (2001), scale and scope economies estimations can be biased if the cost of equity capital is not incorporated to the cost function. Banks' capital structure and, in general, their production decisions are influenced by risk-taking incentives related to capital structure that are controlled by incorporating the cost of equity capital[8].

All the variables were computed employing balance sheet and income statement data provided by the Spanish Banking Association (AEB) and the Spanish Confederation of Savings Banks (CECA). Data on mutual funds distribution is provided by National Financial Markets Commission (CNMV)[9].

4.2. Controlling for changes in competition with output innovations

Hypothesis 1 assumes that adding off-balance sheet activities alters market power and this changes the underlying market structure being evaluated. Testing this hypothesis will also provide estimated scope economies with robustness since the validity of these results depend on the competitive assumptions mentioned earlier. To achieve this goal, we follow the New Industrial Organization literature by estimating the mark-up of price over marginal costs and the Lerner Index for various output definitions[10].

The Lerner index is defined as the mark-up relative to output price ($[(p- c'(y_i, w_j)]/p$). Since marginal cost has to be estimated, the composite function is employed here also to estimate the marginal cost of total assets.

Since the aim is to compare the effect of output innovations on competition, the Lerner index is estimated considering total assets and total assets plus off-balance sheet (including loan commitments and mutual funds) as the output definitions, in order to find out if the level of competition varies significantly with output innovations[11]. The Lerner index is computed for two time periods (1993-1995 and 1996-1999) separated by the advent of the Single Market in Europe and a change in the business cycle[12].

4.3. The composite function and the output mix

A composite function is employed to model the behavior of costs, profits and revenues in a multioutput framework. Compared with other commonly used functional forms –such as the translog or quadratic- the composite produces more robust and efficient results in modeling multioutput technologies. It has been applied to compute scope economies in banking by Pulley and Braunstein (1992) and Berger et al. (1996, 2000) for the US, and McKillop, et al. (1996) for giant Japanese banks.

The composite actually nests a standard translog, a generalized translog and quadratic functional forms. Multiplicative forms such as the translog usually impose separability between inputs and outputs and input demand elasticities are defined equally and independently of changes in input prices. As noted by Carroll and Ruppert (1984) and Snee (1986) the composite function offers an alternative specification by transforming both sides of the cost (profit or revenue equation) and permitting us model empirically the dependent variable both in logarithms or in levels and contrast the results. As noted, by Berger, et al. (2000), the composite admits zero values for output, does not impose separability between outputs and input prices and allows for zero or negative values of the dependent variables, which is likely to occur in the case of profits. A generalized composite cost (alternative profit, revenue) function is, then, defined as a Box-Cox transformation of total costs:

$$f^{(\phi)}(q_i, \ln r_k) =$$

$$TC^{(\phi)} = \left(\begin{array}{l} \left[\alpha_0 + \Sigma\alpha_i q_i + \frac{1}{2}\Sigma\Sigma\alpha_{ij}q_i q_j + \Sigma\Sigma\delta_{ik}q_i \ln r_k \right] \\ .\exp\left[\beta_0 + \Sigma\beta_k \ln r_k + \frac{1}{2}\Sigma\Sigma\beta_{kl} \ln r_k \ln r_l + \Sigma\Sigma\mu_{ik} q_i \ln r_k \right] \end{array} \right)^{(\phi)} + \varepsilon \qquad (10)$$

$$s.t. \quad \begin{array}{ll} TC^{(\phi)} = (TC^\phi - 1)/\phi & when \ \phi \neq 0 \\ = \ln TC & when \ \phi = 0 \end{array}$$

where q_i is the vector of output quantities ($i= 1,..., n+m$), and r_K is the vector of input prices ($k = 1,…n$). Then, the composite in (10) will adopt a logarithmic form when $\phi = 0$, while it will correspond to a generalized form in unlogged output levels when $\phi = 1$ [13].

ϕ is introduced as a parameter to be estimated so that the equation structure is a testable hypothesis itself. However, the composite is non-linear and should be estimated iteratively. Non-linear least squares routines are employed to estimate ϕ and all the other cost (profit or revenues) function parameters in equation (10)[14]. In particular, equation (10) is estimated using a psedo-model (Pulley and Braunstein, 1992) with a dummy $\underline{D} = \underline{0}$ and defining the geometric mean of total cost as TC*, the pseudo-model is:

$$D = [-(TC^{(\phi)}/TC^{*\phi-1}) + (f^{(\phi)}(q_i, \ln r_k)/TC^{*\phi-1}) \tag{11}$$

To estimate the composite function in (11), three inputs ($k = 1, …,3$) are used: the price of deposits (DC), labor (SC) and physical capital (KC). Together, three different outputs are included. We employ two definitions of traditional and non-traditional output mix to estimate changes in cost (profit, revenue) scope economies with 'broad banking':

- Traditional output mix: (1) loans (LN); (2) deposits (DP); and (3) other earning assets (OE), representing a traditional balance sheet output mix.

- Alternative five-output definition: (1) loans (LN); (2) loan commitments (LC); (3) deposits (DP); (4) other earning assets (OE); and (5) mutual funds (MF).

- The alternative five-output definition will be employed to check changes in scope economies when off-balance sheet business is considered, as well as to estimate cost, revenue and profit complementarities between output pairs.

With these input prices and output mix definitions global cost, profit and revenue economies of scope (*GCSE, GPSE* and *GRSE*) can be estimated following equation (10), having in mind the structural form of the cost, profit and revenue functions in (1), (4) and (9), respectively. The reduced form of the cost (alternative profit or revenue) equation would be:

$$TC^{(\phi)} \ (or \ PF^{(\phi)} \ or \ TR^{(\phi)}) = \{F(q, \ln r) \cong \exp[G(\ln r)]\}^{(\phi)} + \varepsilon \tag{12}$$

so that 'quasi specialized' cost, profit or revenues economies of scope (*QCSE, QPSE* and *QRSE*) are defined as:

$$QCSE \ = \ [(m\text{-}1)\alpha_0 \ - \ \frac{1}{2}\sum_i\sum_{j\neq i}\alpha_i q_i q_j]/F(q,\ln r) \tag{13}$$

$$QPSE \ (or \ QRSE) \ = \ [-(m\text{-}1)\alpha_0 \ + \ \frac{1}{2}\sum_i\sum_{j\neq i}\alpha_i q_i q_j]/F(q,\ln r) \tag{14}$$

Then, to analyze subadditivity from complete diversification ($\in= 0$) to complete specialization ($\in= 1/m$), six different specialization levels are defined from $\in= 0$ to $\in= 1/m$ for the three output definition ($\in= 0$, $\in= 0.01$, $\in= 0.05$, $\in= 0.1$, $\in= 0.2$, $\in= 0.3$)[15] and the alternative 5-output definition ($\in= 0$, $\in= 0.01$, $\in= 0.05$, $\in= 0.1$, $\in= 0.15$, $\in= 0.2$). Therefore, if we find scope economies (diseconomies), we will expect these economies to decrease (increase) as we move from $\in= 0$ to $\in= 1/m$, showing that cost, revenue or profit advantages diminish with higher specialization. " 'Quasi specialized' economies of scope permit us to undertake an additional analysis by separating global scope economies in two components, fixed scope economies and complementarities. From (13) and (14) we will have:

$$QCSE \ = \ [(m\text{-}1)\alpha_i / F(q,\ln r)] \ - \ [\frac{1}{2}\sum_i\sum_{j\neq i}\alpha_i q_i q_j / F(q,\ln r)]$$

$$QPSE \ (or \ QRSE) \ = \ [-(m\text{-}1)\alpha_i / F(q,\ln r)] \ + \ [\frac{1}{2}\sum_i\sum_{j\neq i}\alpha_i q_i q_j / F(q,\ln r)] \tag{15}$$

$$(\textit{fixed scope economies}) \quad \pm \quad [\textit{complementarities}]$$

5. Empirical results

5.1. Market power beyond the balance sheet

We first study if off-balance sheet diversification has resulted in significant apparent changes in competition among Spanish banks (hypothesis 1). It is interesting to analyze –as a reference for the competition and scope economies results- how profitability changes across bank specializations, in order to appropriately compare the outcomes of banks with their estimated competitive and output mix behavior. The average value of the ratio of loans to total assets over the period was used to define three different levels of specialization according to sample distribution. Three sub-samples were defined for banks with a ratio of loans to total assets lower than 0.7; between 0.7 and 0.8; and higher than 0.8, respectively. Both ROA and ROE increase over time although there are significant differences with specialization. In particular, highly specialized banks are less profitable (and these profits also seem to be more volatile) than more diversified institutions. This evolution

14

might be the result of both an intensification of competition in traditional activities and of the benefits of a higher diversification.

Once profitability across specialization levels has been assessed, the first hypothesis can be tested. The results of the competition analysis are shown in Table 1. The Lerner index is computed from the composite cost function employing, first, a traditional definition of bank output (total assets) and, second, a definition of output beyond the balance sheet (total assets plus loan commitments and mutual funds). The results suggest an increase in competition between 1993 and 1999 when only balance sheet business is considered. When adding off-balance sheet outputs, the Lerner index rises significantly[16] showing that diversified banks may increase market power with fees and commissions related to off-balance sheet business. Therefore, off-balance sheet diversification may imply a countervailing effect to the rising competition in traditional markets, increasing non-interest revenue and fee-earning activities as to compensate the reduction in loan rates.

Although off-balance sheet business may alter the competition indicators, the changes are not significant enough as to modify the estimated market structure[17]. These results have some important implications for the empirical purposes of the paper. First of all, since the market structure seems to be less than a competitive, the election of the alternative profit and revenue functions appears to be plausible. Second, since competition does not change over time or when including off-balance sheet products as to alter the underlying market structure, the interpretation of the results from different output mix definitions will be less influenced by changes in competition. Finally, since perfect competition does not hold, the coexistence of cost and revenue complementarities is possible, as noted by Berger *et al.* (1996).

5.2. Cost and profit scope economies and complementarities in traditional and non-traditional banking

The composite cost and profit functions were estimated to test hypothesis 2 (scope economies increasing in traditional activities with off-balance sheet technological and informational improvements) and hypothesis 3 (cross-selling benefits from output diversification beyond the balance sheet). Table 2 presents

results for the traditional output mix while Table 3 presents results for the alternative five-output definition. Global scope economies in the joint production of balance-sheet outputs –loans, deposits and other earning assets- are 19% where 3% corresponds to fixed scope effects and 16% to cost complementarities (Table 2). As expected, quasi-specialization levels show that estimated cost advantages diminish with higher specialization ($\in$), that is going from a pure scope effect ($\in= 0$) to a pure scale effect ($\in= 1/m$). When the output includes off-balance sheet activities –adding loan commitments and mutual funds- these economies rise somewhat to 23% overall (Table 3), showing the potential cost economies beyond the balance sheet.

The results are even more informative when analyzing cost complementarities between specific output pairs. Economies between deposits and loans are 25%. Importantly, these cost economies are significantly higher if loan commitments are considered together with loans (43%) or deposits (46%), showing the relevance of the concept of relationship lending in achieving the theoretically assumed complementarities of traditional banking (Kashyap et al., 1999)[18]. Nevertheless, the cost differences between traditional and market-oriented activities are clearly reflected in the diseconomies found between deposits and other saving instruments such as mutual funds, a result in line with Jagtiani et al. (1995). However, as shown above, the overall effects of profit diversification seem to be positive from the cost perspective.

Table 2 also shows the main results derived from the profit composite function. Estimated global profit scope economies are negative (-22%) when considering only balance sheet outputs. Nevertheless, these global diseconomies disappear when adding off-balance sheet services (Table 3) –where profit opportunities are expected to be higher- to the output mix, becoming 2%. It should be noted that, as specialization increases (higher values of $\in$) there are significant reductions of profits (including profit diseconomies). This is a similar result to Berger et al. (1996) for the US.

Table 3 also shows that estimated profit complementarities between deposits and loans are 16%, showing that profit advantages in Spanish traditional banking appear when the connection between lending activity and deposit services is broadly defined. Finally, profit complementarities between deposits or mutual funds are negative, which does not support the hypothesis of profit cross-selling advantages between traditional and non-traditional saving products.

5.3. One-stop banking beyond the balance sheet

The results from the revenue composite function are also shown in Table 2. Global revenue scope diseconomies are found between balance sheet outputs. We consider the positive value of the fixed economies component as spurious since it would imply positive revenues when the output level is zero[19]. However, the diseconomies turn positive and significant (5%) when off-balance sheet business are included (Table 3). Estimated fixed scope economies are zero, as expected, in this case.

In any event, it is difficult to appreciate how consumers value one-stop banking globally. Therefore, revenue complementarities between specific financial services are shown in Table 3. According to Berger, Humphrey and Pulley (1996), revenue complementarities are not found between loans and deposits. Moreover, they are negative (-12%). It should be noted, however, that the valuation of the joint supply of lending and deposit services becomes positive and significant when including loan commitments along with loans (35%) or deposits (27%). However, as for profits, consumers do not appear to value the joint consumption of deposit services with securities or mutual funds. Therefore, regarding hypothesis 4, consumers apparently value one-stop banking in Spain, although this valuation can be only detected when including off-balance sheet business along with traditional services.

5.4. Scope economy estimations for different levels of specialization

The sample of banks has been divided into three different specialization levels according to balance sheet structure in order to show differences in scope economy estimations depending on specialization patterns more directly[20].

The three sub-samples of banks with a ratio of loans to total assets lower than 0.7; between 0.7 and 0.8; and higher than 0.8, respectively, were employed again. The values of the ratio were chosen according to sample composition. Loans represent more than the 80% of total assets for most of the small banks in Spain. However, the proportion of loans for the majority of well diversified (medium and large) banks is usually lower than 70%. This 70% level was quite restrictive for most of the small banks in the sample while many medium banks have a ratio "loans/total assets" between 0,7 and 0,8. The results are shown in Table 4 for the traditional and augmented output mix definitions, and are similar to those obtained in Tables 2 and 3. The results show how the cost, profit or revenue advantages are lower as banks become more specialized. In any event, scope economies increase for all specialization levels with off-balance sheet business. These advantages are

17

particularly significant from the cost side. It is worth noting that less specialized institutions tend to have higher potential cost advantages with diversification. The differences between the sub-samples are statistically significant. The case of revenues for the augmented output mix is particularly interesting, showing a change from positive to negative consumption complementarities with increasing specialization.

6. The coexistence of cost and revenue complementarities: conclusions and competitive caveats

Innovations and changes in regulation are changing the financial landscape all over the world. Financial institutions, as multiouput technologies, are largely conditioned by the development of new products and the limits imposed by regulation to diversify their activities beyond the traditional bounds (broad banking). Since both innovations and regulations have experienced significant transformations across countries and over time, we wonder the extent to which those changes may be affecting banks' cost, profit and revenue differently. Many previous studies have analyzed these parameters but most of them refer to the US in the pre-deregulated environment, with different methodologies to model multioutput technologies and rarely considering off-balance sheet business.

The Spanish banking system seems to be a good laboratory to study the behavior of cost, profits and revenues in a 'broad banking environment' including new business lines in the output mix. A composite function is employed to estimate cost, profit and revenue economies of scope. Four main hypotheses were tested. The main results confer an important role to output mix in revealing cost, profit or revenue scope economies and complementarities between output pairs. It should be noted that the coexistence of cost and profit (revenue) complementarities is possible under a less than perfectly competitive environment, as has been empirically tested by analyzing market power with output diversification (hypothesis 1). However, the results of the competitive analysis reveal that diversification increases market power although these changes have not yet contributed to alter the underlying bank market structure in Spain significantly.

Certain cost and profit complementarities predicted in theoretical models (i.e., between deposits and loans) only appear when their off-balance sheet technological expansion (loan commitments) is incorporated (hypothesis 2), while other cost and profit global scope economies improved significantly when including mutual funds along with other earning assets, showing certain cross-selling and portfolio diversification benefits (hypothesis 3). Together, revenue complementarities were computed as a proxy for consumer valuation of one-

18

stop banking, as the joint supply of various financial services (hypothesis 4). Revenue complementarities between deposits and loans were only found when loan commitments were included, while complementarities between loans and other earning assets increased significantly when mutual funds were added. The results obtained in a 'broad banking system' contrast with previous evidence in more restricted environments.

ACKNOWLEDGEMENTS

References

- Barth, J., Brumbaugh, R.D. and Wilcox, J. (2000.) *The repeal of the Glass-Steagall Act and the Advent of a Broad banking*. Economic Policy Analysis WP 2000-5. Washington: Office of the Comptroller of the Currency.

- Berger, A., Cummins, J.D., Weiss, M.A. and Zi, H (2000.) Conglomeration versus strategic focus: evidence from the insurance industry. *Journal of Financial Intermediation* 9: 323-362.

- Berger, A., Hancock, D. and Humphrey, D. (1993.) Bank efficiency of financial institutions: A review and preview of research past, present and future. *Journal of Banking and Finance* 17: 221-249.

- Berger, A., Humphrey, D. and Pulley, L. (1996.) Do consumers pay for one-stop banking? Evidence from an alternative revenue function. *Journal of Banking and Finance* 20: 1601-1621.

- Berger, A. and Mester, L. (1997.) Inside the black box: what explains the differences in inefficiencies of financial institutions?. *Journal of Banking and Finance* 21: 895-947

- Berger, A. and Udell, G. (1995.) Relationship lending and lines of credit in small firms finance. *Journal of Business* 68: 351-379.

- Bikker, J.A. and Haaf, K. (2002.) Competition, concentration and their relationship. An empirical analysis of the banking industry. *Journal of Banking and Finance* 26: 2191--2214

- Carroll, R. and Ruppert, D. (1984.) Power transformation when fitting theoretical models to data. *Journal of the American Statistical Association*: 79: 321-328.

- Carbó, S., Humphrey, D. and Rodríguez, F. (2003.) Bank deregulation is better than mergers. *Journal of International Financial Markets, Institutions and Money* 13: 429-449.

- Clark, J. (Sep. 1988.) Economies of scale and scope at depository financial institutions: a review of the literature. Federal Reserve Bank of Kansas City, *Economic Review*:16-33.

- Clark, J. and Siems, T.F. (2002.) X-efficiency in banking: looking beyond the balance sheet. *Journal of Money, Credit and Banking* 34: 987-1014.

- Das, S.R. and Nanda, A. (1999.) A theory of banking structure. *Journal of Banking and Finance* 23: 863-895.

- De Bandt, O., and Davis, P. (2000.) Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU, *Journal of Banking and Finance*, 24: 1045-1066.

- Dietsch, M. and Lozano-Vivas, A. (2000.) How the environment determines banking efficiency: a comparison between French and Spanish industries. *Journal of Banking and Finance*, 24: 958-1004.

- Ferrier, G., Grosskopf, S., Hayes, K. and Yaisawarng, S. (1993.) Economies of diversification in the banking industry: a frontier approach. *Journal of Monetary Economics* 31: 229-249.

- Gallo, J.G., Apilado, V.P. and Kolari, J.W. (1996.) Commercial bank mutual fund activities: Implications for bank risks and profitability. *Journal of Banking and Finance* 20:1775-1791.

- Golter, G. (1996.) Banks and Mutual Funds. *Federal Deposit Insurance Company Banking Review* 8: 10-20.

- Hughes, J.P., Mester, L.J. and Moon, C.G. (2001.) Are scale economies in banking elusive or illusive?: Evidence obtained by incorporating capital structure and risk-taking into models of bank production. *Journal of Banking & Finance* 25: 2169-2208.

- Humphrey, D. and Pulley, L. (1997.) Bank's responses to deregulation: profits, technology and efficiency. *Journal of Money, Credit and Banking* 29: 73-93.

- Jagtiani, J. and Khanthavit, A. (1996.) Scale and scope economies at large banks: including off-balance sheet products and regulatory effects, (1984-1991). *Journal of Banking and Finance* 20: 1271-1287.

- Jagtiani, J., Nathan, A. and Sick, G. (1995.) Scale economies and cost complementarities in commercial banks: on- and off-balance sheet activities. *Journal of Banking and Finance* 19: 1175-1190.

- Kane, E.J. (1995.) *What is the value- added for large banks in offering Mutual Funds?.* WP n.5111. Cambridge, MA: National Bureau of Economic Research.

- Kashyap, A.K., Rajan, A.G. and Stein, J.C. (1999.) *Banks as liquidity providers: An explanation for the co-existence of lending and deposit-taking*. WP 6962. Cambridge, MA: National Bureau of Economic Research.

- Lau., L. (1978.) Applications of profit functions, in *Productions Economics: a dual approach to theory and applications* (Fuss, M.A. and D. McFadden, eds.) vol 1. Amsterdam, North Holland, pp. 133-216.

- Lau., L. (2000.) Duality and differentiability in production, in *Econometrics: Econometric Modelling of Producer Behavior* (D.W. Jorgenson, ed.) *vol. 1*. Cambridge, MA: The MIT Press, pp.15-188.

- McKillop, D.G., Glass, J.C. and Morikawa, Y. (1996.) The composite cost function and efficiency in giant Japanese banks. *Journal of Banking and Finance* 20: 1651--1671.

- Mester, L.J. (1987.) A multiproduct cost study of savings and loans. *Journal of Finance* 42: 423-445.

- Mester, L.J. (1992.) Traditional and non-traditional banking: An information-theoretic approach. *Journal of Banking and Finance* 16: 545-566.

- Noulas, A., Miller, S. and Ray, S. (1993.) Regularity conditions and scope estimates: the case of large-sized U.S. banks. *Journal of Financial Services Research* 7: 235-248.

- Panzar, J., and Rosse, J. (1987.) Testing for Monopoly Equilibrium, *Journal of Industrial Economics* 35: 443-456.

- Pulley, L.B. and Braunstein, Y.M. (1992.) A composite cost function for multiproduct firms with an application to economies of scope in banking. *The Review of Economics and Statistics* 74: 213-230.

- Pulley, L.B. and Humphrey, D. (1993.) The role of fixed costs and cost complementarities in determining scope economies and the cost of narrow banking proposals. *Journal of Business* 66: 437-462.

- Rime, B. and Stiroh, K.J. (2003.) The performance of universal banks: evidence from Switzerland. *Journal of Banking and Finance*, 27: 2121-2150.

- Rogers, K (1998.) Product mix, bank powers, and complementarities at U.S. commercial banks. *Journal of Economics and Business* 50: 205-218.

- Scholtens, B. (1999.) Bank and market oriented financial systems, *Banca Nazionale del Lavoro Quarterly Review* 202: 301-323.

- Scholtens, B. and Wensveen, D.V. (2000.) A critique on the theory of financial intermediation, *Journal of Banking and Finance* 24: 1243-1251.

- Stiroh, K.J. (2000.) How did bank holding companies prosper in the 1990s?, *Journal of Banking and Finance* 24: 1703-1745.

- Snee, R. D. (Oct. 1986.) An alternative approach to fitting models when reexpression of the response is useful, *Journal of Quality Technology:* 211--225.

TABLE 1. OUPUT MIX AND RELATED CHANGES IN SPANISH BANKING MARKET STRUCTURE (1993-1999).

Number of observations = 531

LERNER INDEX
Composite cost function results

Basis points = BP

	Lerner (total assets) (%)	Lerner (total assets; loan commitments; mutual funds) (%)
1993-1995	19.7	31.5
1996-1999	12.9	34.3
ENTIRE PERIOD	15.4	32.3

TABLE 2. SCOPE ECONOMIES IN THE SPANISH BANKING SYSTEM. TRADITIONAL OUTPUT MIX (1993-1999).

Composite function results

Global scope economies>0 = economies; Global scope economies<0 = diseconomies
3 Inputs: deposits, labor and physical capital
Number of observations = 531

GLOBAL COST, PROFIT AND REVENUE SCOPE ECONOMIES

Output mix (deposits; loans; securities + other earning assets)

Specialization	Global scope economies			Fixed-scope economies			Complementarities		
	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE
$\in = 0.0$	0.19*	-0.22*	-0.09*	0.03*	0.13*	0.19*	0.16*	-0.35*	-0.28*
$\in = 0.01$	0.18*	-0.21*	-0.08*	0.03*	0.15*	0.15*	0.15*	-0.36*	-0.23*
$\in = 0.05$	0.14*	-0.18*	-0.07	0.03*	0.17*	0.14*	0.11*	-0.35*	-0.21*
$\in = 0.1$	0.10*	-0.14*	-0.06*	0.03*	0.15*	0.18*	0.07*	-0.29*	-0.24*
$\in = 0.2$	0.03*	-0.09*	-0.04*	0.03*	0.13*	0.11*	0.00	-0.22*	-0.15*
$\in = 0.3$	0.01*	-0.06*	-0.03*	0.04*	0.19*	0.21*	-0.03	-0.25*	-0.24*

* statistically significant, at least, at 5 per cent level

24

TABLE 3. SCOPE ECONOMIES IN THE SPANISH BANKING SYSTEM WITH A FIVE-OUTPUTS DEFINITION (1993-1999).

Composite function results

Global scope economies>0 = economies; Global scope economies<0 = diseconomies
3 Inputs: deposits, labor and physical capital
Number of observations = 531

GLOBAL COST, PROFIT AND REVENUE SCOPE ECONOMIES

Output mix (deposits; loans; securities + other earning assets; mutual funds; loan commitments)

Specialization	Global scope economies			Fixed-scope economies			Complementarities		
	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE
∈= 0.0	0.23*	0.02*	0.05*	0.08*	0.00	0.00	0.15*	0.02*	0.05*
∈= 0.01	0.20*	0.01*	0.05*	0.09*	0.00	0.00	0.11*	0.01*	0.05*
∈= 0.05	0.12*	-0.08*	0.04*	0.02*	0.00	0.00	0.10*	-0.08*	0.04*
∈= 0.10	0.05*	-0.18*	0.02	0.09*	0.00	0.00	-0.04*	-0.18*	0.02
∈= 0.15	0.01*	-0.28*	0.01	0.07*	0.00	0.00	-0.06*	-0.28*	0.01
∈= 0.2	-0.01*	-0.38*	-0.01	0.13*	0.00	0.00	-0.14*	-0.38*	-0.01

COST, PROFIT AND REVENUE COMPLEMENTARITIES FOR SPECIFIC OUTPUT PAIRS

Specialization	Complementarities deposits-loans			Complementarities deposits- mutual funds			Complementarities deposits- loan commitments			Complementarities loans-loan commitments		
	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE	COST	PROFIT	REVENUE
∈= 0.0	0.25*	0.16*	-0.12*	-0.19*	-0.11*	-0.43*	0.46*	0.17*	0.27*	0.43*	0.31*	0.35*
∈= 0.01	0.18*	0.14*	-0.11*	-0.19*	-0.10*	-0.43*	0.37*	0.16*	0.27*	0.42*	0.30*	0.33*
∈= 0.05	-0.18	0.08*	-0.11*	-0.18*	-0.09*	-0.41*	0.07*	0.13*	0.26*	0.42	0.28*	0.28*
∈= 0.10	-0.51*	-0.01	-0.10*	-0.17	-0.06*	-0.38*	-0.21*	0.09*	0.24*	0.24*	0.24*	0.22*
∈= 0.15	-0.74*	-0.13*	-0.10*	-0.16*	-0.03	-0.18*	-0.38*	0.05*	0.23*	0.14*	0.18*	0.16*
∈= 0.2	-0.85	-0.28*	-0.09*	-0.15*	0.01	-0.11*	-0.45*	-0.01	0.15*	0.02	0.12*	0.11*

* statistically significant, at least, at 5 per cent level

TABLE 4. LEVEL OF SPECIALIZATION, OUTPUT MIX AND SCOPE ECONOMIES IN THE SPANISH BANKING SYSTEM (1993-1999).

Composite function results

Global scope economies>0 = economies; Global scope economies<0 = diseconomies
3 Inputs: deposits, labor and physical capital
Number of observations = 531
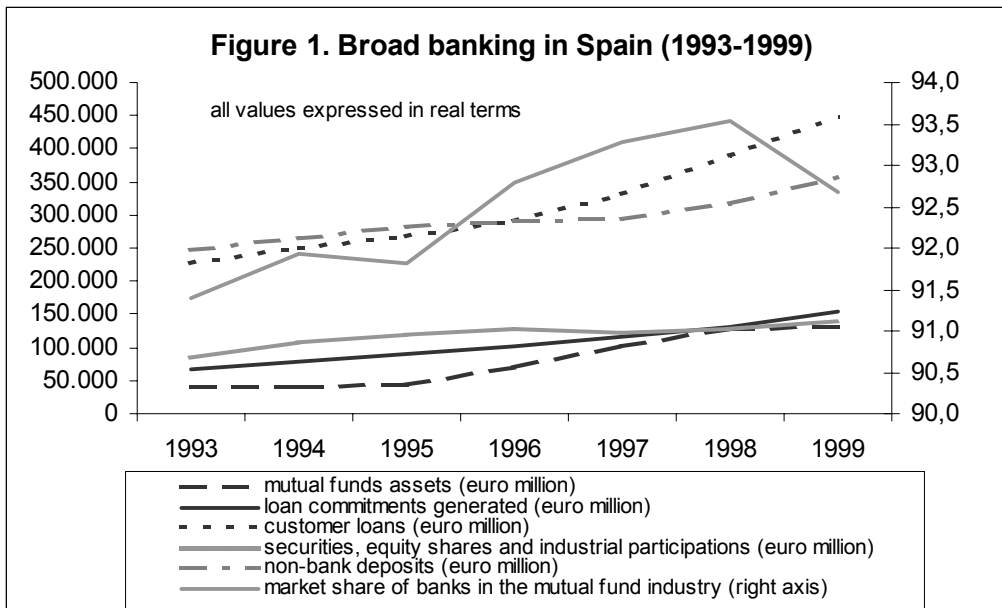
GLOBAL COST, PROFIT AND REVENUE SCOPE ECONOMIES

(1) Output mix (deposits; loans; equity + other earning assets)

Level of specialization	Global scope economies		
	COST	PROFIT	REVENUE
TOTAL SAMPLE	0.17*	-0.21	-0.08
"Loan/total assets"<0.7	0.21*	-0.23	-0.11
0.7<"Loan/total assets"<0.8	0.07*	-0.09*	-0.10*
"Loan/total assets">0.8	0.05*	-0.06*	-0.07*

(2) Output mix (deposits; loans + loan commitments; equity + other earning assets + mutual funds)

Level of specialization	Global scope economies		
	COST	PROFIT	REVENUE
TOTAL SAMPLE	0.44*	0.01*	0.01*
"Loan/total assets"<0.7	0.46*	0.04*	0.06*
0.7<"Loan/total assets"<0.8	0.38*	0.02*	0.01*
"Loan/total assets">0.8	0.23*	-0.01	-0.04*

* statistically significant, at least, at 5 per cent level

Figure 1. Broad banking in Spain (1993-1999)

all values expressed in real terms

- – – mutual funds assets (euro million)
- —— loan commitments generated (euro million)
- ···· customer loans (euro million)
- —— securities, equity shares and industrial participations (euro million)
- –·– non-bank deposits (euro million)
- —— market share of banks in the mutual fund industry (right axis)

Source: Bank of Spain and National Financial Markets Commission (CNMV).

FOOTNOTES:

---

[1] However, these activities were practically prohibited or severely restricted in the US and Japan until recently. In any event, disintermediation has expanded with financial markets, increasing interaction between banks and capital markets and the traditional distinction between market-based (i.e. US, UK) and institutional-based financial systems (i.e. Germany, France, Spain) has been somewhat blurred (Scholtens, 1999).

[2] So that $z = (z_1, \ldots, z_n)$ and if $z_i > 0$, it is an output, whereas if $z_i < 0$, it is an input.

[3] Following Hughes et al. (2001), we will include deposits as outputs along with loans and other earning assets, assuming that deposits incorporate transaction costs to the output function. In this paper, we also tried the intermediation approach – that is, treating deposits as only inputs- but we finally chose the production approach for two reasons. First, we aim to consider deposit-taking as one of the outputs to study scope economies and complementarities with other outputs. Secondly, the estimations and results were more unstable with the intermediation approach.

[4] See Lau (1978, 2000) to analyze the duality of the alternative indirect profit function to a set of multiproduction techniques (such as the composite function). It can be shown that the profit function concept is an economically appropriate way to combine a cost and a revenue functions. The cost function part of the profit function is shown to be dual to a particular production function. The usual profit function assumes perfect competition and so takes input and output prices as given from the market and maximizes profits by adjusting output levels. The alternative profit function differs only in that the profit maximization procedure is somewhat reversed to reflect market power in the output market and little competition. The alternative profit function takes input prices and output quantities as given and maximizes profits by adjusting output. The cost relationship in the alternative profit function still assumes perfect competition in the input market and so will have a dual production function. The only change from the standard profit function is that the revenue relationship here reflects the application of market power.

[5] The standard profit (revenue) function was also estimated in this study similarly to Berger et al. (1993). However, the results were not as robust and stable as those of the alternative profit (revenue) function –according to the competitive assumptions- and these results are not reported for simplicity.

[6] Only those complementarities between output pairs that can be interpreted plausibly were analyzed here.

[7] The banks excluded are small savings banks, the branches of foreign institutions and cooperative banks. It is not possible to obtain information on the off-balance sheet business of these institutions.

[8] Capital depreciation expenditures are here divided by the value of physical capital. It should be noted that market values of equity are not available. As for the robustness of our estimates to changes in capital structure, we also employed the return

on loans and securities as the opportunity cost of a bank's physical and financial capital. According to Hughes et al. (2001) a shadow price for physical and financial capital can be also employed here. This measure can be computed from a variable cost function where capital is treated as "fixed" in the short-run.

[9] Summary statistics are available upon request to the authors.

[10] It is not possible, however, to compute mark-ups, Lerner indexes or conjectural elasticities for any of the outputs employed here with the available information. Our statistical information is based on semi-annual information provided by the Spanish Bank Association (Asociación Española de la Banca, AEB) and the Spanish Confederation of Savings Banks (CECA) that are more homogenous banks found in other countries but do not provide separate information on the different types of customer or interbank loans.

[11] As shown by Carbó, Humphrey and Rodríguez (2003) for the Spanish case, there are situations in which the mark-up decreases and, as a result of a significant reduction in asset prices, the Lerner index increases. There are various ways the Lerner index may be altered and the estimations can be biased. First of all, changes in interest rates affect prices and marginal costs differently. Secondly, this indicator does not account for the cost of risk. Overall, the Lerner index could increase during the upturn of the business cycle or decrease during recessions without any change in competition within the industry. We acknowledge of these limitations although all the influences mentioned affect equally the Lerner index for any of the output mix definitions.

[12] Alternatively, we also estimated the H-statistic of Panzar and Rosse (1987), defined as the elasticity of total revenues to changes in factor prices. We employed panel data techniques as in De Bandt and Davis, (2000) or Bikker and Haaf (2002). H can be negative (input costs falling and revenue rising) suggesting strong monopoly power. If H = 1.0, then all changes in input prices are passed on to output prices, suggesting perfect competition. When H is positive but less than 1.0, monopolistic competition holds. The main results suggested that monopolistic competition holds in Spanish banking markets. These results are available upon request to the authors.

[13] It is generally not feasible to estimate both α_0 and β_0 intercepts. As we are more interested in output than input prices, and on the basis of fit, we set β_0 =0 and retain α_0 in estimation.

[14] This equation was also estimated using standard fixed-effects routines with time dummies and the results remain very similar. In any event, we prefer non-linear methods to estimate cost, revenue and profit scope economies since concavity conditions were always met.

[15] As shown in (2) this methodology permits the analysis of subadditivity from pure scope economies ($\in= 0$) to pure scale economies ($\in= 1/m$). When $\in> 0$, the result is a combination of scope and scale effects. Significance (standard errors) of scope economies and complementarities estimates are obtained following the procedure illustrated by Pulley and

Braunstein (1992), consisting of differentiating the scope equation with respect to the composite parameters and obtaining the values of the gradient at convergence and the variance and covariance matrix.

[16] A mean-difference test was applied to test the significance of changes in the Lerner index both across time and between the different output definitions. The t-statistics of the mean-different test for the change in the Lerner index between periods 1993-1995 and 1996-1999 were -4.70 (total assets) and 2.27 (total assets+ loan commitments+ mutual funds). The t-statistics of the mean-different test between the Lerner Index on total assets and the Lerner Index on "total assets + loan commitments + mutual funds" was 5.21.

[17] The H-statistic always suggest that monopolistic competition holds independently on output specialization.

[18] Deposits usually act as a loss-leader product, that is, they do not certainly contribute to increase revenues but a long-standing relationship is established that permit a bank to offer depositors other bank products such as loans, credit cards, etc. Considering only deposits or loans separately, the valuation of these services will not reflect the current situation in the Spanish banking industry where most consumers have a mortgage and, at the same time, one or more credit cards and a deposit account with the same branch.

[19] A similar result is obtained in Berger, et al. (1996).

[20] A similar analysis was developed by Berger, et al. (2000) to show differences in the strategic behavior of conglomerates depending on specialization.