# THE EFFECTS OF EXPENSE PREFERENCE ON FINANCIAL RISK[♣]

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**Abstract**

This paper analyses the effects that competition among banks with different ownership structure has on financial stability, social welfare and performance. We present a model that considers the strategic competition in retail banking when a profit-maximizing bank (a commercial bank) competes against a bank with expense preference behaviour (a savings bank). The main result is that the presence of a savings bank makes competition fiercer, reducing financial risk and increasing total welfare. We also obtain that savings banks are less risk-inclined, obtaining better performance (in terms of market share and economic profits) than commercial banks. Lastly, any bank is less stable and less profitable when competing against a savings bank. Most of the theoretical predictions can be empirically validated, and some policy implications about financial stability can be easily derived.

**Keywords:** Expense preferences; Ownership structure; Risk-taking; Financial Stability;

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## 1.- INTRODUCTION

The way that corporate governance affects the risk-taking incentives of banks have been thoroughly analyzed by the economic literature during the last years. The general conclusion is that ownership structure plays a crucial role in determining portfolio investment in risky assets: managerially controlled banks are less risky than profit-maximizing banks. (Saunders et al., 1990, Cordel et al. ,1993, Gropper and Beard.,1995; Fraser and Zardkoohi, 1996; Esty, 1997; Leaven and Levine, 2006; Iannotta et all, 2007; Cihak and Hesse, 2007). However, to the best of our knowledge, the implications that competition among banks with different ownership structure has on financial risk are still far from being known and have not yet receive the appropriate attention among policy makers and in the literature. This paper attempts to help remedy this.

The economic implications of this question become relevant because many countries have a portion of their banking system that is not privately owned so understanding the effect that competition among heterogeneous banks has on financial risk may have important policy implications. All these issues are of particular interest at current times: *"The actual financial crisis has put bank stability concern at the heart of public policy debate"* (IMF, 2007). In turn, bank stability seems also partly related to banks´ ownership structure, leading to the question of which ownership form becomes safer.

The present paper is concerned with how ownership structure affects the strategic interaction between two competing banks. In particular, the following questions will be addressed:

- How does a change in a bank's ownership structure (from stakeholder bank to stockholder bank or vice versa) affect financial stability?

- Do the risk profile, market share and the expected economic profits of a stockholder bank differ from a bank controlled by stakeholders?
- Furthermore, does a bank ownership structure affect the risk taking incentives of its competitor?

The answers to these questions will allow us to get a better understanding of the stability of the banking system, and may also yield relevant policy implications.

We present a model of duopolistic competition in the retail banking market where banks have different ownership structure: banks can either be a stockholder bank (a Commercial Bank, CB henceforth) or a stakeholder bank (a Savings Bank, SB).The model specification allows the CB to behave as a SB and vice-versa. We will explore the interaction among the different combinations (i.e., two CBs, two SBs and 1 SB + 1 CB)

Commercial Banks are profit-maximisers, while Savings Banks are not-for-profit commercial organizations: commercial in the sense that they are subject to the same regulatory and competitive conditions as other ownership forms; and not-for-profit because their profits are either retained or paid as social dividend (Hansmann, 1996).[1] We consider that SBs are either mutual institution or private foundations, so SBs can be understood as either cooperative banks or stakeholder banks with no formal owner.[2] The Property Rights theory of the firm suggests that the loose of assignment of property rights in these organizations will allow managers to impose their own preferences. Therefore, a crucial assumption in our analysis is that SBs show *expense*

[1] In Europe, SBs are organised in different ways, depending on national legislation. Thus there are SBs which are joint stock companies or private entities (Ireland, United Kingdom, Italy, Sweden, Belgium, Finland, Holland and Denmark), others are mutual institutions (France), public entities (Portugal, Switzerland, Austria, Germany, Greece and Luxemburg) and, finally, some are private foundations (Spain and Norway)

[2] This understanding allows us to link our theoretical predictions with the empirical evidence on the behaviour of cooperatives banks. It is worth noting that cooperative banks play an important role in many financial systems. In a number of countries they are among the largest financial institutions when considering as a group. And worldwide, these financial institutions serve more than 857 million people. See Cihak and Hesse (2007) for an analysis of their presence and importance around the world.

*preference behaviour* (e.g., preferences for labour expenditures in our case). This preferences specification has been already considered in the literature (Edwards, 1977; Hannan and Mavinga, 1980; Mester, 1989), and its aims to describe the behaviour of workers cooperatives as well as of organizations where the lack of property rights assignment allows managers to pursue personal targets.

We claim that the appearance of expense preference behaviours can have implications on welfare and financial risk: transforming a CB into a SB may provoke two different effects. On the one hand, a *direct effect* on the bank showing the expense preference behaviour. On the other hand, an *indirect effect* on its rival. Moreover, the indirect effect may vary among banks depending on their ownership form. Both effects, direct and indirect, may affect the performance and risk-taking incentives of banks in the same or different manner.

As a result, the overall impact of expense preference on financial stability and welfare is, in principle, undetermined. That is, considering the impact of expense preference behaviour on the risk taking incentives of banks, the shift in ownership structure of a bank from a CB to a SB may result in an homogenous response by this bank and by its competitor (i.e., both banks may increase or reduce their risk- taking behaviour), but also in different responses according to the rival´s ownership form (i.e., the bank showing the expense preference behaviour may reduce its risk-taking behaviour while its rival may increase it). In the former case, financial stability will increase (decrease) if the risk-taking incentives of both banks decrease (increase). In the latter case (different responses), the global effect on financial stability will depend on the dominating response. The effect of this kind of externality (transforming a CB into a SB) on financial stability and welfare underpins many of the conjectures often made in policy discussion on the consequences that the presence of a certain type of banks (e.g.

stakeholder banks) has on the stability of another type of banks ( e.g. stockholder banks). The empirical literature has provided support to the existence of these types of externalities. For instance, Cihak and Hesse (2007) and De Nicolò (2000) show that in systems with a high presence of non-profit maximising banks, CBs become less stable than they would otherwise be. We analyse this type of externality and its implications for financial stability.

Our analysis is primarily based on Allen and Gale (2000, Ch. 8) and Purroy and Salas (2000). The first one develops a model with Cournot competition to evaluate the potential trade-off between financial stability and competition among banks. They show that the optimal level of risk pursued by a bank increases as the number of deposit market competitors becomes arbitrarily large, although the model is restrained to competition between symmetric banks and a homogenous financial product. The second one analyses the effect of different ownership structures on profits, market shares and interest rates. Their model lacks risk considerations, and their conclusions depend on the type of competition, that is, on whether firms compete on quantities with homogeneous products or on prices with differentiated products. Our setup borrows from both models, and considers risk as well as different ownership structures. Furthermore, the kind of competition is endogenously determined. Following Singh and Vives (1984), we show that competition is on quantities. In sum, we introduce ownership considerations into the analysis of the relationship between competition and financial stability, endogenously determining how banks compete.[3]

[3] In contrast, past work focus on either (a) the analysis of different behaviour between commercial and savings (mutual) banks in terms of performance (Carbó et al.,2003; Purroy and Salas, 2000), risk incentives (Saunders et al., 2001; Esty. 1997; Iannotta et al., 2007; Bøhren and Josefsen, 2007; García-Marco and Robles-Fernández, 2008) , lending behaviour (Delgado et al., 2007), or corporate governance practices (Crespí et al., 2004) or (b) the relationship between financial stability and the competition type among symmetric banks (Keely, 1990; Besanko and Thakor, 1993; Demsetz et al., 1996; Brewer and Saidenberg, 1996; Matutes and Vives, 1996, 2000; Hellmann et al., 2000; Salas and Saurina 2003; Repullo, 2004; Boyd et al.,2005,2006; Jiménez et al., 2007).

The main conclusions we obtain are:

- The presence of a SB makes competition fiercer, reduces financial risk and increases total welfare.
- SBs are less risk-inclined, and can outperform CBs in market share and in expected economic profits. Interestingly, our results suggest that CBs may also improve their expected economic profits by showing some degree of expense preference.
- Banks (independently of their ownership structure) are less stable and less profitable when competing against a SB.

These findings are consistent with the existent empirical evidence and have some important policy implications, particularly relevant in the current debate of the conversion of SBs into CBs.

In Section 2, we present and discuss the model assumptions, providing some preliminary results used in following sections. Section 3 analyses (a) how CBs and SBs differ in their risk behaviour, market share, interest rates and economic profits; (b) how competition between banks with different ownership structure does shape risk-taking incentives and profitability. In Section 4, the implications of expense preference behaviour on financial stability and welfare are presented; empirical evidence and policy implications are also discussed. Section 5 concludes, presenting some further research.

## 2.- THE MODEL

In this section we present a model of strategic competition for the retail banking sector where banks' risk is explicitly introduced. The model borrows from both Allen and Gale (2000, 2004) and Purroy and Salas (2000).

Next, we present the model assumptions, and later we will describe the equilibrium.

### 2.1 Assumptions

**(A1)** Consider two banks with different ownership structures: the first one is a *Commercial Bank* (CB hereafter, represented by subindex 1). The second one is a *Savings Bank* (SB hereafter, represented by subindex 2).

Banks offer differentiated financial products, which gives them some market power.[4]

Both banks are risk neutral and choose a portfolio investment consisting of perfectly correlated risks[5]. A portfolio is characterized by its size ($D_i$) and rate of return ($R_i$), where $i = 1, 2$.

**(A2)** Both banks' investments have a two-point return structure: for each dollar invested, the bank $i$ receives a return $R_i$, with probability $P(R_i)$, or a null return (meaning the bank goes bankrupt) with probability $1 - P(R_i)$. Each bank chooses the riskiness of its portfolio by choosing the target return $R_i$ on its investment. Furthermore, the probability functional form is assumed to be

$$P(R_i) = 1 - AR_i \qquad i = 1, 2 \tag{1}$$

where $A \geq 0$ is exogenously given and it represents the price of risk (i.e., the decrease in the probability of success when $R_i$ increases by 1%), and $R_i$ is defined on the interval $[0, 1/A]$.[6]

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[4] Although it can be argued that banking products are largely homogeneous with respect to their physical attributes (e.g., deposits or credit cards), differentiation comes from location and quality reasons (e.g., branch network, automatic teller machines (ATMs), telebanking…) or due to their brand or images (in financial markets, the image is usually not directed to the products, but to their suppliers who seek to create consumer preferences in this way, Neuberger, 1998). Market power could also be justified through the existence of natural and regulatory barriers to entry or exit, e.g, switching cost that lead to lock-in effects in banking, asymmetric information or licensing conditions.

[5] This assumption is equivalent to assuming that the risk of each investment can be decomposed into a common and an idiosyncratic component. If there are a very large number of investments, the purely idiosyncratic component can be pooled perfectly. Then the idiosyncratic risk disappears from the analysis and only the common component representing the systemic risk remains.

[6] Such a functional specification can be seen as the linear approximation of $\exp(-AR_i)$ .

**(A3)** Banks have no capital of their own and have to raise funds from depositors to invest. To attract deposits, bank *i* offers an interest rate $r_i$ that will be paid independently of whether the bank goes bankrupt or not. That is, we assume that there is a full-deposit-insurance, for which banks pay a flat rate s>0.[7] This makes the supply of funds independent of the riskiness of the bank portfolio.

Although we do not consider bank's private cost of bankruptcy, we assume that there is a social cost of failure *K* (which is not internalized by the bank) related to external effects, such as the disruption of the payment system and contagion effects.

**(A4)** Depositors are risk neutral and supply elastically to bank *i=1,2* according to a linear schedule:

$$D_i = l + fr_i - gr_j \quad i, j = 1,2 \tag{2}$$

where *l, f, g* are parameters explicated later.

This supply function can be thought of as coming from a representative depositor (or a continuum of identical depositors) with a utility function linear in income (Matutes and Vives , 2000) :

$$U = r_i(D)D_i + r_j(D)D_j - T(D) \text{ with } T = \alpha(D_i + D_j) + \frac{(D_i^2 + D_j^2) + (2\gamma D_i D_j)}{2} \tag{3}$$

The representative investor maximizes expected utility and this yields the inverse supply:

$$r_i = \alpha + \beta D_i + \gamma D_j, \quad i, j = 1,2 \tag{4}$$

[7] The full deposit insurance assumption can also be found in other studies analysing the relation between competition and financial stability in banking. For instance Allen and Gale (2000, 2004) and Boyd and De Nicoló (2005) developed a theoretical analysis of the relationship between competition and stability in banking under full deposit insurance. Such an approach is taken to investigate whether the moral hazard problem induce by deposit insurance, could be solved by allowing banks to earn monopoly rent, (i.e., by analysing the effect of bank's market power on their risk taking behaviour).

Where $\alpha;\beta;\gamma$ are positive parameters such that $\alpha > 0; \beta \geq \frac{1}{2} \geq \gamma$ [8]

The parameter $\gamma$ measures the degree of product differentiation. When $\gamma$=1, banks offer homogeneous products, and when $\gamma$=0 banks act as monopolists.

The parameter $\alpha$ can be interpreted as the reservation value of the depositors (risk free rate); when both banks offer the same expected return $r_1 = r_2 = r$, supply becomes $D = l + (f - g)r$ which is positive if and only if $r > \alpha$.

Inverting this system we get the direct supplies in equations (2) with :

$$l = \frac{-\alpha}{\beta + \gamma}; f = \frac{\beta}{\beta^2 - \gamma^2}; g = \frac{\gamma}{\beta^2 - \gamma^2}$$

Where: $f \geq g \geq 0$

The representative depositor's utility function suggests that he values variety, i.e., he prefers to use both banks rather than only one (which appears to be according to the fact that most of the people have deposit accounts in more than just one bank). This fact can be due to the existence of different services provided (for example because one bank offers better credit card services while the other one offers better conditions for credit loans.)

**(A5)** Each bank has a production function with a single input ( labour) and constant returns to scale, as follows:

$$D_i = k_i L_i \quad i = 1, 2 \qquad (5)$$

where $k_i$ and $L_i$ represent respectively the marginal productivity and the number of workers. We further assume that both banks are equally efficient [9] ($k_1 = k_2 = k$) and that

[8] In our analysis we will assume $\beta \geq 1/2$. Otherwise consumer surplus could decrease with the number of deposits.

[9] In the case of Spain, the empirical evidence shows that SB´s and CB´s have similar levels of productive efficiency (Grifell-Tatjé and Lovell, 1997, Lozano, 1998).

there is a perfectly elastic supply of labour at a cost $\overline{w}$ per worker. Thus, the expected economic profits of bank *i* is given by:

$$E\pi_i = P(R_i)\left[(R_i - r_i(D) - s)D_i - \overline{w}L_i\right] \quad i = 1,2$$

$$E\pi_i = P(R_i)\left[R_i D_i - r_i(D)D_i - \overline{w}\frac{D_i}{k} - sD_i\right] = P(R_i)(R_i - r_i(D) - c - s)D_i \tag{6}$$

where $c = \frac{\overline{w}}{k}$ represents the marginal cost of one dollar of deposits.

The parameters are such that: $0 \le A < \frac{1}{\alpha + c + s}$ otherwise deposits supply could be negative.

**(A6)** We assume that CBs aims to maximize expected profits ($E\pi_1$). However SB´s multiple goals and its lack of a clear allocation of property rights make their objective function unclear. As was mentioned in the introduction, we focus on those SBs organizes as either private foundations (i.e., stakeholders banks with no formal owners) or as mutual institutions. Then, given this understanding of SBs and as in Purroy and Salas (2000), we appeal to the empirical evidence on (a) financial institutions with a no clear allocation of property right where managers maximise their personal utility (b) mutual banks (Edwards, 1977; Hannan and Mavinga, 1980; Mester, 1989)[10] and assume that SBs will follow an *Expense-Preference behaviour* (i.e., preferences for labour expenditures in our case: $\overline{w} \cdot L$ ).

Therefore SB´s expected utility function (SB´s *overall expected benefits*, hereafter) depend on expected profits ($E\pi_2$) and expected labour expenditures ($EZ_2 = P(R_2)\overline{w}L_2$) such that $EU_2 = (E\pi_2, EZ_2); \frac{\delta U_2}{\delta E\pi_2} > 0; \frac{\delta U_2}{\delta EZ_2} > 0$ where expected

[10] Other empirical studies providing support for the expense preference hypothesis in banking, in general, and in cooperatives and SBs in particular are: Rees, 1974; Verbrugge and Goldstein, 1981;Verbrugge and Jahera ,1981; Akella and Greenbaum,1988; Mester ,1991, 1993;Hassan and Lozano, 2002.

labour expenditures equal the total expected income pay to workers, that is $E(Z_2) = P(R_2)(R_2 - r_2(D) - s)D_2) = P(R_2)\overline{w}L_2$.

Then SB´s objective function is given by:

$$\mathrm{E}U_2 = E\pi_2 + \theta_2 E(Z_2) = P(R_2)(R_2 - r_2(D) - c - s)D_2 + \theta_2 P(R_2)(\overline{w}L_2) \quad (7)$$

Where $\theta_2$ is a positive parameter measuring the degree of expense preference behaviour (expense preference hereafter).[11]

Replacing $L_2 = \frac{D_2}{k}$ *and* $c = \frac{\overline{w}}{k}$ we have:

$$EU_2 = P(R_2)(R_2 - r_2(D) - c - s)D_2 + \theta_2 P(R_2)cD_2 = P(R_2)(R_2 - r_2(D) - c(1-\theta_2) - s)D_2 \quad (8)$$

***Remark 1*: (a)** If $\theta_2$=0 $EU_2 = E\pi_2$, the SB objective will be profit maximisation (i.e., a SB behaves as a CB). **(b)** $0<\theta_2<1$ captures the general case of a SB with expense preference behaviour. **(c)** If $\theta_2$=1 then $EU_2 = EZ_2$ (i.e., we face a pure SB aiming to maximize the total expected income paid to the workers, that is, their total labour expenditures: $EU_2 = EZ_2 = P(R_2)\overline{w}L_2 = P(R_2)(R_2 - r_2 - s)D_2$

Note that for values of $\theta_2 \leq 1$, expense preference will lead to a reduction of deposits marginal cost and hence it acts as a "strategic competitive advantage in terms of production costs".

In addition, competition between two SBs will occur if we allow the CB to show some expense preference. To do so, we could assume that the CB´s objective function is given by:

$$EU_1 = P(R_1)(R_1 - r_1(D) - c(1-\theta_1) - s)D_1 \quad (9)$$

[11] $\theta_2$ is positive because utility increase with labour expenditures. It is exogenously given and it may depend on the regulation of the different regions or in SB´s ownership structure ( see García-Cestona and Surroca, 2008).

As before, $\theta_1$ is a positive parameter, representing the degree of expense preferences. If $\theta_1$=0 then $EU_1 = E\pi_1$, so we will face a CB. If $\theta_1$>0 the CB will behave as a SB. [12]

***Remark 2***: **(a)** If $\theta_1 = \theta_2 = 0$ competition is between two CBs; **(b)** if $\theta_1 > 0$ and $\theta_2 > 0$ competition is between two SBs; **(c)** if $\theta_1 = 0$ and $\theta_2 > 0$ competition is between a CB and a SB.

In summary, to capture competition among all different possibilities of institutions, we assume that both banks maximize the following utility function:

$$MAX\ EU_i = P(R_i)\left[(R_i - r_i(D) - s - c(1-\theta_i)\right]D_i \qquad i = 1,2 \qquad (10)$$

Now, we are interested in determining the nature of strategic competition between banks. Instead of assuming that banks face Cournot competition (offering identical products) or Bertrand competition (offering differentiated ones), we endogenously obtain how banks compete. The following lemma tells us the kind of competition established in equilibrium.

***Lemma 1*****:** *In the retail banking market, banks* compete *à la Cournot.*

Proof: See Appendix 1.

The intuition behind Lemma 1 is that the crucial decision variable in the sector is (something related to) the number of branches rather than interest rates. We can interpret it in the sense that in the retail banking market banks competition refers to the quality of services. Quality variables of bank competition are, for instance, the density of their branch network, the number of Automated Teller Machines (ATM), their

[12] We assume that $\theta_1$>0 implies the transformation of a CB into a SB. Therefore in this case $\theta_1$ is also exogenously given. However it could also be interpreted that $\theta_1$ depends on CB´s managerial discretion. That is, if we appeal to the agency theory literature that argues that shareholder-owned firms may also follow non value maximization strategies (Jensen and Meckling, 1976, Chamberlain and Gordon, 1991) the CB may also show expense-preferences. In this case $\theta_1$ could be endogenously influenced by the CBs incentive system.

reputation for solvency, or the quality of the staff (Neven, 1990: 164). Since quality of the banking services (perceived by a consumer) is higher the larger the expected total number of the bank's customer, banks will compete to get the maximum number of deposits, hence they will compete à la Cournot. This result is consistent with Neuberger (1998) and De Bandt, (1996) statements that Bertrand competition is not appropriate for retail banking services. They claim that in the retail banking market, the strategic variable decision is quality.

Once we have determined that competition is established in quantities, we will assume that the game timing is as follows:

**(A7)**.- The economy lasts two dates 0 and 1: at date 0, each bank simultaneously chooses $D_i$ and $R_i$, unobservable to outsiders. At date 1, outsiders can only observe and verify at no cost whether the investment's outcome has been successful (positive output) or unsuccessful (zero output). It is important to note that the bank has complete control over the choice of risk.

### 2.2. Characterization of the equilibrium

In the (Nash-Cournot) equilibrium, each bank *i,* simultaneously chooses $D_i, R_i \in \left[0, \frac{1}{A}\right] R_+$ that is, the best response to the strategies of other banks. The pair $(D_i, R_i)$ is chosen to maximise:

$$\underset{D_i, R_i}{MAX}\ EU_i = P(R_i)\left[(R_i - r_i(D) - s - c(1-\theta_i)\right] D_i \quad i = 1,2 \tag{11}$$

Maximising $EU_i$ with respect to $D_i$ and $R_i$ yields the following First Order Conditions giving the necessary conditions for an interior solution ( $D_i > 0 \, and \, R \in (0, \frac{1}{A})$ :

$$\frac{\delta U_i}{\delta D_i} = 0 \Rightarrow R_i - r_i(D) - c \cdot (1-\theta_i) - s = D_i \cdot r'_i(D)$$
$$\frac{\delta U_i}{\delta R_i} = 0 \Rightarrow R_i - r_i(D) - c \cdot (1-\theta_i) - s = \frac{-P(R_i)}{P'(R_i)} \quad (12)$$

Hence for each bank $i = 1,2$ the equilibrium is given by the following condition:

$$R_i - r_i(D) - c \cdot (1-\theta_i) - s = D_i \cdot r_i'(D) = \frac{-P(R_i)}{P'(R_i)} \quad (13)$$

The next result characterizes the Nash-Cournot equilibrium between banks:

***Lemma 2*:** There is a unique equilibrium $(D^*_i, R^*_i) > 0$ determined from the equation:

$$R_i - r_i(D) - c \cdot (1-\theta_i) - s = D_i \cdot r_i'(D) = \frac{-P(R_i)}{P'(R_i)}.$$

Proof: See Appendix 2

Applying our parametric function to the above equilibrium condition yields the following reaction functions and equilibrium solutions:

$$R_i(R_j) = \frac{4\beta^2 - \gamma^2}{A(6\beta^2 - \gamma^2)} + \frac{(\alpha + c + s)(2\beta^2 - \beta\gamma)}{(6\beta^2 - \gamma^2)} - c\theta_i \left[\frac{2\beta^2}{(6\beta^2 - \gamma^2)}\right] + c\theta_j \left[\frac{\beta\gamma}{(6\beta^2 - \gamma^2)}\right] + R_j \left[\frac{\beta\gamma}{(6\beta^2 - \gamma^2)}\right] \quad (14)$$

$$D_i(D_j) = (\frac{1}{A} - \alpha - c - s)\left[\frac{4\beta^2 - \gamma^2}{2\beta(6\beta^2 - \gamma^2 - \beta\gamma)}\right] - c\theta_i \left[\frac{12\beta^4 - (6\beta^2 - \gamma^2)^2 - 2(\beta\gamma)^2}{2\beta((6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2)}\right] + c\theta_j \left[\frac{4\beta^3\gamma - \beta\gamma^3}{2\beta((6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2)}\right] - \frac{\gamma}{2\beta} D_j \quad (15)$$

$$R_i^* = \frac{4\beta^2 - \gamma^2}{A(6\beta^2 - \gamma^2 - \beta\gamma)} + \frac{(\alpha + c + s)(2\beta^2 - \beta\gamma)}{6\beta^2 - \gamma^2 - \beta\gamma} - c\theta_i \left[\frac{12\beta^4 - 3(\beta\gamma)^2}{(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2}\right] + c\theta_j \left[\frac{4\beta^3\gamma - \beta\gamma^3}{(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2}\right] \quad (16)$$

$$D^*_i = \frac{2\beta - \gamma}{A(6\beta^2 - \gamma^2 - \beta\gamma)} + (\alpha + c + s)\left[\frac{\gamma - 2\beta}{(6\beta^2 - \gamma^2 - \beta\gamma)}\right] - c\theta_i \left[\frac{24\beta^3\gamma^2 - 3\beta\gamma^4 - 48\beta^5}{(4\beta^2 - \gamma^2)[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2]}\right] + c\theta_j \left[\frac{8\beta^3\gamma^3 - 16\beta^4\gamma - \gamma^5}{(4\beta^2 - \gamma^2)[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2]}\right] \quad (17)$$

$$r^*_i = \alpha + \frac{2\beta^2 + \beta\gamma - \gamma^2}{A(6\beta^2 - \gamma^2 - \beta\gamma)} + \frac{(\alpha + c + s)(\gamma^2 - 2\beta^2 - \beta\gamma)}{(6\beta^2 - \gamma^2 - \beta\gamma)} - c\theta_i \left[\frac{40\beta^4\gamma^2 + \gamma^6 - 48\beta^6 - 3\beta^2\gamma^4 - 8\beta^3\gamma^4}{(4\beta^2 - \gamma^2)[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2]}\right] + c\theta_j \left[\frac{8\beta^4\gamma^3 + 32\beta^5\gamma + 2\beta\gamma^5 - 24(\beta\gamma)^3}{(4\beta^2 - \gamma^2)[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2]}\right] \quad (18)$$

$$E\pi^*_i = P(R^*_i)\cdot(R^*_i - r^*_i - c_i - s)\cdot D^*_i \quad (19)$$

$$EU^*_i = P(R^*_i)\cdot(R^*_i - r^*_i - c_i(1-\theta_i) - s)\cdot D^*_i \quad (20)$$

i,j=1,2

Equation (19) and (20) with equilibriums values are shown in appendix 3

The model solution allows us to obtain predictions on two main issues. First, we check the effect that the interplay between competition in retail banking market and bank ownership structure (CBs vs. SBs) may have on profits, market share, interest rates, and risk taking incentives (Proposition 1). Second, we look for the implications that expense preferences have on welfare and financial stability (Proposition 2). The next section is devoted to obtain and comment on proposition one, while proposition two is presented later in Section 4.

## 3.- THE EFFECTS ON BANK'S PERFORMANCE

This section analyses the relationship between ownership and competition. In particular, we explore whether there are differences in the behaviour of banks depending on their own ownership structure and on the rival's. The following proposition establishes the effects that expense preference has on risk, market share and profits:

***Proposition 1: (a)*** *The risk shifting decreases (increases) with its own (the rival's) expense preference (*$\frac{\partial R_i}{\partial \theta_i} < 0$ *,* $\frac{\partial R_i}{\partial \theta_j} > 0$ *).*

*The market share increases (decreases) with its own (the rival's) expense preference (*$\frac{\partial D_i}{\partial \theta_i} > 0$ *,* $\frac{\partial D_i}{\partial \theta_j} < 0$ *).*

*Interest rate (offered) increases with its own and rival expense preference* ($\frac{\partial r_i}{\partial \theta_i} > 0, \frac{\partial r_i}{\partial \theta_j} > 0$).

***(b)*** *The expected economic profit is inversely U-shaped (decreases) with respect to its own (the rival's) degree of expense preference* ( $\frac{\partial^2 E\pi_i}{\partial \theta_i^2} < 0$ , $\frac{\partial E\pi_i}{\partial \theta_j} < 0$ ) .

(Proof: See Appendix 3)

The intuition behind these results lies in the association between competition charter values and risk-taking behaviour. Following the empirical findings by Keely (1990) of a negative relation between competition and bank failures in the United States during the eighties, the theoretical research initially stressed how competition worsened banks' incentives to take risks.[13]

The key argument is the relationship between charter values and risk taking behaviours. Let's see it in more detail: a *charter value* is the benefit that accrues to a bank's shareholders (or stakeholders) from its future operations, and it represents the opportunity cost of going bankrupt. In determining its risk-taking behaviour, a bank must balance the gains from increased risk-taking with the loss of charter values if it fails. Then the general idea is that competition could erode the franchise value of a bank, which might encourage the bank's shareholders (stakeholders) to pursue riskier policies to maintain their former expected economic profits (*franchise value* paradigm). According to our model, this franchise value paradigm may explain why SBs are less risk-inclined than CBs, and why it is the best response for an organization to increase its

[13] In terms of theoretical analysis, papers like Keeley (1990), Besanko and Thakor (1993), Suárez (1994), Matutes and Vives (1996, 2000), Hellmann et al. (2000), and Repullo (2004) contain models that support a trade off between competition and financial stability. In empirical terms the papers by Keely (1990), Demsetz et al (1996), Brewer and Saidenberg (1996), Hellman et al (2000), Salas and Saurina (2003) and Jiménez et al (2007), they all provide support to these models.

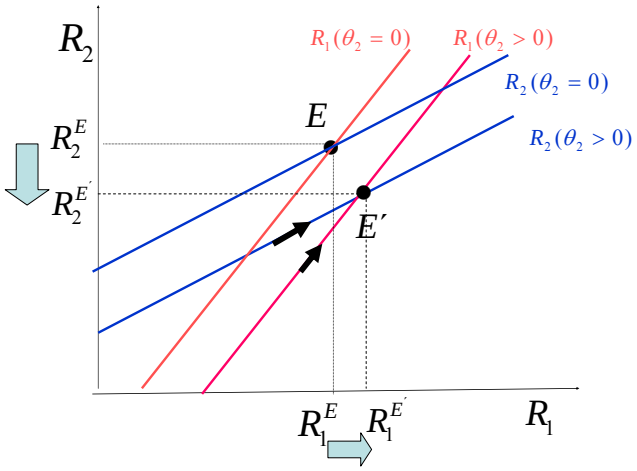
risk when they compete against a SB. To see this, let us first define what we understand by competition:

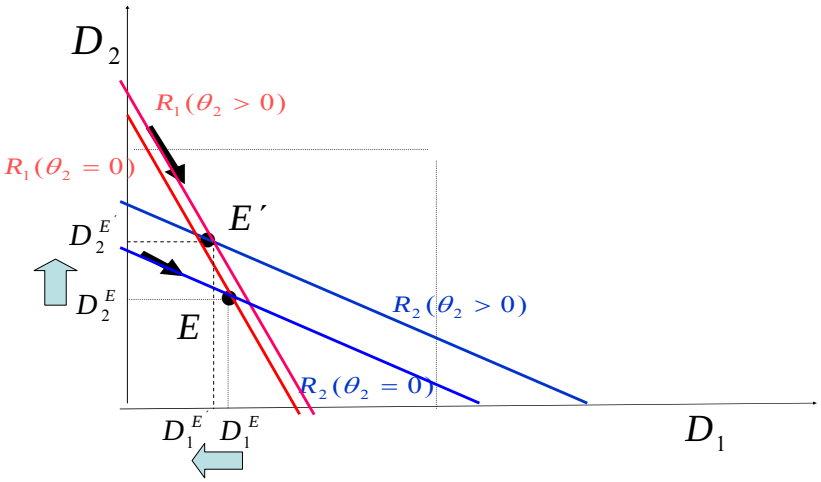
*Competition for deposits* refers to the absence of market power, i.e., to the inability of a bank to extract rent from deposits. Since we are in a duopoly setting we will proxy competition by the intensity of rivalry, understood as the difficulty faced by a bank (given the competitive behaviour of its rival) to offer lower interest rates to get higher margins.

Then, the consistency of our predictions with the "franchise value" paradigm can be seen noting that the presence of expense preference banks increases the intensity of rivalry. The explanation is as follows: expense preference, by reducing the "effective" marginal cost of deposits, yields a strategic competitive advantage, making the SB more efficient and competitive. This higher efficiency allows the SB to increase its deposit supply (and interest rates) increasing then the aggressiveness of their growth strategy. In turn, SB´s higher market share translates into an increase in their number of branches and labour expenditures, increasing its "overall" benefits.[14] As a result, the SB becomes more valuable, and thus it reduces the risk of bankruptcy, because bankruptcy would cause the loss of valuable charter. On the other hand (providing that decisions are strategic substitutes) a more aggressive behaviour of the SB reduces (increases) its rival's markets share (interest rates) and charter values (or rents available to shareholders/managers). Thus, banks (independently of their ownership structure) become more eager to seek low probability, high return outcomes, when competing against a SB. In short, expense preference increases (decreases) the SB´s (SB´s rival) opportunity cost of going bankrupt, which deters (encourages) its risk-taking behaviour. Figures 1a and 1b show how these two effects take place.

[14] Remember that SBs objective function put weight on both expected economic profits and labour expenditures (i.e., the growth objective is explicitly state in their objective function).

**FIGURES (1A)-(1B)**




Figures 1a and 1b above do show reaction functions for deposits and revenues, respectively.

We start with the basic case of competition between two CB and analyse what happen when a bank turn to show an expense preference behaviour. First, when both firms maximize profits the symmetric equilibrium solution is point E =( $D_1^E, D_2^E, R_1^E, R_2^E$ ). Then, under SB´s expense preference behaviour ( $\theta_2 > 0$ ; $\theta_1 = 0$ , that is, under competition between a SB and a CB) the position of the SB and of the CB´s deposit and revenues reaction functions are shifted to the right. Firms end up in equilibrium E´= ( $D_1^{E'}, D_2^{E'}, R_1^{E'}, R_2^{E'}$ ), with $D_1^{E'} < D_1^E; D_2^{E'} > D_2^E; R_1^{E'} > R_1^E; R_2^{E'} < R_2^E$ .

It is worth noting that a CB prefers symmetric markets where competition occurs between profit-maximising banks.[15] Similarly, a SB will also prefer to compete against a CB. Furthermore, for any given value of the rival's expense preference parameter ($\theta_j$), the economic profits of the SB will increase and decrease with its expense preference parameter (an inverse U-shaped relation).[16] Interestingly, our result suggests that a CB may be better off inducing some degree of expense preference on its manager's objective function. This could be achieved by means of managerial incentives, as in Purroy and Salas (2000). In this way, the best response to expense preference behaviour by CBs shareholders is to imitate SBs by inducing a more aggressive behaviour in their managers.[17] This conclusion is also consistent with Allen et al. (2006) prediction of that profits may increase when the firm adopts a multidimensional objective function that recognizes the interest of several stakeholders. This result suggests that corporate governance research may benefit from reconsidering the conventional wisdom on the role of stakeholders in general and stockholders in particular.

Regarding the comparison of expected economic profits between CBs and SBs, we do not have a clear prediction on whether the former outperforms the later, or vice

[15] Therefore such a result helps us to understand the request of Spanish commercial banks for more "symmetry" in the retail's market for their particular interest.

[16] There is an optimal value of $\theta_i$ that maximize the SB expected economic profits. This value of $\theta_i$ is the solution to a second degree equation. Simulation shows that for a given value of A (price of risk) the optimal value of $\theta_i$ increase with $\gamma$ (i.e. the more homogeneous the banking products are, the higher is the optimal value of $\theta_i$ ) For a given value $\gamma$, the optimal value of $\theta_i$ decrease with A. That is, as higher the price of risk the lower the optimal value of $\theta_i$.

[17] This finding is in line with the strategic incentives theory. A central notion in this stream of research is that, when firms choose output, they may gain from distorting their manager's incentives relative to profit maximisation because of its effects on strategic interaction (Fershtman and Judd, 1987; Sklivas 1987; Vickers (1985); Schelling, 1960).

versa. SBs may have higher or lower expected economic profits than CBs depending on their degree of expense preference ($\theta_i$)[18] (for a formal proof see Appendix 4).

We can link our theoretical results with the existing empirical evidence:

(a) Recent empirical studies show that, in the retail banking market of countries where SBs are more relevant (Spain and Norway), SBs are less risk inclined and outperform CBs by gaining market share (García-Marco and Robles-Fernández, 2008, Bøhren and Josefsen, 2007, Maroto, 1993; Lagares, 1995; Rodríguez López**,** 1995).

(b) The empirical work on the behaviour of mutual banks (MBs). This evidence suggests that widely held managerially-controlled banks have lower incentives to take on more risk than shareholder-controlled banks. (O'Hara, 1981; Rasmusen, 1988; Saunders et al, 1990; Cordell *et al.*, 1993; Gropper and Beard, 1995 Fraser and Zardkoohi, 1996; Knopf and Teall, 1996; Esty, 1997; Leonard and Biswas, 1998; Hansmann, 1996; Laeven & Levine, 2006; Iannotta et al 2007; Cihak and Hesse ,2007) The widely agreed explanation to the above findings lies on moral hazard and reputation hypothesis[19]. Our theoretical model provides an alternative explanation to these issues.

(c) The finding that more efficient banks are less likely to fail than those technically inefficient; Wheelock and Wilson (2000), Berger and De young (1997), Kwan and Eisenbeis (1997). (Recall that expense preference reduces SB´s effective

[18] This value of $\theta_i$ is the solution of a third degree equation. Simulation shows that for a given degree of differentiation ($\gamma$) the value of $\theta_i$ for which the SB outperforms CB´s expected economic profits decreases with A ( price of risk).

[19] According to the moral hazard hypothesis manager-controlled banks will have lower incentives to get involve in risk shifting practices since managers are not residual claimant and as a result they can not appropriate from the potential benefit of taking a higher risk. Instead they will risk their wealth, their specific human capital or the associated advantages with controlling the firm. The reputation hypothesis was first pointed out by Carey et al. (1998) they raise the issue of respectability concerns when lending to borrowers of different ex ante observable credit risk. Their argument is that banks will weight the benefits of lending to ex ante risky borrowers with the reputation damage of being frequently involved in borrowers' liquidations. In this way, bank's ownership form, that value reputation most will tend to specialize in lower risk borrowers than those that value it least. Following the explanation of Hansmann (1996) that not-for-profit banks were created to restore trust in banking markets. Delgado et al (2007) claim that savings banks and cooperatives are expected to have higher reputation concerns than commercial bank and hence to engage in lees risky policies.

marginal cost. This is the reason why our theoretical study is backed by the empirical evidence on the relationship between efficiency and risk behaviour).

(d) The empirical evidence shows that the liberalization process of Spanish SBs allowed them to expand beyond their original areas, to compete nationwide and among-themselves (that is, expense preference banks competing against each other) lead them to assume more risks (Illueca, Norden and Udell, 2008). This is consistent with our result showing that a bank (independently of its ownership structure) faces a higher rivalry and takes more risk when competing against a SB.

(e) Finally, some studies show that in those systems with a high presence of non-profit maximising banks, CBs are less stable than they would otherwise be (Cihak and Hesse, 2007; De Nicolò, 2000).

Therefore, differences in performance and risk between banks with different ownership structure may have implications for bank supervisory policy. CBs become riskier than SBs, and (any) bank's risk incentives increase under the presence of SBs. Hence policy makers may best set regulation to control the risk incentives of banks in a different manner depending upon how ownership is structured.

## 4. THE EFFECTS ON FINANCIAL STABILITY AND WELFARE.

In this section we analyse the financial stability and welfare implications of competition between banks with different ownership structures. We begin defining *welfare* (Matutes and Vives, 2000).

*Welfare* is understood as: Expected Gross Surplus (Consumer Surplus plus Banks overall expected utilities) minus the deadweight loss corresponding to the expected social cost of bankruptcy (DL):

$\mathrm{W} = CS + EU_i + EU_j - \mathrm{DL}$ , with

$CS = U(D) = r_i(D) \cdot D_i + r_j(D) \cdot D_j - T(D)$ , DL=$\left[(1-P(R_i))(1-P(R_j))\right]K$ , ( $i, j=1,2$)

Therefore, we have:

$$W = D_i\left[P(R_i)(R_i - r_i - c(1-\theta_i) - s) + r_i(D)\right] + D_j\left[P(R_j)(R_j - r_j - c(1-\theta_j) - s) + r_j(D)\right] - T(D) - \left[(1-P(R_i))(1-P(R_j))\right]K \quad (21)$$

With this definition we are assuming that a lower probability of default together with greater deposit supply and higher interest rates will achieve (ceteris paribus) higher welfare, since the larger the number of deposits, the higher the amount of loan funds available to firms and households. This fact, in turn, is associated with higher levels of economic growth and welfare (Levine et al., 2000).

From a global perspective, the impact of ownership structure on welfare and financial risk, becomes:

***Proposition 2****: The presence of a Savings Bank helps to (a) reduce the overall level of risk; (b) increase the social welfare.*

Proof: See Appendix 5.

The intuition behind Proposition 2 lies on that expense preference has a direct (indirect) effect on the SB (SB's rival). Both effects increase the interest rate offered by each bank. Moreover, the direct (indirect) effect on the SB (SB's rivals) increases (reduces) both its market share and the overall benefits, at the time that it reduces (increases) its risk-taking incentives (see Prop. 1). In absolute terms, the direct effect becomes stronger than the indirect effect. As a result, the existence of SBs in the market increases the total numbers of deposits, raises interest rates, and reduces the level of risk in the system. Thus, the presence of expense preference behaviours makes competition tougher (that is, it leads to an increase on consumer surplus and a reduction on

aggregate expected economic profits) at the time that increases welfare and reduces financial instability.

It is worth noting that considering different ownership structures allows us to distinguish between the effect that an increase in competition (due to the presence of expense preferences) has on banks´ risk-taking incentives (*individual effect*: Prop. 1), as well as on welfare and financial stability (*overall effect*: Prop. 2).

Adding up these two effects, our analysis reveals that an increase in rivalry, coming from the expense preference behaviour, threatens the solvency of banks (independently of their ownership structure, banks become riskier when competing against a SB) and, at the same time, it increases financial stability and welfare. Hence, we concluded that individual and overall effects go in opposite directions (as mentioned above, the increase in individual bank's risk-taking is overcompensated by the increase in solvency coming from the more efficient SB). These results suggest that when analysing the relationship between competition and stability, two features are particularly relevant:

(a) competition between heterogeneously owned banks ( since banks with different ownership structure may response to an increase in competition in a distinct way, so *individual* and *overall* effects may vary);

(b) factors enhancing competition (since different drivers may have different effects on financial stability).

In particular, we show that if the increase in competition comes from the introduction of more efficient and less risky institutions (SBs), then there will not be a trade-off between competition and financial stability. We therefore conclude that when the increase of rivalry is due to expense preference behaviour, then the financial stability increases.

Yet, most of the literature focuses on the relationship between financial stability and competition (proxy by concentration[20]) among symmetric banks. As a result, these studies do not differentiate between "individual" and "overall" effects as we have done here. This literature does not provide a clear prediction (neither theoretical nor empirical) on the trade-off between competition and financial stability. The two basic basic hypotheses in the literature are: First the *franchise value paradigm* (competition reduces financial stability). Second, the *risk- shifting hypothesis*[21] (competition increases financial stability). Our model provides support to the franchise value paradigm when considering the relationship between an increase in competition and *individual* bank risk-taking. However, the risk shifting hypothesis is confirmed when considering the *overall* effect on financial stability (i.e., an increase in competition coming from the exhibition of expense preference reduces financial instability).

Let us now have a look at the empirical evidence and how does it match with the model predictions. First, our conclusion on higher welfare on those systems dominated by SBs is in line with the higher "social role" played by stakeholder-controlled banks. Savings banks, credit unions and financial cooperatives contribute significantly to provide financial services to communities that, otherwise, could be excluded. This access is especially critical in the current economic crisis, since the higher the

[20] However concentration is only one of the variables that one must look at in order to determine competition. Other variables are for example the relative position of competitors, the existence of potential entrants, and the countervaling power of buyers. Our finding suggests that bank´s ownership structure is another factor determining the degree of bank´s contestability. Different researchers (e.g., Berger et al. 2004; Beck et al., 2006; Schaech et al., 2006; Jiménez et al., 2007) have claimed that concentration is not a good proxy for competition given that factors other than concentration may drive competition and vice-versa. These authors differentiated between competition and concentration by testing both, the effect of competition, as measured by the H statistic or Lerner indexes, and the effect of concentration, on the likelihood of banking crisis. They found that competition and concentration are distinct from each other and that only competitive behaviour of banks impacts upon financial stability.

[21] The risk shifting model was first pointed out by Boyd and De Nicolò (2005) empirically it has been supported by Boyd et al., (2006); De Nicolò and Luoikoanova (2007).

opportunity of people to get finance, the higher their chances to generate income accumulate assets or build human capital.

Second, regarding financial stability and risk taking incentives, our model predicts that stakeholder-controlled banks are less risky and help to reduce financial instability. This fact is supported by the empirical work of Cihak and Hesse (2007). These authors find, for a sample of OECD countries, that cooperative banks are more stable than commercial banks and that a higher number of cooperatives helps to reduce financial instability[22]. This fact seems to be in line with the behaviour of cooperatives banks along financial crisis where they have proved to be more stable. For instance, the group of banks that has seemingly been least affected by the current financial crisis are cooperative banks. None of them, anywhere in the world, has received government recapitalization as a result of the financial downturn and they seem to remain well capitalized. (World Council of Credit Unions, 2009). One possible explanation lies on their business model. First, they mostly focus on the retail banking market. Second, they are generally conservative in their credit policies, placing member needs ahead of institutional profits. These facts have in effect restricted stakeholder's banks from engaging in careless lending practices. As a result they have not invested in structured financial product (one of the culprits of the current economic downturn)[23]. The mutual banking approach has also proved successful in past crises in different countries around the world. For instance, French cooperatives banks suffered less than commercial banks during times of banking stress in the 1980s and 1990s. During Ecuador's financial crisis of 1999, the largest banks collapsed while mutual banks continued to operate. Similarly,

[22] The empirical analysis of Cihak and Hesse (2007) provide support to our theoretical results on proposition 1 and 2. These authors show that cooperatives banks are more stable than commercial banks and that a high presence of cooperatives banks makes commercial banks less stable than they would otherwise be (prop. 1). However given the high inherent stability of cooperatives banks, they find a positive overall impact of cooperatives presence on overall banking system stability (prop. 2).

[23] Nevertheless, the recent case of Spanish Savings Banks also show that they may present some specific problems due to the lack of external control of the managers' private objectives, a feature which is not captured in this model.

during Jamaica's banking crisis of the late 1990s, cooperative banks on the island performed much better than the four largest banks that were consolidated with assistance from the International Monetary Fund. We may say that these isolated national-level experiences are now being replicated at the global level.

Therefore, we would expect those countries with a higher proportion of SBs to be less affected by the current financial crisis. Particularly, this is the case of Spain, where its banking system has a high proportion of SBs, and its financial stability has been less hurt by the crisis. Again, one word of caution must be added, if the specific problems of a real-state bubble and an excess of foreign debt are combined with some mismanagement of the resources, particularly in the case of some Spanish SBs.

From a regulatory point of view, Proposition 2 suggests that policy makers aiming to maximise social welfare may favour a stakeholder-approach in the retail banking sector. This could be achieved by dictating social responsibility for all banks (such as imposing employee directors), or by favouring depositors' preferences for stakeholder-controlled banks.

## 5.- CONCLUSIONS

This paper has analysed the effect that rivalry between banks with different ownership structures has on welfare, financial stability, risk-taking and performance. With those objectives, we have presented a duopoly model of retail banking competition between a profit-maximizing bank and a bank exhibiting *expense preference behaviour*.

Our theoretical analysis extends previous literature in two main directions. First, we establish the nature of the competition: instead of assuming it, we invoke a known result of Singh and Vives (1984) and show that the strategic decision variable of banks when offering a differentiated product is quantity rather than prices (obviously, when

the product is homogeneous, competition is also in quantities). Second, we introduce ownership structure and welfare considerations into the analysis of the relationship between competition and financial stability.

The paper has also practical and policy motivations since many countries have a portion of their banking system that is not privately owned and where profit and no-profit maximising banks compete against each other. We have considered three alternative situations: competition between two CBs, two SBs and one CB and one SB. Each of these scenarios may represent and provide some intuition on the more general context observed in the retail banking market of different regions where the relative weight of shareholders (CBs) and stakeholders (SBs) banks differs.

The main conclusions obtained are:

(a) the presence of a SB makes competition fiercer at the time that increases total welfare and reduces financial risk (Prop.2).

(b) SBs are less risk-inclined, obtain a higher market share and offer higher interest rates than CBs. For some degree of expense preferences, they can also outperform CBs in economic profits. This finding suggests that CBs would be better off by inducing a more aggressive behaviour in their managers (this could be achieved through incentives).

(c) Banks (independently of their ownership structure) are less stable and less profitable when competing against a SB than they would otherwise be.

All these results are supported by the existent empirical evidence and may yield policy implications. In particular, two broad policy suggestions emerge from our analysis. First, supervisory policy should differ between financial systems and between banks: regulation may be set in a more or less restrictive way depending on i) bank's ownership, ii) the proportion of stockholders and stakeholders banks in the system.

Second, policy makers aiming to maximize social welfare may favour a stakeholder-approach in the retail banking sector.

We must recognize that the model presented above, although offering some light on the effect of the strategic interaction between banks with different ownership structure, is still a simple model that lacks many features of banking competition that could be analysed in future research. Some limitations of our model are, for instance, the full deposit insurance assumption, and its abstraction from the consequences of diversification-based or size related economies of scale. The model could also be improved by considering a continuous asset return distribution instead of the two point return structure considered here.

Left for further research are some questions in several directions. We sketch some of them:

In first place, we must wonder whether the existence of n players may change our conclusions. This is quite possible, taking into account that Singh and Vives (1984) result is not robust when the number of firms is larger than two. (Häckner, 2000, shows that under vertical differentiation and more than two firms, high-quality firms may earn higher profits under price competition than under quantity competition).

Second, we do not consider two-sided competition (see Yanelle 1989) and restrict our attention to deposit rivalry. We thus ignore the existence of a loan market. As a result, in our model banks have total control over the level of risk. That is, they solve a "portfolio problem". However, as shown by Boyd and De Nicoló (2005), it makes a difference when the loan market is considered and moral hazard is introduced. In this case banks will solve an "optimal contracting problem". Therefore, future modelling effort may include elements of both the "portfolio model" and the "contracting model." This makes sense since as stated in De Nicoló (2005), banks in

reality hold at the same time large portfolios of debt and equity securities traded in markets in which they are price-takers, and many different kinds of loans (with different potential for moral hazard problems).

Third, in our model banks differ according to their expense preference behaviour. However CBs and SBs may also be subject to different adverse selection problems (e.g. government may influence SB´s commercial decisions) at the time that they may have different reputation concerns. Hence, it would be interested to further distinguish between CBs and SBs by allowing for differences in: (a) the efficiency of their screening technology to identify borrowers' quality (e.g. CBs rely more on "hard" information while SBs on "soft" information) or (b) on their level of bankruptcy costs.

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**APPENDIX 1: Proof lemma 1**

To show that competition is à la Cournot, we appeal to a well-known result by Singh and Vives (1984). They proved that in a duopoly setting it is a dominant strategy for each firm to compete on quantities provided the following assumptions are satisfied: (A1) Goods are substitutes and differentiated, (A2) linear demand structure, (A3) constant marginal cost, (A4) no fix cost, (A5) no capacity limits, (A6) firms´ objective functions is concave.

Although the demand function in our model is an upward sloping lineal function, the banks objective function remains concave:

$$EU_i = P(R_i)\left[(R_i - \alpha - \beta D_i - \gamma D_j - s - c\cdot(1-\theta_i)\right]\cdot D_i \;\Rightarrow\; \frac{\partial^2 U_i}{\partial D_i^{\,2}} = -2\beta P(R_i) < 0 \quad \text{i=1,2}$$

Then all the required assumptions are satisfies and we can appeal to Singh and Vives (1984) result when firms have asymmetric marginal cost.

**APPENDIX 2: Proof lemma 2**

We prove by contradiction that given equation (1) in A2 and equation (4) in A4 equation (13) has a unique solution:

Let assume that for each bank $i = 1,2$ there are two equilibriums $(D_i, R_i)$ and $(D_i', R_i')$ that satisfy equilibrium condition (13) such that $R_i > R_i'$ this implies that $\frac{-P(R_i)}{P'(R_i)} < \frac{-P(R'_i)}{P'(R'_i)} \Rightarrow D_i' > D_i$ (since $\frac{\delta r_i(D)}{\delta D_i} = \frac{\delta r_i(D')}{\delta D'_i} = \beta$) hence given our assumption on $r_i(D), D_i' > D_i$ implies that $r_i(D) < r_i(D')$ and this means that $R_i - r_i(D) - c\cdot(1-\theta_i) - s > R'_i - r_i(D') - c\cdot(1-\theta_i) - s$ which can not be the case if as state in the first equation $\frac{-P(R_i)}{P'(R_i)} < \frac{-P(R'_i)}{P'(R'_i)}$. Then there is at most one solution that satisfies

the equilibrium condition in equation (13) and determines both, the size and the riskiness of each bank portfolio at equilibrium.

**APPENDIX 3: Proof proposition 1 part (b)**

For each bank $i, j = 1,2$ the optimal value of $\theta_i$ (i.e. degree of expense preference behaviour that maximizes expected economic profits) can be obtained by solving the optimization problem by backward induction. First for a given $\theta_j$ the Nash equilibrium solution is obtained (as we did in section 2).Then, since this solution depend on $\theta_i$ its optimal value is the one that maximizes expected economic profits.

The first problem as already shown in section 2 is:

$$\underset{D_i, R_i}{MAX}\ EU_i = P(R_i)\left[(R_i - r_i(D) - s - c\cdot(1-\theta_i)\right]\cdot D_i \quad i = 1,2 \tag{A1.3}$$

That yields the equilibriums solutions in equations 14-18. With these equilibrium solutions expected profits are given by:

$$E\pi_i = P(R_i)\left[(R_i - r_i(D) - s - c\right]\cdot D_i = \left[M + c\theta_i Q - c\theta_j B\right]\cdot\left[K + c\theta_j E - c\theta_i F\right]\cdot\left[Z + c\theta_j T - c\theta_i H\right] \tag{A2.3}$$

where:

$$M = \frac{(2\beta^2 - \beta\gamma)(1 - A(\alpha + c + s))}{6\beta^2 - \gamma^2 - \beta\gamma},\ Q = \frac{12\beta^4 - 3(\beta\gamma)^2}{(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2},\quad B = \frac{A(4\beta^3\gamma - \beta\gamma^3)}{(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2}$$

$$K = \frac{(2\beta^2 - \beta\gamma)(1 - A(\alpha + c + s))}{A(6\beta^2 - \gamma^2 - \beta\gamma)},\ E = \frac{16\beta^3\gamma^3 - 16\beta^5\gamma - \beta\gamma^5 - 8\beta^4\gamma^3}{(4\beta^2 - \gamma^2)\left[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2\right]}$$

$$F = \frac{96\beta^6 - 64\beta^4\gamma^2 + 6\beta^2\gamma^4 + 8\beta^3\gamma^4 - \gamma^6}{(4\beta^2 - \gamma^2)\left[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2\right]}, Z = \frac{(2\beta - \gamma)(1 - A(\alpha + c + s))}{A(6\beta^2 - \gamma^2 - \beta\gamma)},$$

$$T = \frac{8\beta^3\gamma^3 - 16\beta^4\gamma - \gamma^5}{(4\beta^2 - \gamma^2)\left[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2\right]}, H = \frac{24\beta^3\gamma^2 - 3\beta\gamma^4 - 48\beta^5}{(4\beta^2 - \gamma^2)\left[(6\beta^2 - \gamma^2)^2 - (\beta\gamma)^2\right]}$$

Therefore the optimal value of $\theta_i$ is the solution to:

$$\underset{\theta_i}{Max}: \left[ M + c\theta_i Q - c\theta_j B \right] \cdot \left[ K + c\theta_j E - c\theta_i F \right] \cdot \left[ Z + c\theta_j T - c\theta_i H \right] \tag{A3.3}$$

Maximising with respect to $\theta_i$ yields the following FOC:

$$\begin{aligned} \frac{\delta E\pi_i}{\delta \theta_i} &= 3\theta_i^2 c^3 FQH - 2\theta_i \left[ c^2 (FQZ - FMH + KQH) + c^3 \theta_j (QFT + QEH + BFH) \right] + \\ &+ \theta_j^2 c^3 \left[ QET + BFT + BHE \right] + \theta_j c^2 \left[ QEZ + TQK + BFZ + FMT + BHK - HME \right] + \\ &+ CQKZ - CFMZ - CHMK \end{aligned} \tag{A4.3}$$

Providing $\beta > \gamma$; we have that:

$$M > 0; Q > 0; B > 0; K > 0; E < 0; F > 0; Z > 0; T < 0; H < 0$$

hence

$$\frac{\partial^2 E\pi_i}{\partial \theta_i^2} = 6\theta_i c^3 FQH - 2\left[ c^2 (FQZ - FMH + KQH) + c^3 \theta_j (QFT + QEH + BFH) \right] < 0 \tag{A5.3}$$

This inequality holds for typical parameters values.

Then there is an optimal value of $\theta_i$ that maximise SB´s expected economic profits. This optimal value of $\theta_i$ is given by the solution of the second degree equation (A4.3) Simulation shows that for a given value of A (price of risk) the optimal value of $\theta_i$ increase with the degree of product differentiation $\gamma$ ( i.e the more homogeneous the banking products are, the higher is the optimal value of $\theta_i$ ). For a given value $\gamma$, the optimal value of $\theta_i$ decrease with A. That is, as higher the price of risk the lower the optimal value of $\theta_i$ .

On the other hand $\frac{\delta E\pi_i}{\delta \theta_j} < 0$ since from (A2.3) we have that:

$$\frac{\delta P(R_i)}{\delta \theta_j} = -cB < 0 \,; \frac{\delta (R_i - r_i(D) - c - s)}{\delta \theta_j} = cE < 0 \,; \frac{\delta D_i}{\delta \theta_j} = cT < 0$$

And these are sufficient conditions for $\frac{\delta E\pi_i}{\delta \theta_j} < 0$ Q.E.D.

**APPENDIX 4: SB´s can outperform commercial banks in expected economic profits**

Here we show that SBs may have higher or lower expected economic profits than CBs depending on its degree of expense preference ( $\theta_i$ ).

When $\theta_1 = 0$ ( CB) and $\theta_2 \geq 0$ (SB). SBs and CBs´ expected economic profits are given by:

$$E\pi_1 = P(R_1)\left[(R_1 - r_1(D) - s - c\right]\cdot D_1 \ = \left[M - c\theta_2 B\right]\cdot\left[K + c\theta_2 E\right]\cdot\left[Z + c\theta_2 T\right] \quad \text{(A1.4)}$$

$$E\pi_2 = P(R_2)\left[(R_2 - r_2(D) - s - c\right]\cdot D_2 \ = \left[M + c\theta_2 Q\right]\cdot\left[K - c\theta_2 F\right]\cdot\left[Z - c\theta_2 H\right] \quad \text{(A2.4)}$$

Where the values of the parameters M, K, Z, B, Q, E, F, T, H are the ones show in appendix 3 above.

The value of $\theta_2$ for which $E\pi_2 > E\pi_1$ is the solution to the following third degree equation:

$$\begin{aligned}&(c\theta_2)^3(FQH - EBT) + (c\theta_2)^2\left[Z(FQ - EB) + K(QH - BT)\right] \\ &-C\theta_2\left[KZ(B - Q) + MZ(F - E) + KM(T - H)\right] - M(FH - ET) = 0\end{aligned} \quad \text{(A3.4)}$$

Simulation shows that for a given degree of differentiation ( $\gamma$ ) the value of $\theta_2$ for which the SB outperforms CB´s expected economic profits decrease with A (price of risk). That is, as higher the price of risk the lower the value of $\theta_i$ for which the SB can outperform the CB in expected economic profits.

**APPENDIX 5: Proof proposition 2**

The appearance of a SB *i,j=1,2* in the system ( that is from $\theta_i = 0$ to $\theta_i > 0$ ), will lead to an increase in welfare if for a given value of the rival expense preference behaviour $\theta_j$ ( i.e the rival can either be a SB or a CB) it happen that: $\frac{\delta W}{\delta \theta i} > 0$ . *i=1,2*

Given our definition of welfare W= ( $CS + EU_1 + EU_2$ -DL) , sufficient condition for $\frac{\delta W}{\delta \theta i} > 0$ are :

$$\frac{\delta CS}{\delta \theta_i} > 0 \qquad (A1.5)$$

$$\frac{\delta (EU_1 + EU_2)}{\delta \theta_i} > 0 \qquad (A2.5)$$

$$\frac{\delta (DL)}{\delta \theta_i} < 0 \qquad (A3.5)$$

where:

$$CS = r_i(D)D_i + r_j(D)D_j - \alpha(D_i + D_j) - \frac{(D_i^2 + D_j^2) + (2\gamma D_i D_j)}{2}$$

DL=$\left[((1-P(R_i))((1-P(R_j))\right]K$

$$EU_i = P(R_i)\left[(R_i - r_i(D) - s - c\cdot(1-\theta_i)\right]\cdot D_i =$$
$$\left[M + c\theta_i Q - c\theta_j B\right]\cdot\left[K + c\theta_j E + c\theta_i(1-F)\right]\cdot\left[Z + c\theta_j T - c\theta_i H\right] \quad i, j = 1,2$$

The values of the parameters M, K, Z, B, Q, E, F, T, and H are the ones states in appendix 3

Then given that

$$\frac{\delta CS}{\delta D_i} = D_i(2\beta - 1) > 0 \Leftrightarrow \beta > \frac{1}{2}$$
$$\frac{\delta DL}{\delta R_i} = KA(AR_j) > 0$$
$$i = 1,2$$

and since $\frac{\delta D_i}{\delta \theta_i} > 0;\ \frac{\delta D_j}{\delta \theta_i} < 0;\ \frac{\delta R_i}{\delta \theta_i} < 0;\ \frac{\delta R_j}{\delta \theta_i} > 0$ sufficient conditions for (A1.5) and (A3.5) to hold are:

$$\left|\frac{\delta D_i}{\delta \theta_i}\right| > \left|\frac{\delta D_j}{\delta \theta_i}\right| \qquad (A4.5) \qquad \left|\frac{\delta R_i}{\delta \theta_i}\right| > \left|\frac{\delta R_j}{\delta \theta_i}\right| \quad (A5.5) \quad i\,j = 1, 2$$

Providing our assumption on $\beta > \gamma$ conditions (A4.5) and (A5.5) hold:

(A4.5) $$\left|\frac{24\beta^3\gamma^2 - 3\beta\gamma^4 - 48\beta^5}{(4\beta^2-\gamma^2)\left[(6\beta^2-\gamma^2)^2-(\beta\gamma)^2\right]}\right| > \left|\frac{8\beta^3\gamma^3 - 16\beta^4\gamma - \gamma^5}{(4\beta^2-\gamma^2)\left[(6\beta^2-\gamma^2)^2-(\beta\gamma)^2\right]}\right|$$

(A5.5) $$\left|\frac{12\beta^4 - 3(\beta\gamma)^2}{(6\beta^2-\gamma^2)^2-(\beta\gamma)^2}\right| > \left|\frac{4\beta^3\gamma - \beta\gamma^3}{(6\beta^2-\gamma^2)^2-(\beta\gamma)^2}\right|$$

Now we just have to proof that condition (A2.5) is satisfy. Since $\frac{\delta EU_i}{\delta\theta_i} > 0$; $\frac{\delta EU_j}{\delta\theta_i} < 0$

condition (A2.5) is satisfy if :

(A6.5) $$\left|\frac{\delta EU_j}{\delta\theta_i}\right| < \left|\frac{\delta EU_i}{\delta\theta_i}\right|$$

Given (A4.5) and (A5.5), sufficient condition for (A6.5) is:

$$\left|\frac{\delta(R_i - r_i(D) - s - c\cdot(1-\theta_i))}{\delta\theta_i}\right| > \left|\frac{\delta(R_j - r_j(D) - s - c\cdot(1-\theta_j))}{\delta\theta_i}\right| \text{ (A7.5)}$$

Where given $\beta > \gamma$ condition (A7.5) is satisfies: $|c(1-F)| > |cE|$

Therefore $\forall\beta > \frac{1}{2}$ condition (A1.5),(A2.5) and (A3.5) are satisfies which mean $\frac{\delta W}{\delta\theta i} > 0$

*i=1,2 QED*