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Assessing Competition in the Banking Industry: A Multi-Product Approach*

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Abstract

This paper investigates the competitive aspects of multi-product banking operations. Extending Panzar and Rosse (1987)'s model to the case of a multi-product banking firm, we show that the higher the economies of scope in multi-product banking are, the lower Panzar-Rosse's measure of competition in the banking sector is. To test this empirical implication and determine the impact of multi-production/conglomeration on market power, we use a new dataset on Brazilian banking conglomerates. Consistent with our theoretical prediction, we find that banks offering classic banking products (i.e., loans and credit cards) and other banking products (i.e., brokerage services, insurance and capitalization bonds) have substantially higher market power than banks that offer only classic products. These results suggest a positive bias in the traditional estimates of competition in which multi-output actions are not considered.

Keywords: Bank Competition; Panzar and Rosse; Multi-product Bank.
JEL classification: L11; G21.

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1 Introduction

The global banking sector has experienced enormous changes during the last few decades. Marked growth in technological and financial innovation and strong deregulation in the sector have led to increased banking concentration and the creation of large financial conglomerates (Bikker and Haaf, 2002).

Curiously, the theoretical and applied literature has paid little attention to the competitive effects of banking conglomerates. These institutions can be defined as entities that offer financial, banking and insurance services using the same corporative structure (Freixas, Lóránth and Morrison, 2007). Possession of a multi-product structure allows these companies to benefit from economies of scale and scope, in addition to providing greater opportunities for risk diversification when supplying this range of services as a package.[1] Indeed, conglomerations and multi-product operations have become a characteristic feature of the banking sector in recent years and even received special attention in the new banking regulations drafted in the aftermath of the recent international financial crisis (see, for example, Levine, 2011).

Some studies in the literature have analyzed the cost efficiency of financial conglomerates and universal banks vis-à-vis commercial banks. Allen and Rai (1996), for instance, estimate economies of scale and scope in financial conglomerates by investigating countries with and without universal banks. Vander Vennet (2002) empirically analyzes the cost and profit efficiency of European financial conglomerates and universal banks. However, the only research that has addressed the effects of multi-product operations on banking competition is that of Berger and Kim (1994). Berger and Kim analyze the behavior of banks operating simultaneously in the retail and corporate banking loan segments. The results revealed asymmetries in the degree of competition, which may be related to the characteristics of the consumers in each of these segments. Although important, Berger and Kim's article is essentially descriptive and does not investigate the possible relationship between multi-production operations in banking conglomerates and competition.

This article aims, both theoretically and empirically, to fill the gap in the literature on the relationship between multi-production operations in banking conglomerates and competition by studying the effects of a multi-product structure on the patterns of competition in the banking sector. The operating costs of multi-product banks should be lower than those of specialized banks if integration allows for the realization of operational synergy. In addition, bank

[1] A more detailed discussion of the economic justification for the development of conglomerates may be found in Milbourn et al. (1999) and Dierick (2004).

conglomerates may exhibit superior performance if informational or other advantages, such as multi-output production, produce positive spillover to the traditional and non-traditional banking activities that these conglomerates undertake. Because bank conglomeration can significantly change a bank's cost structure, it may also have a significant effect on banking competition.

In this paper, we look at the behavior and the conduct of multi-product banks that supply classic bank products (i.e., loans and credit cards) and other bank products (i.e., brokerage services, insurance and capitalization bonds) as compared to those of banks that offer only classic bank products. Bank conglomerates that jointly offer classic and other bank products may benefit from economies of scope and, therefore, may be more efficient than two separate entities that specialize in offering either classic or other banking products. The sharing of inputs such as labor, technology and information across multiple outputs constitutes the major source of such potential cost savings. As documented by Vander Vennet (2002), multi-product banks are more revenue efficient than their specialized competitors, and the degree of both cost and profit efficiency is higher at universal banks than it is at non-universal banks. As Vander Vennet shows, economies of scope in bank conglomerates are one of the main forces driving improvements in measures of cost efficiency.

This paper departs from Panzar and Rosse's (1987) model to derive a theoretical model that explicitly analyzes the behavior and conduct of a representative multi-product bank that enjoys economies of scope in supplying classic and other banking products. Panzar and Rosse (1987) develop a model that allows for a distinction between perfect competition, monopolistic competition and monopoly. Panzar and Rosse's test procedure became popular in the literature largely due to the low level of information required about the sector under investigation. The level of market competition can be inferred using simple restrictions on the values of price elasticity in the revenue equation. Panzar and Rosse show how the effects of variations in input prices on revenues in the banking sector are influenced by market power. The test statistic (H) for the level of competition is given by the sum of the elasticities of revenue in relation to input prices. A monopoly situation would be consistent with an H value lower than or equal to 0 because the company would always operate in the elastic part of the demand curve. On the other hand, equilibrium with perfect competition would mean that H is equal to 1. In this market environment, a rise in input prices would lead to a proportional increase in both marginal costs and income in the sector. Lastly, intermediate values of H

that lie between 0 and 1 would be typical of monopolistic competition.[2]

We begin by extending the original Panzar and Rosse (1987) model to the case of a multi-product bank with economies of scope and computing the multi-product Panzar-Rosse H-Statistic. Second, we show how economies of scope at multi-product banks affect the H-Statistic. In particular, we find that the greater the economies of scope at multi-product banks are, the lower the Panzar-Rosse H-Statistic is. This relationship exists because a multi-product bank that supplies classic and other banking products benefits from economies of scope. Economies of scope reduce a bank's marginal costs for every product and, therefore, increase its price-cost margin (i.e., mark-up) in the banking and non-banking markets. Consequently, a multi-product bank will have a higher mark-up than the banks that supply only classic bank products. Finally, we develop an econometric strategy that allows us to test this theoretical prediction.

To test for such empirical implications, we must consider the multi-product dimension intended in our empirical analysis. Thus, the dataset must be adjusted to include the accounting information of banking conglomerates instead of single institutions. This strategy is data heavy because we must identify the final products and the individual institutions that compose a given banking conglomerate. In our empirical analysis, we used information on Brazilian banking conglomerates. Brazil is a perfect testing ground for the effects of banking multi-production/conglomeration using Panzar and Rosse's (1987) measure of competition for several reasons.

First, the Brazilian regulatory authorities release accounting statements that include the information for every banking conglomerate and the individual institutions that compose each banking conglomerate in Brazil. As far as we know, Brazil is the only country whose regulatory authorities provide such information. This fact is important in the present context because attempting to build accounting statements by simply aggregating individual records would produce misleading results. For example, intra-group credit operations, which could be miscalculated in an aggregation procedure, are already accounted for in the consolidated statements. Additionally, regulatory authorities also provide information on the final products offered by each individual institution. This information allows us to identify which bank products are supplied by which banking conglomerates and which accounting statements come

[2]Shaffer (1982, 1983) explores the relationship between the H statistic, the conduct parameter proposed by Bresnahan (1982) and a firm's demand elasticity. In a recent paper, Bikker, Shaffer and Spierdijk (2012) show the implications of Panzar and Rosse's (1987) interpretation of the test, which uses specifications with price equations and includes firm scale controls.

from which banking conglomerates, which, in turn, is crucial to testing the empirical implications described above. This information enables us to generate a new and complete dataset using account data for Brazilian banking conglomerates from between 2001Q1 and 2012Q4.

Based on the extension of Panzar and Rosse's (1987) empirical test to the case of a multi-product banking firm, we infer the impact of multi-production operations in banking conglomerates on market power. We find that banks that offer classic products (i.e., loans and credit cards) and other products (i.e., brokerage services, insurance and capitalization bonds) have substantially greater market power than banks that offer classic products only. Therefore, Panzar and Rosse's (1987) test reveals that market power is underestimated when multi-product information is not considered.

To identify which of these other banks acquire increases in market power through multi-product banking, we estimate the market power of banks that offer the following products: (i) classic and other financial banking products (such as brokerage and currency exchange services), (ii) classic and other nonfinancial banking products (such as insurance, life insurance, capitalization bonds and reinsurance), and (iii) classic, financial and nonfinancial products with the banks that offer classic products only. Our estimates show that banks that offer any of these three product profiles enjoy greater market power than banks that offer only classic products. These results indicate that either financial or nonfinancial banking products may increase a bank's market power. Our theoretical and empirical results suggest that empirical models that do not take into account the multi-product nature of banking conglomerates underestimate the market power of these conglomerates in the banking markets.

This paper is organized as follows. Section 2 presents a theoretical discussion that extends Panzar and Rosse's original (1987) model to the case of a multi-product firm that enjoys economies of scope by supplying classic and other banking products. That section also discusses the effect of economies of scope in multi-product banks on Panzar and Rosse's (1987) measure of competition. In Section 3, we briefly present the major features of the Brazilian banking system, explaining why Brazil is a perfect testing ground for the effects of banking multi-production/conglomeration on competition. In Section 4, we present the data and empirical procedures used in this study, along with its main econometric results. Section 5 presents our conclusions. The proofs, figures and tables are in the appendix.

2 Panzar and Rosse's Test and Economies of Scope in a Multi-product Bank: Theoretical Framework

In this section, we derive a theoretical model that explicitly analyzes the behavior and conduct of a representative multi-product bank that enjoys economies of scope in supplying classic and other banking products. We begin by extending Panzar and Rosse's (1987) original model to the case of a multi-product bank with economies of scope, computing the multi-product Panzar-Rosse H-Statistic. Next, we show how economies of scope in multi-product banks affect H-Statistics in the market for classical banking products. More specifically, we demonstrate that the greater the economies of scope for a multi-product bank, the lower the Panzar-Rosse H-Statistic. This empirical implication will be tested in the remaining sections of the paper.

2.1 The Model

Consider a representative multi-product bank that confronts a downward-sloping demand curve for classic bank products (i.e., loans and credit cards), $q_c(p_c)$, and other bank products (i.e., brokerage services, insurance and capitalization bonds), $q_o(p_o)$. For the sake of convenience, these demand curves will be represented, respectively, by the following demand functions: $p_c(q_c)$ and $p_o(q_o)$, which relate prices p_i to output q_i, for $i = c, o$. We note that bank elasticity of demand in the market for classic bank products and other bank products is given by $e_c = -\frac{\partial q_c}{\partial p_c}\frac{p_c}{q_c}$ and $e_o = -\frac{\partial q_o}{\partial p_o}\frac{p_o}{q_o}$, respectively.

Banking technology is represented by a cost function $C(q_c, q_o; w_1, w_2)$, interpreted as the function of managing a volume q_c of classic banking products and a volume q_o of other banking products. For the sake of simplicity, we assume that the bank uses only two inputs (e.g., capital and labor) to produce outputs, such that w_1 and w_2 are input prices. We also assume that $C(.)$ is an increasing, convex and twice continuously differentiable function in (q_c, q_o). This means that (i) $\frac{\partial C(.)}{\partial q_i} \geq 0, \forall i$, (ii) $\frac{\partial^2 C(.)}{\partial q_c^2}\frac{\partial^2 C(.)}{\partial q_o^2} - \left[\frac{\partial^2 C(.)}{\partial q_c q_o}\right]^2 \geq 0$, and (iii) $\frac{\partial^2 C(.)}{\partial q_i^2} \geq 0, \forall i$.

We assume that banking technology exhibits economies of scope between classic and non-classic banking products. Thus, we suppose that $\frac{\partial^2 C(.)}{\partial q_c q_o} \leq 0$. This condition means that an increase in q_c decreases the marginal cost of q_o. This is a particular case of economies of scope because it implies that a multi-product bank that jointly offers classic and other banking products is more efficient than two separate entities that specialize in classic and other banking products, respectively.

For the sake of simplicity, we suppose that banking technology has constant economies of scope. Formally, we assume that $\frac{\partial^2 C(.)}{\partial q_c q_o} = -\gamma, \gamma \geq 0$, where the parameter γ measures the economies of scope in banking technology. This assumption allows us to evaluate the effect of the change in economies of scope γ on Panzar and Rosse's measure of competition, which will be computed in the next subsection.

Under the aforementioned assumptions, a bank's profit can be expressed using the following equation:

$$\Pi = \Pi(q_c, q_o; w_1, w_2) = p_c(q_c)q_c + p_o(q_o)q_o - C(q_c, q_o; w_1, w_2) \tag{1}$$

where the first two terms correspond, respectively, to the revenue from classic banking products and other banking products, and where the third term corresponds to management costs.

The bank's decision variables are q_c (the amount of classic bank products) and q_o (the amount of other bank products), and the bank chooses q_c and q_o such that it maximizes the profit function in equation (1).

The first-order conditions, which equate marginal revenue and marginal cost in each product market, are as follows:

$$\frac{\partial \Pi}{\partial q_c} = p_c\Big[\frac{e_c - 1}{e_c}\Big] - \frac{\partial C(.)}{\partial q_c} = 0; \tag{2}$$

$$\frac{\partial \Pi}{\partial q_o} = p_o\Big[\frac{e_o - 1}{e_o}\Big] - \frac{\partial C(.)}{\partial q_o} = 0. \tag{3}$$

The second-order conditions associated with the bank's profit maximization problem are

$$\frac{\partial^2 \Pi}{\partial q_c^2} = \frac{p_c}{q_c}\Big[\frac{1 - e_c}{e_c^2}\Big] + \frac{p_c}{e_c^2}\frac{\partial e_c}{\partial q_c} - \frac{\partial^2 C(.)}{\partial q_c^2} \leq 0;$$

$$\Big[-\frac{p_c}{q_c}\Big[\frac{e_c - 1}{e_c^2}\Big] + \frac{p_c}{e_c^2}\frac{\partial e_c}{\partial q_c} - \frac{\partial^2 C(.)}{\partial q_c^2}\Big]\Big[-\frac{p_o}{q_o}\Big[\frac{e_o - 1}{e_o^2}\Big] + \frac{p_o}{e_o^2}\frac{\partial e_o}{\partial q_o} - \frac{\partial^2 C(.)}{\partial q_o^2}\Big] - \gamma^2 \geq 0.$$

As in Shaffer (1982), we assume that the elasticity of demand in both markets is locally constant ($\frac{\partial e_i}{\partial q_i} = 0, \forall i$) and that the bank's cost function is locally linear in every output ($\frac{\partial^2 C(.)}{\partial q_i^2} = 0, \forall i$). Therefore, the second-order conditions can be written as follows:

$$\frac{\partial^2 \Pi}{\partial q_c^2} = \frac{p_c}{q_c}\Big[\frac{1 - e_c}{e_c^2}\Big] \leq 0; \tag{4}$$

$$D \equiv \frac{p_c p_o}{q_c q_o}\Big[\frac{e_c - 1}{e_c^2}\Big]\Big[\frac{e_o - 1}{e_o^2}\Big] - \gamma^2 \geq 0. \tag{5}$$

Equations (4) and (5) imply that $e_c \geq 1$ and $e_o \geq 1$. This means that a multi-product bank that faces a downward-sloping demand curve for its products, q_c and q_o, will always choose to operate in the elastic region of the demand curve.

The first order described by equations (2) and (3) implicitly defines the optimal bank's supply of classical and other banking products, (q_c^*, q_o^*). Note that the banking products are a function of the exogenous variable input prices, w_1 and w_2, and the economies of scope parameter γ. The next proposition describes how the optimal bank's supply of classical banking and other banking products varies when those exogenous variables change.

Proposition 1 *Let $q_c^* = q_c(w_1, w_2, \gamma)$ and $q_o^* = q_o(w_1, w_2, \gamma)$ be, respectively, the optimal bank's supply of classical and other banking products, defined implicitly by equations (2) and (3). If the banking technology has constant economies of scope, $\frac{\partial^2 C(.)}{\partial q_c q_o} = -\gamma$, the elasticity of demand in both markets is locally constant ($\frac{\partial e_i}{\partial q_i} = 0, \forall i$), and that the bank's cost function is locally linear in every output ($\frac{\partial^2 C(.)}{\partial q_i^2} = 0, \forall i$), then the optimal bank's supply of classical banking and other banking products changes when the input prices, w_1 and w_2, and the economies of scope parameter γ change according to the following expressions:*

$$\frac{\partial q_i}{\partial w_1} = \frac{1}{D}\Big[\frac{p_j}{q_j}\Big(\frac{1 - e_j}{e_j^2}\Big)\frac{\partial^2 C(.)}{\partial q_i \partial w_1} - \gamma\frac{\partial^2 C(.)}{\partial q_j \partial w_1}\Big], i, j = c, o; \tag{6}$$

$$\frac{\partial q_i}{\partial w_2} = \frac{1}{D}\Big[\frac{p_j}{q_j}\Big(\frac{1 - e_j}{e_j^2}\Big)\frac{\partial^2 C(.)}{\partial q_i \partial w_2} - \gamma\frac{\partial^2 C(.)}{\partial q_j \partial w_2}\Big], i, j = c, o; \tag{7}$$

$$\frac{\partial q_i}{\partial \gamma} = \frac{1}{D}\Big[\frac{p_j}{q_j}\Big(\frac{1 - e_j}{e_j^2}\Big)\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} - \gamma\frac{\partial^2 C(.)}{\partial q_j \partial \gamma}\Big], i, j = c, o. \tag{8}$$

■

Equations (6)-(8) in Proposition 1 are key to computing a multi-product bank's measure of competition (the H-Statistic) in the market for classical banking products using Panzar and Rosse's method. These equations are also important to evaluating the effect of economies of scope on that H-Statistic.

Note that if we assume that the economies of scope parameter γ reduces marginal costs such that $\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} \leq 0, \forall i$, then the optimal supply of classical and other banking products increases as the economies of scope increase ($\frac{\partial q_i}{\partial \gamma} \geq 0, \forall i$).

2.2 Economies of Scope and Panzar-Rosse's H-Statistic in the Market for Banking Products

Panzar and Rosse (1987) developed an empirical test that allows one to discriminate between perfect competition, monopolistic competition and monopoly using industry or bank-level data. For this test, Panzar and Rosse derived an H-Statistic defined as the sum of revenue elasticities with respect to input prices. Based on H-Statistics, it is possible to investigate the extent to which changes in factor input prices are reflected in equilibrium or bank-specific revenues and then to infer market competition.

In the context of the model presented in the previous subsection, the H-Statistic of a multiproduct bank is defined as follows:

$$H = \frac{w_1}{R(w_1, w_2)} \frac{\partial R(w_1, w_2)}{\partial w_1} + \frac{w_2}{R(w_1, w_2)} \frac{\partial R(w_1, w_2)}{\partial w_2}, \tag{9}$$

where $R(w_1, w_2, \gamma) = p_c q_c + p_o q_o$ is the multi-product bank's total revenue and where $q_c = q_c(w_1, w_2, \gamma)$ and $q_o = q_o(w_1, w_2, \gamma)$ are, respectively, the optimal bank's supply of classical and other banking products. They are defined implicitly in equations (2) and (3). Note also that

$$\frac{\partial R(w_1, w_2)}{\partial w_i} = \frac{\partial R(.)}{\partial q_c} \frac{\partial q_c(.)}{\partial w_i} + \frac{\partial R(.)}{\partial q_o} \frac{\partial q_o(.)}{\partial w_i}. \tag{10}$$

In manipulating (9) and (10), we find that the H-Statistic of a multi-product bank is equal to

$$H = \theta H_c + (1 - \theta) H_o, \tag{11}$$

where $\theta = \frac{p_c q_c}{p_c q_c + p_o q_o}$, which is the fraction of the bank's revenue that is derived from classic banking products, and where H_i is the bank's H-Statistic in the market for the bank product i, with $i = c, o$. The expression (11) means that the multi-product bank's H-Statistic is the sum of the bank's H-Statistics for every product, weighted by the share of each product in the bank's total revenue.

Because this paper assesses competition in the banking industry when banks exhibit economies of scope in a multi-product technology, we focus on the H_c, which is the bank's H-Statistic in the market for classical banking products. H_c is formally defined as:

$$H_c = \left[\frac{w_1}{R_c} \frac{\partial q_c(.)}{\partial w_1} + \frac{w_2}{R_c} \frac{\partial q_c(.)}{\partial w_2} \right] \frac{\partial R_c(.)}{\partial q_c}, \tag{12}$$

where $R_c = p_c q_c$. Note that the H-Statistic of a single-product bank that supplies only classical banking products is exactly the same as H_c when it is evaluated with γ equal to 0.

Replacing $\frac{\partial q_c}{\partial w_1}$ and $\frac{\partial q_c}{\partial w_2}$, defined in Proposition 1, into equation (12), we obtain the following:

$$H_c = \frac{1}{DR_c}\frac{\partial R_c(.)}{\partial q_c}\Big\{\frac{p_o}{q_o}\Big(\frac{1-e_o}{e_o^2}\Big)\Big[w_1\frac{\partial^2 C(.)}{\partial q_c \partial w_1} + w_2\frac{\partial^2 C(.)}{\partial q_c \partial w_2}\Big] - \gamma\Big[w_1\frac{\partial^2 C(.)}{\partial q_o \partial w_1} + w_2\frac{\partial^2 C(.)}{\partial q_o \partial w_2}\Big]\Big\}. \quad (13)$$

To move forward, we need an intermediary result in Lemma 1.

Lemma 1 *Assume that the multi-product bank is price-taker in the market for inputs (x_1,x_2), and that the cost function $C(q_c, q_o; w_1, w_2)$ is defined as*

$$C(q_c, q_o; w_1, w_2) \equiv \min_{x_1, x_2} w_1 x_1 + w_2 x_2 \qquad s.t. \qquad (q_c, q_o; x_1, x_2) \in Y, \quad (14)$$

where Y is a production set. Then,

$$\Big[w_1\frac{\partial^2 C(.)}{\partial q_i \partial w_1} + w_2\frac{\partial^2 C(.)}{\partial q_i \partial w_2}\Big] = \frac{\partial R_i(.)}{\partial q_i}, \forall i. \quad (15)$$

■

Replacing equation (15) into equation (13), we have

$$H_c = \frac{1}{DR_c}\frac{\partial R_c(.)}{\partial q_c}\Big[\frac{p_o}{q_o}\Big(\frac{1-e_o}{e_o^2}\Big)\frac{\partial R_c(.)}{\partial q_c} - \gamma\frac{\partial R_o(.)}{\partial q_o}\Big]. \quad (16)$$

From the equations (2) and (3) in the first-order conditions, we know that $\frac{\partial R_i(.)}{\partial q_i} = p_i\Big[\frac{e_i - 1}{e_i}\Big], \forall i$. Replacing this result into the expression above, we find that

$$H_c = -\frac{1}{D}\Big[\frac{p_c p_o}{q_c q_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2} + \gamma\frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\Big], \quad (17)$$

where D is as defined in equation (5).

Because we want to show how economies of scope in a multi-product bank affect the H-Statistic in the market for classical banking products, all we need to know is how H_c varies with the parameter γ. Despite the closed formulae solution for H_c in equation (17), the process of computing the derivative of H_c with respect to γ is not straightforward. The fact that H_c-Statistic depends directly on γ and indirectly on q_c, p_c, q_o, p_o and D makes the computation

complex.[3] Fortunately, we can show that H_c decreases with γ, as stated in Proposition 2.

Proposition 2 *Assume that the elasticity of demand in the market for classical and other bank products is locally constant ($\frac{\partial e_i}{\partial q_i} = 0, \forall i$), and that the bank's cost function is locally linear in every output ($\frac{\partial^2 C(.)}{\partial q_i^2} = 0, \forall i$). Then,*

(i) we have that

$$\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} = -\frac{q_c}{p_c} e_c e_o < 0. \tag{18}$$

In particular,

(ii) if the economies of scope parameter γ reduces marginal costs ($\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} \leq 0, \forall i$), then

$$\frac{dH_c(\gamma)}{d\gamma} \leq 0, \forall \gamma. \tag{19}$$

■

Proposition 2 (i) indicates that if we compare the Panzar-Rosse's H-Statistic in the market for classical banking products offered by a single-product bank with the corresponding value for a multi-product bank that supplies classical and other banking products, the latter should be lower than the former. Proposition 2 (ii) shows that the greater the economies of scope at multi-product banks are, the lower the H_c-Statistic is. These results should occur because a multi-product bank that supplies classic and other banking products should benefit from economies of scope. Economies of scope reduce a bank's marginal costs for every product and, therefore, increase the bank's price-cost margin (i.e., mark-up) in the banking and non-banking market. Consequently, a multi-product bank will have higher mark-up than banks that supply only classic banking products.

The next subsection presents an econometric strategy that can be used to test for the empirical implications of Proposition 2. These empirical implications will be tested in the remainder of the paper.

2.3 The Multi-Product-Adjusted Panzar-Rosse's Statistic: An Empirical Strategy

This subsection describes the econometric model that we use to estimate the change H_c-Statistic in the market for classical banking products due to economies of scope that emerge for

[3] q_c, p_c, q_o, p_o and D are implicit functions of γ.

multi-product banks. Following the banking literature summarized by Degryse et al. (2009), we estimate the change in market power resulting from multi-product banking operations using the empirical approach suggested by Panzar and Rosse (1987). We first estimate the financial intermediation revenue equation as a function of bank financial intermediation input prices and compute the Standard Panzar-Rosse H_c-Statistic and the change in the H_c-Statistic due to the economies of scope that emerge from multi-product banking technologies: namely, ΔH_c. To conclude, we obtain the Adjusted Panzar and Rosse H-Statistic for conglomerate, multi-product banks.

The revenue equation is described by the following equation:

$$\ln(RT_{it}) = \alpha + \ln(w_{it})'\beta + \ln(w_{it}).dumMultiProduct_i'\gamma + Z_{it}\theta + \mu_i + \delta_t + \varepsilon_{it}, \tag{20}$$

where $\ln(RT_{uit})$ is the total financial revenue of a bank i at time t. The vector w_{it} corresponds to the bank input prices. The variable $dumMultiProduct_i$ is a dummy variable that is equal to 1 if the bank i supplies other banking products and is equal to 0 otherwise. The vector Z_{it} and the variables μ_i, δ_t and ε_{it} are, respectively, the control variables, the bank fixed effects, the time fixed effects and an erratic term that is assumed to be uncorrelated to the other independent variables in equation (20).

The usual Panzar-Rosse H_c-Statistic is estimated using the following equation:

$$\text{Standard-H} = \sum_{k=1}^{m} \widehat{\beta}_{m,it}, \tag{21}$$

such that each market competition yields a different H_c-Statistic. The relationship between H_c-Statistic and market competition is described in Table 1. A monopoly situation yields a value for H_c-Statistic that can be negative or 0. A monopolist yields values of H_c-Statistic between 0 and 1, and perfect competition implies an H_c-Statistic equal to 1 (Degryse, Kim and Ongema, 2009).

The change in a traditional Panzar-Rosse H_c-Statistic due to the multi-product nature of the bank, ΔH_c, is estimated by $\Delta H_c = \sum_{k=1}^{m} \widehat{\gamma}_{m,it}$. Therefore, the Adjusted Panzar-Rosse H-Statistic accounting for the multi-product nature of a bank is estimated as follows:

$$\text{Adjusted-H} = \sum_{k=1}^{m} \widehat{\beta}_{m,it} + \sum_{k=1}^{m} \widehat{\gamma}_{m,it}. \tag{22}$$

In this paper, we empirically examine whether a bank's market power increases when its

multi-product nature (revenues and costs that stem from other banking products rather than classical banking products) is taken into account. This hypothesis is tested in the econometric model described above using the following hypothesis test:

$$H_0\text{: } \Delta H_c \geq 0 \text{ and } H_a\text{: } \Delta H_c < 0.$$

If we reject H_0, then the market power of the bank increases when the multi-product nature of the bank is taken into account.

For ease of notation, we suppress subscripts in the H-Statistics, such that H and ΔH refer to the H-Statistics in the market for classical banking products for the rest of the paper.

3 Institutional Background

In this section we present the Brazilian banking system and discuss the multi-product nature of the country's banks.

3.1 The Banking System in Brazil

The Brazilian banking system has experienced important changes in the last few decades.[4] Since the implementation of the Real Plan, the sector has been characterized by strong financial deepening and changes in the sector's structure that have led to the entry of foreign banks and market consolidation.

The first significant change in the operation of Brazilian banks was caused by the qualitative improvement in the macroeconomic environment. Until the early nineties, high inflation rates had guided the actions of economic agents. With the Real Plan, launched in July 1994, the Brazilian inflation rate decreased from the annual average of 715% p.a. between 1980 and 1993 to 22% p.a in December 1995.

Macroeconomic stability has increased economic agents' predictability, increasing supply and demand for banking products, particularly credit. During the hyperinflationary period, Brazilian banking operations concentrated on gains from "floating" on basic banking services.[5] With greater monetary stability and more favorable macroeconomic conditions, particularly in

[4]For a historical overview of the evolution of Brazilian banks, see Baer and Nazmi (2000) and Ness Jr. (2000).

[5]Floating revenues can be defined as financial gains that originate from raising non-indexed and low-cost resources (for example, through bill and tax collection) and investing in interest-indexed financial assets. According to Baer and Nazmi (2000), inflationary revenues from floating operations reached 40% of total banking revenues between 1990 and 1992.

the last decade, banking system actions have become targeted toward the traditional functions of raising funds and providing credit.

The improvement in the macroeconomic environment was not the only determinant of the recent growth in the provision of banking services. The Brazilian government has also promoted important reforms of the financial system's institutional environment, which has contributed to the expansion of the credit markets in Brazil. Costa and De Mello (2006) argue that these governmental measures were implemented to reduce information asymmetries in the credit market, increase the quality of collateral instruments, increase the enforcement of contracts improve the regulatory system for addressing insolvency and create alternative mechanisms for credit.[6]

As a result of these improvements in Brazil's macroeconomic conditions and in the institutional environment, the country's economy underwent a robust process of financial deepening. The proportion of total credit to GDP increased from an average of 27% between 1998 and 2003 to 53% in 2012.

In addition to the process of financial deepening, the Brazilian banking system has also been characterized by important structural changes. The end of easy gains from floating operations induced painful adjustments in the sector. Along with the international crises of the nineties, this change created great difficulties for domestic banks, resulting in a credit crunch and increasing losses.

The problems in Brazil's banking system in the nineties led the Brazilian government to promote a series of packages that were intended to restructure the industry. The *Program of Incentives for the Restructuring and Strengthening of the National Financial System* (PROER), *Program of Incentives for the Reduction of the State-Level Public Sector in Bank Activity* (PROES) and *Program for the Strengthening of the Federal Financial Institutes* (PROEF) represented the beginning of important changes in the market structure of Brazilian banking.[7] One of these programs generated an increase in market concentration, with a reduction in the number of commercial banks. In 1996, there were 230 commercial banks authorized to operate in Brazil. By 2012, the number of commercial banks had fallen to 159. In this period, foreign banks represented the only segment of the economy that experienced

[6]Examples of such measures include the approval of the New Bankruptcy Law (Law 11,105/2005) and the Law on Positive Registers (Law 12,414/2011) and the stricter rules for risk credit operation classification and provision (Resolution 2,682/1999). For further discussion of these institutional changes, see Costa and De Mello (2006).

[7]For a more detailed discussion, see Baer and Nazmi (2000), Ness Jr (2000) and Nakane and Weintraub (2005).

market gains. Foreign institutions such as HSBC, ABN Amro and Santander took advantage of the consolidation of commercial banks to enter the Brazilian market. As a result, the number of banks in Brazil under foreign control increased from 41 in 1996 to 59 in 2012.

Finally, it is important to stress the remarkable position of state-owned banks in Brazil. Despite the reduction in the public banking sector promoted by PROES, state-owned banks are still widespread in Brazil. Three state-owned banks, Banco do Brasil (BB), Caixa Econômica Federal (CEF) and BNDES, were the largest banks in the country in terms of total assets as of December 2012. Furthermore, state-owned banks accounted for 44% of assets, 49% of credit and 49% of total deposits in the banking sector in December 2012. The leading position of state-owned banks gives the Brazilian government an important role in credit market dynamics. For example, the Brazilian government used its state-owned institutions to provide liquidity to the markets after the global financial crisis broke in 2008.

3.2 Conglomerates in the Brazilian Banking System

An important characteristic of the Brazilian banking industry is the leading participation of banks in conglomerates. Banks in other countries are exhibiting a similar tendency, using a common corporate structure to offer a wider range of financial products.

In fact, conglomerates play a major role in the Brazilian banking market. According to BCB, in 2012 only 20% of total loans were provided by independent banking institutions. Other market indicators show an identical pattern. Additionally, banks associated with conglomerates hold the greatest amount of total deposits (78 %), banking branches (85 %) and total assets (84 %) in Brazil.

The financial system in Brazil is composed of a large variety of individual institutions that can be roughly classified into three groups: credit, financial and insurance companies.[8] The first group includes all institutions that focus on the provision of loans as their core activity, including commercial banks, investments banks, housing finance and consumer finance companies. Brokers and dealers that specialize in the administration and negotiation of foreign exchange, government bonds, corporate securities, stocks and futures contracts are the institutions in the second category. The credit and financial segments are under the supervision of the Brazilian Central Bank (BCB) and the Securities and Exchange Commission (CVM). Finally, the insurance sector includes a variety of insurance and reinsurance compa-

[8]More details on the organization and the structure of the Brazilian financial system can be found in Fortuna (2010).

nies, capitalization funds and entities operating private pension funds. The Private Insurance Superintendence (Susep) is responsible for supervising this insurance market.

Figure 1 uses this classification to illustrate the types of conglomerates with which Brazilian banks are typically associated. At the first level, banks may form financial conglomerates in partnership with other credit institutions or financial companies. The formation of a financial conglomerate in association with other financial companies allows a bank to expand its production set beyond traditional credit lines.

A higher level of conglomeration is produced by the junction of individual banks or financial conglomerates with insurance institutions or insurance conglomerates under Susep's supervision. This type of arrangement gives rise to economic-financial conglomerates. Economic-financial conglomerates make it possible for individual banks and financial conglomerates to operate in the insurance market. These various possibilities stemming from the formation and service provision of conglomerates are the basis of the multi-product classification that will be proposed in the next section.

4 Estimation and Results

4.1 Data

As stated in the last section, Brazilian banking institutions, whether individually or as part of a conglomerate, can offer credit, financial and insurance services. To build a dataset that is consistent with this production set, we listed 526 individual institutions, including banks and financial entities supervised by the BCB and insurance companies under Susep's supervision. Then, for each single institution, we classified the various segments according to the services that each company had been authorized to offer. The Brazilian Central Bank's website has a complete list of services that banks and financial entities are authorized to charge for and offer.[9] Insurance companies supervised by Susep were automatically assigned to the insurance segment.

The second step in the procedure is the agglomeration of individual institutions into financial and insurance conglomerates. This process was based on the supervision entities' records regarding the governance structure of conglomerates. The BCB and Susep maintain lists that make it possible to link each individual entity to its corresponding conglomerate. Finally,

[9]This information is available at http://www.bcb.gov.br/?TARBANINST.

using the website's information on insurance institutions and insurance conglomerates, we matched these companies with individual banks and financial conglomerates.

Based on the procedure above and the classification proposed in Figure 1, banks may operate in the Brazilian financial system by offering classic (credit), financial and insurance products within the following categories: (i) as individual banks offering classic banking products; (ii) as individual banks offering classic banking and financial products; (iii) within conglomerates offering classic banking products; (iv) within conglomerates offering classic banking and financial products; (v) within conglomerates offering classic banking and insurance products, and (vi) within conglomerates offering classic banking, financial and insurance products. Appendix C provides a detailed description of the procedure used to identify different banking products (classic, financial and nonfinancial) offered by the banking conglomerates in our data set.

Brazilian banks present their statements to local regulators at three levels of consolidated accounts: economic-financial[10], financial[11] and single units.[12] The economic-financial accounts refer to groups of companies of any nature that integrate their economic groups, including financial and non-financial companies. The financial records are the accounting statements for the group of banks that have integrated their economic groups. The single units are the set of legal units with the National Registers of Legal Entities (CNPJ) whose financial statements are published monthly by their regulators: in this case, the BCB for banks and SUSEP for insurance companies.

To analyze the multi-product operation of banks as proposed in this article, we used economic-financial statements for each bank in cases (v) and (vi) because these statements cover a range of companies, including financial and insurance institutions. In cases in which the banks did not belong to any banking economic-financial conglomerate, we used information from financial records (cases (iii) and (iv)) and single units records (cases (i) and (ii)) to obtain the financial statements of the institutions operating in Brazil.

To our knowledge, Brazil is the only country for which this consolidated information on the global operations of conglomerates is available. This fact is important in the present context because the attempt to build accounting statements by simply aggregating individual records could yield misleading results. For example, intra-group credit operations, which could be miscalculated in an aggregation procedure, are accounted for in the consolidated statements.

[10]Economic-financial conglomerate (CONEF) records: document 4050 from the BCB.
[11]Financial conglomerate records: document 4040 from the BCB.
[12]Single unit records: document 4010 from the BCB.

The data used in this paper were obtained from the BCB database. The data were obtained from the BCB 's online reports, more specifically its Informações Financeiras Trimestrais (IFT). These reports provide information from the financial statements of all financial institutions authorized to operate in Brazil at all three levels described above on a quarterly basis. The reports can be downloaded directly from the BCB website free of charge.[13]

Our final sample is an unbalanced panel composed of 74 banking conglomerates with a total of 2,219 observations, as shown in tables 3, 4, 5, 6 and 7 in the appendix. All figures are expressed in real values from 2001Q1 according to the official Brazilian consumer price index (IPCA).

Table 3 presents the number of banks and their distribution by ownership and capital origin. Most of the banking conglomerates in the sample are private and national. Only 12.1% (9) of the conglomerates are foreign, and four (5.4%) are state-owned. Table 3 shows the distribution of banks in the proposed three-product division. The majority of the banking conglomerates operate only in the classical banking segment, which indicates the prevalence of single-output operations in the banking industry. However, 30% of the conglomerates operate jointly and offer other types of products, particularly financial banking products. Finally, only 10 conglomerates are active in all three segments.

Market structure varies across the segments, with signals of higher levels of market concentration in the multi-output definitions of supply. As we can see in the second column in Table 5, banks that supply only classic products typically have a lower average market share in terms of total assets. The average market share of classic banks is 2.8%, whereas the corresponding figure is 15.7% for conglomerates supplying classic and other financial products and 13.7% for conglomerates supplying classic and non-financial products. The same pattern arises regardless of whether market share is calculated in terms of total revenue or whether the Herfindhal-Hirschman Index (HHI) is used to capture the level of concentration within the segments.

Finally, the banks offering each set of products are different. Tables 6 and 7 show that in general, more diversified banking conglomerates are larger and enjoy a higher market share and higher input prices. Table 6 presents figures for conglomerates that supply only classic banking products (in the third column) and conglomerates that operate simultaneously in classic and financial or non-financial products (second column). The fourth and fifth columns present the test for mean equality, with strong evidence of heterogeneity for these two types

[13]Data available in: https://www3.bcb.gov.br/iftimagem.

of banks. The null hypothesis of equality cannot be rejected for the variable of fixed capital cost. On the other hand, in Table 7, we compare the characteristics of banks that supply all three products and the average characteristics of all other conglomerates. The nature of the results remains the same. On average, multi-product operations are associated with bigger banks operating in an environment with greater concentration and higher input prices.

4.2 Econometric Model

To estimate the values of Standard-H and Adjusted-H, as in (21) and (22), we run the regression (20) using the natural logarithm of the total revenues of financial intermediation (*ln(Revenue)*) as the dependent variable. The vector w_{it} containing the input prices of banking activity is given by

- **Funding expenses (*ln(cost of capital)*):** the natural logarithm of the ratio of total expenses associated with raising funds (capital) to total assets.
- **Personnel expenses (*ln(wage)*):** the natural logarithm of the ratio of total payroll to total assets.
- **Fixed capital expenses (*ln(cost of fixed capital)*):** the natural logarithm of the ratio of total fixed capital (own and leased) to total assets.

The variable $dumMultiProduct_i$ is a dummy variable that is equal to 1 if the banking conglomerate i supplies financial products (e.g., interbank credit, market trades) or nonfinancial banking products (e.g., insurance, capitalization bonds) in addition to classic banking products and zero otherwise. We also estimate equation (20), examining the profiles of various products: (i) classic and other financial banking products (such as brokerage and currency exchange services); (ii) classic and other nonfinancial banking products (such as insurance, life insurance, capitalization bonds and reinsurance), and (iii) classic and financial and nonfinancial products. We compare banks that offer such products with banks that offer only classic products.

The estimated models include a set of control variables, Z_{it}, to capture the effects of other relevant factors on revenue:

- **Provision rate:** the ratio of the total of provision for doubtful accounts to shareholder equity.

- **Profitability:** the return on equity by the ratio of total profits to shareholder equity.
- **Market share:** the banking conglomerate's market share in terms of total assets.
- **HHI:** the Herfindhal-Hirschman Index in the relevant market in terms of total assets.

The estimation and econometric results are presented in the following subsection.

4.3 Econometric Results

Table 8 presents several estimates of equation (20), in which the dependent variable is the natural logarithm of a bank's financial revenue. The independent variables of interest are the input prices (*ln(cost of capital)*, *ln(wage)*, and *ln(cost of fixed)* and the interaction of input prices with the dummy variable *dummy banks with classic and other banking products*. The dummy variable assumes a value of 1 if the bank offers classic and some other banking products (financial or nonfinancial products) and a value of 0 otherwise. The coefficients associated with these independent variables are used to estimate the Standard-H, ΔH and Adjusted-H in order to account for the multi-product nature of the banks. These estimates are included at the bottom of the table.

Each column in Table 8 corresponds to a different estimated specification of equation (20). In all specifications, we take into account the panel structure of the dataset by including fixed effects for each bank, quarter and year. The aim is to control for unobservable bank characteristics and some trend dependence in the banks' revenues.

In column (1) in Table 8, we estimate equation (20) using generalized least squares (GLS), in which we include only the input prices and their interaction with the dummy banks with classic and other bank products as the independent variables. In columns (2)-(4), we estimate the coefficients of interest, including the characteristics of observable banks and market structures. In particular, we include the provision rate and profitability as independent variables in column (2), bank market share in column (3) and industry HHI in column (4).

First, we observe that in all four specifications, the estimated Standard H is between 0 and 1, which supports the hypothesis that there is monopolistic competition within Brazilian banks that offer only classic products. This observation is consistent with previous works by Belaish (2003), Araujo, Jorge Neto and Ponce (2005) and Lucinda (2010). However, we find that in all of the regressions, the estimated ΔH is negative, which indicates that banks offering classic banking products (i.e., loans and credit cards) and other banking products

(i.e., brokerage services, insurance and capitalization bonds) have greater market power than banks that offer classic products only. As a result, the estimated Adjusted-H is negative. The negative Adjusted-H suggests that banks supplying classic and other banking products operate in an environment with little competition.

To examine whether ΔH is statically negative, we test the following hypothesis: H_0: $\Delta H \geq 0$ and H_a: $\Delta H < 0$. The results of these one-sided tests reject H_0 at 4.7 percent at the specification in column (1) and at 3.7 percent at the specification in columns (2) to (4). These results indicate that the estimated market power of banks offering classic banking products (i.e., loans and credit cards) and other banking products (i.e., brokerage services, insurance and capitalization bonds) is greater than the market power estimated for banks that offer only classic products. Note that the results are robust for different specifications and that the punctual estimated ΔH is approximately the same for all specifications.

To identify which of the other banking products (financial or nonfinancial products) produce increases in multi-product banking market power, we estimate the ΔH for the banks that offer each subset of products. In particular, Table 9 estimates the market power of the banks offering classic and other financial banking products (such as brokerage and currency exchange services) relative to that of banks that only offer classic products. In Table 10, we estimate the ΔH for banks that offer classic and other nonfinancial banking products (such as insurance, life insurance, capitalization bonds and reinsurance). Finally, Table 11 estimates the ΔH for those banks that offer classic, financial and nonfinancial products relative to those that offer only classic products.

Banks that supply classic and other financial banking products versus classic banks. Table 9 presents several estimates of equation (20), in which the dependent variable is the natural logarithm of a bank's financial revenue. The independent variables of interest are the input prices (*ln(cost of capital)*, *ln(wage)*, and *ln(cost of fixed)*, and the interaction of input prices with the dummy variable *dummy banks with classic and financial banking products*. The dummy variable is equal to 1 if the bank offers classic and financial products (such as brokerage and currency exchange services) and 0 otherwise. The banks supplying classic or nonfinancial products only are excluded from the regressions in the table. As in Table 8, the coefficients associated with the independent variables are used to estimate the Standard-H, ΔH and Adjusted-H. Those estimates are included at the bottom of the table.

As in Table 8, each column in Table 9 corresponds to a different estimated specification

of equation (20). In all of the specifications, we include fixed effects for each bank, quarter and year. In column (1) in Table 9, we estimate equation (20) using generalized least squares (GLS), in which we include only the input prices and their interaction with the dummy banks with classic and other financial products as the independent variables. In columns (2) to (4), we estimate the coefficients of interest, including the provision rate and profitability, bank market share and industry HHI, as independent variables.

We find that in all of the regressions, the estimated ΔH is negative, which indicates that banks that offer classic and other financial products have more market power than banks that offer only classic products. The hypothesis test with H_0: $\Delta H \geq 0$ and H_a: $\Delta H < 0$ rejects H_0 at 4.6 percent for the specification in column (1) and at 3.6 percent for the specification in columns (2) to (4). These results show that the estimated market power of banks that offer classic and other financial products is greater than the estimated market power for banks that offer only classic products. Note that the results are robust to different specifications and that the punctual estimated H is similar in all specifications.

Banks that supply classic and other nonfinancial bank products versus classic banks. Table 10 presents several estimates of equation (20), in which the dependent variable is the natural logarithm of a bank's financial revenue. The independent variables of interest are the input prices (*ln(cost of capital)*, *ln(wage)*, and *ln(cost of fixed)*, and the interaction of input prices and the dummy variable *dummy banks with classic and nonfinancial bank products*. The dummy variable is equal to 1 if the bank offers classic and nonfinancial products (such as life and nonlife insurance, and capitalization bonds) and 0 otherwise. The banks that supply classic or financial products only are excluded from the regressions in the table.

Table 10 reports several estimates of equation (20). In all of the specifications, we include fixed effects for each bank, quarter and year. In column (1) in Table 10, we estimate equation (1) using generalized least squares (GLS), in which we include only the input prices and their interaction with the dummy banks with classic and other nonfinancial products as the independent variables. In columns (2) to (4), we estimate the coefficients of interest, including the observable characteristics of the banks and market structure.

According to all of the estimations in Table 10, the estimated H is negative, indicating that the market power of banks that offer classic and other nonfinancial products is greater than that of banks that offer classic products only. The hypothesis test with H_0: $\Delta H \geq 0$ and H_a: $\Delta H < 0$ rejects H_0 at 4.1 percent for the specification in column (1), at 6.2 percent

for the specification in column (2), and at 6.9 percent for the specifications in columns (3) and (4). These results indicate that the banks offering classic and other nonfinancial products have greater market power than banks offering classic products only. Note that the results are robust to different specifications.

Banks that supply classic and other financial and nonfinancial banking products versus classic banks. Table 11 presents several estimates of equation (20), in which the dependent variable is the natural logarithm of a bank's financial revenue. The independent variables of interest are also the input prices (*ln(cost of capital)*, *ln(wage)*, and *ln(cost of fixed)* and the interaction of input prices with the dummy variable *dummy banks with classic, financial and nonfinancial bank products*. The dummy variable is equal to 1 if the bank offers classic, financial and nonfinancial products and 0 otherwise. The banks that supply classic or financial or nonfinancial products only are excluded from the regressions in the table.

Table 11 details several estimates of equation (20). In all of the specifications, we include fixed effects for each bank, quarter and year. As in Table 10, in column (1) in Table 11, we estimate equation (20) using generalized least squares (GLS), in which we include only the input prices and their interaction with the dummy banks with classic, financial and nonfinancial products as independent variables. In columns (2) to (4), we estimate the coefficients of interest, including the observable characteristics of the banks and market structure.

All estimations in Table 11 show that the estimated H is negative, which indicates that the market power of banks offering classic, financial and other nonfinancial products is greater than the market power of banks offering classic products only. The hypothesis test using H_0: $\Delta H \geq 0$ and H_a: $\Delta H < 0$ rejects H_0 at 6.0 percent for all estimations. These results indicate that the banks that offer classic and other nonfinancial products have greater market power than the banks that offer classic products only. Note that the results are robust for different specifications.

In summary, the estimations in Tables 9 -11 show that banks with any of the product profiles studied have more market power than the banks that offer classic products only. These results indicate that both financial and nonfinancial banking products can increase a bank's market power.

5 Conclusion

In this paper, we investigated the competitive aspects of multi-product banking operations. Extending Panzar and Rosse's (1987) test to the case of multi-product banking firms, we used a new dataset for Brazilian banking conglomerates to determine the impact of conglomeration on market power. We found that banks offering classic and other banking products have substantially greater market power than banks offering classic products only. Various tests developed by Panzar and Rosse (1987) reveal that market power is underestimated when multi-product information is not considered.

In addition, our estimates show that banks with any of the product profiles studied have greater market power than banks that offer only classic products. These results indicate that both financial and nonfinancial banking products can increase a bank's market power.

Future research could extend this project by investigating the causal effects of the positive relationship between market power and a bank's decision to supply classic and other banking products.

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A Appendix 1: Proofs

Proof of Proposition 1: The first-order conditions described by equations (2) and (3) define the $q_c^* = q_c(w_1, w_2, \gamma)$ and $q_o^* = q_o(w_1, w_2, \gamma)$ as implicitly functions of w_1 , w_2, and γ. For convenience, we will prove Proposition 1 by showing a general expression for $\frac{\partial q_c}{\partial k}$ and $\frac{\partial q_o}{\partial k}$ for any exogenous variable $k = w_1, w_2, \gamma$. We then conclude the proof by showing that the expressions (6) to (8) hold.

Differentiating the first-order conditions, equations (2) and (3), with respect to k, we obtain the following expressions:

$$\frac{p_c}{q_c}\left[\frac{1-e_c}{e_c^2}\right]\frac{\partial q_c}{\partial k} - \frac{\partial^2 C(.)}{\partial q_c^2}\frac{\partial q_c}{\partial k} - \frac{\partial^2 C(.)}{\partial q_c \partial q_o}\frac{\partial q_o}{\partial k} - \frac{\partial^2 C(.)}{\partial q_c \partial k} = 0$$

$$\frac{p_o}{q_o}\left[\frac{1-e_o}{e_o^2}\right]\frac{\partial q_o}{\partial k} - \frac{\partial^2 C(.)}{\partial q_c \partial q_o}\frac{\partial q_c}{\partial k} - \frac{\partial^2 C(.)}{\partial q_o^2}\frac{\partial q_o}{\partial k} - \frac{\partial^2 C(.)}{\partial q_o \partial k} = 0$$

As we have assumed that the banking technology has constant economies of scope, $\frac{\partial^2 C(.)}{\partial q_c q_o} = -\gamma$, the elasticity of demand in both markets are locally constant ($\frac{\partial e_i}{\partial q_i} = 0, \forall i$), and bank's cost function is locally linear in every output ($\frac{\partial^2 C(.)}{\partial q_i^2} = 0, \forall i$), the equations above can be written as follows:

$$\frac{p_c}{q_c}\left[\frac{1-e_c}{e_c^2}\right]\frac{\partial q_c}{\partial k} + \gamma\frac{\partial q_o}{\partial k} - \frac{\partial^2 C(.)}{\partial q_c \partial k} = 0 \tag{23}$$

$$\frac{p_o}{q_o}\left[\frac{1-e_o}{e_o^2}\right]\frac{\partial q_o}{\partial k} + \gamma\frac{\partial q_c}{\partial k} - \frac{\partial^2 C(.)}{\partial q_o \partial k} = 0 \tag{24}$$

Equations (23) and (24) define the following system of equation:

$$\begin{pmatrix} \frac{p_c}{q_c}\left[\frac{1-e_c}{e_c^2}\right] & \gamma \\ \gamma & \frac{p_o}{q_o}\left[\frac{1-e_o}{e_o^2}\right] \end{pmatrix} \begin{pmatrix} \frac{\partial q_c}{\partial k} \\ \frac{\partial q_o}{\partial k} \end{pmatrix} = \begin{pmatrix} \frac{\partial^2 C(.)}{\partial q_c \partial k} \\ \frac{\partial^2 C(.)}{\partial q_o \partial k} \end{pmatrix}.$$

Let

$$D = \frac{p_c p_o}{q_c q_o}\left[\frac{e_c - 1}{e_c^2}\right]\left[\frac{e_o - 1}{e_o^2}\right] - \gamma^2 \geq 0$$

be the determinant of the coefficient matrix on the left. Note that it is the same expression in equation (5). Then,

$$D\begin{pmatrix} \frac{\partial q_c}{\partial k} \\ \frac{\partial q_o}{\partial k} \end{pmatrix} = \begin{pmatrix} \frac{p_o}{q_o}\left[\frac{1-e_o}{e_o^2}\right] & -\gamma \\ -\gamma & \frac{p_c}{q_c}\left[\frac{1-e_c}{e_c^2}\right] \end{pmatrix} \begin{pmatrix} \frac{\partial^2 C(.)}{\partial q_c \partial k} \\ \frac{\partial^2 C(.)}{\partial q_o \partial k} \end{pmatrix}$$

So, we have that

$$\frac{\partial q_c}{\partial k} = \frac{1}{D}\Big[\frac{p_o}{q_o}\Big(\frac{1-e_o}{e_o^2}\Big)\frac{\partial^2 C(.)}{\partial q_c \partial k} - \gamma\frac{\partial^2 C(.)}{\partial q_o \partial k}\Big],$$

$$\frac{\partial q_o}{\partial k} = \frac{1}{D}\Big[\frac{p_c}{q_c}\Big(\frac{1-e_c}{e_c^2}\Big)\frac{\partial^2 C(.)}{\partial q_o \partial k} - \gamma\frac{\partial^2 C(.)}{\partial q_c \partial k}\Big].$$

Replacing k by w_1, w_2 or γ, we obtain the equations (6)-(8) in Proposition 1.

■

Proof of Lemma 1: We prove Lemma 1 in 3 steps. First, we to show that $C(q_c, q_o; w_1, w_2)$, defined in equation (14), is homogenous of degree 1 in input prices (w_1, w_2). That is in Lemma 2.

Lemma 2 *Let $C(q_c, q_o; w_1, w_2)$ be the cost function defined in equation (14). Then, $C(.)$ is homogenous of degree 1 in input prices (w_1, w_2), such that:*

$$C(q_c, q_o; \lambda w_1, \lambda w_2) = \lambda C(q_c, q_o; w_1, w_2), \lambda > 0. \tag{25}$$

Proof of Lemma 2:

Part-I: In this part we will show that

$$(x_1', x_2') = \arg\min_{x_1, x_2} w_1 x_1 + w_2 x_2 \qquad s.t. \qquad (q_c, q_o; x_1, x_2) \in Y,$$

if, and only if,

$$(x_1', x_2') = \arg\min_{x_1, x_2} \lambda w_1 x_1 + \lambda w_2 x_2 \qquad s.t. \qquad (q_c, q_o; x_1, x_2) \in Y.$$

Proof of Part-I: By contraction. Suppose not:

$$(x_1', x_2') = \arg\min_{x_1, x_2} w_1 x_1 + w_2 x_2 \qquad s.t. \qquad (q_c, q_o; x_1, x_2) \in Y, \tag{26}$$

but

$$(x_1'', x_2'') = \arg\min_{x_1, x_2} \lambda w_1 x_1 + \lambda w_2 x_2 \qquad s.t. \qquad (q_c, q_o; x_1, x_2) \in Y, \tag{27}$$

such that $(x_1', x_2') \neq (x_1'', x_2'')$.

Hence, from the program (26), we have that $w_1x_1' + w_2x_2' > w_1x_1'' + w_2x_2''$, which implies that $\lambda(w_1x_1' + w_2x_2') > \lambda(w_1x_1'' + w_2x_2'')$. However, from the program (27), we have that $\lambda w_1x_1'' + \lambda w_2x_2'' > \lambda w_1x_1' + \lambda w_2x_2'$, which implies that $\lambda(w_1x_1'' + w_2x_2'') > \lambda(w_1x_1' + w_2x_2')$. This inequality contradicts the previous one. So, we have a contradiction.

Part-II: In this part we explicitly show that $C(q_c, q_o; \lambda w_1, \lambda w_2) = \lambda C(q_c, q_o; w_1, w_2)$, for $\lambda > 0$. So, by definition, $C(q_c, q_o; w_1, w_2) = w_1x_1' + w_2x_2'$, and $C(q_c, q_o; \lambda w_1, \lambda w_2) = \lambda w_1x_1' + \lambda w_2x_2'$, which is equal to $\lambda(w_1x_1'' + w_2x_2'')$, that is equal to $\lambda C(q_c, q_o; w_1, w_2)$. So, $C(q_c, q_o; \lambda w_1, \lambda w_2) = \lambda C(q_c, q_o; w_1, w_2)$.

Secondly, we will show that:

$$\left[w_1 \frac{\partial^2 C(.)}{\partial q_i \partial w_1} + w_2 \frac{\partial^2 C(.)}{\partial q_i \partial w_2}\right] = \frac{\partial C(.)}{\partial q_i}, \forall i. \tag{28}$$

By definition, we have:

$$\frac{\partial C(q_c, q_o; \lambda w_1, \lambda w_2)}{\partial q_c} = \lim_{h \to 0} \frac{C(q_c + h, q_o; \lambda w_1, \lambda w_2) - C(q_c, q_o; \lambda w_1, \lambda w_2)}{h}.$$

By Lemma 2, we know that $C(q_c, q_o; w_1, w_2)$, defined in equation (14), is homogenous of degree 1 in input prices (w_1, w_2). Therefore, the equation above can be written as follows:

$$\frac{\partial C(q_c, q_o; \lambda w_1, \lambda w_2)}{\partial q_c} = \lambda \lim_{h \to 0} \frac{C(q_c + h, q_o; w_1, w_2) - C(q_c, q_o; w_1, w_2)}{h}.$$

So,

$$\frac{\partial C(q_c, q_o; \lambda w_1, \lambda w_2)}{\partial q_c} = \lambda \frac{\partial C(q_c, q_o; w_1, w_2)}{\partial q_c}.$$

Differentiate it with respect to λ, we have that

$$w_1 \frac{\partial^2 C(q_c, q_o; \lambda w_1, \lambda w_2)}{\partial q_c \partial w_1} + w_2 \frac{\partial^2 C(q_c, q_o; \lambda w_1, \lambda w_2)}{\partial q_c \partial w_2} = \frac{\partial C(q_c, q_o; w_1, w_2)}{\partial q_c}.$$

Evaluating the equation above at $\lambda = 1$, we have that

$$\left[w_1 \frac{\partial^2 C(.)}{\partial q_c \partial w_1} + w_2 \frac{\partial^2 C(.)}{\partial q_c \partial w_2}\right] = \frac{\partial C(.)}{\partial q_c},$$

which is exactly what we want to show for the case of $i = c$. Since the same analysis also applies for $i = o$, so we have proved that equation (28) holds.

The third step concludes the proof showing that equation (15) holds. From, the first-order conditions described by equations (2) and (3), we know that a profit-maximizing bank equates marginal revenue and marginal cost in each product-market. That implies that

$$\frac{\partial R_i(.)}{\partial q_i} = \frac{\partial C(.)}{\partial q_i}, \forall i. \tag{29}$$

Replacing equation (29) in (28), we obtain (15).

■

Proof of Proposition 2:

Part-(i): From equation (17), we have that

$$H_c = -\frac{1}{D}\Big[\frac{p_c p_o}{q_c q_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2} + \gamma\frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\Big],$$

where D is defined in equation (5) as equal to:

$$D(\gamma) = \frac{p_c p_o}{q_c q_o}\Big[\frac{e_c-1}{e_c^2}\Big]\Big[\frac{e_o-1}{e_o^2}\Big] - \gamma^2.$$

Define Ω as follows:

$$\Omega(\gamma) = \frac{p_c p_o}{q_c q_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2} + \gamma\frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}. \tag{30}$$

So,

$$\frac{dH_c(\gamma)}{d\gamma} = -\frac{1}{D(\gamma)^2}\Big[\frac{d\Omega(\gamma)}{d\gamma}D(\gamma) - \Omega(\gamma)\frac{dD(\gamma)}{d\gamma}\Big]. \tag{31}$$

In particular,

$$\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} = -\frac{1}{D(\gamma=0)^2}\Big[\frac{d\Omega(\gamma)}{d\gamma}\Big|_{\gamma=0}D(\gamma=0) - \Omega(\gamma=0)\frac{dD(\gamma)}{d\gamma}\Big|_{\gamma=0}\Big]. \tag{32}$$

The derivative of $\Omega(\gamma)$ with respect to γ is equal to

$$\frac{d\Omega(\gamma)}{d\gamma} = \frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big] + \frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o} + \gamma\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big]. \tag{33}$$

Hence,

$$\frac{d\Omega(\gamma)}{d\gamma}\Big|_{\gamma=0} = \frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big]\Big|_{\gamma=0} + \frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}. \tag{34}$$

The derivative of $D(\gamma)$ in equation (5) with respect to γ is equal to

$$\frac{dD(\gamma)}{d\gamma} = \frac{e_c-1}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big] - 2\gamma. \tag{35}$$

Hence,

$$\frac{dD(\gamma)}{d\gamma}\Big|_{\gamma=0} = \frac{e_c-1}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big]\Big|_{\gamma=0}. \tag{36}$$

Replacing equations (5), (30), (34) and (36) into equation (32), we obtain that

$$\begin{aligned}\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} \;=\; & -\frac{1}{D(\gamma=0)^2}\Big\{\Big[\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big]\Big|_{\gamma=0} + \frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\Big]\frac{p_c p_o}{q_c q_o}\Big[\frac{e_c-1}{e_c^2}\Big]\Big[\frac{e_o-1}{e_o^2}\Big] \\ & -\Big[\frac{e_c-1}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big]\Big|_{\gamma=0}\frac{p_c p_o}{q_c q_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\Big]\Big\}.\end{aligned}$$

After some algebraic manipulations, we have that

$$\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} = -\frac{1}{D(\gamma=0)^2}\Big[\frac{(e_c-1)^2}{e_c^3}\frac{(e_o-1)^2}{e_o^3}\frac{p_c p_o^2}{q_c q_o^2}\Big].$$

Replacing $D(\gamma=0)$ from equation (5) into the expression above, we obtain that

$$\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} = -\frac{q_c^2 q_o^2}{p_c^2 p_o^2}\frac{e_c^4}{(e_c-1)^2}\frac{e_o^4}{(e_o-1)^2}\frac{(e_c-1)^2}{e_c^3}\frac{(e_o-1)^2}{e_o^3}\frac{p_c p_o^2}{q_c q_o^2}.$$

After some algebraic manipulations, we have that

$$\frac{dH_c(\gamma)}{d\gamma}\Big|_{\gamma=0} = -\frac{q_c}{p_c}e_c e_o < 0,$$

which is negative, since e_c and e_o are positive.

Part-(ii): Define $\Phi(\gamma)$ as follows:

$$\Phi(\gamma) = \frac{d\Omega(\gamma)}{d\gamma}D(\gamma) - \Omega(\gamma)\frac{dD(\gamma)}{d\gamma}. \tag{37}$$

So, if we want to show that $\frac{dH_c(\gamma)}{d\gamma}$, defined in equation (31), is negative, then we have to show that $\Phi(\gamma) > 0$ for all $\gamma > 0$.

Replacing equations (5), (30), (33) and (35) into equation (37), we obtain that

$$\begin{aligned}\Phi(\gamma) &= \Big\{\Big[\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big] + \frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o} + \gamma\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big]\Big] \times \\ &\quad \times\Big[\frac{p_cp_o}{q_cq_o}\Big[\frac{e_c-1}{e_c^2}\Big]\Big[\frac{e_o-1}{e_o^2}\Big] - \gamma^2\Big]\Big\} \\ &\quad -\Big\{\Big[\frac{p_cp_o}{q_cq_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2} + \gamma\frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\Big]\Big[\frac{e_c-1}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big] - 2\gamma\Big]\Big\}.\end{aligned}$$

After some algebraic manipulations of the equation above, we have that

$$\begin{aligned}\Phi(\gamma) &= \underbrace{\frac{p_c^2p_o}{q_c^2q_o}\frac{(e_c-1)^2}{e_c^3}\frac{(e_o-1)^2}{e_o^3}}_{(a)} + 2\gamma\underbrace{\frac{p_cp_o}{q_cq_o}\frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}}_{(b)} + \gamma\underbrace{\frac{p_o}{q_c}\frac{(e_c-1)^2}{e_c^3}\frac{(e_o-1)^2}{e_o^3}}_{(c)}\underbrace{\Big[\frac{p_c}{q_o}\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big] - \frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big]\Big]}_{(d)} \\ &\quad \underbrace{\gamma^2\Big[\frac{p_o}{q_c}\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o} - \frac{(e_c-1)^2}{e_c^2}\frac{(e_o-1)}{e_o^2}\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big]\Big]}_{(e)} + \gamma^3\underbrace{\Big[-\frac{(e_c-1)}{e_c}\frac{(e_o-1)}{e_o}\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big]\Big]}_{(f)}.\end{aligned}$$

Note that (a), (b) and (c) are positive because $e_c \geq 1$ and $e_o \geq 1$ (from the profit maximization problem).

Computing $\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big]$, we obtain that

$$\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big] = \frac{1}{(q_cq_o)^2}\Big[\Big(p_c\frac{\partial p_o}{\partial q_o}\frac{\partial q_o}{\partial \gamma} + p_o\frac{\partial p_c}{\partial q_c}\frac{\partial q_c}{\partial \gamma}\Big)q_cq_o - p_cp_o\Big(q_o\frac{\partial q_c}{\partial \gamma} + q_c\frac{\partial q_o}{\partial \gamma}\Big)\Big].$$

After some algebraic manipulations of the equation above, we have that

$$\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big] = -\frac{1}{(q_cq_o)^2}\Big[p_cq_cp_o\Big(1+\frac{1}{e_o}\Big)\frac{\partial q_o}{\partial \gamma} + p_cp_oq_o\Big(1+\frac{1}{e_c}\Big)\frac{\partial q_c}{\partial \gamma}\Big]. \tag{38}$$

From Proposition 1, we know that if we assume that the economies of scope parameter γ reduces marginal costs such that $\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} \leq 0, \forall i$, then the optimal supply of classical and other banking products increases as the economies of scope increase ($\frac{\partial q_i}{\partial \gamma} \geq 0, \forall i$). Therefore, $\frac{d}{d\gamma}\Big[\frac{p_cp_o}{q_cq_o}\Big]$ is negative. Hence, expression (e) is positive.

Computing $\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big]$, we obtain that

$$\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big] = \frac{1}{q_c^2}\Big[q_c\frac{\partial p_o}{\partial q_o}\frac{\partial q_o}{\partial \gamma} - p_o\frac{\partial q_c}{\partial \gamma}\Big].$$

After some algebraic manipulations of the equation above, we have that

$$\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big] = -\frac{p_0}{q_c}\Big[\frac{1}{e_o}\frac{1}{q_o}\frac{\partial q_o}{\partial \gamma} + \frac{1}{q_c}\frac{\partial q_c}{\partial \gamma}\Big]. \tag{39}$$

From Proposition 1, we have that $\frac{\partial q_i}{\partial \gamma} \geq 0, \forall i$ if $\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} \leq 0, \forall i$. Therefore, $\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big]$ is negative. Hence, expression (f) is positive.

We still have to show that (d) is positive. Note that (d) is defined as

$$(d) = \Big[\frac{p_c}{q_o}\frac{d}{d\gamma}\Big[\frac{p_o}{q_c}\Big] - \frac{d}{d\gamma}\Big[\frac{p_c p_o}{q_c q_o}\Big]\Big]. \tag{40}$$

Replacing (38) and (39) into (41), we obtain that

$$(d) = \frac{p_c p_o}{q_c q_o}\frac{e_o - 1}{e_c e_o}\Big[\frac{1}{q_o}\frac{\partial q_o}{\partial \gamma} + \frac{1}{q_c}\frac{\partial q_c}{\partial \gamma}\Big], \tag{41}$$

which is positive if we assume $\frac{\partial^2 C(.)}{\partial q_i \partial \gamma} \leq 0, \forall i$.

Given that the expressions from (a) to (f) are positive for all γ, then $\Phi(\gamma) > 0, \forall \gamma$. Therefore, $\frac{dH_c(\gamma)}{d\gamma} < 0, \forall \gamma$.

■

B Appendix 2: Figures and Tables

Figure 1: Banking conglomerates

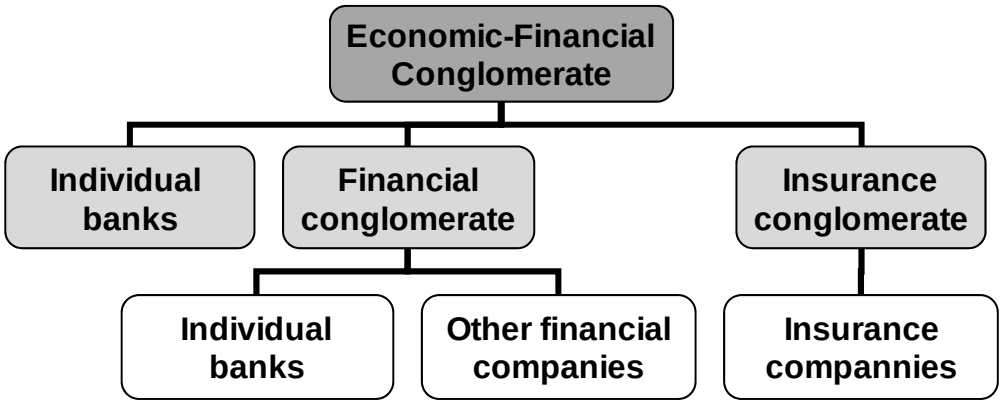

Table 1: H-Statistic and Market Competition

Values for Standard-H	Market Power compatible with
Standard-H ≤ 0	Monopoly or Monopoly Competition
Standard-H $\in (0, 1)$	Monopoly Competition
Standard-H $= 1$	Perfect Competition

Table 2: Financial Products

	Other Bank Products	
Classic Bank Products	Other Financial Products	Other Non Financial Bank Products
Working capital	Interbank credit	Life Insurance
Credit Cards	Market Trades (currency, money, etc)	Capitalization Bonds
Personal loans		Other Insurance

Table 3: Banks and Financial Products

Description	Number of Banks
All Banks	74
Ownership	
Private Banks	70
Public Banks	4
Capital Origin	
National Banks	65
Foreign Banks	9
Bank Products (Classic and Other Bank Products)	74
Only Classic Bank Products	52
Classic and Other Bank Products	22
Bank Products (Classic, Other Financial and Non Financial Bank Products)	74
Only Classic Bank Products	52
Classic Products and	22
only Financial Bank Products	11
only Non Financial Bank Products	1
all types of bank products	10

Table 4: Descriptive Characteristics: Bank Characteristics and Market Concentration - All Banks

Variable	Number of Observations	Mean	Standard Deviation	Min	Max
Panel A - Bank Characteristics					
Dummy Private Bank	2219	0.94	0.25	0	1
Dummy Brazilian Bank	2219	0.9	0.3	0	1
Dummy Banks with other Bank Products	2219	0.22	0.42	0	1
Dummy Banks with other Financial Products	2219	0.22	0.41	0	1
Dummy Banks with other Non Financial Products	2219	0.12	0.32	0	1
Total Assets (price index Q12001=1)	2219	10500000	42200000	277	403000000
Total Bank Products Revenue (price index Q12001=1)	2219	382254	1494794	0	17100000
Labor Cost (Wage)					
= TotalPayoll/Total Assets	2219	0.045	0.056	0	0.584
Cost of Capital					
= Total Capital Expenditure / Total Assets	2219	0.2	0.667	-0.723	29.552
Cost of fixed capital					
= Total Fixed Capital/Total Assets	2219	0.205	0.776	0	11.873
Provision					
= Provision for doubtful accounts/ Shareholder Equity	2219	0.009	0.018	-0.06	0.24
Profitability = Total Profits / Shareholder Equity	2219	0.032	0.116	-2.485	1.818
Market Share (assets)	2219	0.022	0.069	0	0.496
Market Share (revenue)	2219	0.022	0.067	0	0.497
Panel B - Market Concentration					
HHI (revenue)	2219	0.232	0.041	0.15	0.35
HHI (assets)	2219	0.245	0.037	0.19	0.39
Panel C - Time Dummies					
Quarter - Dummies					
1st Quarter	2219	0.248	0.432	0	1
2nd Quarter	2219	0.245	0.43	0	1
3rd Quarter	2219	0.254	0.435	0	1
4th Quarter	2219	0.253	0.435	0	1
Year - Dummies					
2001	2219	0.08	0.271	0	1
2002	2219	0.082	0.274	0	1
2003	2219	0.081	0.273	0	1
2004	2219	0.082	0.274	0	1
2005	2219	0.089	0.284	0	1
2006	2219	0.098	0.298	0	1
2007	2219	0.106	0.308	0	1
2008	2219	0.12	0.325	0	1
2009	2219	0.095	0.293	0	1
2010	2219	0.055	0.228	0	1
2011	2219	0.055	0.228	0	1
2012	2219	0.058	0.233	0	1

The variables price paid, bid and estimated price are deflated by the monthly official price index (IPCA - base January, 2000).

Table 5: Relevant Market, Market Concentration and Bank Products

Relevant Market and Bank Products	Market Concentration: Average Market Share and HHI			
	Market Share (assets) Average	Market Share (revenue) Average	HHI (assets)	HHI (revenue)
Banks supplying				
Classic Products	0.028	0.028	0.182	0.154
Classic and Other Bank Products	0.073	0.073	0.285	0.275
Classic and Other Financial Products	0.157	0.157	0.363	0.324
Classic and Other Non Financial Products	0.137	0.137	0.31	0.31

Table 6: Mean Difference Test - Banks - Only Classic versus Other Banks

	Banks Supplying		t-test	
Variable	Classic and Other Bank Products	Only Classic Bank Products	t-statistics	p-value
Panel A - Market Share and Bank Size				
Market Share (assets)	0.07	0.01	18.23	0
Market Share (revenue)	0.07	0.01	19.05	0
Total Assets (price index Q12001=1)	43600000	1039240	21.73	0
Total Bank Products Revenue (price index Q12001=1)	1593522	37179	22.59	0
Panel B - Other Characteristics				
Dummy Private Bank	0.71	1	-26.72	0
Dummy Brazilian Bank	0.94	0.89	3.22	0.001
Labor Cost (Wage) = TotalPayoll/Total Assets	0.09	0.03	19.86	0
Cost of Capital = Total Capital Expenditure / Total Assets	0.36	0.16	5.94	0
Cost of fixed capital = Total Fixed Capital/Total Assets	0.23	0.2	0.75	0.451
Provision = Provision for doubtful accounts/ Shareholder Equity	0	0.01	-5.03	0
Profitability = Total Profits / Shareholder Equity	0.05	0.03	3.33	0.001
Number of Observations	492	1727		

Table 7: Mean Difference Test - Banks Supplying Classic, Financial and Non Financial Bank Products versus other Banks

Variable	Banks Supplying Classic and All other Banks Products	Other Banks	t-test t-statistics	t-test p-value
Panel A - Market Share and Bank Size				
Market Share (assets)	0.13	0.01	31.02	0
Market Share (revenue)	0.13	0.01	31.57	0
Total Assets (price index Q12001=1)	81300000	1370592	35.47	0
Total Bank Products Revenue (price index Q12001=1)	2918683	55847	36.14	0
Panel B - Other Characteristics				
Dummy Private Bank	0.72	0.96	-15.9	0
Dummy Brazilian Bank	0.97	0.89	3.83	0
Labor Cost (Wage) = Total Payoll/Total Assets	0.1	0.04	18.22	0
Cost of Capital = Total Capital Expenditure / Total Assets	0.36	0.18	4.11	0
Cost of fixed capital = Total Fixed Capital/Total Assets	0.33	0.19	2.79	0.005
Provision = Provision for doubtful accounts/ Shareholder Equity	0	0.01	-3.62	0
Profitability = Total Profits / Shareholder Equity	0.05	0.03	2.23	0.026
Number of Observations	253	1966		

Table 8: In all of the columns below the dependent variable is the natural logarithm of the financial revenue. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1).

	Dependent Variable: ln (Revenue)			
Independent variables	(1)	(2)	(3)	(4)
ln (wage)	-0.194	-0.197	-0.196	-0.196
	(0.123)	(0.122)	(0.121)	(0.122)
ln (cost of capital)	0.334***	0.356***	0.356***	0.356***
	(0.053)	(0.06)	(0.06)	(0.06)
ln (cost of fixed capital)	-0.012	-0.011	-0.011	-0.011
	(0.044)	(0.045)	(0.045)	(0.045)
ln (wage)*Dummy Banks	-0.134	-0.134	-0.134	-0.132
with Classic and other Bank Products	(0.147)	(0.141)	(0.141)	(0.141)
ln(cost of capital)*Dummy Banks	-0.032	-0.05	-0.05	-0.051
with Classic and other Bank Products	(0.079)	(0.082)	(0.082)	(0.082)
ln(cost of fixed capital)*Dummy Banks	-0.114	-0.104	-0.104	-0.104
with Classic and other Bank Products	(0.089)	(0.089)	(0.089)	(0.089)
	Control Variables			
Provision Rate		-1.662	-1.651	-1.629
		(1.968)	(1.967)	(1.979)
Profitability		1.493***	1.498***	1.494***
		(0.306)	(0.304)	(0.302)
Market Share (assets)			-0.178	-0.166
			(0.503)	(0.510)
HHI (assets)				-0.851
				(0.994)
H-Statistics (Panzar and Rosse)				
Standard H	0.128	0.128	0.128	0.128
ΔH	-0.281	-0.288	-0.288	-0.289
Adjusted H = Standard H + ΔH	-0.153	-0.16	-0.16	-0.161
ΔH-Statistics				
Estimated ΔH	-0.281	-0.288	-0.288	-0.289
Standard Deviation ΔH	0.166	0.159	0.159	0.159
Degrees of Freedom	71	71	71	71
p-value Test - Ho: $\Delta H \geq 0$, Ha: $\Delta H < 0$	0.047	0.037	0.037	0.037
Confidence Interval (95%)	-0.557/-0.004	-0.553/-0.023	-0.553/-0.023	-0.554/-0.023
Observations	1,998	1,998	1,998	1,998
R-Square	0.36	0.416	0.416	0.416

Notes:

All regressions are estimated with intercept.

Robust standard errors in parenthesis. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 8: In all columns below the dependent variable is the natural logarithm of the financial revenue. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). (continued)

	(1)	(2)	(3)	(4)
Fixed Effects				
Bank Fixed-Effect	Yes	Yes	Yes	Yes
Month Fixed-Effect	Yes	Yes	Yes	Yes
Year Fixed-Effect	Yes	Yes	Yes	Yes

Table 9: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table.

	Dependent Variable: ln (Revenue)			
Independent variables	(1)	(2)	(3)	(4)
ln (wage)	-0.193	-0.196	-0.196	-0.196
	(0.123)	(0.122)	(0.121)	(0.122)
ln(cost of capital)	0.334***	0.356***	0.355***	0.356***
	(0.053)	(0.06)	(0.06)	(0.06)
ln(cost of fixed capital)	-0.013	-0.012	-0.011	-0.012
	(0.044)	(0.045)	(0.045)	(0.045)
ln (wage)*Dummy Banks	-0.132	-0.132	-0.132	-0.13
with Classic and Financial Bank Products	(0.148)	(0.142)	(0.142)	(0.142)
ln(cost of capital)*Dummy Banks	-0.036	-0.054	-0.054	-0.055
with Classic and Financial Bank Products	(0.08)	(0.083)	(0.083)	(0.082)
ln(cost of fixed capital)*Dummy Banks	-0.116	-0.105	-0.105	-0.105
with Classic and Financial Bank Products	(0.089)	(0.089)	(0.089)	(0.089)
	Control Variables			
Provision Rate		-1.624	-1.614	-1.592
		(1.969)	(1.968)	(1.979)
Profitability		1.494***	1.499***	1.495***
		(0.306)	(0.304)	(0.302)
Market Share (assets)			-0.18	-0.168
			(0.502)	(0.51)
HHI (assets)				-0.832
				(0.996)
H-Statistics (Panzar and Rosse)				
Standard H	0.128	0.126	0.127	0.126
ΔH	-0.283	-0.291	-0.291	-0.29
Adjusted H = Standard H + ΔH	-0.155	-0.165	-0.164	-0.164
ΔH-Statistics				
Estimated ΔH	-0.283	-0.291	-0.291	-0.29
Standard Deviation ΔH	0.166	0.159	0.159	0.159
Degrees of Freedom	70	70	70	70
p-value Test - Ho: $\Delta H \geq 0$, Ha: $\Delta H < 0$	0.046	0.036	0.036	0.036
Confidence Interval (95%)	-0.559/-0.007	-0.556/-0.026	-0.557/-0.026	-0.556/-0.025
Observations	1,988	1,988	1,988	1,988
R-Square	0.361	0.417	0.417	0.417

Notes:
All regressions are estimated with intercept.
Robust standard errors in parenthesis. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 9: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table. (continued)

	(1)	(2)	(3)	(4)
Fixed Effects				
Bank Fixed-Effect	Yes	Yes	Yes	Yes
Month Fixed-Effect	Yes	Yes	Yes	Yes
Year Fixed-Effect	Yes	Yes	Yes	Yes

Table 10: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table.

	Dependent Variable: ln (Revenue)			
Independent variables	(1)	(2)	(3)	(4)
ln (wage)	-0.197	-0.2	-0.198	-0.198
	(0.123)	(0.122)	(0.121)	(0.122)
ln(cost of capital)	0.333***	0.355***	0.355***	0.355***
	(0.053)	(0.061)	(0.061)	(0.061)
ln(cost of fixed capital)	-0.013	-0.012	-0.011	-0.012
	(0.044)	(0.045)	(0.045)	(0.045)
ln (wage)*Dummy Banks	-0.252	-0.181	-0.173	-0.171
with Classic and NonFinancial Bank Products	(0.18)	(0.174)	(0.177)	(0.176)
ln(cost of capital)*Dummy Banks	0.05	0.036	0.036	0.033
with Classic and NonFinancial Bank Products	(0.07)	(0.078)	(0.078)	(0.075)
ln(cost of fixed capital)*Dummy Banks	-0.077	-0.094	-0.099	-0.098
with Classic and NonFinancial Bank Products	(0.053)	(0.055)	(0.057)	(0.057)
	Control Variables			
Provision Rate		-1.643	-1.618	-1.6
		(2.032)	(2.027)	(2.038)
Profitability		1.489***	1.500***	1.497***
		(0.311)	(0.31)	(0.308)
Market Share (assets)			-0.413	-0.4
			(0.433)	(0.439)
HHI (assets)				-0.879
				(1.098)
H-Statistics (Panzar and Rosse)				
Standard H	0.123	0.121	0.124	0.123
ΔH	-0.279	-0.24	-0.236	-0.236
Adjusted H = Standard H + ΔH	-0.156	-0.119	-0.112	-0.113
ΔH-Statistics				
Estimated ΔH	-0.279	-0.240	-0.236	-0.236
Standard Deviation ΔH	0.158	0.154	0.157	0.157
Degrees of Freedom	61	61	61	61
p-value Test - Ho: $\Delta H \geq 0$, Ha: $\Delta H < 0$	0.041	0.062	0.069	0.069
Confidence Interval (95%)	-0.544/-0.015	-0.497/0.017	-0.497/0.026	-0.498/0.026
Observations	1,786	1,786	1,786	1,786
R-Square	0.394	0.454	0.454	0.455

Notes:

All regressions are estimated with intercept.

Robust standard errors in parenthesis. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 10: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table. (continued)

	(1)	(2)	(3)	(4)
Fixed Effects				
Bank Fixed-Effect	Yes	Yes	Yes	Yes
Month Fixed-Effect	Yes	Yes	Yes	Yes
Year Fixed-Effect	Yes	Yes	Yes	Yes

Table 11: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table.

	Dependent Variable: ln (Revenue)			
Independent variables	(1)	(2)	(3)	(4)
ln (wage)	-0.197	-0.199	-0.198	-0.198
	(0.123)	(0.122)	(0.121)	(0.122)
ln(cost of capital)	0.333***	0.355***	0.354***	0.355***
	(0.053)	(0.061)	(0.061)	(0.061)
ln(cost of fixed capital)	-0.013	-0.012	-0.012	-0.012
	(0.044)	(0.045)	(0.045)	(0.045)
ln (wage)*Dummy Banks with	-0.256	-0.185	-0.177	-0.175
Classic, Financial and NonFinancial Bank Products	(0.179)	(0.174)	(0.177)	(0.176)
ln(cost of capital)*Dummy Banks with	0.044	0.029	0.029	0.026
Classic, Financial and NonFinancial Bank Products	(0.069)	(0.077)	(0.077)	(0.075)
ln(cost of fixed capital)*Dummy Banks with	-0.078	-0.094	-0.099	-0.098
Classic, Financial and NonFinancial Bank Products	(0.054)	(0.056)	(0.057)	(0.058)
Control Variables				
Provision Rate		-1.608	-1.583	-1.566
		(2.033)	(2.029)	(2.039)
Profitability		1.490***	1.501***	1.497***
		(0.311)	(0.309)	(0.308)
Market Share (assets)			-0.413	-0.4
			(0.433)	(0.439)
HHI (assets)				-0.856
				(1.1)
H-Statistics (Panzar and Rosse)				
Standard H	0.123	0.121	0.122	0.122
ΔH	-0.29	-0.25	-0.246	-0.247
Adjusted H = Standard H + ΔH	-0.167	-0.129	-0.124	-0.125
ΔH-Statistics				
Estimated ΔH	-0.29	-0.25	-0.246	-0.247
Standard Deviation ΔH	0.157	0.154	0.156	0.156
Degrees of Freedom	60	60	60	60
p-value Test - Ho: $\Delta H \geq 0$, Ha: $\Delta H < 0$	0.035	0.054	0.06	0.06
Confidence Interval (95%)	-0.553/-0.027	-0.507/0.006	-0.507/0.015	-0.507/0.015
Observations	1,776	1,776	1,776	1,776
R-Square	0.395	0.455	0.455	0.456

Notes:
All regressions are estimated with intercept.
Robust standard errors in parenthesis. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 11: The natural logarithm for financial revenue can be found in all of the columns below the dependent variable. The unit price paid by the public body is deflated by the monthly official price index (IPCA=1 in 2001Q1). The banks supplying classic or nonfinancial products only are excluded from the regressions in this table. (continued)

	(1)	(2)	(3)	(4)
Fixed Effects				
Bank Fixed-Effect	Yes	Yes	Yes	Yes
Month Fixed-Effect	Yes	Yes	Yes	Yes
Year Fixed-Effect	Yes	Yes	Yes	Yes

C Appendix 3: Procedure for Identifying Banking Products

Table 12 provides an example of the procedure used in the dataset base don the information from Banco do Brasil, a state-owned bank with a leading position in the Brazilian banking market. In the first row, we can see the classification of this bank as a provider of credit and other financial services. In association with other banks and financial companies, Banco do Brasil makes up the financial conglomerate BB, which offers credit and other financial products (institutions 1-7). Additionally, the affiliated insurance conglomerate BB Seguros is composed of 6 entities (institutions 8-13) that provide insurance and capitalization services. BB and BB Seguros are branches of the economic-financial conglomerate Banco do Brasil that, through BB's affiliated conglomerates, offer traditional products (credit), other financial products and insurance products. The figures included in the dataset are derived from the BB economic-financial conglomerate's accounting statements, which provide consolidated information on individual entities 1-13.

Table 12: Example of Bank Product Assignment in an Economic-Financial Conglomerate

Economic-Financial Conglomerate	**Financial/Insurance Conglomerate**	**Individual Institution**	**Core Activity**
BANCO DO BRASIL	BB	1. BANCO DO BRASIL S.A.	Credit and other financial services
BANCO DO BRASIL	BB	2. BANCO NOSSA CAIXA S.A.	Credit and other financial services
BANCO DO BRASIL	BB	3. BB ADMINISTRADORA DE CONSORCIOS S.A.	Other financial services
BANCO DO BRASIL	BB	4. BB GESTÃO DE RECURSOS Ű DISTRIBUIDORA DE TÍTULOS E VALORES M	Other financial services
BANCO DO BRASIL	BB	5. BB-BANCO DE INVESTIMENTO S/A	Other financial services
BANCO DO BRASIL	BB	6. BB-LEASING S/A ARRENDAMENTO MERCANTIL	Credit and other financial services
BANCO DO BRASIL	BB	7. BESC-DISTRIBUIDORA DE TITULOS E VALORES MOBILIARIOS SA-BESCV	Other financial services
BANCO DO BRASIL	BB SEGUROS	8. ALIANÇA DO BRASIL SEGUROS S.A.	Insurance
BANCO DO BRASIL	BB SEGUROS	9. BB CAPITALIZAÇÃO S.A.	Capitalization
BANCO DO BRASIL	BB SEGUROS	10. BRASILCAP CAPITALIZAÇÃO S.A.	Capitalization
BANCO DO BRASIL	BB SEGUROS	11. BRASILPREV SEGUROS E PREVIDÊNCIA S.A.	Insurance
BANCO DO BRASIL	BB SEGUROS	12. BRASILVEÍCULOS COMPANHIA DE SEGUROS	Insurance
BANCO DO BRASIL	BB SEGUROS	13. COMPANHIA DE SEGUROS ALIANÇA DO BRASIL	Insurance