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Industrial organization of the banking industry, financial regulation, and antitrust

Organización industrial de la banca, regulación financiera y antimonopolios

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Abstract

This article aims to theoretically examine the relation between prudential and antitrust regulation of banks. For this, we built a theoretical model that considers different situations of prudential regulation and their repercussions on the market power and the industrial organization of banks are evaluated. When market power is high, antitrust regulation is feeble, and therefore there is little competition. The theoretical results allow us to conclude that the market power of a bank is higher when prudential regulation is rigid, implying a conflict between prudential regulation and antitrust regulation. Finally, we show empirical evidence on this situation and propose a new regulation scheme to solve the problem for the case of Mexico.

JEL Code: G11, G18, D81, L40
Keywords: industrial organization; financial regulation; banks

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Resumen

El objetivo de este artículo es examinar teóricamente la relación entre la regulación prudencial y antimonopolios de los bancos. Para esto se elabora un modelo teórico donde se consideran diferentes situaciones de regulación prudencial y se evalúan sus repercusiones sobre el poder de mercado y la organización industrial de los bancos. Cuando el poder de mercado es elevado significa que la regulación antimonopolios está siendo poco efectiva y, por lo tanto, existe poca competencia. Los resultados teóricos permiten concluir que el poder de mercado de un banco es más elevado cuando la regulación prudencial es rígida, lo que implica que existe un conflicto entre la regulación prudencial y la regulación antimonopolios. Por último, se ofrece evidencia empírica de esta situación para el caso de México y se propone un nuevo esquema de regulación para solucionar esta inconsistencia.

Código JEL: G11, G18, D81, L40
Palabras clave: organización industrial; regulación financiera; bancos

Introduction

Currently, a central bank serves as one of the main regulatory and supervisory institutions for private banks in most countries. Its main objective is to maintain the stability of the payment system, that is, to minimize and keep stable systematic risk, which is a residual and exogenous risk for banks since it comes from the entire financial system. Regulation of this type of risk is important because its neglect can generate a crisis in the financial sector and the entire economy. Nevertheless, prudential regulation—the regulations for overseeing systematic risk—may vary from one country to another and is usually fragmented into different types of institutions whose regulatory missions have specific purposes at micro and macroeconomic levels, but the monetary authority is one of the main institutions that apply this regulation.[1]

On the other hand, antitrust regulation is responsible for reducing the market power of banks, which allows for a greater degree of competition in the sector and improves conditions for consumers of financial services. According to White (2009) and VanHoose (2017), this regulation is particularly in charge of preventing collusion in the banking system and controlling stock market acquisitions or mergers

[1]According to Barth *et al.* (2005) and OECD (2011), prudential regulation can encompass different groups of regulatory instruments that are responsible for supervising, monitoring, and strengthening the discipline of the banking market through tools such as audits, capital requirements, depositor protection, or discretionary measures by the agencies in charge of overseeing risk. This regulation is complemented by the compensation mechanisms that the central bank offers to banks to avoid liquidity shortages in the payment system and prevent them from becoming contagious. The legislation passed after the 2008 financial crisis in most countries paid more attention to the regulation of financial conglomerates that participate in these clearing mechanisms—called SIFIs—in order to control systematic risk.

between relatively large financial firms that could cause concentrations that harm competition in the market. Antitrust regulation is overseen primarily by antitrust agencies.[2]

Thus, while prudential regulation—through the monetary authority—monitors the risks to the financial system, antitrust regulation monitors the market power of financial firms. However, these two regulations may collide if risk regulation influences the industrial organization of banks and vice versa. On this point, there is extensive literature investigating the relation between bank competition and financial system stability, e.g., Bandaranayake et al. (2020), Karadima and Louri (2020), Aleemi et al. (2019), Degl'Innocenti et al. (2019), Chen et al. (2019), Davis and Karim (2018), Kim (2017), OECD (2011). Nonetheless, this paper assumes that competition can affect the riskiness of the financial system. The motivation of this paper is to consider reverse causality, i.e., that prudential regulation and risk management may increase the market power of banks, which would end up hindering the enforcement of antitrust regulation.

Consequently, this paper aims to examine theoretically the relation between prudential and antitrust regulations of banks. The methodology used is a theoretical model that considers different situations of prudential regulation and evaluates their impact on banks' market power and industrial organization. When market power is high, antitrust regulation is ineffective, and therefore, there is little competition. The theoretical model constructed is then used with data for the case of Mexico to develop a simulation to test the predictive nature of the results obtained.

The main working hypothesis is that prudential regulation affects antitrust regulation since attempts to control risk in the financial system can increase banks' market power. This can be an incentive to increase financial innovation and the volume of loans granted, which would end up hindering the application of prudential regulation itself, making it ineffective. A conflict between both regulations would eventually be generated, so neither would effectively fulfill its function.

This article is organized as follows: The second section reviews the literature on financial and antitrust regulations. The third section presents a portfolio choice model where the effects of prudential regulation on banks' market power and, thus, antitrust regulation are contrasted. The fourth section discusses the results obtained and presents a proposal for regulatory improvement. The last section presents the conclusions.

[2]See Cofece (2014) and VanHoose (2017) for more details on the cases of Mexico and the United States, respectively. In the specific case of Mexico, for example, antitrust regulation is exercised by the Bank of Mexico (Banxico), but the Federal Economic Competition Commission (Cofece) (Spanish: Comisión Federal de Competencia Económica) is in charge of overseeing it, i.e., it proposes regulation and supervises the results.

Review of the literature

According to Freixas and Rochet (2008) and VanHoose (2017), banks are examined from two perspectives at the theoretical level. The first is to consider banks as firms; this approach is called the industrial organization approach. The second is called the portfolio manager approach and examines banks as if they were managers of a portfolio containing assets and liabilities given a certain risk. These two perspectives have the limitation of separating the analysis of risk issues and their related prudential regulation proposals and also competition issues and their related antitrust regulation proposals. This implies that the portfolio approach may have limitations in examining the industrial organization of banks, as VanHoose (2017) claimed, but the industrial organization approach may have limitations in examining banks' choice of risks.

The literature in general uses the industrial organization approach and its indices to examine competition and its regulation in the banking sector. For example, Chen et al. (2019), Davis and Karim (2018), and OECD (2011) use the Herfindahl index to examine the degree of industrial concentration. Other literature, such as Bandaranayake et al. (2020), Karadima and Louri (2020), Aleemi et al. (2019), Degl'Innocenti et al. (2019), and Kim (2017) use the conventional Lerner index to determine market power in the industry. Antitrust regulation specifically examines the level of the Herfindahl index to consider when the banking sector is uncompetitive. For example, in the case of the United States, the antitrust authority sets the index level at 1500; above that limit, the sector is considered concentrated (see VanHoose, 2017). In the case of Mexico, the Federal Economic Competition Commission also uses the Herfindahl index to enforce antitrust laws in the sector (see Cofece, 2014).

Using the Herfindahl index to examine competition and enforce antitrust regulation presents several problems for the case of the banking sector. First, it does not explicitly consider the impacts of prudential regulation on competition. Indeed, it is assumed that prudential regulation does not hinder antitrust regulation. Secondly, it is assumed that the banking sector produces goods identical to those produced by the industrial sector; this represents a constraint because banks issue loans with a risk of default, so considering the concentration index in the sector omits any influence of risks on bank competition. On the other hand, using a conventional Lerner index to examine banks' market power also represents a limitation since it does not consider loans as assets with a certain expected return and a certain risk but rather considers loans as a product with a price and a quantity. This implies that price and quantity choices are not influenced by risk and, since prudential regulation influences risk, it has no effect. However, if risk management impacts banks' pricing and quantity decisions, it would imply that the conventional Lerner index would be a very limited measure for examining market power in the sector.

Different authors have presented their proposals for regulating the banking sector at the regulatory level based on their examination of existing regulations and their impact on risk and competition. For example, Barth and Sun (2019) criticize financial regulations that prevent industrial firms from entering the banking market because these entries may increase the risk to the banking sector. It is also stated that the entry of commercial firms into banking activities can concentrate the sector to the extent that these firms possess infrastructure that gives an advantage over competing banks. For example, retail stores such as Walmart could put a bank branch in each store, giving them an advantage over banks. Barth and Sun (2019) conclude that the entry of industrial firms into banking activities would not represent increases in systematic risk and, on the contrary, would benefit the economy. These authors are therefore indirectly evidencing a conflict between prudential and antitrust regulations as the entry of industrial firms is prevented by systematic risk management issues.

This is emphasized by Barth et al. (2020), who state that prudential regulation places banks at a competitive disadvantage in the specific case of negotiated certificates of deposits (CDs). Indeed, recent financial regulation in this area has been stricter as the use of these instruments is restricted and monitored, and the authors state that the restrictions may put banks that rely on these types of instruments at a disadvantage with banks that do not require them for loan issuance. Thus, these authors provide more indirect evidence about the conflicts between prudential regulation and antitrust regulation in the banking sector since stricter regulation of certain deposits may cause banks with less monitored deposits to have market power advantages.

On the other hand, Borio (2016) states that prudential policies are ineffective in certain phases of the financial cycle of the economy as they can encourage booms and deepen the downward phases of the cycle. The author claims that prudential policy cannot be overburdened, and that this regulatory policy needs extra support from other policies. He mentions that capital requirements as a regulatory measure may be ineffective as capital is cheap and abundant in boom phases. He also mentions that prudential regulation can generate incentives for regulatory arbitrage, meaning that banks take advantage of prudential regulation to obtain greater profits, which could also increase the bank's market power and harm antitrust regulation.

Something in common between Borio (2016) and other authors, such as Turner (2012 and 2016), is that there may be an overexpansion of the volume of bank loans in the economy, and prudential policy, being static, cannot regulate this possible excess of loans. For Borio (2016), prudential regulation is inefficient when the volume of credits is growing too rapidly (which he identifies as the bull phase of the financial cycle); for Turner (2012), the banking sector may be issuing an excess of credits for the size of the economy, and he questions whether the volume of credits is compatible with a socially optimum level. This leads both authors to seek new prudential regulations to regulate the volume of credits, or that can

channel these credits to different sectors. What is relevant about this argument, specifically that of Turner (2016), is that the author explains that credit provision has recently been very profitable. This clearly implies that the volume and provision of credit may be due to a question of profitability and market power. Therefore, perhaps the best regulatory response to Borio and Turner's concerns could result from antitrust regulation, as this policy could limit credit profitability and reduce its issuance or channel it to specific sectors.

It is thus possible to connect some points from the previous review to theoretically examine the relation between prudential and antitrust regulation of banks. The first is to construct a new indicator that captures the sector's market power and systematic risk, allowing it to capture prudential and antitrust regulations simultaneously. The second is to consider the credit expansion posited by Borio and Turner by trying to examine whether it can come from the relationship between prudential and antitrust regulation. The third is to consider Barth's findings on the conflicts of prudential regulation on competition and to assess whether these hold true on a more general level that encompasses the entire banking sector.

A portfolio choice model for banking companies

It is necessary to unite the portfolio manager approach to banks with the industrial organization approach to examine theoretically the operation of two different regulations in the banking sector since the former explicitly includes risk management, and the latter includes competition in the sector. The portfolio approach will be used in an attempt to include the elements of the industrial organization[3]. For this task, the existence of financial innovation[4] will be considered since the industrial organization literature considers innovation as an element that increases firms' market power (see, for example, Belleflamme & Peitz, 2015; and Pepall et al., 2014). However, financial innovation is mainly studied for its influence on financial system risk (see Bliss et al., 2018; Hernandez et al., 2018; Loutskina, 2011; and OECD, 2011). From this consideration, a new market power indicator will subsequently be constructed to simultaneously capture prudential and antitrust regulations of banks.

[3]Using the portfolio approach has the limitation of not examining in depth the strategic interactions among competitors as in the case of oligopoly models. The approach could also be interpreted as if it were a particular case of bank monopoly. Nevertheless, as White (2009) points out, it is possible to examine industrial organization by assessing the intensity of competition beyond just counting the number of firms. For example, when the market power of the bank under examination increases, it means that competition has intensified implying that new competitors have arrived or that existing competitors became more competitive in reaction to their rivals.

[4]As Khraisha and Arthur (2018) point out, financial innovation is a complex element for any analysis. Henceforth, financial innovation will be interpreted as an increase in the variety of financial assets.

Consequently, developing a portfolio choice model for the banking firm is proposed, mainly following the theoretical developments of Freixas and Rochet (2008) and VanHoose (2017). It starts by assuming that banks are risk-averse when issuing credits. Indeed, the bank will take its choice of credits issued given the expected return and the degree of risk of this portfolio. The gap between deposits and credits will be the degree of liquidity shortage that the commercial bank may face, which is compensated by the central bank. This implies that banks will have a liquidity alternative in case the credits they provided at the end of the period are greater than the deposits they collected. This assumes that the risk-free assets in the banks' portfolio—the bank reserves—are zero or fixed. In terms of prudential regulation, this assumption implies that there is a minimum level of capital requirements for banks.

The main source of risk comes from the probability of default on loan payments. It is therefore assumed that the proportional amount of loans repaid is a random variable X with a density function defined as f(x), which has an upper bound equal to 1 and a lower bound equal to 0 relative to the total amount of loans, i.e., the density function shows the probability of loan repayment relative to the total supply of loans. To maintain the general analysis, making some a priori assumptions about the type of density function is unnecessary. If R is defined as the return on banks' risky assets, the following is obtained:

$$R = iQX \tag{1}$$

where

$$\Pr[0 \leq X \leq 1] = \int_0^1 f(x)dx$$

Q denotes the number of loans, and i is the interest rate charged on the loans. The equation shows that the bank's return corresponds to the proportion of loans repaid given a random variable. Applying the expectation to [1] will give the expected return:

$$E(R) = iQ \cdot E(X) \tag{2}$$

Consequently, the expected return on the bank's risky assets corresponds to the average proportion of effective payments given a density function. Since there is a default risk, obtaining the second central moment that will define the degree of dispersion with respect to the mean is necessary, which in portfolio choice models corresponds to an asset's degree of risk. Therefore, the variance of R is defined as:

$$\sigma_R^2 = E[R - E(R)]^2 \tag{3}$$

Placing Equations [1] and [2] in [3], and simplifying in terms of the standard deviation of the return (σ_R), leads to:

$$\sigma_R = iQ\sigma_X \tag{4}$$

Where σ_x indicates the dispersion of the random variable, i.e., the degree of riskiness of the proportional payment of credits. If it is cleared for the risky asset, then:

$$Q = \frac{\sigma_R}{i\sigma_X} \tag{5}$$

Placing the definition [5] in [2] will yield a set of feasible combinations between portfolio risk and expected return:

$$E(R) = \sigma_R \frac{\mu_X}{\sigma_X} \tag{6}$$

Then, the expected return will depend on the ratio of the average loan payment value (μ_X), the degree of default risk (σ_x), and its impact on the return risk (σ_R). Equation [6] can provide a frontier of feasible combinations between the expected return and the risk of the banks' portfolio. This implies that it can be considered a constraint in a bank choice problem; it is convenient to call it a risk constraint. Defining an expected utility function that concentrates the choice interests of those who direct the banks' portfolio decisions would be necessary. Essentially, and to maintain generality in the analysis, the expected utility function will depend on the return, the mean, and the standard deviation of that return, which will be the variables of choice. Consequently, the following optimization program can be defined:

$$\underset{\mu_R, \sigma_R}{\text{Max}} \; E(u) = u(R, \mu_R, \sigma_R) \tag{7}$$

s.a.

$$\mu_R = \sigma_R \frac{\mu_X}{\sigma_X}$$

The optimization program indicates that the bank will choose the degree of risk and the expected portfolio return (μ_R) that maximizes its expected utility given the constraint [6]. Risk aversion implies that $u'_\sigma < 0$ where u'_σ indicates the marginal utility of risk; this implies that the bank's portfolio will be convex, and the expected utility will be strictly concave to find a maximum value. By solving the problem [7], the following equilibrium condition will be found:

$$-\frac{u'_\mu}{u'_\sigma} = \frac{\mu_X}{\sigma_X} \tag{8}$$

where u'_μ represents the marginal utility of the expected return. Note that the right-hand side of the equation is simply the slope of the risk constraint. The left-hand side corresponds to a marginal ratio of expected substitution where the bank is indifferent between its choice of risk and expected return. Because of the sign of the marginal ratio, the only way for the equilibrium condition to be valid is if $u'_\mu > 0$ and $u'_\sigma < 0$. The first derivative is always valid as it assumes that any increase in profitability will raise expected utility; on the other hand, the second derivative implies that the bank is risk-averse, which is an assumption of the model. Now, clearing [8] and substituting in [6] will find the risk chosen by the bank[5]:

$$\sigma_R^* = \left(\frac{u'_\mu}{u'_\sigma}\right)\mu_R \tag{9}$$

The expression indicates that the risk chosen depends on the expected marginal rate of substitution and the expected return. In effect, the bank will choose the level of risk that maximizes its expected utility given the degree of risk aversion it considers and the expected return on the loans it grants given the defaults. The optimal supply of bank loans will be obtained by placing [9] in [5]:

$$Q^* = \left(\frac{u'_\mu}{u'_\sigma}\right)\frac{\mu_R}{i\sigma_X} \tag{10}$$

Therefore, the supply of loans will depend on the contribution that the interest rate and the risk of default have on the expected profitability and on the marginal substitution ratio. Figure 1 shows a diagram of the bank's choices regarding the level of loans it issues, the risk, and the chosen level of profitability. On the right side of the diagram is the equilibrium of the expected utility maximization

[5]The process to obtain the other optimal choice variable, in this case the expected return, is analogous.

process subject to the risk constraint in a μ_R-σ_R space. Note that the point of intersection between the indifference curves and this constraint is the equilibrium condition described by Equation [8]. This equilibrium will define the degree of risk assumed by the bank and the level of expected profitability, which will determine the level of credits issued, which can be seen on the left side of the diagram in the μ_R-Q space and is derived from Equation [10].

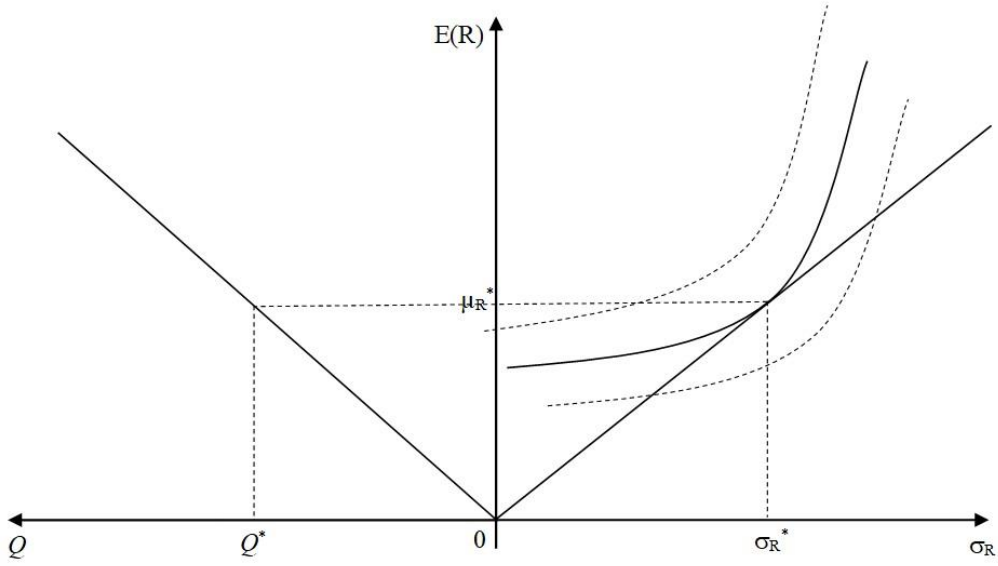

Figure 1. Supply of credits in a portfolio choice diagram
Source: created by the author

The analysis performed and condensed in Figure 1 justifies a bank's choices about its risky assets. It is observed that the bank will issue loans up to a level that balances its risk and return choices, given its risk aversion. Nonetheless, the model constructed is still incomplete because the composition of portfolio risk (σ_R) has not been clearly distinguished between the types of risk that make up a portfolio within this approach: systematic and unsystematic risks (see Ingersoll, 2010). The following section will examine risk decomposition and then perform comparative statics by contrasting prudential and antitrust regulations on the model.

Risk composition

Markowitz (1952) pioneered in theoretically examining the concept of systematic risk. In his portfolio choice theory, he realized that if a portfolio is diversified in the type of financial assets, the variance of portfolios will fall asymptotically to a minimum risk threshold unaffected by diversification.[6] This residual and persistent risk is known as systematic or non-diversifiable risk and, together with diversifiable risk, makes up the total risk of a portfolio. These findings allow Allen and Gale (1994) to suggest that financial innovation reduces risk because it diversifies risk. Indeed, as long as a portfolio is diversified in the type of financial assets, risks will fall, but they will persist. Empirical evidence supports these results; for example, Hsu (2015) shows that when there is a wider variety of assets in the market, the unsystematic risk of portfolios falls asymptotically.

The risk composition of a portfolio is relevant to the analysis carried out in this paper because it shows that the variety of financial assets influences the reduction of risks that are not systematic. In the case of a banking company, the intuition can be understood: every loan has a risk of default, but issuing insurance, a derivative, or different types of loans (or at different terms, as stated by Turner, 2012) makes banks diversify their portfolio of assets, which allows them to ensure with a higher degree of probability the repayment of the loan they granted. This reflection allows the following equation to be appended to the proposed model:

$$\sigma_X = \theta + f(n^{-1}) \tag{11}$$

Where

$$n > 1$$

In [11], n represents the number of varieties of financial assets in the market. The assumed nonlinearity captures that portfolio risk is an asymptotically decreasing function of financial innovation. This implies a persistent risk even if the variety of financial assets tends to infinity, thus allowing systematic risk to be captured—the latter being represented by the parameter θ. Furthermore, financial innovation will act as an element that simultaneously captures the industrial organization since changes in it would imply movements in market power, as discussed in the industrial organization literature (see Belleflamme & Peitz, 2015; and Pepall et al., 2014).

[6]See Ingersoll (2010) for a more in-depth analytical treatment.

Figure 2 shows the composition of the risk faced by a banking company and derived from Equation [11].

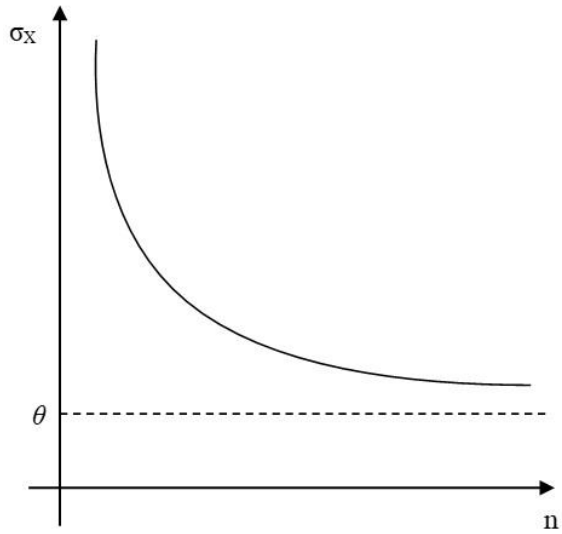

Figure 2. Composition of the risk of banking assets
Source: created by the author

The dotted lines in Figure 2 represent the systematic risk whose supervision and control are the monetary authority's responsibility. Above the dotted line and up to the curve, the non-systematic risk that the banking company can manage is represented.

Effects of financial regulation on the proposed model

With Figures 1 and 2, evaluating the effects of prudential and antitrust regulation on the proposed model is possible. The procedure is simple: First, two cases will be defined, one assuming rigid prudential regulation and the other assuming lax prudential regulation. Second, changes in the industrial organization of banks through changes in financial innovation will be assumed. The contrast between the two cases will make it possible to distinguish which of the two situations has greater market power, which will subsequently determine whether prudential regulation collides with antitrust regulation. Then, prudential regulation will be captured through assuming exogenous changes in non-systematic risk, and antitrust regulation through changes in financial innovation and market power. For example, if a bank's market power is higher in a situation of rigid prudential regulation relative to lax prudential regulation, it would

mean that the monetary authority may be increasing the market power of banks through the operation of prudential regulation, implying that antitrust regulation is being obstructed.

Specifically, to capture movements in prudential regulation, changes in parameter θ will be assumed. To capture changes in industrial organization, changes in parameter n will be assumed. Thus, for Case 1, where there is rigid prudential regulation, there will be a situation where n increases and there is a fixed systematic risk[7]. This implies that there are lax liquidity compensation mechanisms and rigid supervision by the monetary authority toward the bank. On the other hand, for Case 2, where there is lax prudential regulation, there will be a situation where n and θ increase; this implies that the central bank makes liquidity compensation more rigid and supervision of banks laxer. Figure 3 condenses in a single graph Figures 1 and 2 and represents the comparative statics of Case 1.

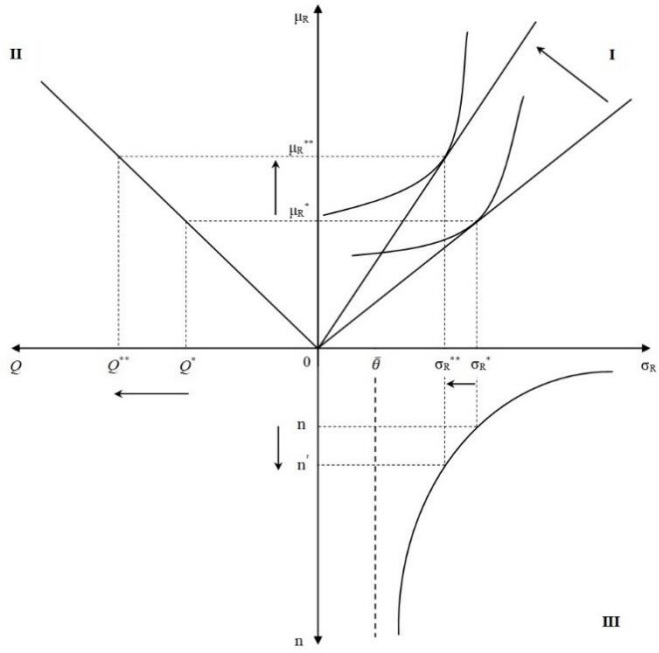

Figure 3. Case 1: Portfolio choice of a bank in the presence of financial innovation and rigid prudential regulation
Source: created by the author

[7]Considering that systematic risk remains fixed in the face of an increase in financial innovation is simply to reduce the analytical treatment of the model presented. Of course, any increase in financial innovation leads to an increase in systematic risk regardless of the rigidity of prudential regulation. However, this paper only seeks ordinality in the analysis, i.e., it is only necessary to consider that when prudential regulation is lax, systematic risk increases more than in a situation of rigid prudential regulation.

Figure 3 considers an increase in financial innovation (from n to n') and a fixed systematic risk ($\bar{\theta}$) as exogenous. Note that in quadrant III, there is a proportional equivalence between banks' portfolio risk (σ_R) and credit default risk (σ_X); this is so given the existence of fixed or zero bank reserves in the model[8]. In this quadrant, it is observed that an increase in the number of varieties of financial assets reduces the unsystematic risk of issuing loans; change is observed from σ_R^* to σ_R^{**}.

If Equation [10] is placed in equilibrium [8], what happens in quadrants II and I can be observed. Indeed, the presence of financial innovation makes the risk constraint less elastic, implying that the expected return is less sensitive to default risk. In quadrant II this is observed with a counterclockwise change in the slope of the constraint, which, given the risk aversion of banks, allows a new choice equilibrium to be reached. Given this, portfolio risk is reduced, but the expected loan return increases. This causes credit issuance to increase, as seen in quadrant I, specifically from Q^* to Q^{**}.

Thus, Case 1 provides theoretical evidence showing that financial innovation—in a context of rigid prudential regulation—influences the industrial organization of the banking sector by increasing the expected profitability of credit issuance by reducing unsystematic risks.[9] Nonetheless, to assess whether the same happens when prudential regulation becomes laxer or central bank compensation mechanisms become weaker, it is necessary to analyze the case where systematic risk is not fixed and can move when financial innovation increases. Figure 4 summarizes Case 2.

[8]Notwithstanding, if different impact sensitivities are assumed between default risk and portfolio risk—which assumes different balances in the regulation of bank reserves—the results presented here remain unchanged.
[9]Certainly this result still does not explicitly capture the possible effects on market power and antitrust regulation of banks; however, based on this result, the following section will construct a specific market power index that also considers the effects on antitrust regulation.

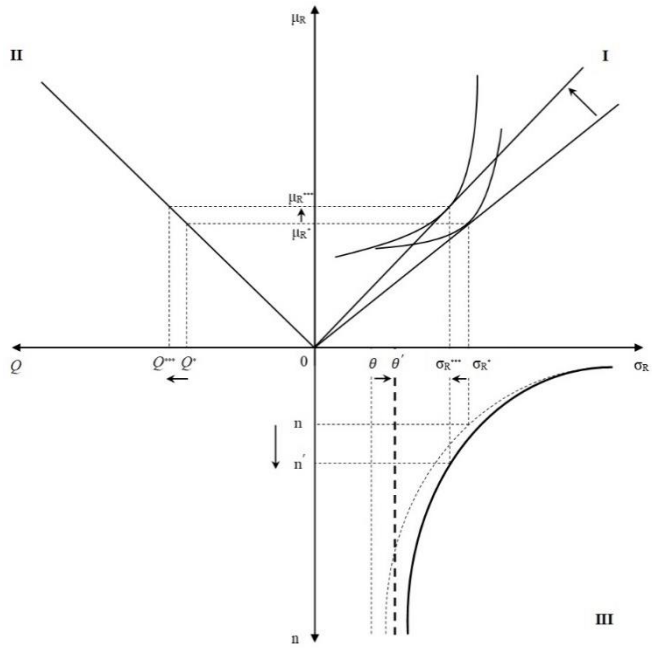

Figure 4. Case 2: A bank's portfolio choice in the presence of financial innovation and lax prudential regulation
Source: created by the author

Figure 4 shows a situation where systematic risk rises more than the fall in unsystematic risk, which implies that financial innovation increases the risks of the financial system as a whole more than it reduces the risks generated for individual banks. In simple terms, Figure 4 considers a situation where financial innovation generates more liquidity shortage problems than the default problems it solves.

Therefore, an increase in systematic risk from θ to θ' and a change in the variety of financial assets from n to n' will have as a final effect a reduction in banks' portfolio risk from σ_R^* a σ_R^{***}. Indeed, the results obtained from the change in these parameters are the same as for Case 1: an increase in expected profitability and in credit issuance. The main difference between Case 1 and Case 2 is that the effects of financial innovation have a greater impact on the expected profitability of banks in Case 1, which confirms analytically that prudential regulation affects the industrial organization of financial firms by allowing them to increase their expected profitability.

Of course, showing that rigid prudential regulation increases the expected profitability of financial firms is not the same as saying that it increases banks' market power by reducing the unsystematic risks they face. With market power, examining how antitrust regulation is specifically affected will also be possible, as this point has not yet been examined. To show this, it is necessary to

construct a new market power index that captures the composition of risk in the sector, as this will simultaneously capture prudential and antitrust regulation.

Antitrust risk and regulation: A proposed financial Lerner index

A conventional Lerner index is an indicator that captures the intensity of competition between companies and in turn reflects the sensitivity of the demand for a good to variations in its price. This index therefore captures the extent to which a market manages to separate itself from a fully competitive situation. As discussed in the second section of this article, in the case of banks, antitrust regulation tends to use a conventional Herfindahl index to evaluate changes in competition between banking firms because countries' antitrust rules do not distinguish between specific sectors. Nevertheless, as discussed, using this type of index fails to capture changes in banking sector risk, making it impossible to examine prudential regulation and antitrust regulation simultaneously.

The purpose of this section is to propose a new Lerner index that captures risk and its impact on banks' market power. With this index, it will be possible to evaluate Cases 1 and 2 of the previous section and determine whether prudential regulation affects banks' market power and therefore may obstruct antitrust regulation. The following equation defines the proposed financial Lerner index:

$$L_f = \frac{\mu_R - r_f}{\theta} \tag{12}$$

Note that μ_R indicates the expected profitability of banks and θ is the systematic risk. r_f represents the return on a risk-free asset. Equation [12] shows that each time the banks' expected returns move away from the return on a risk-free asset—ceteris paribus the systematic risk—the bank will increase its market power. Note that the index is weighted by systematic risk, which makes it possible to distinguish its influence from changes in the expected return on loans and risk-free assets. This makes it possible to explicitly consider prudential regulation since a higher θ implies laxer prudential regulation, and the opposite occurs with a lower θ.

In turn, the value taken by L_f explicitly considers antitrust regulation since a high value of L_f implies weak antitrust regulation, but a low value of L_f implies stronger antitrust regulation. Therefore, the value taken by the parameters θ and L_f will simultaneously capture the prudential and antitrust regulation of banks. For example, a high L_f value accompanied by a low θ value implies that the bank has high market power and relatively low systematic risk, which in turn implies that prudential regulation is rigid and antitrust regulation is weak.

The results of Case 1 and Case 2 will be evaluated to test this financial Lerner index. Considering the results of the previous section, the following equations can be defined for each case evaluated:

Case 1

$$L_f^{C1} = \frac{\mu_R{}^{**} - r_f}{\bar{\theta}} \tag{13}$$

Case 2

$$L_f^{C2} = \frac{\mu_R{}^{***} - r_f}{\theta'} \tag{14}$$

Given the previous section, it can be noted from Equations [13] and [14] that since $\mu_R{}^{**} > \mu_R{}^{***}$ and $\theta' > \bar{\theta}$ it follows that $L_f^{C1} > L_f^{C2}$, and this shows that the financial Lerner index is higher for Case 1 than for Case 2. Also, since the financial Lerner index is higher in Case 1, but the systematic risk θ is higher in Case 2, it can be concluded that prudential regulation is more rigid in Case 1, but antitrust regulation is weaker in Case 2. This yields the following conclusion regarding antitrust regulation: when prudential regulation is more rigid, antitrust regulation is weaker as there is high market power and lower systematic risk. On the contrary, when prudential regulation is more lax, antitrust regulation is more effective because the financial Lerner index is lower.

A simulation exercise

This last section aims to develop a simulation to test the predictive nature of the results obtained. The exercise is done with information for the case of Mexico (period 2005-2021)[10]. Table 1 presents the results of the simulations for Case 1 and Case 2. The variety of financial assets (n) was obtained from the Bank for International Settlements (BIS), and the number of derivative contracts of the Credit Default Swaps (CDS) type—that both banks and insurers can acquire—was taken. For the risk-free asset (r_f), 28-day cetes were taken with data from the Bank of Mexico (Banxico). Systematic risk (θ) was approximated with the Stock Exchange Price and Quotations Index (IPC) standard deviation, with data from Yahoo! finance.

[10]The choice of the study period considered is essentially arbitrary, although it is supported by some restrictions in obtaining the data used to try to match all data sources simultaneously.

For the expected return on return (μ_R), Equation [6] is used, approximating the value of μ_X with commercial banks' return on equity (ROE) with data from the National Banking and Securities Commission (CNBV). The functional form considered in Equation [11] is $f(n^{-1}) = 1/n$ for simplicity; however, simulations with other functional forms yielded similar results.

Table 1
Model calibration

Simulation of Case 1					
Δn	n*	θ**	μ_R***	r_f****	L_f
-	320	0.049	10.74	5.49	107.05
20	340	0.049	10.77	5.49	107.82
30	370	0.049	10.82	5.49	108.84
50	420	0.049	10.89	5.49	110.22
100	520	0.049	10.99	5.49	112.22
1000	1520	0.049	11.27	5.49	117.93
Simulation of Case 2					
Δn	n*	θ**	μ_R***	r_f****	L_f
-	320	0.049	10.74	5.49	107.05
20	340	0.053	10.82	5.49	100.56
30	370	0.057	10.90	5.49	94.97
50	420	0.061	10.99	5.49	90.18
100	520	0.065	11.09	5.49	86.18
1000	1520	0.069	11.31	5.49	84.38

Source: created by the author with data from *BIS, **Yahoo! Finance, ***CNBV y ****Banxico.

Table 1 simulates an increase in the variety of financial assets (column Δn). The simulation of Case 1 keeps the systematic risk fixed (column θ), which implies that the monetary authority does not allow the standard deviation to exceed that value, i.e., rigid prudential regulation is being exercised. Note that as the number of financial assets increases (column n), the expected profitability of banks will increase accordingly (see column μ_R). Finally, note that each time n increases, the financial Lerner index increases accordingly (column L_f).

For the simulation of Case 2, a constant change in systematic risk (column θ) is considered as a way to capture lax prudential regulation. The results are the same as for Case 1, only with lower values. The shaded boxes help to contrast Case 1 with Case 2. Indeed, when there is rigid prudential regulation, the financial Lerner index has a value of 117.93 in the face of an increase in the type of financial assets, but when the prudential regulation is lax, the Lerner index has a value of 84.38. The fact that the index goes from 117.93 to 84.38 shows that prudential regulation hinders the action of antitrust regulation since in the first case there is greater market power, but the systematic risk is lower, which means that in that case, prudential regulation is rigid and antitrust regulation is weak.

Discussion and proposal for regulatory improvement

Using the conventional Herfindahl or Lerner indices to examine and enforce antitrust regulation in the banking sector is limited because these indices do not capture the influence of prudential regulation on competition. This is the case of Bandaranayake et al. (2020), Karadima and Louri (2020), Aleemi et al. (2019), Degl'Innocenti et al. (2019), Chen et al. (2019), Davis and Karim (2018), Kim (2017), and OECD (2011), as these authors consider that banks' risk management will not impact antitrust regulation. Conversely, the proposal of a financial Lerner index captures both elements and shows that prudential regulation affects antitrust regulation, which can generate financial instability and large financial conglomerates with high market power.

The results obtained are partly in line with what Borio (2016) stated: overburdening prudential regulation could be counterproductive. In this model, this is because prudential regulation incentivizes banks to issue higher volumes of loans and diversify risks through financial innovation. This occurs because banks assume that systematic risk will not be a problem as long as the monetary authority keeps it supervised, but this in turn creates a problem for prudential regulation itself. Nonetheless, the best regulatory response to this dilemma would be to coordinate prudential regulation with antitrust regulation since taking market power away from banks can reduce credit expansion and financial innovation to the extent that such expansion becomes more costly.

Indeed, antitrust agencies can reduce the profitability of credit issuance by reducing market power, and this method may be a more direct way to avoid increases in systematic risk. This type of regulation could also overcome financial innovation because as long as lending remains excessively profitable, innovation will be a way to leapfrog prudential legislation. This proposal partially differs from that suggested by Borio (2016) and Turner (2012 and 2016) as it posits that improving prudential regulation comes from improved antitrust regulation and not from increased rigidity of prudential regulation. To this end, this proposal ties in with the arguments of Barth et al. (2020) and Barth and Sun (2019), as it would not be subordinating antitrust regulation to prudential regulation. This model shows that this precisely generates a greater risk increase to the extent that it makes the issuance of bank assets more profitable. From this approach, the criticisms of Barth and Sun (2019) and Barth et al. (2020) are consistent with the model since restricting bank competition or disadvantaging certain banking companies to apply rigid prudential regulation only encourages risky credit expansion.

In more concrete terms, the regulatory improvement proposal of this research is as follows: In the first instance, the monetary and antitrust authority can consider the financial Lerner index calculated in this paper as an additional indicator in their enforcement of prudential and antitrust regulation. As this market power indicator also captures movements in systematic risk, if both regulatory agencies set a

common threshold value, the two regulations would be coordinated and therefore prudential regulation would not affect antitrust regulation or vice versa. Thus, the limit value in the index would prevent the monetary authority from applying excessive prudential regulation to the point that it becomes ineffective. At the same time, the limit value would make the antitrust authority not subordinate to the application of prudential regulation and limit banks' market power.

Conclusions

The objective of banks is to maximize the return on their assets, which means they are driven by a quest for profitability. Financial innovation can reduce risks at a microeconomic level, and this risk reduction increases credit expansion. Nonetheless, the constant growth of credit and innovation increases risk at a macroeconomic level, creating difficulties for the monetary authority in applying prudential regulation. Therefore, reducing the profitability of credit issuance could prove to be a more efficient alternative to simply limiting the increase in systematic risk, as credit expansion and innovation in the banking sector will still be very profitable. Indeed, the results of this research suggest that a bank's market power is higher when prudential regulation is rigid, implying a conflict between prudential regulation and antitrust regulation in charge of reducing market power.

The proposed way to solve this inconsistency is employing a new proposed financial Lerner index that simultaneously captures banks' systematic risk and market power. Then, if the monetary authority and the antitrust authority set a common limit value for this indicator, coordination in applying their respective regulations can be established because whenever systematic risk increases, the monetary authority has to reduce the risk. Whenever market power increases, the antitrust authority has to reduce the degree of profitability in credit expansion. If the limit value in the indicator is exceeded, it would imply that one of the two regulations is affecting the other, which would make it necessary to modify risk management or credit profitability management to return the indicator to its limit value.

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