Cooperatives versus traditional banks: the impact of interbank market exclusion

Raphael Bergoeing and Facundo Piguillem

Abstract

We analyse the desirability of allowing cooperative banks to participate in the interbank market in Chile. We find that it is advisable to allow this if the quality of their governance is not too deficient relative to that of traditional commercial banks. When cooperative banks do participate in the interbank market, both the probability of financial crises and the volatility of gross domestic product (GDP) rise. However, because the inclusion of cooperatives generates large efficiency gains in the financial sector, both GDP and aggregate welfare substantially increase. We conclude that there is no policy reason to unilaterally exclude cooperatives from the Chilean interbank market.

Keywords

Financial institutions, banks, cooperatives, credit unions, financial services, markets, banking, financial crisis, econometric models, Chile

JEL classification

G01, G20, C60

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I. Introduction

The literature on bank regulation is extensive, but most of it treats all banks as homogeneous legal entities.[1] In reality, however, there is a wide spectrum of organizational structures. Around 10% of Chilean financial institutions are organized as cooperative banks.[2] Because of their different legal status, they are not allowed to participate in the interbank market (IM) and, as a result, do not have access to the central bank's lender of last resort function either. The purpose of this paper is to analyse and quantify the implications of this exclusion for financial stability and aggregate welfare.

To fix our terms, it is useful to establish the main differences between commercial banks and cooperative banks. Commercial banks are mostly corporations (companies in private sector ownership) with limited liability. This means (i) that their goal is to maximize value and (ii) that in general they are owned by a set of shareholders with voting power (management power) closely related to the proportion of shares they own. In contrast, cooperative banks (i) do not have the maximization of either value or profits as their main goal, seeking instead to meet the needs of a well-defined group, and (ii) all members of a cooperative bank have the same voting power irrespective of how many shares they own.

At first sight, since the main goals of these two kinds of bank are different, it might be thought that the distinction in respect of profit maximization was the key to their observed conduct. However, because cooperatives must still achieve efficiency to survive and be able to provide their services, this does not make much difference to their everyday behaviour. Accordingly, the main point that worries regulators is the difference in organizational structures and its implications for accountability. It is argued that because corporations have a concentrated structure, and large shareholders have a great deal at stake, governance tends to be of good quality. In cooperatives, by contrast, power is atomized, with all shareholders having one vote apiece irrespective of their number of shares, so that each shareholder has less at stake. This reduces managers' accountability and may lead cooperative banks to pursue objectives that could compromise financial stability.[3] In this paper, we will not dispute this claim but will take it at face value in order to analyse whether this potential drawback is sufficient grounds to exclude cooperative banks from the IM.

Access to the IM would have two implications for cooperative banks. The first, an operational one, is that they could borrow and lend from and to other banks through the IM daily in an efficient way. For instance, they could allocate (lend) surplus funds at a good interest rate when they had excess liquidity and borrow whenever they needed liquidity. Lacking this option, they have to borrow in the retail market, which is more expensive, and earn zero or very low returns on their surplus funds. Second, if cooperative banks had access to the IM they could obtain loans from the central bank through the lender of last resort function. These two functions of the IM are connected and difficult to disentangle.

When it comes to the lender of last resort function of the IM, the potential risks are unclear. Since the central bank retains discretionality as the lender of last resort, the matter is conceptually simple. The central bank can always deny additional funds to any bank it suspects of any wrongdoing. In addition, cooperative banks are (potentially) subject to the same rules, regulations and monitoring as any other bank, so that the central bank should be as well able to detect misconduct by cooperatives as by traditional banks. Lastly, cooperatives are well integrated with the rest of the financial sector, so any argument for using the lender of last resort function to aid commercial banks also applies to cooperative banks. In short, the question of whether the central bank should be allowed to lend to cooperatives

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[1] See, for instance, the seminal work by Díaz-Giménez and others (1992) and the attempts to explain the elusive borrowing and lending spread in Mehra, Piguillem and Prescott (2011), extended by Ordoñez and Piguillem (2019) to explain the borrowing boom in the United States in the 2000s. Recently, a growing literature has sought to incorporate heterogeneity in a meaningful way, an example being Corbae and D'Erasmo (2018).

[2] We use the term "cooperative banks" to include credit unions.

[3] See Hesse and Cihák (2007).

can be answered in the affirmative: the central bank can always choose not to lend. Binding itself ex ante to not doing so brings only costs and no benefits.[4]

Even if cooperative banks are allowed to access the lender of last resort, there is another question with a less obvious answer: should cooperatives be allowed to participate in the IM? For two reasons, the answer to this question is non-trivial.

On the one hand, allowing this would lead to a better allocation of resources and better liquidity management; on the other hand, it could affect the normal functioning of the IM and increase the probability of financial crises. Precluding access to the IM means that cooperative banks cannot borrow from other banks when "good" projects arise and they do not have enough funds to finance them. Furthermore, permitting it would allow cooperatives to lend to other financial institutions when they do not have good opportunities but other banks do. Lastly, as mentioned before, access to the IM allows liquidity risk to be managed more efficiently, since without it banks must hoard large and inefficient amounts of liquidity.

However, access to the IM may increase the probability and impact of a financial crisis. When cooperatives participate, the IM becomes larger, which facilitates the expansion of credit in situations where there is overborrowing. Also, the normal functioning of the IM can be disrupted when cooperatives face a more serious moral hazard problem than other financial institutions, leading to market collapse, as described in Akerlof (1970).

To address these issues, we build on Boissay, Collard and Smets (2016), adding idiosyncratic liquidity shocks and two types of bank: those that can participate in the IM and those that cannot. This is a general equilibrium model with (i) consumer-savers, (ii) the corporate (productive) sector and (iii) the financial sector. Consumers hold the capital in the economy and are the only agents that can accumulate financial assets. Production is carried out by firms which cannot hold capital and therefore must borrow to be able to produce. However, consumers cannot directly lend to firms either, but must use financial intermediaries. Here is where banks play an important role, borrowing from consumers and lending to firms.

Banks are heterogeneous in two dimensions, one exogenous and due to nature, the other determined by regulation. First, some banks are "more efficient" than others at intermediating, in the sense that they need fewer physical resources to produce intermediation services. In addition, banks can borrow from and lend to each other in an IM. This market serves to smooth liquidity shocks and reallocate resources to other banks when there is a mismatch between banks that have bad (good) business opportunities and the availability of funds. The key element of the model is that there are two main types of bank, normal banks, which can participate in the IM, and cooperative banks, which cannot. Our main goal is to analyse how the equilibrium is reshaped when all banks are allowed to participate in the IM.

To this end, we calibrate the model to replicate important moments of the Chilean economy. The main moments that we target are the intermediation spread, the probability of a financial crisis, the capital-output ratio, the relative efficiency of cooperatives at intermediating financial services and the relative size of the IM. We also calibrate the model to replicate other business cycle properties of the Chilean economy, although these are less relevant to the question we are trying to answer.

We use the calibrated economy to perform a series of counterfactual experiments. First, we assume that both cooperative and commercial banks are characterized by the same fundamental parameters, i.e., there is no observable difference between them in either efficiency or moral hazard,

[4] This argument requires a committed and benevolent central bank. If central bank decisions may be inefficiently affected by some financial institutions, there could be reasons to ban the central bank from lending to banks. See, for instance, Carré and Gauvin (2018). We assume in this paper that the central bank is frictionless, so that endowing it with the ability to lend does not entail any cost.

and we grant all financial intermediaries access to the IM. The purpose of this exercise is to isolate the pure general equilibrium effects of enlarging the IM. We find, as expected, that both the probability of a financial crisis and the volatility of output increase. At the same time, however, average output, aggregate consumption and welfare also increase. In other words, even though granting IM access to cooperatives has some negative effects, overall welfare improves. In numbers, although the probability of a financial crisis increases from 1.93% to 2.43%, average output and aggregate welfare increase by 0.05% and 1.6%, respectively.

Next, we incorporate the fact that cooperatives are more efficient on average and we assess how different degrees of the moral hazard problem affect the outcomes. There are many reasons to believe that cooperatives might be more efficient at providing intermediation services. First, they tend to have niche strategies, targeting particular markets to the point where they can better assess the risk profile of potential clients. Second, they tend to be focused on either regions or industries, which also enables them to better evaluate the common risks faced by their customers. Third, they are able by law to retrieve a larger proportion of loan repayment instalments directly from customers' wages (cooperatives can take 25% of the wage instead of the 15% for traditional banks).[5] [6] Regarding the moral hazard problem, as mentioned before, we do not have a direct measure of the severity of this for cooperatives as compared to commercial banks. We thus take it as given that cooperatives always perform worse on this and show how the equilibrium outcomes vary as we continuously worsen the severity of the problem for cooperatives relative to traditional banks.

As expected, if cooperatives are subject to the same moral hazard problems as other banks, granting them access to the IM only improves welfare. There are two factors contributing to the improvement. First, some cooperatives are very efficient, since cooperatives are more efficient on average than other banks, and there are some very good projects that they could finance but are unable to because of their limited funding capacity, as already mentioned. To finance such good projects, these efficient cooperatives would have to borrow from other banks at an interest rate too high to make it worthwhile, and they therefore lend out only the deposits they receive. When granted access to the IM, however, the efficient cooperatives can borrow from other less efficient banks or cooperatives at an attractive interest rate, increasing the supply of loans to the private sector. Cooperatives that cannot find good business opportunities also benefit from the IM. Without access to it, less efficient cooperatives must keep their funds in very inefficient, low-yielding financial instruments. When they do have access, they can lend those funds to other banks that can make better use of them. Overall, the probability of a crisis falls to 1.45%, while GDP increases by an additional 0.75% and welfare by an extra 0.47%.

When we consider heterogeneity in the moral hazard problem, the desirability of granting access to the IM becomes less obvious. Here, the effect stems from the negative externality that cooperatives' moral hazard problems impose on other banks through the IM. In relation to this effect, it is important to keep in mind that the quality of the banks participating in the IM is private information, and therefore not observed by other participants. Thus, if cooperatives are "worse" than other banks, their participation lowers the average quality of borrowers in the IM, which in turn diminishes the willingness of lenders to provide funds. The presence of some lower-quality borrowers affects the ability of all banks to borrow in the IM. As a result, fewer banks become lenders and the size of loans decreases. At the extreme, if the new participants are bad enough, the IM completely shuts down. However, we show that for reasonable values, the potential severity of cooperatives' moral hazard problem is insufficient to generate welfare loses. It is still optimal to grant cooperatives access to the IM.

[5] See Berger and Mester (1997) for similar arguments about the potential sources of the greater efficiency of cooperative banks.

[6] Girardone, Molyneux and Gardener (2004) and Battaglia and others (2010) analyse the efficiency of the Italian banking sector, distinguishing cooperative banks from others. They find that, allowing for size, there are no large differences in efficiency and that cooperative banks can be as efficient as quoted large banks taking advantage of economies of scale.

The main conclusions of this paper for Chile have implications for other emerging economies as well. Several countries in Latin America have regulations that limit the supply of credit, restricting it to traditional banks,[7] the main reason being concerns about financial stability stemming from the early 1980s debt crisis. The regulations contributed to aggregate stability while these were low-income economies. Today, when some of them are halfway to development, these limitations on competition may reduce financial inclusion, which is vital to continue closing the development gap. Thus, the Chilean experience suggests the need to evaluate the current benefits of such regulations in the rest of the region.[8]

The following section presents the model and its general equilibrium solution. Section III simulates the two alternative systems, one with cooperative banks restricted and another with all financial institutions having access to the IM. Section IV presents the main results of the paper. Lastly, section V concludes.

II. The model

There is a representative consumer who consumes and saves by depositing unspent resources with the financial sector. The financial sector is composed of two types of financial intermediaries: traditional banks and cooperative banks. From now on we will refer to the former just as "banks" and to the latter as "cooperatives". The main difference between them is that banks can participate in the IM, while cooperatives cannot. We also consider other differences that are not defining characteristics. For instance, we allow one type of intermediary to be more efficient than the other, subject to greater moral hazard problems or both. We will discuss these possibilities later, showing the quantitative implications.

The financial sector lends consumers' deposits to a representative firm with a standard Cobb-Douglas production function:

$$y = k^{\alpha} h^{1-\alpha} + (1-\delta)k \tag{1}$$

where k is aggregate capital, h is the total labour supply and δ is the capital depreciation rate. Note that under this framework the financial sector does not provide important services such as insurance and consumer credit. We therefore interpret the production function as encompassing the value of all these services.

1. The financial sector

The financial sector model is based on Boissay, Collard and Smets (2016). We first describe the equilibrium with traditional banks only and then show how the presence of cooperatives alters the framework.

There is a continuum of banks indexed by $p \in [0,1]$. Here, p will represent banks' efficiency. Types of banks are distributed with a cumulative distribution $\mu(p)$, with $\mu(0) = 0$ and $\mu(1) = 1$. All banks are ex ante identical and only live for one period. Thus, we can interpret p as the project type rather than the bank type; i.e., each time a bank deals with a potential borrower, that borrower comes with an inherent "intermediation" cost. This cost can be taken to represent not only physical costs associated with the lending process but also the costs incurred in the loan recovery process. It is important to consider that the spread between borrowing and lending rates is determined not only by p but also by the liquidity cost.

The timing of activities in the financial sector is as follows:

(i) Banks are born in period $t - 1$ and receive deposits a.

[7] Credit unions are excluded from the IM not only in Chile but in Argentina, the Bolivarian Republic of Venezuela, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama, Paraguay, Peru and Uruguay (see Arzbach and Durán, 2019).

[8] See Lemus and Rojas (2019) for evidence on the contribution of credit unions to financial inclusion in Chile.

(ii) They observe the idiosyncratic shock type p and lend to the corporate sector with return R.

(iii) With probability π some banks lose ϵ deposits, and with probability $1 — \pi$ other banks receive ϵ extra deposits.

(iv) Banks can operate in the IM, where they borrow and lend at rate ρ.

(v) At the end of period t, all banks die.

Because banks are ex ante identical, there is no difference between them when consumers deposit the amount a, so all banks receive the same amount of deposits. Since the parameter p determines a bank's efficiency, a proportion $(1-p)R$ of the loan must be used to pay intermediation costs. Thus, the net return on a loan is pR.

Banks also have an outside option: they can always invest in a project that yields a gross return of γ irrespective of the state of the economy and of p. We will refer to this outside option as "storage", although it could have alternative interpretations, e.g., in terms of subprime lending. This storage technology will play an important role in the working of the banking sector.

Absent liquidity shocks, bank (project) heterogeneity gives rise to an intraperiodic IM, where the least efficient banks lend to the most efficient ones at gross rate p. In equilibrium, this rate must be lower than the corporate loan rate, R. Similarly, the interbank rate p must be greater than the return on storage, γ; otherwise no bank would lend to other banks. It necessarily follows that in equilibrium $\gamma < R$. In other words, storage is an inefficient technology. Point (iii) of the timing of activities is an extension of the original timing in Boissay, Collard and Smets (2016). In this way, we extend the reallocation function of the IM so that it also serves as a market for providing liquidity to financial institutions. As will be seen later, the two components and their interaction play an important role in generating inefficiencies when cooperatives are excluded from the IM. Conversely, because banks can participate in the IM, liquidity shocks do not affect them.

Banks take the rates p and R as given. In view of these rates, and following the liquidity shock ϵ, bank p decides whether and how much to borrow or lend. We will call banks that supply funds on the IM "lenders" and those that borrow "borrowers". This terminology can lead to confusion when the corporate sector comes to be considered. To avoid misunderstanding, it should be kept in mind that "lenders" only lend to other banks, while "borrowers" borrow from other banks and lend to the corporate sector. Corporations only borrow from banks.

Let $\phi \geq 0$ be the endogenous, and publicly observable, amount borrowed on the IM per unit of original deposit (i.e., per unit of deposit before the liquidity shock is revealed) by a borrower p. Since ϕ is the ratio of market funding to traditional funding, we will refer to it as the banks' "market funding ratio".

Recall that banks choose how much to lend to the private sector before being apprised of the liquidity shock. Given the quantity lent, if a bank experiences a bad liquidity shock, it borrows from the IM, while if it experiences a good liquidity shock it lends. Thus, if bank p decides to exhaust its borrowing capacity, its gross unit return on deposits is equal to:

$$pR(1+\phi) - \rho[\,\pi\,(\phi + \epsilon) + (1\text{-}\pi)\,(\phi - \epsilon)] \tag{2}$$

If instead bank p decides to lend to other banks, it receives a return of $\rho(\pi(1-\epsilon) + (1-\pi)(1+\epsilon))$. Denoting the gross return on deposits by $r(p)$ one therefore gets:

$$r(p) = max\,\{p\,R(1+\phi) - \rho[\phi + (2\pi - 1)\epsilon],\rho\,(1 + (1 - 2\pi)\epsilon)\} \tag{3}$$

A bank chooses to be a borrower when:

$$pR(1+\phi) - \rho[\phi + (2\pi - 1)\epsilon] \geq \rho\,(1 + (1 - 2\pi)\epsilon) \Longrightarrow p \geq \bar{p} = \frac{\rho}{R} \tag{4}$$

which is the same as in Boissay, Collard and Smets (2016).

We also assume that the proceeds of the storage technology are not traceable and cannot be seized by creditors. Therefore, interbank loan contracts are not enforceable, and banks may renege on their interbank debt by walking away from the lenders. A bank that walks away with $(1 + \epsilon + \phi)a$ and invests in the storage technology gets $\gamma(1 + \theta(\epsilon + \phi))a$ as payoff, where $\theta \in [0,1]$ captures the cost of walking away from the debt (the higher θ is, the lower the cost).

Banks' intermediation skills (p) are privately known, and lenders can neither observe them ex ante nor verify them ex post. Lenders therefore ignore borrowers' private incentives to divert funds. As a result, the loan contracts signed on the IM are the same for all banks and neither the market funding ratio (ϕ) nor the interbank rate (p) depends on p.

Lenders want to deter borrowers from diverting. They can do so by limiting the quantity of funds that borrowers can borrow so that even the most inefficient banks with $p < \bar{p}$ (those that should be lending) have no interest in taking out a loan and diverting it:

$$\gamma(1 + \theta(\phi + \epsilon)) \leq \rho\,(1 + \epsilon), \text{ for banks with high liquidity} \tag{5}$$

$$\gamma(1 + \theta(\phi - \epsilon)) \leq \rho\,(1 - \epsilon), \text{ for banks with low liquidity} \tag{6}$$

Notice that the above equations are computed ex post. We want to prevent the banks from diverting after observing the liquidity shock. The latter determines the borrowing capacity of each bank, which is:

$$\phi = \frac{\rho(1+\epsilon)-\gamma}{\theta\gamma} - \epsilon, \text{ for banks with high liquidity} \tag{7}$$

$$\phi = \frac{\rho(1-\epsilon)-\gamma}{\theta\gamma} + \epsilon, \text{ for banks with low liquidity} \tag{8}$$

Observational assumptions about the liquidity shock are important here. If it is publicly observed, then there will be two debt limits, one for each type of bank. If the liquidity shock is not observable, i.e., information is private, the tighter limit can always be chosen, and that will make the incentive compatible for all banks. Since the maximum debt limit should be an incentive compatible with all types of banks, we choose the smaller of (7) and (8), which is (8) if $\rho > \gamma$ and $\theta < 1$. Therefore, the funding ratio is:

$$\phi = \frac{\rho(1-\epsilon)-\gamma}{\theta\gamma} + \epsilon \tag{9}$$

In addition, since we are interested in equilibria with $\phi>0$, we impose the additional restriction:

$$\epsilon \leq \frac{\rho-\gamma}{\rho-\theta\gamma} \tag{10}$$

2. Equilibrium for banks

The equilibrium of the IM is characterized by the gross interbank rate ρ which clears the market. We look for an equilibrium in which the interbank rate exceeds the return on storage ($\rho > \gamma$) so that trading takes place. Since a mass $\mu(\bar{p})$ of banks lend and the complement $1 - \mu(\bar{p})$ of banks borrow ϕ per unit of deposit, the market clears when:

$$a\,[\pi\,\mu(\bar{p})(1-\epsilon) + (1-\pi)\mu(\bar{p})(1+\epsilon)] = a\,[\pi(1-\mu(\bar{p}))(\phi+\epsilon) + (1-\pi)(1-\mu(\bar{p}))(\phi-\epsilon)\,] \tag{11}$$

Using the threshold definition and (7) and (8):

$$\mu\left(\frac{\rho}{R}\right)[\pi\,(1-\epsilon) + (1-\pi)(1+\epsilon)] = \left(1-\mu\left(\frac{\rho}{R}\right)\right)[\pi\,(\phi+\epsilon) + (1-\pi)(\phi-\epsilon)] \tag{12}$$

Now, note that we do not want aggregate effects from the liquidity shock, i.e., we want $-\pi\epsilon + (1-\pi)\epsilon = 0$, which immediately implies $\pi = \frac{1}{2}$. Alternatively, we might assume that the negative shock $abs(-\epsilon_L) \neq \epsilon_H$. This would allow us to have $\pi \neq \frac{1}{2}$, but for the time being let us assume that $\pi \neq \frac{1}{2}$. Then we get:

$$\mu\left(\frac{\rho}{R}\right) = \left[1 - \mu\left(\frac{\rho}{R}\right)\right]\phi \tag{13}$$

Then:

$$\mu\left(\frac{\rho}{R}\right) = \frac{\phi}{1+\phi} \tag{14}$$

Therefore, the equilibrium interest rate is determined by:

$$R = \frac{\rho}{\mu^{-1}\left(\frac{\phi}{1+\phi}\right)} \tag{15}$$

Since ϕ depends on ρ, equation (15) determines the equilibrium mapping between R and ρ. We will show later that the presence of the liquidity shock does not affect the qualitative properties of the equilibrium mapping of the original model.

As in Boissay, Collard and Smets (2016), there will be two equilibria, one in normal times and one when the market freezes in bad times. The return on deposits is:

$$r = \int_0^1 r(p)d\mu(p)$$

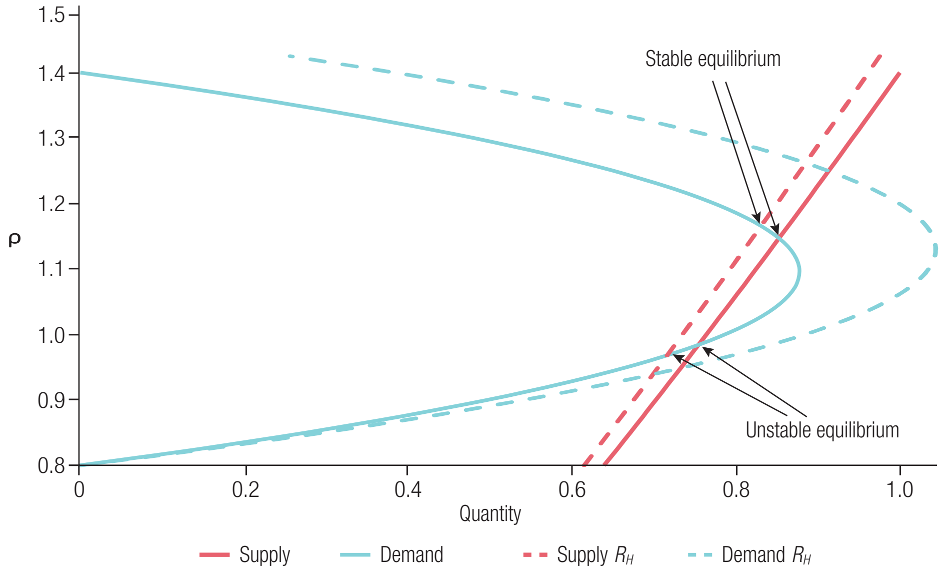
Using (3):

$$r = \begin{cases} R \int_{\bar{p}}^{1} \frac{p}{1-\mu(\bar{p})} d\mu(p), \text{ if the interbank market operates} \\ R\left[\frac{\gamma}{R}\mu\left(\frac{\gamma}{R}\right) + \int_{\frac{\gamma}{R}}^{1} p \, d\mu(p)\right], \text{ otherwise} \end{cases} \tag{17}$$

It is important to analyse the equilibrium behaviour arising from equation (13). The mechanism is the same as in Boissay, Collard and Smets (2016), and is depicted in figure 1. There we plot the equilibrium IM rate, ρ, as a function of the aggregate demand for and supply of funds at a given interest rate R. To take the solid lines first, the straight line is R the supply of funds, corresponding to the left-hand side of equation (13), while the curve that bends back on itself is the demand for funds, corresponding to the right-hand side of equation (13). The demand for funds bends backwards because of the interaction between the extensive and intensive margin of demand. As the interbank rate increases, the demand for funds decreases and more banks switch from being borrowers to being lenders. This is expressed by the term $1 - \mu\left(\frac{\rho}{R}\right)$. But at the same time, borrowers can borrow more (intensive margin) as the interbank rate increases, which is captured by the increase in ϕ. When ρ is high, the extensive margin dominates and demand therefore has a standard negative slope. When the interest rate is low, however, the intensive margin dominates, and this generates an upward-sloping demand curve.

This shape of the demand curve has two important implications. First, as can be seen in figure 1, there are potentially two equilibrium interest rates. However, as shown in Boissay, Collard and Smets (2016), the equilibrium in the region of the chart where the demand curve is upward-sloping is unstable. From now on, accordingly, we shall focus only on the stable equilibrium. Second, it can be seen that the curves do not need to intersect. Whether they intersect or not depends on the value of R. To show this, in figure 1 we have plotted the same supply and demand but with a higher corporate lending rate RH. As can be seen, this generates a greater demand for loans and a smaller supply (dashed lines), which in turn increases the IM rate. As the interest rate on loans to the corporate sector increases, more banks want to lend to firms, which results in a switch from the lending to the borrowing side in the IM.

Figure 1
Equilibrium interbank market characterization



Source: Prepared by the authors, on the basis of the calibrated model.
Note: R_H denotes a higher corporate loan rate.

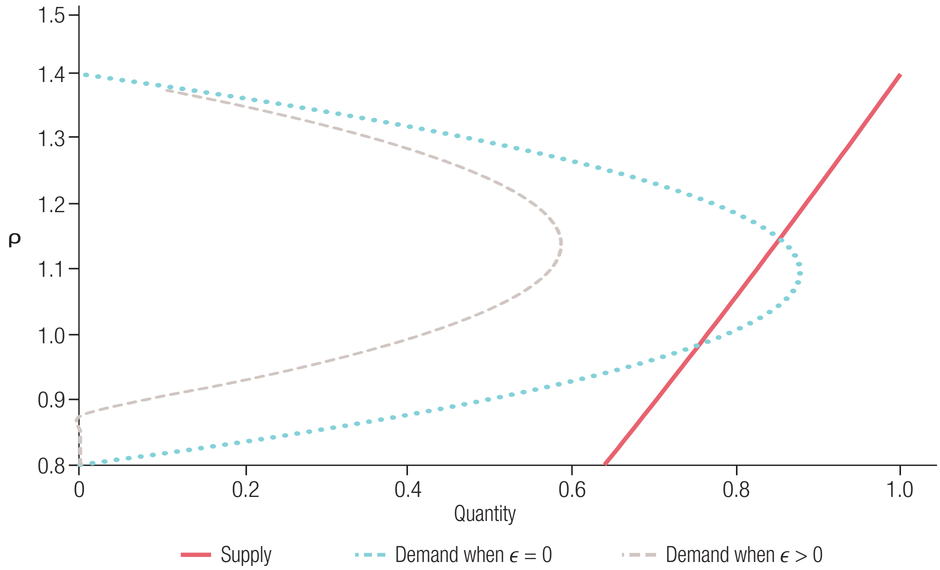
This effect is intuitive and clear, but a more important feature is that as R decreases, so do both the interbank rate and the funding ratio, to the point where eventually the curves no longer intersect. At this point, the IM freezes, ρ collapses to γ and there is no more borrowing or lending in the IM ($\phi = 0$). When this happens, there is a financial crisis. This is an important feature of the model that generates cyclical crises. Broadly speaking, the dynamics are as follows. As the economy experiences successive positive total factor productivity (TFP) shocks, the private sector accumulates capital, and production also increases. Despite this accumulation of capital, returns in the private sector likewise increase because R is increasing in TFP. As a result, the IM expands. There is a virtuous cycle of saving-lending and production: a lending boom. Note, however, that capital accumulation tends to decrease R, and the only reason it does not actually fall is that the direct effect of the increase in productivity more than compensates for the indirect effect of the accumulation of capital (recall that technology exhibits decreasing returns to each factor). Nevertheless, R becomes more sensitive to TFP shocks, in the sense that smaller changes to TFP can drive R below the threshold at which the IM freezes. This is the mechanism that generates financial crises in the economy. After long periods of growth and lending booms, the financial sector becomes more sensitive to reversals of the business cycle. Eventually, the economy is hit by a negative shock and financial markets collapse.

A key part of this mechanism is that the "savings glut" has generated positive productivity shocks, fuelled by the IM. This produces an important trade-off: the more efficient the IM is, the larger GDP is, but the more sensitive the economy becomes to negative shocks.

Following Boissay, Collard and Smets (2016), the addition of liquidity needs does not alter the main mechanism. This can be seen in figure 2, where we plot net demand with $\epsilon = 0$ (the dotted line) and net demand with $\epsilon > 0$ (the dashed line). It can be seen that the possibility of liquidity shocks does not affect the qualitative implications of the model: the average demand for funds decreases, but everything else remains the same.[9] All that changes is the way the economy has to be calibrated.

[9] Absent liquidity shocks, ϕ represents the individual and the average demand for funds in the IM. When $\epsilon > 0$, however, the average demand for funds is still ϕ but the individual demand is $\phi + \epsilon$ for some banks and $\phi - \epsilon$ for other banks.

Figure 2
Equilibrium effect of liquidity shocks



Source: Prepared by the authors, on the basis of the calibrated model.

3. Equilibrium for cooperatives

Suppose that a proportion λ of financial intermediaries sharing the same features as traditional banks do not have access to the IM. The timing for cooperatives is the same as for banks, the only difference being that they lack access to the IM. They can still borrow and lend when they experience liquidity shocks, but borrowing has to be from the other banks at the same interest rate as the productive corporate sector. In other words, the interest rate they have to pay is R instead of ρ. In addition, because they cannot lend in the IM, all funds not lent to the private sector are kept in the "vaults", so they obtain the return on the storage technology, γ_c. This rate could be equal to γ, but for the time being we shall keep it different.

This fact has two implications. First, recall that when cooperatives lend they are apprised of the efficiency shock, but not yet of the liquidity shock. If a cooperative cannot meet the needs generated by the liquidity shock, it fails, except that failure is not an option.

Given efficiency p, a cooperative does not leverage when it decides how to allocate its funds, i.e., $\phi_c = 0$. This follows from the fact that a cooperative must pay R when it borrows, while the return on any loan to the corporate sector is pR, which delivers a net return of $(p-1)R < 0$. Accordingly, cooperatives do not leverage. The question is whether a cooperative will borrow the maximum amount of resources it can get, or less than that.

The cooperative has four options: (i) to lend nothing and obtain a return γ_c on deposits, (ii) to lend only $(1 - \epsilon)$ and avoid borrowing in the case of a bad liquidity shock, (iii) to lend out only the deposits it has received and borrow in the event of a bad liquidity shock or (iv) to borrow $(1 + \epsilon)$ and bet with probability $1 - \pi$ that it can raise extra funds because of a good liquidity shock.

The returns per unit of deposit are, respectively:

(i) γ_c

(ii) $p\,R(1 - \epsilon) + 2(1 - \pi)\epsilon\,\gamma_c$

(iii) $p\,R - \pi\,\epsilon\,R + (1 - \pi)\epsilon\,\gamma_c$

(iv) $p\,R(1 + \epsilon) - 2\pi\epsilon\,R$

The above assumes that when the cooperative holds funds without lending to the private sector, they generate the return of the storage technology. In the second case, for instance, the cooperative loses ϵ deposits if affected by a bad liquidity shock, but since it lent only $1 - \epsilon$ it has ϵ left in the vault to compensate, and the amounts cancel out. In the case where the cooperative experiences a good liquidity shock, whose probability is $1 - \pi$, it receives ϵ extra funds. Since it already has ϵ in the vault, it is left with 2ϵ, generating a return of γ_c when the storage technology is used.

In the third case, the cooperative lends all the deposits it originally has, relying on borrowing if there is a bad liquidity shock, whose probability is π. If this shock arrives, the cooperative must borrow ϵ at rate R to pay for it (note that banks in this case pay only $\rho < R$). If there is a good shock (probability $1 - \pi$), the cooperative is left with ϵ extra funds that then generate the return of the storage technology. This last option can be constructed using these arguments.

Since the returns in each case are linear in p, it is easy to see that there would be some intervals for p with ranges that would lead the cooperative to take different decisions. It is straightforward to show that the following happens (recall that $\pi = \frac{1}{2}$):

(i) If $p \in \left[0, \frac{\gamma_c}{R}\right]$, the cooperative keeps everything in storage (option 1).

(ii) If $p \in \left[\frac{\gamma_c}{R}, \frac{\gamma_{c+R}}{2R}\right]$, the cooperative lends $(1\text{-}\epsilon)$, keeping ϵ in storage (option 2).

(iii) If $p \in \left[\frac{\gamma_{c+R}}{2R}, 1\right]$, the cooperative lends all it potentially can $(1+\epsilon)$ and borrows in the event of a bad liquidity shock (option 3).

This choice of strategies allows us to assess the difference from banks that have access to the IM. First, cooperatives with poor opportunities (low p) allocate funds outside the sphere of corporate private sector market lending. Thus, these resources never reach the production sector. In contrast, banks, which have access to the IM, lend to other banks when their p is low. They thus pass the resources to other banks which are more efficient (have better opportunities), so that the resources eventually make their way to the right agents.

Second, cooperatives with intermediate p do not lend at full capacity. They are concerned that a bad liquidity shock could arrive, in which case they would have to pay a high borrowing rate (R), and so keep some resources in storage. This does not happen with banks, since they have access to the IM and can borrow at a lower interest rate $(\rho < R)$. if necessary. These are two sources of inefficiency that arise because of the lack of access to the IM.

Note here that there is an interaction between the two functions the IM serves. First, the fact that cooperatives do not have access to the IM has a direct effect. When cooperatives do not have good opportunities, they are forced to store assets with the inefficient technology γ_c. Thus, those funds never reach the corporate sector. Banks, though, can transfer assets to other banks, which in turn lend them to the corporate sector. Second, there is also an indirect effect. Because cooperatives do not have efficient ways of hedging the risk of liquidity shocks, they lend to the corporate sector less than would be efficient, keeping some funds as a buffer stock.

Lastly, only cooperatives with very high p use their full lending capacity $(1 + \epsilon)$, which will still be less than that of a comparably efficient bank with access to the IM if $\epsilon < \phi$ And because they must borrow at a very high interest rate (R) when they have liquidity issues, the return that they pay to depositors must necessarily be smaller.

In short, the return on deposits for cooperatives is:

$$r = R\left[\frac{\gamma_c}{R}\mu^c(p_0) + \int_{p_0}^{p_1} p(1-\epsilon)d\mu^c(p) + \int_{p_1}^{1} p(1+\epsilon)d\mu^c(p) + 2(1-\pi)\epsilon\left(\frac{\gamma_c}{R}\right)\left[\mu^c(p_1) - \mu^c(p_0)\right] - 2\pi\epsilon\left[1-\mu^c(p_1)\right]\right] \tag{18}$$

where $p_0 = \frac{\gamma_c}{R}, p_1 = \frac{\gamma_{c+R}}{2R}$ and $\mu^c(p)$ is the distribution of efficiency for cooperatives, which could potentially be different from $\mu(p)$. Note that since cooperatives with low and medium p receive a flat return on deposits left in the storage technology and those with high p pay a flat price on borrowed capital, these cumulative distribution functions are given by the return multiplied by the distribution function. For deposits lent to firms by cooperatives with medium and high p, however, the return is a function of p, so the cumulative distribution is given by the integrals.

The average return on deposits will then be a convex combination of the cooperative interest rate and the traditional bank interest rate:

$$r = (1-\lambda)r_{bank} + \lambda\, r_{coop} \tag{19}$$

4. Equilibrium with banks and cooperatives

Let λ be the proportion of cooperatives. Given a total amount of deposits a, the total supply of loans, l, is:

$$l_t = \begin{cases} (1-\lambda)a_t + \lambda\left[1-\mu^c\left(\frac{\gamma_c}{R_t}\right) - \epsilon\,\mu^c\left(\frac{\gamma_{c+R}}{2R_t}\right)\right]a_t, & \text{if the interbank market operates} \\ (1-\lambda)\left[1-\mu\left(\frac{\gamma}{R_t}\right)\right]a_t + \lambda\left[1-\mu^c\left(\frac{\gamma_c}{R_t}\right) - \epsilon\,\mu^c\left(\frac{\gamma_{c+R}}{2R_t}\right)\right]a_t, & \text{otherwise} \end{cases} \tag{20}$$

Since production capital must be equal to loans, and since markets are competitive, it must be the case that $1 + f_k(K) - \delta = R$ in general equilibrium. Therefore:

$$f_k^{-1}\left(\frac{R+\delta-1}{z_t}\right) = \begin{cases} (1-\lambda)a_t + \lambda\left[1-\mu^c\left(\frac{\gamma_c}{R_t}\right) - \epsilon\,\mu^c\left(\frac{\gamma_{c+R}}{2R_t}\right)\right]a_t, & \text{if the interbank market operates} \\ (1-\lambda)\left[1-\mu\left(\frac{\gamma}{R_t}\right)\right]a_t + \lambda\left[1-\mu^c\left(\frac{\gamma_c}{R_t}\right) - \epsilon\,\mu^c\left(\frac{\gamma_{c+R}}{2R_t}\right)\right]a_t, & \text{otherwise} \end{cases} \tag{21}$$

The above relationship characterizes the equilibrium corporate loan rate R_t as a function of the two aggregate state variables of the model, a_t (savings) and z_t (productivity). It also points to the two-way relationship that exists between the interbank loan and corporate loan markets, since R_t affects and is affected by whether the IM operates.

As discussed earlier, crises occur when the interest rate is too low. In other words, there is an $\bar{R}$ such that for all $R_t < \bar{R}$ the IM freezes. Note that (20), when there is trade, can be written as:

$$f_k^{-1}\left(\frac{R+\delta-1}{z_t}\right) = g(R)a \tag{22}$$

where $g'(R) > 0$. It is straightforward to show that because $f(.)$ is Cobb-Douglas and $g'(R) > 0$, R is decreasing on a. Thus, the IM operates if and only if:

$$a_t \leq \bar{a} = \frac{f_k^{-1}\left(\frac{\bar{R}+\delta-1}{z_t}\right)}{g(\bar{R})} \quad \text{and} \quad z_t \geq \bar{z} = \frac{\bar{R}+\delta-1}{f_k(ag(\bar{R}))} \tag{23}$$

Also, note that $0 < g(R) < 1$ if $\lambda > 0$, and that $g(R;\lambda)$ is decreasing in λ. Thus, the fewer banks have access to the IM, the higher the interest rate and thus the higher the threshold for a crisis. This relationship shows the main trade-off entailed by the potential inclusion of cooperatives in the IM. The smaller λ is, the more efficient the financial sector is at allocating resources to production, but also the greater the probability of a financial crisis. This trade-off is the key element analysed in this paper.

5. Measurement

Since we have a storage technology that, although inefficient, is sometimes used, we need to properly measure GDP in the economy. Output must be adjusted for the stored capital of cooperatives and the potentially different storage yields earned by cooperatives and traditional banks:

$$y = \begin{cases} zk_0^{\alpha} h^{1-\alpha} + (\gamma_c + \delta - 1)(a - k_0), & \text{if the interbank market operates} \\ zk_0^{\alpha} h^{1-\alpha} + (\gamma_c + \delta - 1 + (1-\lambda)(\gamma - \gamma_c)\mu(p_b))(a - k_0), & \text{otherwise} \end{cases} \tag{24}$$

Bank assets

The size of the banking sector (encompassing the total financial sector, i.e., banks and cooperatives) must be adjusted now. The increase in the banking sector through the IM is smaller when cooperative banks are included as it is multiplied by the share of traditional banks $(1-\lambda)$:

$$b_{size} = \begin{cases} \left(1 + (1-\lambda)p_b^{\xi}\right) a, & \text{if the interbank market operates} \\ a, & \text{otherwise} \end{cases} \tag{25}$$

It is then straightforward to calculate non-core assets, which must be multiplied by the share of the traditional banks $(1-\lambda)$:

$$ncore = \begin{cases} (1 - p_b^{\xi})\, \phi(1-\lambda)a, & \text{if the interbank market operates} \\ 0, & \text{otherwise} \end{cases} \tag{26}$$

Core assets, which include cash holdings, thus include the assets of cooperatives, something that is already reflected in the size of the financial sector:

$$core = \begin{cases} b_{size} - ncore, & \text{if the interbank market operates} \\ a, & \text{otherwise} \end{cases} \tag{27}$$

Cash holdings are now greater than zero even in normal times because of the cooperatives:

$$cash = \begin{cases} \left((1-\epsilon)p_{0,c}^{\xi} + \epsilon\, p_{1,c}^{\xi}\right) \lambda\, a, & \text{if the interbank market operates} \\ \left((1-\epsilon)p_{0,c}^{\xi} + \epsilon\, p_{1,c}^{\xi}\right) \lambda\, a + (1-\lambda)p_b^{\xi}\, a, & \text{otherwise} \end{cases} \tag{28}$$

III. Calibration

We calibrate the model to reflect stylized facts for the Chilean economy.

Technology is represented by a constant return to scale production function of the form $z_t k_t^{\alpha}(\Psi_t h_t)^{1-\alpha}$, where the term Ψ_t captures labour-augmenting technological progress, which is exogenous and grows at the constant gross rate $\psi > 1$. Households are endowed with preferences for consumption, c_t, and hours worked, h_t, represented by Greenwood, Hercowitz and Huffman's (1988) utility function:

$$u(c_t, h_t) = \frac{1}{1-\sigma}\left(c_t - \vartheta \Psi_t \frac{h_t^{1+\nu}}{1+\nu}\right)^{1-\sigma} \quad (29)$$

where $\nu > 0$ is the inverse Frisch labour supply elasticity and ϑ is a parameter governing the average utility of leisure. As such, it should serve to determine the aggregate labour supply. The presence of the technological progress term in the utility function provides for a balanced growth path with a constant labour supply. Given that with Greenwood-Hercowitz-Huffman (GHH) preferences there is no income effect on the labour supply, if productivity growth were not included in the utility function there would be an ever-increasing labour supply, which is counterfactual. Also, this specification serves to generate a closed form solution for the banking sector's detrended absorption capacity, which greatly simplifies the numerical solution of the equilibrium.

The calibration is reported in table 1. We set the discount factor β so that households discount the future at an annual rate of 4% in the detrended economy. We set ν at 1 so that the labour supply elasticity is equal to 1. As shown by Coble and Faúndez (2016), the Frisch elasticity of labour supply is relatively low in Chile compared to other countries. The labour disutility parameter ϑ is such that a household would supply one unit of labour in a deterministic version of the model. The risk aversion parameter σ is set at 4.5, which lies within the range of estimated values. The capital income share is set at 0.3, and we assume that capital depreciates at 9%.

To calibrate the data-generating process for TFP, we first back out a model-consistent series of the logarithm of TFP for the Chilean economy over the period 1980–2015:

$$\log(TFP_t) = \log(y_t) - \alpha \log(k_t) - (1-\alpha)\log(h_t) \quad (30)$$

where y_t is real GDP and h_t is total annual hours worked as reported by a University of Chile survey of employment and unemployment in the Greater Santiago area (Encuesta de Ocupación y Desempleo del Gran Santiago (EOD)). The physical capital series k_t is constructed by the inventory method. We follow Bergoeing (2015) to construct capital stock and TFP. Note that in this economy, the capital-output ratio $\frac{k}{y} = \frac{\alpha\beta}{[\psi - \beta(1-\delta)]}$, which we set at a value of 2.9. Lastly, we fit a linear trend to the logarithm of TFP series and use the deviations from this trend to estimate the first-order autoregressive process for TFP in the last equation, obtaining $\rho_z = 0.85$ and σ_z = 2.5% as estimates.

The remaining parameters pertain to the banking sector and include the return on storage γ, the diversion technology θ and the distribution of banks μ(.). For tractability, we assume that $(p) = p^{\xi}$, with $\xi > 0$. The banking sector parameters are calibrated jointly so that (i) the spread between the real corporate loan rate and the implicit real risk-free rate equals 2.8%, (ii) the real corporate loan rate equals 4.6% and (iii) a financial recession occurs on average every 42 years (which depends on the facts of the economy). For statistics (i) and (ii), we use the real lending rate on medium-sized business loans in the United States between 1990 and 2011, as reported in the United States Federal Reserve's Survey of Terms of Business Lending, and the real federal funds rate.[10] We obtain $\gamma = 0.942$, $\xi = 25$ and $\theta = 0.085$. On the basis of this calibration, the model generates an average interbank loan rate of 0.90% and an implied threshold for the real corporate loan rate of 2.72% (i.e., $\bar{R} = 1.0272$).

[10] Although discontinued in 2017, the survey results can still be found at [online] https://www.federalreserve.gov/releases/e2/201212/default.htm.

For the baseline calibration, we assume that the proportion of cooperatives, λ, is 10% and that they share the same fundamental parameters in respect of ξ and θ as the rest of the banks. Later, in the counterfactual scenarios, we maintain the same functional form for the distribution of cooperatives, i.e., $\mu^c(p) = p^{\xi c}$, but we calibrate ξ_c to an alternative value. To this end, we compute the spread for the portfolio of loans of the largest credit union in Chile, and we choose ξ_c to match the difference in spreads.[11] This generates a value of 27 (and a corresponding spread that is 0.3 percentage points smaller), consistent with higher efficiency in the provision of intermediation services relative to traditional banks, as discussed in section I. Regarding θ_c, since we do not have a direct measure of its value in respect of θ, we consider alternative ratios for $\theta/\theta c$.

Table 1
Calibrated parameters and targeted moments

Parameter	Variable	Value	Moment
Discount factor	β	0.97	Risk-free interest rate
Inverse Frisch elasticity	ν	1	From microdata
Labour	ϑ	0.9686	Normalize $h = 1$
Risk aversion	σ	4.5	Equity premium (literature)
Capital income share	α	0.3	From national accounts
Depreciation rate	δ	0.09	To match $k/y = 3$
Growth	ψ	1.013	From GDP growth
TFP volatility	σ_z	0.025	Fitting log regression
TFP persistence	ρ_z	0.85	Fitting log regression
Bank distribution $\mu(p) = p^{\xi}$	ξ	25	Jointly to match (i) risk-free lending rate spread = 1.7, (ii) lending rate = 4.4 and (iii) two recessions per century
Diversion cost	θ	0.085	
Storage technology	γ	0.942	

Source: Prepared by the authors.

IV. Results

In this section, we present the main results of the paper. As mentioned earlier, the first exercise consists in comparing the benchmark economy where $\lambda = 10\%$ with the counterfactual scenario in which most financial institutions (traditional banks and cooperatives) are granted access to the IM and $\lambda = 3\%$. These results are shown in table 2.

When $\lambda = 10\%$, we are in the benchmark case, showing what the situation is when only traditional banks can participate in the IM. We then solve the model with $\lambda = 3\%$. This change generates two opposing forces. On the one hand, because of (20), the supply of loans expands, increasing capital accumulation and output. This is the positive effect of the policy. However, the higher level of capital generates a lower equilibrium interest rate R, increasing the probability of a crisis, which in turn makes output and consumption more volatile. This trade-off implies an ambiguous outcome for welfare.

In table 2, we show the main variables of interest plus three measures of welfare. For the first measure of welfare, in present value, we compute the present value of utility for different simulated paths. The second measure of welfare is the mean utility over all the simulated paths (50,000 simulations). This measure approximates the long-run value of welfare. One drawback with these two measures is the special form adopted for the utility of leisure. This choice was made to simplify the calculations,

[11] We use information on average saving and consumer lending interest rates from the Central Bank of Chile and Coopeuch, a Chilean credit union.

but this also has implications for welfare. To deal with the issue, we use a third measure in which we compute the average value of the utility of consumption only (i.e., we assume $\vartheta = 0$). We then use the consumption equivalent approach to compute the proportional changes, asking how much higher individuals' lifetime consumption would have to be in the benchmark economy for the counterfactual to be indifferent to them. For instance, the last row in table 2 should be interpreted as meaning that a representative consumer would be willing to give up 1.62% of his or her lifetime consumption to move to an equilibrium in which the calibrated cooperative can participate in the IM.

Table 2
Counterfactual scenario with the proportion (λ) of financial institutions excluded from the interbank market set at 3%

Variable	Counterfactual	Benchmark	Change *(Percentages, percentage points and absolute numbers)*
	Cooperatives $\lambda = 3\%$	Cooperatives $\lambda = 10\%$	
Capital	3.229	3.199	0.95
Output	1.442	1.441	0.05
Labour	1.015	1.018	-0.28
Consumption	1.098	1.080	1.68
Risk-free rate *(Percentages)*	2.79	2.79	0.003pp
Lending rate *(Percentages)*	4.487	4.61	-0.12pp
Spread *(Percentages)*	1.693	1.82	-0.13pp
Probability of a crisis *(Percentages)*	2.43	1.93	0.5
Cash	0.033	0.049	-0.016
Welfare (present value)	-52.554	-59.503	3.49[a]
Welfare (average)	-64.046	-70.971	2.89[a]
Welfare (consumption)	-7.652	-8.101	1.62[a]

Source: Prepared by the authors.

[a] Consumption-equivalent changes. Because preferences are homothetic, the numbers in this column are calculated as: $x = \left(\frac{W_0}{W_1}\right)^{\frac{1}{1-\sigma}} - 1$, where W_0 and W_1 are the total utility in the benchmark and counterfactual equilibria, respectively.

As can be seen, and as expected, both the probability of financial crises and the volatility of output increase. At the same time, however, average output, aggregate consumption and welfare also increase. Even though granting cooperatives access to the IM has some negative effects, overall welfare improves. In numbers, while the probability of a financial crisis rises from 1.93% to 2.43%, average output and aggregate welfare increase by 0.05% and 1.6%, respectively.

In the next exercise, we maintain the assumption that cooperatives are subject to the same moral hazard problems as traditional banks, but we introduce the fact that cooperatives are more efficient at lending (conditional on the type of loans). We do this by translating the distribution of efficiency towards larger values. In numbers, we assume that the distribution of efficiency for cooperatives is determined by the parameter $\xi_c = 27$, rather than $\xi = 25$, which is the calibration for traditional banks. The results are shown in table 3.

As expected, the welfare gains of granting access to cooperatives only become greater.[12] There are two factors contributing to the improvement. First, some cooperatives are very efficient, since cooperatives are more efficient on average than other banks. The reason, as already mentioned, is that they could finance particularly good projects but are unable to do so because of their limited funding

[12] In annexes A1 and A2, we simulate alternative values for ξ_c as a robustness test to allow for the possibility that cooperatives may be even more efficient (a reduction of 45 basis points in the average spread) or less efficient (an increase of 12 basis points in the spread). The results do not change qualitatively.

capacity. To finance the good projects, these efficient cooperatives would have to borrow from other banks at an interest rate too high to make it worthwhile, and so they only lend out the deposits they have received. When granted access to the IM, conversely, the efficient cooperatives can borrow from other less efficient banks or cooperatives at an attractive interest rate, which increases the supply of loans to the private sector. At the same time, cooperatives that cannot find good business opportunities also benefit from the IM. Without access to the IM, the less efficient cooperatives must keep their funds in inefficient, low-yielding financial instruments. When they do have access to the IM, they can lend out those funds to other banks which are able to make better use of them. Overall, the probability of a crisis falls to 1.45%, while GDP increases by 0.75% and welfare by 0.47%.

Table 3

Counterfactual scenario with a change in the distribution parameter (λ) from 25 to 27

Variable	Counterfactual	Benchmark	Change *(Percentages, percentage points and absolute numbers)*
	Cooperatives $\lambda = 3\%$ and ξ_c=27	Cooperatives $\lambda = 10\%$	
Capital	3.301	3.199	3.18
Output	1.453	1.441	0.80
Labour	1.017	1.018	-0.04
Consumption	1.1031	1.0797	2.17
Risk-free rate *(Percentages)*	2.80%	2.79	0.0065pp
Lending rate *(Percentages)*	4.31%	4.61	-0.32pp
Spread *(Percentages)*	1.51%	1.82	-0.32pp
Probability of a crisis *(Percentages)*	1.45%	1.93	-0.38
Cash	0.021	0.049	-0.027
Welfare (present value)	-52.218	-59.503	3.66[a]
Welfare (average)	-63.505	-70.971	3.13%[a]
Welfare (consumption)	-7.525	-8.101	2.09[a]

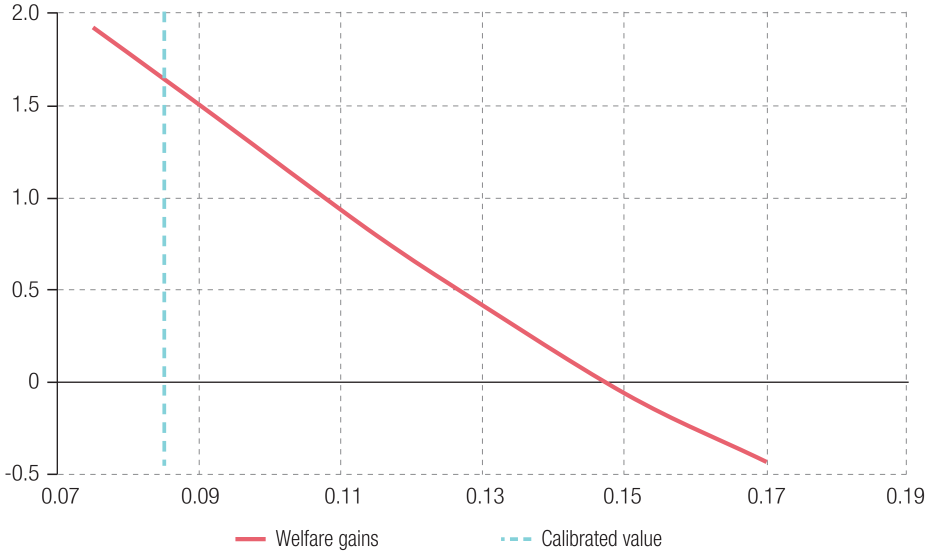
Source: Prepared by the authors.

[a] Consumption-equivalent changes. Because preferences are homothetic, the numbers in this column are calculated as: $=\left(\frac{W_0}{W_1}\right)^{\frac{1}{1-\sigma}} - 1$, where W_0 and W_1 are the total utility in the benchmark and counterfactual equilibria, respectively.

Lastly, we analyse the aggregate effect of allowing cooperatives to participate in the IM when they have a different quality of governance, θ_c. To that end, we solve different equilibria using the table 2 calibration with $\lambda = 3\%$ but changing θ_c from 0.075 to 0.17. Figure 3 shows the computed welfare gains (using the mean value of the utility of consumption only) for different qualities of governance. We can see in figure 3 that as the quality of governance deteriorates (the moral hazard problem worsens), the welfare gains decrease, to the point that when θ_c is almost double the original value, allowing cooperative banks to participate in the IM generates welfare loses.

To understand the effect of cooperatives' moral hazard problem in the IM, recall that θ captures the cost of walking away from the debt. If $\theta = 0$, the bank cannot divert any resources, while when $\theta = 1$ a bank can divert all the borrowed resources at no cost. Also recall that the quality of the banks participating in the IM is private information and therefore not observed by other participants. Thus, if cooperatives are "worse" than other banks, their participation lowers the average quality of the borrowers in the IM, which in turn diminishes the willingness of lenders to provide funds to all banks. At the extreme, there may be a complete market breakdown as in Akerlof (1970). The presence of some unobserved lower-quality borrowers affects the ability of all banks to borrow in the IM. As a result, fewer banks become lenders and the size of loans decreases. Thus, if the new participants are bad enough, the IM completely shuts down. Figure 3 shows that when cooperatives can divert at least twice the resources of traditional banks, their own moral hazard problem together with the induced negative externality for the other participants distort the IM enough that the efficiency gains are completely offset by the costs.

Figure 3
Welfare gains as a function of the quality of governance (θ)
(Percentages)



Source: Prepared by the authors.
Note: Welfare is computed as the mean consumer utility.

V. Conclusions

Cooperative banks have a long history of providing financial services to customers who would not have access to credit otherwise. Being created for a very precise purpose and by the same people who would eventually benefit from them, they tend to have a better knowledge than other banks of the needs and creditworthiness of their clients. Moreover, perhaps due to their perceived social function, cooperatives are in most cases legally endowed with greater powers to enforce repayment from borrowers (e.g., the right to take up to 25% of the customers' wages to retrieve loan repayment instalments directly, rather than the 15% for traditional banks). Because of their atomistic governing structure, however, they are considered riskier than other financial institutions. It is thus argued that their interaction with the rest of the financial sector could add unnecessary risks through contagion, compromising financial stability and increasing the volatility of GDP. As a result, in Chile and many other countries of Latin America, cooperative banks (or credit unions) are prevented from accessing the IM or financial assistance from the central bank.

In this paper we have constructed a model encompassing cooperative and traditional banks to analyse the trade-off posited by regulators. We assume cooperatives to have worse governance than traditional banks, and we quantitatively assess the benefits of better and more efficient financial integration against the potential negative spillover generated by their inclusion. We find that if cooperative banks are "worse" (in terms of governance) than traditional banks to a sufficient degree, they should indeed be separated from the main financial network. However, the threshold determining whether inclusion would be advisable or not appears to leave considerable latitude. As long as a cooperative bank is not twice as bad as the average traditional bank, it should be allowed to participate in the IM and receive assistance from the central bank. Since in Chile the largest cooperative banks are subject to the same regulators as traditional banks, meaning that they must comply with the same set of potential regulations, their governance quality may be not too far below the average in the financial sector. Still, having the possibility of including them does not make inclusion mandatory. The regulator could always state the minimum governance standards required for access to be granted to the IM and the lender of last resort function. Whether or not a bank is a cooperative is not the decisive feature: the quality of governance is.

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Annex A1

Table A1.1
Change in the distribution parameter (λ) from 25 to 29

Variable	Cooperatives $\lambda = 3\%$ and $\xi_c = 29$	Cooperatives $\lambda = 10\%$	Change *(Percentages and absolute numbers)*
Capital	3.356	3.199	4.91
Output	1.461	1.441	1.38
Labour	1.0181	1.018	0.03
Consumption	1.107	1.0797	2.53
Risk-free rate *(Percentages)*	2.80	2.79	0.01
Lending rate *(Percentages)*	4.17	4.61	-0.44
Spread *(Percentages)*	1.37	1.82	-0.45
Probability of a crisis *(Percentages)*	0.81	1.93	-1.12
Cash	0.014	0.049	-0.035
Welfare (present value)	-52.038	-59.503	3.90[a]
Welfare (average)	-63.134	-70.971	3.40[a]
Welfare (consumption)	-7.433	-8.101	2.49[a]

Source: Prepared by the authors.

[a] Consumption-equivalent changes. Because preferences are homothetic, the numbers in this column are calculated as: $x = \left(\frac{W_0}{W_1}\right)^{\frac{1}{1-\sigma}} - 1$, where W_0 and W_1 are the total utility in the benchmark and counterfactual equilibria, respectively.

Annex A2

Table A2.1
Change in the distribution parameter (λ) from 25 to 23

Variable	Cooperatives λ = 3% and ξ_c = 23	Cooperatives λ = 10%	Change *(Percentages and absolute numbers)*
Capital	3.137	3.199	-1.94
Output	1.428	1.441	-0.90
Labour	1.0121	1.018	-0.58
Consumption	1.091	1.0797	1.04
Risk-free rate *(Percentages)*	2.79	2.79	0.00
Lending rate *(Percentages)*	4.72	4.61	0.11
Spread *(Percentages)*	1.94	1.82	0.12
Probability of a crisis *(Percentages)*	3.79	1.93	1.86
Cash	0.052	0.049	0.003
Welfare (present value)	-53.237	-59.503	3.23[a]
Welfare (average)	-64.850	-70.971	2.61[a]
Welfare (consumption)	-7.832	-8.101	0.96[a]

Source: Prepared by the authors.

[a] Consumption-equivalent changes. Because preferences are homothetic, the numbers in this column are calculated as: $x = \left(\frac{W_0}{W_1}\right)^{\frac{1}{1-\sigma}} - 1$, where W_0 and W_1 are the total utility in the benchmark and counterfactual equilibria, respectively.