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Financial Repression is Knocking at the Door, Again. Should We Be Concerned?

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Abstract

Financial repression (legal restrictions on interest rates, credit allocation, capital movements, and other financial operations) was widely used in the past but was largely abandoned in the liberalization wave of the 1990s, as widespread support for interventionist policies gave way to a renewed conception of government as an impartial referee. Financial repression has come back on the agenda with the surge in public debt in the wake of the Global Financial Crisis, and some jurisdictions have reintroduced administrative ceilings on interest rates. By distorting market incentives and signals, financial repression induces losses from inefficiency and rent-seeking that are not easily quantified. This study attempts to assess some of these losses by estimating the impact of financial repression on growth using an updated index of interest rate controls covering 90 jurisdictions over 45 years. The results suggest that financial repression poses a significant drag on growth, which could amount to 0.4-0.7 percentage points.

JEL Classification Numbers: G21; G28; H23; H81; K23; N20; O43

Keywords: Financial Repression; Financial Liberalization; Financial Regulations; Growth.

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I. INTRODUCTION

Financial repression has a long history. Defined as direct government intervention that alters the equilibrium reached in the financial sector, it usually aims at providing cheap loans to companies and governments, reducing their burden of repayments by lowering returns to savers below the rate that otherwise would prevail.[1] It has been applied in numerous forms such as ceilings on interest rates, directed credits to certain industries, or constraints on the composition of bank portfolios. Financial repression is typically accompanied by additional restrictions on financial activity, such as controls on international capital movements aimed at reducing the alternative investment opportunities available to savers.

Views on financial repression have undergone significant changes over time, reflecting an evolution in economic thinking (Appendix I).[2]

- Theoretical arguments for using financial repression generally refer to market failures (Stiglitz 1989, 1993, 2000) and information frictions (Espinosa-Vega and Smith 2001). Referring to the cases of Japan and Korea, papers justifying restrictions claim that they are most useful when combined with industrial policies (Yulek 1997).

- From the 1960s onward, an initial consensus emerged in support of government intervention (stemming from the combination of "Keynesian" views on the role of government with the interventionist legacy of wartime restrictions). This later shifted to the current prevailing view of government as that of an "impartial referee"—ensuring the smooth functioning of markets without changing their equilibrium allocation function. This gradual shift in views led to the widespread adoption of reforms aimed at removing existing restrictions and liberalizing financial markets since the 1980s.

- The global financial crisis of 2008-09 rekindled the debate on the role of government, with some calling for expanded regulations and supervision, ostensibly to prevent and correct imbalances that could weaken financial stability. Moreover, the surge in government debt in the wake of the crisis has relaunched a debate on the possible role of financial repression as a second-best solution to mobilize seigniorage revenue that can be used to reduce debt burdens.

More recently, there have been renewed calls for a more explicit government intervention in the financial sector, including the return of long-unused measures such as quantitative constraints on credit allocation and ceilings on bank interest rates. In several cases (e.g.,

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[1] Administrative controls occasionally aim to *both* reduce costs for borrowers and increase returns for savers, for instance by imposing interest rate ceilings on loans and floors under deposits. Obviously, unless these measures are financed through significant fiscal subsidies, the burden would be placed on financial institutions, which may raise financial stability concerns.

[2] Appendix I provides an overview of the literature, underscoring swings between views in favor of more forceful government intervention and in favor of liberalization.

Tanzania and Azerbaijan) such calls have not resulted in effective action, however in a few such measures have been adopted (Section IV), raising concerns about their efficiency implications. At the same time, there have been some recent cases of liberalization. The long-forgotten debate on financial repression is thus re-emerging.

Whatever its purported benefits, financial repression comes at a cost by creating market distortions. First, by compressing returns to savers, financial repression leads to a suboptimal savings rate and hence increases the scarcity of the funds available for investment, leading to disintermediation and reduced access to financing. If the costs are placed on banks by putting a floor on deposit rates, financial stability risks increase. Second, by weakening price signals, it distorts the allocation of investment, reducing its average quality and rate of return. Third, by awarding rents to a limited number of beneficiaries, it also encourages wasteful rent-seeking competition that can, at times, take illegal forms (such as corruption). All these distortions presumably have a tangible macroeconomic impact, but are these effects visible in the data?

This study focuses on a specific aspect of financial repression, namely government-mandated limits on the interest rates that commercial banks can apply to their deposits and loans. On the basis of recent data, the study assesses the impact of financial repression on per capita real GDP growth and on the probability of crisis. To this end, we have extended the database compiled by Abiad, Detragiache, and Tressel (2008) covering the period 1973-2005 until 2017. While their database covers a variety of indicators, its extension here is limited to the interest rate ceiling indicator because of data constraints.

Our results suggest that, over time, countries would be better-off without financial repression. Specifically, interest rate restrictions reduce growth by about 0.4-0.7 percentage points, with the effect being larger in economies with larger financial systems. However, we also find that a full liberalization is necessary to significantly increase growth, and changes in interest rate restrictions short of full liberalization have a limited impact. There are significant differences across regions, with the effect appearing to be strongest in countries in sub-Saharan Africa (SSA) and the Middle East and North Africa (MENA) region, and in transition countries. We also find that while financial repression reduces the probability of crisis (which is good for growth), this positive effect is dwarfed by the larger adverse direct effect mentioned above. On net, financial repression has a significant adverse effect on growth.

This paper is organized as follows: Section II provides a stylized analysis of interest rate restrictions using a model to illustrate the key transmission channels. Section III describes the data and methods and presents the results of various empirical analyses; Section IV discusses two cases in which controls on interest rates were recently reintroduced; and Section V concludes. Additional supportive information is provided in the appendices.

II. A Stylized Analysis of Interest Rate Restrictions

Financial repression is used to meet different fiscal, quasi-fiscal, and financial stability goals. These generally include: (a) public financing through seigniorage (by maintaining real

interest rates below their market equilibrium levels), often aimed at facilitating the reduction of public debt; (b) subsidizing particular sectors or industries (by ensuring access to low-cost credit financed by "captive" savers), and (c) maintaining financial stability in the medium term by creating a predictable credit environment protected from competition.[3]

Accordingly, financial repression takes many different forms. Major types include:

- Interest rate controls (ceilings or, less frequently, floors on bank lending and deposits rates);
- Directed lending (mandatory instructions to banks to allocate a minimum amount of loans to specific beneficiaries);
- Restrictions on international capital movements;
- Restrictions to entry into the banking sector;
- Direct government intervention in the financial sector (establishing and operating state-owned banks);
- Unconventional monetary policies that keep the interest rate curve artificially flat, which is rather atypical in the sense that it relies mostly on market operations and could be qualified more properly as a measure of monetary policy.

Governments that intervene directly in the financial sector frequently use more than one of these forms of intervention, not least because most of them are more effective if accompanied by others. For instance, as discussed below, ceilings on interest rates on loans result in a rationing of credit based on non-economic criteria; if the government intervenes to set these criteria, it effectively directs lending. Ceilings on deposit rates yield a rent to banks and rationing on the deposit side, requiring some entry barriers into the sector. Ceilings on either deposits or loans encourage international capital movements, inducing the government to restrict such transactions to prevent capital loss or an accumulation of foreign debt. While this study focuses on interest rate controls, it is important to keep in mind that such controls are frequently part of a wider and more complex set of direct government interventions.[4]

A. A Brief Theoretical Illustration of the Financial Repression Mechanism[5]

Consider an economy composed of three categories of actors: savers, borrowers, and financial intermediaries (banks). Savers provide liquid assets that can be used by borrowers

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[3] Whether financial repression is effective at achieving this latter aim in the long term is more controversial, as it encourages a shift of financial resources out of the regulated sector into nonregulated "shadow banks" and other risky ventures.

[4] The data collected by Abiad, Oomes, and Ueda (2004), covering 91 jurisdictions over the 1973-2005 period, distinguish between seven different "components" of financial sector policy. These include credit controls and excessively high reserve requirements, interest rate controls, entry barriers, state ownership in the banking sector, capital account restrictions, prudential regulations and supervision of the banking sector, and securities market policy. They show that most of these restrictions are highly correlated, as jurisdictions with more restrictive policies in one area have restrictive policies in other areas as well.

[5] A more detailed stylized model of financial intermediation with interest rate controls is presented in Appendix II.

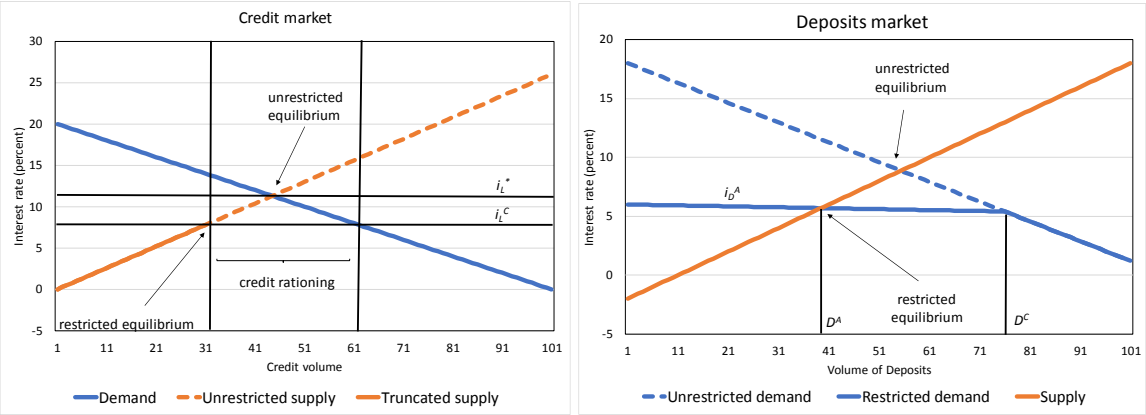
to finance investments; owing to informational asymmetries and other transaction costs, savers do not interact directly with borrowers, but deposit their savings in banks, which in turn lend them to borrowers.

Savers demand interest from the banks, and banks charge interest to the borrowers. Since banks incur some costs of intermediation, banks demand a positive spread between the interest they charge on loans and the interest they pay on deposits.[6] For illustrative purposes, it can be assumed that this spread is exogenous, constant, and equal to zero, and that there are no reserve requirements; in other words, banks act as mere intermediaries that convey the savings of the savers to the borrowers as loans.

In equilibrium, in the absence of restrictions, the interest rate clears both the deposits and loans market, balancing the supply of savings/deposits with the demand for loans. If instead the authorities introduce an administrative ceiling $i_L{}^C$ on the interest rate on loans, and this ceiling is binding (below the market clearing equilibrium level i_L*), there will be an excess demand for loans: since the lower rate will encourage borrowers to increase their demand for loans, it will also induce banks to reduce their supply, because to remain profitable they must reduce the interest paid on deposits, which, in turn, will reduce the supply of deposits and thus the amount of funds available for credit (Figure 1). This will result in credit rationing, forcing banks to allocate the scarce credit on the basis of non-interest criteria.

In the deposit market, demand for deposits now follows a kinked line (Figure 1). It overlaps with the unconstrained demand at high volumes (where, to find enough borrowers, the funds would have to be lent in any case at a rate below the ceiling) and becomes flat at lower volumes (where the bank, unable to lend the funds at rates above the ceiling, cannot offer a higher rate to depositors without incurring a loss).

Figure 1. Restricted and Unrestricted Equilibrium in Credit and Deposit Markets



Source: Authors' simulations.

[6] For simplicity, we ignore other sources of funds (such as equity capital or bonds) and other types of assets (such as government bonds).

Since the ceiling reduces the volume of loans and lowers interest rates compared to a free-market equilibrium, it also reduces the equilibrium volume and interest rates on deposits; in other words, a ceiling on lending interest rates reduces financial intermediation.

How will banks select borrowers given that demand for loans is likely to exceed supply when interest rates are capped? Besides circumventing the restriction by imposing higher non-interest charges (like fees and commissions, as frequently happens in these cases), banks could be more selective about the quality of their loans (extending credit only to the least risky projects), could give preferences to their existing long-term customers (e.g., with a view to maximizing long-term profits by rewarding loyalty), or could base their selection on non-economic criteria (such as personal connections).

Selecting borrowers on the basis of these criteria is likely to result in an inefficient allocation of credit; even a selection that favors less risky borrowers could discourage innovation and reduce access to credit to potentially profitable but more risky ventures. This can provide a justification for direct state intervention in the selection of borrowers, for instance by requesting banks to extend a minimum amount (or share) of credit to specific sectors, projects, or categories of borrowers (possibly including state-owned enterprises). Hence, restrictions on loan interest rates are likely to be accompanied by some forms of directed lending. To contain disintermediation, authorities may impose capital restrictions on depositors to discourage alternative investment opportunities in foreign markets.

Notice that a ceiling on loan interest rates benefits selected borrowers at the expense of (a) borrowers that would be able to borrow in a market equilibrium but are now excluded through the rationing process; (b) depositors who get lower rates on their deposits; and (c) depositors that withdraw from the market as a result of the lower rates.

The losses incurred by (b) are transferred to the beneficiary borrowers (essentially, a quasi-fiscal operation that taxes depositors and subsidizes selected borrowers), but the losses incurred by (a) and (c) are deadweight losses, a net decline in efficiency. Aside from other costs that could emerge, for instance, from the incentives for fraud and corruption arising from the rationing process, authorities should thus consider whether or not the benefits achieved through this quasi-fiscal redistributive operation (i) outweigh the costs associated with the deadweight losses, and (ii) could not be achieved, at lower costs, through more explicit fiscal measures.

What motivates authorities to pursue these (costly) measures? Besides serving their own and private interests at the expense of the public (e.g., as a result of lobbying or corruption by banking sector representatives or insiders who gain access to rationed credit), authorities might attempt to support an infant financial sector at an early stage of development, favoring groups of borrowers considered particularly needy or worthy of public support (such as low-income households), or they may be trying to provide sufficient resources to encourage perceived critical innovations that entail significant externalities (such as investments in cybersecurity).

In all these cases, financial repression would be a form of quasi-fiscal operation, where some agents are effectively taxed (and others taxed out of the market) in order to finance the pursuit of a public objective.

III. EMPIRICAL ANALYSIS

To quantify the macroeconomic impact of interest rate controls, we have to assess its impact on the rate of growth of real GDP. Following a stream of empirical studies on similar issues, we have run augmented growth regressions on panel data covering 90 jurisdictions and 45 years, including macroeconomic and institutional variables to control for other factors that could affect real GDP growth and economic stability.

A. Data

The principal variable used in this analysis is an index of "interest rate controls" (IRC) representing the presence, and importance, of administrative or legal controls on the interest rates that commercial banks apply to the deposits and loans of their customers. The index includes annual data for 90 economies[7] over 45 years, from 1973 to 2017.[8] The index has been compiled by comparing information from secondary sources and integrating it with additional information collected from International Monetary Fund documents (such as FSAP or country reports), Fund desk economists, and resident representatives.[9]

Like similar indices developed in other studies (e.g. Abiad, Detragiache, and Tressel, 2008), IRC is a qualitative index that assumes four possible numerical values, ranging from 0 (representing the strictest controls on interest rates) to 3 (representing a situation where banks are essentially free to set their own interest rates, subject at most to nonbinding consumer protection limits forbidding usury). In between, a value of 1 represents a situation in which interest rate controls are extensive but not universal, and pose a significant, binding constraint to a dominant share of the market; while 2 represents situations in which binding constraints apply to a significant share of the market, but the dominant share remains free of binding restrictions or subject at most to loose (i.e., not stringently binding) constraints. For

[7] 89 countries and one Special Administrative Region, hereafter referred to as "economies" or "jurisdictions."

[8] For China, data are only available from 1981; for other 18 countries that became independent or joined the Fund between 1990 and 1993 data are only available for 24-27 years.

[9] We are grateful to Sergio Martinez for valuable research assistance in compiling this database. The secondary sources used for this purpose include Abiad, Detragiache, and Tressel (2008), EIU Microscope (2014; 2015-16), Kaminsky and Schmukler (2008), Lora (2012), Ferrari, Masetti, and Ren (2018), Maimbo (2014), Maimbo and Gallegos (2014). A list of the cases of "financial repression" (with an IRC score below 3) from 2006 is provided in Appendix V (Table A.V.1).

example, in 2017 the average IRC score is 3 for all G-7 countries, 2.8 for LA-5 countries,[10] and 2.4 for sub-Saharan countries.[11]

For computational purposes, the IRC index, which is an ordinal variable, has been mapped into a binary financial restrictions index (FRI; a categorical value) that measures the presence or absence (in each country and year) of controls on interest rates (Table 1). It takes the value of 0 if the IRC index is equal to 3 and 1 if the IRC index is smaller than 3. In other words, FRI is equal to 1 when significant restrictions on interest rates are present, independently of how pervasive they may be, and to 0 when there are no significant restrictions (a condition henceforth described as "full liberalization"). Note that changes in the IRC and FRI have opposite signs.

Table 1 shows that sub-Saharan African (SSA), Latin American and Caribbean (LAC), and Asian-Pacific (AP) economies went from tight interest rate controls in 1973 to less restrictive situations by 1995. Advanced (ADV) countries fully liberalized by 1995 while European (EUR) and LAC countries saw an increase in restrictions by 2017.

The other variables used in the analysis include macroeconomic data from the IMF's *World Economic Outlook* and *International Financial Statistics* databases and from the Penn World Tables database (Feenstra, Inklaar, and Timmler, 2015); financial stability indicators from the IMF's Financial Soundness Database; and institutional, demographic, and social indicators from the World Bank's World Development Indicators and from the International Country Risk Guide (ICRG).[12] The variables also include a binary indicator of a debt crisis compiled by the IMF's Strategy and Policy Review Department. A "crisis" is defined as a situation in which a country experiences high inflation, high risk premia on its debt, is in arrears on its external debt, is restructuring its debt, or is receiving emergency financial assistance from official sources (such as IMF arrangements).

Table 1. Financial Repression Index Score by Region and Year[13]

	ADV	AP	EUR	LAC	MENA	SSA
2017	0	0.36	0.07	0.35	0.20	0.43
1995	0	0.36	0	0.12	0.40	0.43
1973	0.75	1	0.86	1	0.80	1

[10] Brazil, Chile, Colombia, Mexico, and Peru.

[11] Since the numerical values of the IRC are qualitative symbols and not quantitative indicators, computing an arithmetic average provides limited information. The values reported in the Table reflect, however, the significant reduction in interest rate restrictions in all regions over time.

[12] International Country Risk Guide, the PRS Group, Inc., www.prsgroup.com.

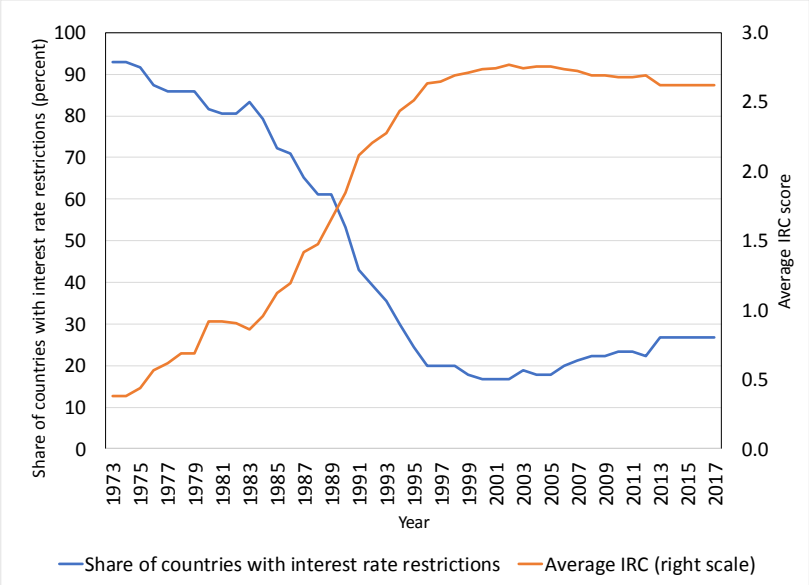
[13] ADV (advanced economies): 8 countries: Canada, France, Germany, Italy, Japan, Korea, the United Kingdom, the United States; AP (Asia/Pacific): 14 jurisdictions in the Asia/Pacific region not included in ADV; EUR: 14 European countries not included in ADV; LAC: 17 countries in the Latin American and Caribbean region; MENA: 5 countries in the Middle East/North Africa region; SSA: 14 countries in sub-Saharan Africa.

Source: Authors' estimates.

B. Simple Observations from the Data

The FRI highlights that a major wave of liberalization took place over a twelve-year period, roughly between 1984 and 1996. Until 1984, three-fourth of the jurisdictions in the sample had some form of interest rate restrictions. By 1991, this ratio had fallen below one-half, and after 1995 less than a quarter of the jurisdictions still maintained restrictions on interest rates. In 1999, this ratio stabilized around 17-18 percent, increasing toward 25 percent only in recent years (Figure 2).

Figure 2. Jurisdictions with Interest Rate Controls, 1973-2017



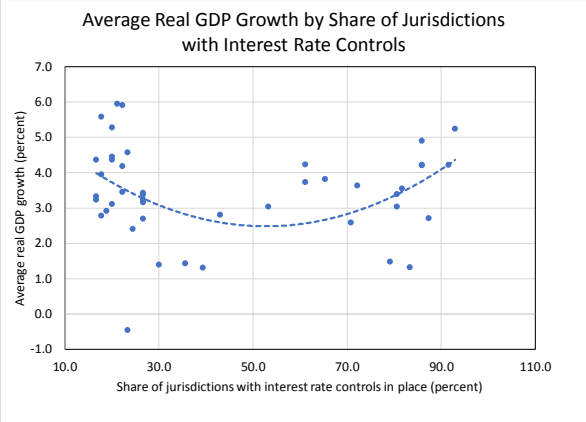
Source: Authors' estimates.

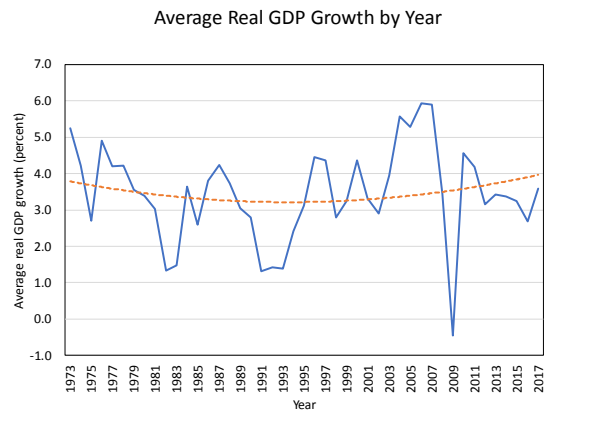
The average annual rate of growth broadly exhibits a U-shaped relation with the share of jurisdictions that applied interest rate controls. This relation reflects changes that occurred over the period examined: the average rate of real GDP growth of the economies in the sample declined between 1973 and 1991, when the liberalization wave took place, but increased again after 1993, when the number of jurisdictions maintaining interest rate controls declined further (Figure 3). On average, across all observations (economies and years), per capita growth has been 0.52 percentage points higher in the absence of interest rate restrictions. The relation has, however, changed over time: until 1990, the (few) economies that did not have interest rate controls experienced, on average, lower real GDP and per capita growth than those where such controls were present; after 1990, however, growth has been stronger in the (growing number of) economies that did not have interest rate controls (Figure 4).

What other variables are correlated with the financial repression index?

- Per-capita GDP exhibits a strong negative correlation on the entire sample (-40 percent) and in annual averages across jurisdictions (-34 percent), but not in jurisdictions averages across periods; in other words, as per capita GDP grows, jurisdictions are more likely to liberalize.
- The FRI is also negatively correlated with public and external debt and the money/GDP ratio (the latter can be considered as a proxy for the size of the banking sector). The relation is strongest in terms of annual averages and weaker among jurisdictions averages. The FRI is positively correlated with inflation (Table 2), showing that countries with interest rate controls also tend to have a higher "inflation tax."

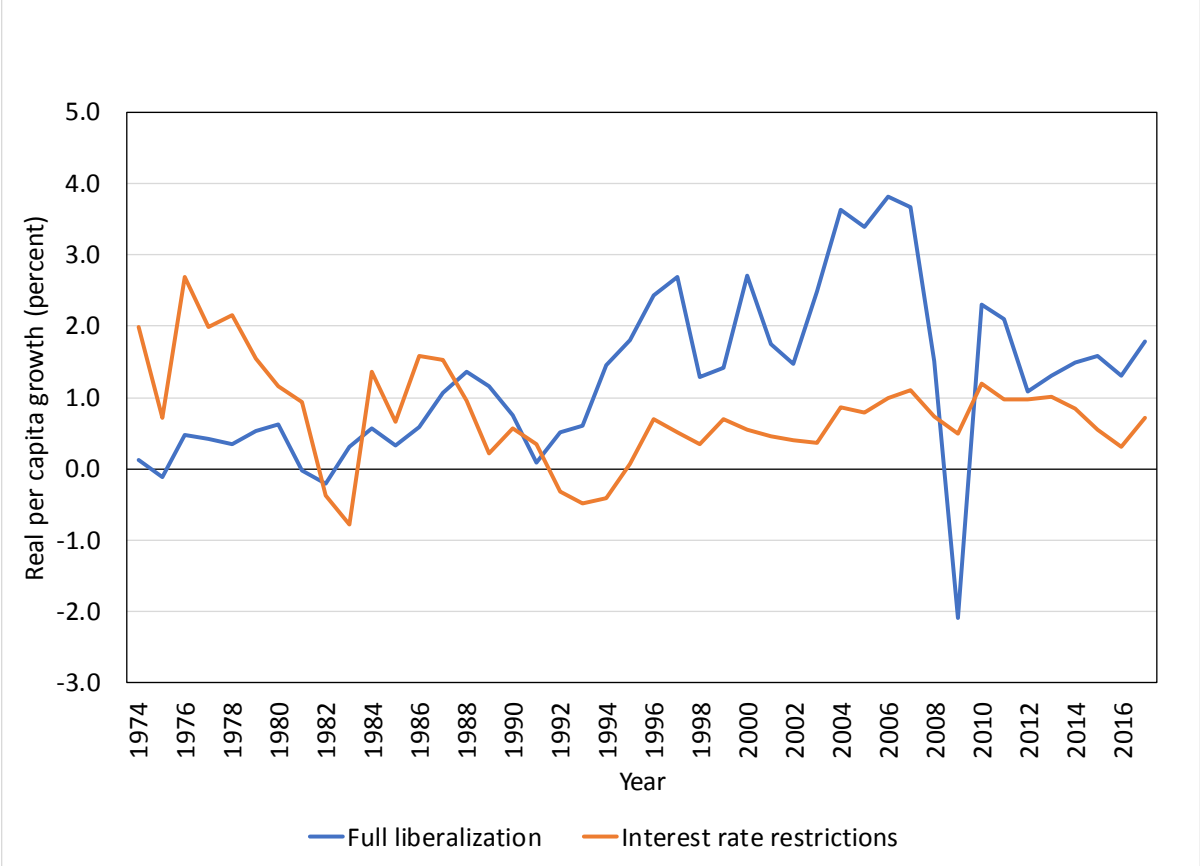
Figure 3. Average Real GDP Growth





Each data point represents a different year.
Source: Authors' estimates.

Figure 4. Real Per Capita GDP Growth by Interest Rate Regime, 1974-2017



Source: Authors' estimates.

Table 2. Correlation: Financial Repression Index and Selected Macroeconomic Variables

	Individual observations	Average by year	Average by country
Per capita GDP	-5.1***	-33.8**	6.8
Public debt	-36.2***	-93.6***	-23.6**
External debt	-12.3***	-55.6***	-19.8*
Broad money/GDP	-17.5***	-82.2***	-0.1
Inflation	2.6**	19.3	-4.6

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

C. Analysis of Episodes of Tightening and Liberalization

One way to assess the impact of financial repression is to observe how selected variables behave during episodes of financial liberalization (or tightening). An episode of liberalization (tightening) is defined as a seven-year window centered on the year (t = 0) when restrictions on interest rates have been fully removed (or reintroduced). We focus here on episodes of "full" liberalization, where all significant restrictions on interest rates were removed (the IRC index increased from less than 3 to 3, and the FRI index declined from 1 to 0), and on the opposite occurrences, where such restrictions were re-introduced (when the IRC index declined from 3 to less than 3, and the FRI index increased from 0 to 1). The analysis is carried out using the Gourinchas and Obstfeld (2012) method, based on the estimation of a panel fixed effect regression in the form:

$$y_t = a_c + \sum_{z=-3}^{3} b_z d_{zt} + \varepsilon_t \qquad (1.)$$

where a_c is a country-specific constant, z denotes the time distance from the liberalization events (negative for the years preceding liberalization, positive for the years following liberalization, and zero for the year when the liberalization occurred), and d_{zt} are dummies equal to 1 if t is z years away from liberalization and to zero otherwise (for instance, if liberalization occurred in 1992 in country X, then in 1990 z = *-2* and all d_{zt} are zero except

$d_{-2,t}$, which is equal to 1). The coefficients b_z measure the average deviation of the variable y from the average in each year preceding and following a liberalization event.

Episodes of Full Liberalization

Out of the 90 jurisdictions in the sample, 71 experienced episodes of full liberalization, 9 maintained interest rate restrictions throughout the period, and 10 always maintained a liberal regime (Table 3). We identified 84 episodes of full liberalization, concerning 568 observations out of 3,718, mostly between 1985 and 1995.

What are the characteristics of jurisdictions that liberalized? And how do they compare to those that have always maintained a liberal regime or have always maintained some restrictions? It should be noted that the jurisdictions that liberalized interest rates at some point form the largest group; the other two groups are relatively small. Compared with the largest group, jurisdictions that have always had a liberal regime had higher per capita income and growth, while those that never liberalized had lower per capita income but higher per capita growth.

Table 3. Full Liberalization Episodes

(average values unless otherwise indicated)

	Jurisdictions that liberalized at some point during the period	Jurisdictions that maintained a restricted regime throughout the period	Jurisdictions that maintained a liberal regime throughout the period
Number of jurisdictions	71	9	10
Real GDP growth (percent)	3.4	5.0	2.1
Real per capita growth (percent)	1.9	3.3	2.3
Inflation (percent)	44.3	32.7	73.7
Excl. high-inflation cases [1]	7.0	6.5	4.5
Public debt (percent of GDP)	31.6	25.3	37.7
External debt (percent of GDP)	46.9	31.3	54.2
Per capita income (U.S. dollars)	9,161	1,177	19,246

Source: Authors' estimates.
[1]Defined as observations in which the rate of inflation exceeds 25 percent.

Table 4 shows how key variables change during these episodes—from the three years *preceding* the event to the three years *following* the event. For comparison, the table also reports the average values for observations that do not fall into an episode. As can be seen, growth increases markedly in the wake of liberalization. There is no significant change in savings, net capital formation, or private sector credit in percent of GDP, but the real growth rate in net capital formation appears to increase after liberalization, even if private sector credit declines. Liberalization is also associated with a lower inflation rate. In fact, many jurisdictions liberalized interest rates during periods of particularly high inflation, and this and other reforms that accompanied interest rate liberalization reduced inflation effectively and rapidly.

A crisis is more likely to start in the three years *preceding* liberalization than in the three years that follow it, even if jurisdictions with interest rate restrictions, on average, experience a lower probability of debt crises. On the one hand, if a debt crisis starts, it lasts, on average, longer in the wake of a liberalization. On the other hand, while liberalization does not appear

to be associated with a lower probability of entering a recession,[14] it entails a higher probability of exiting it if one has already started.

Table 4. Liberalization Episodes: Before and After

(percent of GDP unless otherwise indicated)

	Liberalization episodes		Values outside episodes	
	Three preceding years	Three following years	Liberalized regime	Restricted Regime
Real per capita growth (percent)	0.6	2.3	2.3	2.0
Net capital formation	20.3	21.5	22.1	20.2
Savings	20.3	20.2	21.8	18.7
Private sector credit	28.7	30.8	56.9	28.4
Net capital formation (real annual growth in percent)	-13.5	5.6	46.8	4.9
Private sector credit (real annual growth in percent)	97.9	9.7	7.9	-2.0
Inflation (percent)	143.8	22.2	19.5	54.3
Probability of the start of a recession (percent)	16.2	13.5	9.8	12.4
Percent of years in a recession	34.5	23.4	16.5	28.5
Probability of the start of a debt crisis (percent)	5.0	2.5	2.8	1.2
Percent of years in a debt crisis	10.0	15.6	9.9	3.8
Fiscal deficit	-1.6	-1.4	-1.7	-1.1
Public debt	19.3	25.9	46.8	14.5
Current account balance	-3.2	-3.0	-1.0	-3.1
External debt	45.3	39.3	55.9	34.5
Per capita income (U.S. dollars)	4,313	5,685	15,900	2,253

Source: Authors' estimates.

Liberalization seems to be associated with an increase in public debt, in line with the argument that financial repression enables the government to extract more seigniorage. External debt, on the contrary, appears to decline in the years following liberalization, even though it is generally higher in jurisdictions with a liberal regime.

Looking more closely at the behavior of per capita growth around liberalization episodes, the analysis based on Gourinchas and Obstfeld (2012) shows a slight deceleration in the years preceding liberalization, followed by a marked and immediate acceleration after liberalization has taken place. This change appears both in the *unconditional* value of growth (estimated using Equation 1 above) and in the *conditional* value estimated by augmenting the

[14] A recession is defined, here, with some adjustments, as a decline in real per capita GDP. Isolated cases in which real per capita GDP declined by less than 0.5 percent in only one year are not counted as recession, while isolated cases in which real per capita GDP increased in one year in the midst of a period of contraction in which real GDP growth remained negative in most years and was negative on average are counted as recessions.

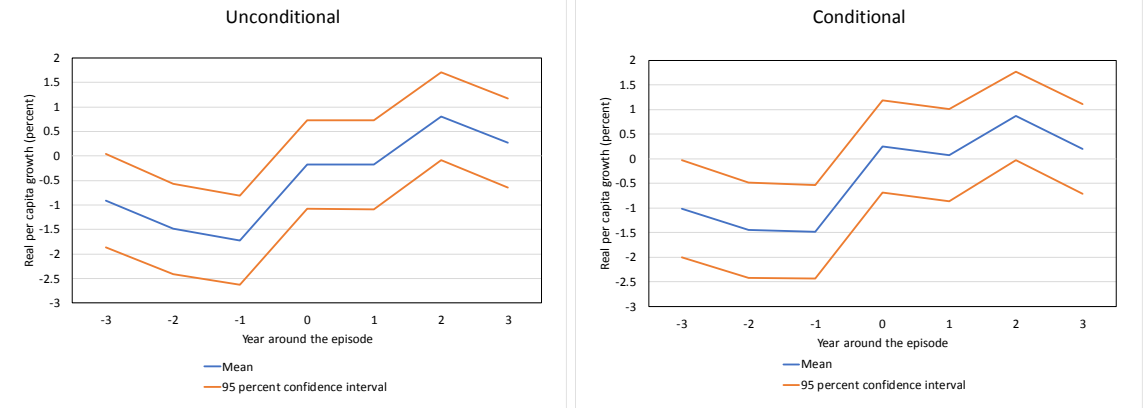
equation with a set of control variables (discussed in the following section) assumed to have an impact on growth:

$$y_{ct} = a_c + \sum_{z=-3}^{3} b_z d_{zct} + \sum_{k=1}^{K} \gamma_k x_{kct} + \varepsilon_{ct} \qquad (2.)$$

where x_k are the K control variables (Figure 5).

Figure 5. Economic Growth During Liberalization Episodes

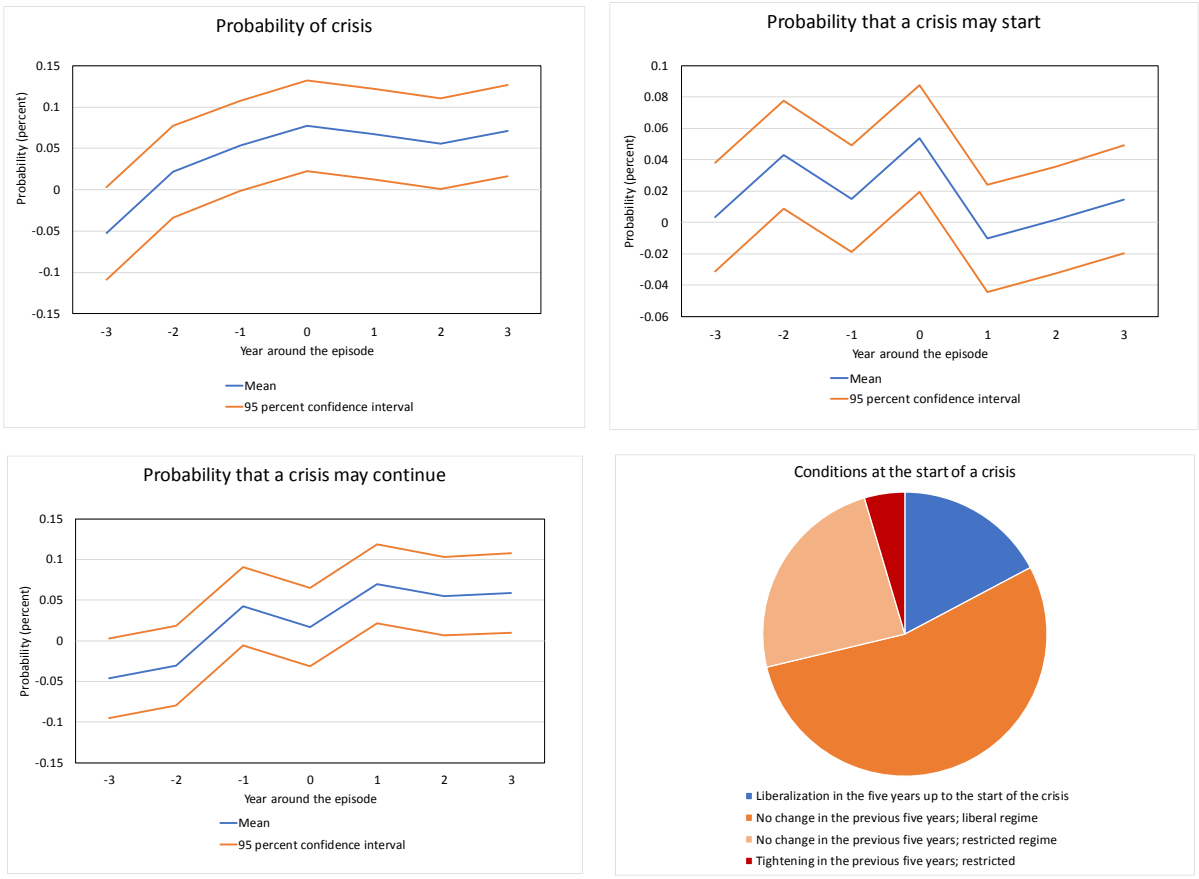
(In percent)



Source: Authors' estimates.

The estimates based on Gourinchas and Obstfeld's methodology also show that the (unconditional) probability of a crisis is higher in the wake of liberalization. This reflects the fact that, if a crisis has started, it is more likely to continue if liberalization has occurred. Furthermore, the probability that a crisis may start is somewhat lower in the years following liberalization (Figure 6). It should be noted that about three-fourth of crises in the sample were accompanied, or preceded, by a change in the interest rate regime (usually an easing of restrictions).

Figure 6. Probability of Crisis Around Liberalization Episodes



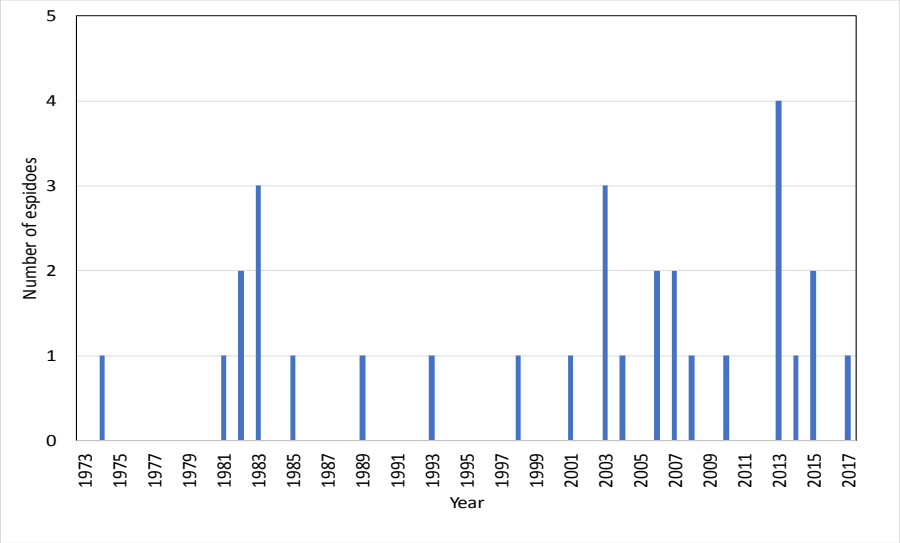
Source: Authors' estimates.

Introduction of Controls

Episodes of introduction of controls occur when a country with a fully liberalized interest rate regime introduces significant restrictions on bank interest rates. There were 30 such episodes in the sample, in 30 different jurisdictions,[15] for a total of 203 observations. Episodes of introduction of controls are more evenly distributed over time than episodes of liberalization, centering around three clusters: 1981-85, 2001-08, and 2013-15 (Figure 7).

[15] 29 countries and one Special Administrative Region.

Figure 7. Episodes of Introduction of Controls, 1973-2017



Source: Authors' estimates.

The behavior of key economic variables during these episodes mirrors closely what happens during episodes of liberalization: inflation, the fiscal deficit, external debt, and the probability of crisis increase. The absolute changes in per capita growth and public debt are smaller than during episodes of liberalization, while tightening episodes exhibit a stronger net change (decline) in the current account balance.

Remarkably, private sector credit increases in percent of GDP after the introduction of controls, but this does not translate into higher investment (capital formation), whose real growth appears to slow down instead (Table 5).

The net change in per capita growth after the introduction of controls is visible at the median, but less evident at the top and bottom quartiles of the distribution (Figure 8). The analysis based on Gourinchas and Obstfeld does not highlight a particular change in growth in the wake of the introduction of controls.

The probability that a crisis may start (or continue) increases – at least temporarily – after interest rate controls are introduced (Figure 9).

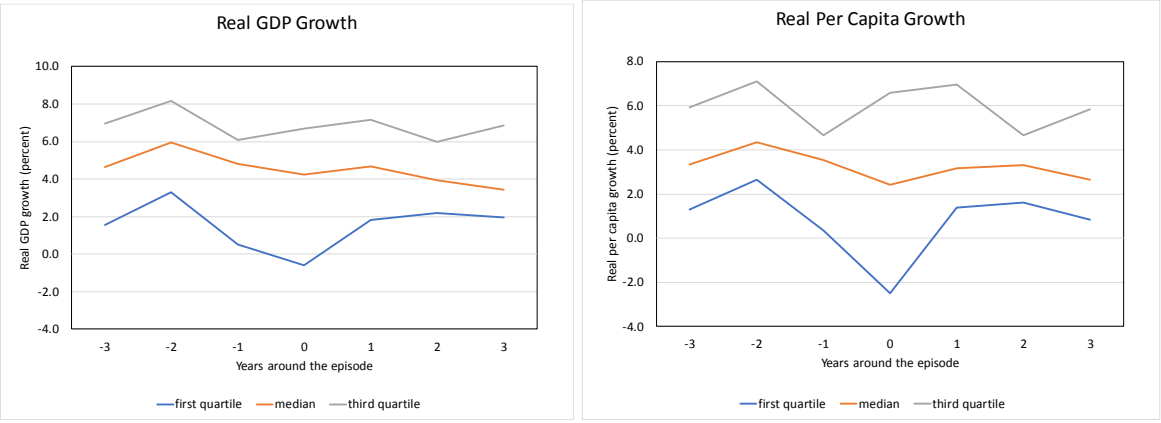
Table 5. Tightening Episodes: Before and After

(percent of GDP, unless otherwise indicated)

	Episodes of introduction of controls		Values outside episodes	
	Three preceding years	Three following years	Liberalized regime	Restricted regime
Real per capita growth (percent)	3.3	2.9	2.3	1.7
Net capital formation	21.4	22.4	22.0	20.0
Savings	20.7	20.5	21.7	18.9
Private sector credit	37.2	43.1	53.5	27.5
Net capital formation (real annual growth in percent)	8.1	7.2	40.4	1.9
Private sector credit (real annual growth in percent)	19.9	-2.3	8.3	14.5
Inflation (percent)	16.2	38.7	30.3	70.3
Probability of the start of a debt crisis (percent)	1.1	3.5	3.0	1.5
Percent of years in a debt crisis	5.7	8.2	11.1	4.4
Fiscal balance	-0.9	-1.2	-1.7	-1.1
Public debt	26.6	27.4	44.4	14.4
Current account balance	-1.5	-3.1	-1.3	-3.2
External debt	32.8	37.1	54.3	36.2
Per capita income (U.S. dollars)	3,927	4,951	14,807	2,410

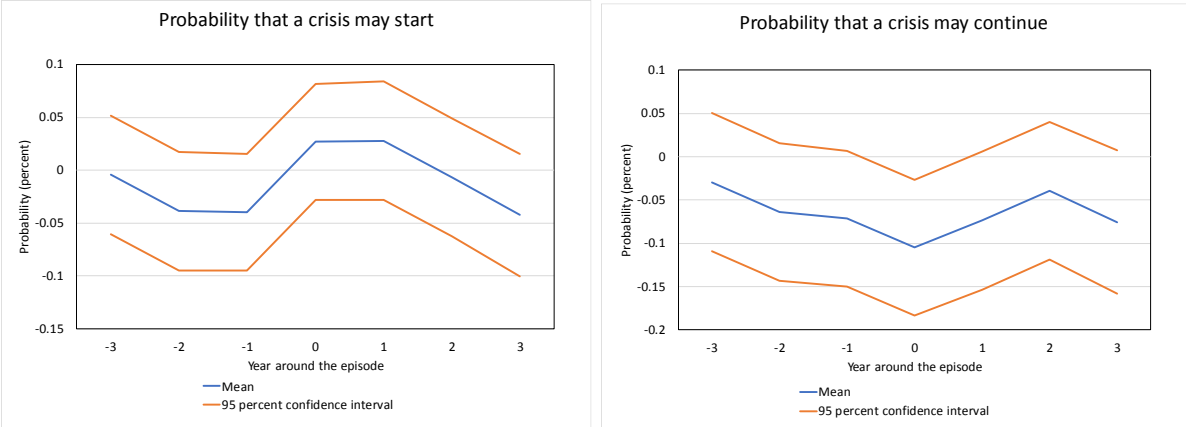
Source: Authors' estimates.

Figure 8. Economic Growth After the Introduction of Controls



Source: Authors' estimates.

Figure 9. Probability of Crisis (Around the Introduction of Controls)



Source: Authors' estimates.

D. Panel Data Analysis

In this section, we estimate the impact of financial liberalization on growth after accounting for the impact of other variables that are also likely to affect growth. Following an established practice,[16] we run an expanded growth regression on panel data, where the dependent index is annual per capita real GDP growth and the explanatory variables include, besides the variable of interest rate controls, factors such as the rate of growth in factor supply (capital, measured by the investment/GDP ratio, and labor, measured by population growth or growth in the labor force), as well as human capital (measured by years of secondary schooling) and macroeconomic variables that can affect short- or long-term growth dynamics (inflation, trade openness/trade balance, real interest rates, public and external debt).

More specifically, we estimate the coefficients of an equation of the form

$$y_{c,t} = a_c + \beta x_{c,t} + \gamma X_{c,t} + \varepsilon_{c,t}, \qquad (3.)$$

where $x_{c,t}$ is the key variable measuring interest rate controls (some lagged, differenced, or averaged value of FRI or IRC), $X_{c,t}$ is the set of control variables, c represents the jurisdictions, and t the time periods.

We consider different definitions of the key variable of interest rate controls that are all derived from the IRC index: (a) the FRI variable (a dummy representing full liberalization if equal to zero), lagged one year; (b) the average value of FRI in the preceding three years; (c)

[16] Among others, Achy (2003); Bekaert, Harvey, and Lundblad (2005); Ben Gamra (2009); Bussière and Fratzscher, (2008); Bonfiglioli and Mendicino (2004); Garita (2009); Lee and Shin (2008); McLean and Shreshta (2002); Rancière, Tornell, and Westermann (2006); Romero-Àvila (2009); and Tornell, Westermann, and Martinez (2004). See the metastudy compiled by Bumann, Hermes, and Lensink (2013).

the net change in FRI in the previous three years (capturing any change in recent years that resulted in full liberalization, or the loss thereof); and (d) the net change in the IRC variable in the preceding three years (capturing any easing or tightening of restrictions, including but not limited to full liberalization). We also consider interaction terms of the FRI variable (lagged one year) with other variables that may have constituted important channels through which financial repression may have affected growth: broad money (as an indicator of the size of the banking sector), external debt (as a measure of the country's external vulnerability), and public debt (capturing the use of financial repression as a tool to enhance the mobilization of seigniorage).

Results

Estimates obtained from the entire sample suggest that the presence of interest rate controls (IRC index below 3, or FRI equal to 1) has a significant adverse impact on growth, even after controlling for other explanatory factors (Table 6). Interest rate controls reduce growth, on average, by 0.6-0.7 percentage points, which is equivalent to 28-33 percent of the average growth rate of the entire sample (2.1 percent; columns 1-3). Liberalization (or its opposite, the introduction of controls) in the previous three years has a milder impact (about 0.5 percentage points; column 4), suggesting – as might be expected – that the full impact of these changes is felt with a significant lag. Still, the impact that is manifested within three years accounts for about two-thirds of the total. The tightening or easing of restrictions in general (i.e., net change in the IRC index; column 5) does not appear to have a significant impact, suggesting that a change between the presence and absence of restrictions is more important than a change between different degrees of restrictions.[17] [18]

Most of the other explanatory variables have the expected sign. The significant negative value of the crisis dummies signals that GDP growth is on average 2 percentage points lower at times of crises. Inflation has (predictably) an adverse impact on growth, while the negative coefficient (above -1) of population growth shows that, while the rate of growth of the labor force contributes positively to growth, this contribution is significantly lower than the rate of growth of the population, even though population growth is generally higher in high-growth economies. Investment, trade openness, and fiscal balance have the expected positive impact on growth, while external debt has a negative impact.

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[17] The explanatory power of these models is comparatively low (high R^2 values are often obtained either by including a large number of dummy variables or by compressing the number of observations using five-period averages), and the results should be interpreted with the cautionary reminder that a significant coefficient on the variable of interest could, in fact, be capturing the effects of other important, omitted variables.

[18] One problem with this type of estimates is that the direction of causality is not clear a priori. Causality could run in both directions: while financial repression is likely to affect growth, growth may in turn affect the likelihood that a country may adopt, maintain, or change a particular regime of restrictions (or introduce liberalization). Indeed, Granger causality tests suggest the possibility that causality could run in both directions. Lagged values of per capita growth (especially the second and fourth lag) appear to have a significant impact on the FRI value, and their joint significance is not rejected at the 2 percent confidence level (see Appendix V, Table A.V.2). The results should thus be interpreted with caution.

Table 6. Panel Data Estimates (Entire Sample, Fixed Effects, 1973-2017)

VARIABLES[1]	(1) Basic	(2) Lagged FRI	(3) FRIante	(4) FRId3	(5) IRCd3	(6) FRI*money	(7) interactions
FRI (lagged)		-0.6485***				-0.4268	-0.4193
		(0.2017)				(0.2951)	(0.3675)
FRIante (average FRI in preceding 3 years)			-0.6689***				
			(0.2146)				
FRId3 (net change in FRI in the past three years)				-0.4621**			
				(0.2303)			
IRCd3 (net change in IRC in the past three years)					0.1015		
					(0.1064)		
FRI*money						-0.0048	-0.0077
						(0.0047)	(0.0049)
FRI*external debt							-0.0009
							(0.0040)
FRI*public debt							0.0105**
							(0.0052)
Debt crisis	-2.0014***	-2.0682***	-2.0553***	-2.0340***	-2.0159***	-2.0519***	-2.0241***
	(0.2586)	(0.2590)	(0.2588)	(0.2590)	(0.2590)	(0.2595)	(0.2596)
Inflation	-0.0058***	-0.0057***	-0.0057***	-0.0058***	-0.0058***	-0.0057***	-0.0057***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Population growth (percent)	-0.9705***	-0.9342***	-0.9285***	-0.9750***	-0.9733***	-0.9425***	-0.9122***
	(0.0975)	(0.0980)	(0.0983)	(0.0975)	(0.0976)	(0.0983)	(0.0994)
Fixed capital formation	0.1677***	0.1677***	0.1678***	0.1674***	0.1674***	0.1711***	0.1659***
	(0.0148)	(0.0148)	(0.0148)	(0.0148)	(0.0148)	(0.0151)	(0.0153)
Fiscal balance	0.1874***	0.1854***	0.1848***	0.1883***	0.1875***	0.1839***	0.1880***
	(0.0235)	(0.0235)	(0.0235)	(0.0235)	(0.0235)	(0.0235)	(0.0237)
Public debt	0.0089***	0.0067**	0.0065**	0.0090***	0.0090***	0.0072***	0.0021
	(0.0027)	(0.0027)	(0.0028)	(0.0027)	(0.0027)	(0.0028)	(0.0034)
Openness	0.0370***	0.0359***	0.0358***	0.0371***	0.0371***	0.0359***	0.0346***
	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0048)	(0.0049)
FDI (average of previous three years)	-0.0729**	-0.0593*	-0.0586*	-0.0738**	-0.0740**	-0.0583*	-0.0560*
	(0.0304)	(0.0306)	(0.0307)	(0.0304)	(0.0304)	(0.0307)	(0.0308)
External debt (percent of GDP)	-0.0058***	-0.0056***	-0.0055***	-0.0059***	-0.0058***	-0.0060***	-0.0057***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0018)
Real interest rate on bonds	-0.0031	-0.0059	-0.0058	-0.0037	-0.0030	-0.0063	-0.0069
	(0.0291)	(0.0291)	(0.0291)	(0.0291)	(0.0291)	(0.0291)	(0.0292)
Stock of money (annual growth in percent)	0.0066***	0.0066***	0.0066***	0.0066***	0.0066***	0.0065***	0.0066***
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Stock of money (percent of GDP)	-0.0418***	-0.0432***	-0.0435***	-0.0413***	-0.0415***	-0.0429***	-0.0454***
	(0.0043)	(0.0043)	(0.0044)	(0.0043)	(0.0043)	(0.0044)	(0.0046)
Constant	-0.5561	-0.1109	-0.0828	-0.5852	-0.5798	-0.1871	-24.7658
	(0.4408)	(0.4613)	(0.4656)	(0.4408)	(0.4415)	(0.4672)	(20.4547)
Observations	2,880	2,880	2,880	2,880	2,880	2,880	2,880
R-squared	0.1935	0.1965	0.1963	0.1947	0.1938	0.1968	0.1986
Number of jurisdictions	86	86	86	86	86	86	86
r2_w	0.193	0.196	0.196	0.195	0.194	0.197	0.199
r2_b	0.216	0.202	0.201	0.216	0.217	0.193	0.186
r2_o	0.148	0.145	0.144	0.149	0.148	0.142	0.140

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[1]See Appendix III for variable description.

Source: Authors' estimates.

Public debt appears positively correlated with growth, while net foreign investment is negatively correlated. Among the monetary variables, the money/GDP ratio (a measure of the size of the banking sector) is adversely correlated with growth, but the growth rate of money is positively correlated. While an expansionary monetary policy boosts growth, a large financial sector is associated with a lower growth rate. The latter result may reflect the fact that more developed economies (which typically have a larger financial sector) generally have higher per capita GDP and lower growth. Among the interaction terms, only that with public debt appears statistically significant (column 7). These estimates explain 19-20 percent of the within-country variance of the dependent variable, and about 14-15 percent of the variance of the entire sample. Interest rate controls explain about 0.3-0.4 percent of the variance (about 1.5-2 percent of the explained variance).

The relation between financial repression and growth appears to have grown stronger since the early 1990s (Table 7). This observation may reflect the large wave of liberalization that took place around those years: before that, as only a few jurisdictions had fully liberalized regimes, there may have been too little cross-country variation to highlight the impact of repression on growth. In any case, the data confirm that, at least in the past couple of decades, controls on interest rates were associated with lower real GDP growth by about 0.8 percentage points.

The link between financial repression and growth also appears to have been strongest, and most significant, in countries in the SSA and MENA regions, and in countries that experienced a transition from a planned to a market economy.

Table 7. Impact of Financial Repression on Growth—FRI Coefficient by Period

Sample	Before	After
1990	0.285	-0.816 ***
1995	-0.064	-0.777 **
2000	-0.537	-0.802 *

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

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However, in these countries, the coefficients may also be capturing the effects of other concomitant economic reforms (Table 8). Accordingly, we added to the set of explanatory variables selected indicators of institutional quality taken from the World Bank's World Governance Indicators (WGI) database. This reduced the number of observations and the sample period because these variables are only available from 1984. Since 1984 also marks the start of the big wave of liberalization, this loss of data reduces the variability in the sample of the explanatory variable of interest, weakening the significance of the results. The estimated coefficients of the financial repression variable remain negative and generally significant (Table 9). Nonetheless, these results should be interpreted with caution since there is significant correlation between FRI and some of these added variables.

Table 8. Impact of Financial Repression on Growth—FRI Coefficient by Region[19]

Sample	FRI (average of the previous three years)	Lagged FRI	FRI*money/GDP
All sample	-0.069 ***	-0.427	-0.005
SSA/MENA	-1.113 **	-0.924	-0.005
Transition	-3.167 ***	-5.210 ***	0.077 ***
Non transition	-0.353 *	0.208	-0.015 ***
EUR/advanced	-0.502	-0.413	0.006
Asia	0.390	1.538 ***	-0.023 ***
LAC	-0.039	0.240	-0.017

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

Table 9. Impact of Financial Repression on Growth—Controlling for Institutional Variables

Variable	Control of corruption	Law and order	Bureaucratic quality	Democratic accountability	Voice and accountability
FRI (lagged), without interaction term	-0.651 ***	-0.176	-0.494 **	-0.352	-0.634 ***
FRI (lagged), with interaction term	--	-0.078	-0.761 **	-1.064 ***	-0.656 ***
Interaction term	--	-0.042	0.183	0.254 ***	-0.186
FRIante (average FRI in preceding 3 years)	-0.673 ***	-0.148	-0.488 **	-0.328	-0.655 ***
FRId3 (net change in FRI in the past three years)	-0.461 ***	-0.390 *	-0.486 **	-0.466 **	-0.453 **

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates obtained also using data from the WGI and from the International Country Risk Guide, The PRS Group, Inc., www.prsgroup.com.

Transmission Channels

Through what channels does the relation between financial repression and growth mainly operate? To address this question, we run similar regressions replacing real per capita GDP growth, the left-side variable, with variables that determine real GDP growth (according to the existing literature), such as savings, investment, private sector credit, and total factor productivity.

The results (Table 10) highlight that (a) the share of savings in GDP is significantly negatively related to the presence of interest rate controls (first and second row), but not to

[19] "Asia" does not include Japan and Korea and "EUR" does not include France, Germany, Italy, and the United Kingdom; these countries are included in the group of advanced economies, which also includes Canada and the United States. "EUR" also does not include any of the "transition" countries. "Transition" economies include Albania, Azerbaijan, Belarus, the Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, the Kyrgyz Republic, Latvia, Lithuania, Poland, Romania, Russia, Ukraine, Uzbekistan, and Vietnam.

changes in regime that occurred in the past three years (third row); (b) private sector credit (both in percent of GDP and in terms of real annual growth) is negatively related to financial repression *and* to a recent removal of interest rate controls (FRId3) or easing of restrictions (IRCd3); and (c) the growth in total factor productivity is adversely related to the presence of interest rate controls, but not to a change in interest rate regime. How can one interpret these results? One possibility is that while interest rate controls hurt growth in the long term by reducing savings and private sector credit – and by distorting its allocation toward less productive investments (thereby hurting total factor productivity growth) – in the medium term (1-3 years) an easing of restrictions may not yet have a visible positive impact on savings and may even have a temporary adverse impact on private sector credit. Overall, however, the impact of an easing of interest rate controls on growth may still be positive (possibly, through higher total factor productivity).

Table 10. Transmission Channels

Variable	Savings (percent of GDP)	Private Savings (percent of GDP)	Private sector credit (percent of GDP)	Private sector credit (real annual growth)	Total factor productivity
FRI (lagged)	-0.660 **	-0.824 ***	-3.041 ***	-0.145 *	-0.006 **
FRIante (average FRI in preceding 3 years)	-0.741 **	-1.036 ***	-5.334 ***	-0.141	-0.006 **
FRId3 (net change in FRI in the past three years)	-0.054	0.434	6.940 ***	-0.035	-0.003
IRCd3 (net change in IRC in the past three years)	0.130	-0.116	-3.340 ***	0.139	0.000

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

Robustness Analysis

To check the robustness of the previous results, we run a series of estimations using additional variables, methods, procedures, and data sets (Appendix IV). These analyses broadly support the conclusion that interest rate controls reduce growth significantly.

First, we compared fixed effects estimates with estimates obtained using fixed and time effects, random effects, and using a dynamic model that includes one or two lags of the dependent variable (applying the Arellano-Bond procedure). The various estimation techniques reveal a qualitatively similar picture, although the coefficients and statistical significance of different indicators of financial repression vary across methods.

We also run estimates using five-year averages instead of annual data, and an alternative regression, using Penn World Tables data, relating real GDP growth to the real growth rates in physical and human capital, and growth in the labor force, plus their interactions with the index of interest rate controls. Finally, we estimated the relation between financial repression and growth using a "treatment effect" matching model, whereby the effect of interest rate controls is estimated by comparing the difference in real per capita growth within pairs of

otherwise similar observations. The results are not qualitatively different, although their statistical significance varies (see Appendix IV for details).

E. Analysis of the Probability of Crisis

Financial repression may also affect growth indirectly by altering the stability of the economy and hence the probability that it could, at some point, experience a crisis. Thus, financial repression has an impact on the probability of crisis and an indirect impact on per capita growth. This effect has been analyzed empirically (e.g., Lee and Shin 2008; Rancière, Tornell, and Westermann 2006). Following the methodology used in these studies, we apply probit panel data methods to estimate the impact of financial repression on the probability that a country may experience a debt crisis. These estimates are then combined with those obtained in the growth regressions (discussed in the previous section) to estimate both the direct effect of financial repression on growth and its indirect effect on growth through its impact on financial stability.

Unlike linear regressions, the coefficients returned by probit estimates do not represent the marginal impact of the explanatory variable on the dependent variable. Instead, they represent its impact on a "latent variable," which is used as the argument of a cumulative standard normal distribution to estimate the probability of a "positive" outcome. It is thus not possible to estimate the indirect impact of financial stability on growth by merely multiplying the probit coefficients by the "crisis" coefficients in the growth regression. We proceeded in two separate ways:

(a) we estimated the "marginal effect" of the financial repression variable in the probit equation by applying the coefficient to the average values of the variables, and then multiplying this value by the "crisis" coefficient to derive an estimate of the average marginal impact;

(b) we estimated the impact of financial repression on the estimated probability of crisis *in each observation* by computing the difference between the estimated probability of crisis and the probability that would be estimated by the model if the financial repression variable were zero and all other variables remained the same; the estimates thus obtained were then used as additional variables in the growth regression.

The probit equations relate the probability of a crisis to the same macroeconomic variables included in the growth regression discussed above, but also include a financial stability variable (the ratio of liquid assets to total assets of the banking sector) as well as per capita income in the initial year. The equations also include the average real GDP growth rate of the previous three years, which in turn may have been affected by the presence of interest rate controls; hence, the effect of the presence of interest rate controls captured by the equation is only the direct effect on the probability of a crisis, *net* of any indirect effect through its impact on growth.

All explanatory variables in this model appear to have a significant impact on the probability of crisis, generally with the expected sign, except for the current account balance (which has a positive sign, but is not significant; see Appendix V, Appendix Table V.3). Growth in the

previous three years appears to have a significant negative statistical relation with the probability of a crisis, suggesting that the probability of a crisis increases after cyclical downturns. The model predicts crises correctly in 92 percent of the cases: a crisis occurs in more than one-half of the cases when it is "predicted" (with an estimated probability above 50 percent), and in 8 percent of the cases when it is not (compared with an unconditional probability of 8.4 percent (Table 11).

Table 11. Probability of Crisis

(In percent)

		FRI			IRC
Measure of financial repression	**None**	**Lagged**	**Average of previous three years**	**Net change in previous three years**	**Net change in previous three years**
Unconditional probability of crisis	8.4	8.4	8.4	8.4	8.4
Crisis occurs when predicted	50.0	53.6	53.6	50.0	50.0
Crisis occurs when not predicted	7.9	8.0	8.0	7.9	7.9
Share of accurate predictions	91.6	91.6	91.6	91.6	91.6

Source: Authors' estimates.

Adding indicators of financial restriction to the basic equation improves its predictive power, increasing the model's (limited) capacity to predict a crisis as well as the accuracy of a positive prediction. Except for the average cumulative value, all financial restriction indicators have a significant impact on the probability of a crisis. Remarkably, this impact is negative: the presence of financial restrictions *reduces* the probability that a country may be in crisis in a given period. A change in regime has a less significant impact, but` full interest rate liberalization increases the probability of a crisis (Table 12).

Table 12. Probit Panel Data Results

(In percent)

	FRI			IRC
Measure of financial repression	**Lagged**	**Average of previous three years**	**Net change in previous three years**	**Net change in previous three years**
Average probability of a debt crisis	8.4	8.4	8.4	8.4
Average value of the financial repression indicator	0.422	0.437	-0.047	0.158
Probit coefficient	-0.603 ***	-0.593 ***	-0.241 *	0.082
Average estimated probability of a debt crisis	3.26	3.25	3.24	3.24
Marginal effect	-0.010	-0.010	-0.005	0.002
Average impact	-0.010	-0.011	0.001	0.001
Average impact in a debt crisis	-0.011	-0.013	0.003	0.002
Average impact outside debt crises	-0.010	-0.011	0.001	0.001

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

Impact of Financial Repression on Debt Crises

The coefficient of financial repression in the Probit equations for a debt crisis is significant and *negative*, suggesting that financial repression (as measured by the FRI index) could reduce the risk of a crisis. This result can be compared with the findings of Lee and Shin (2008) and Rancière, Tornell, and Westermann (2006), who found that financial repression *reduces* the risk of a *financial* crisis. A change in the FRI value in the previous three years (full liberalization, or the introduction of controls) also appears with a significant coefficient of the same sign, but of lower magnitude and at a lower confidence level, while a more general change in the interest control regime does not exhibit a significant coefficient.

The impact of financial repression on the probability of a debt crisis can be quantified in two ways: through the *marginal effect* of the financial repression index (computed at the average value of all the other variables in the sample) and as the *average impact* of the financial repression variable across all individual observations.[20] Both estimates suggest that financial repression could have reduced the probability of a debt crisis (compared to a case where the financial repression variable were equal to zero) by about 1 percentage point.

One way to estimate the indirect effect of financial repression on growth is to multiply the average impact thus estimated by the coefficients of the "crisis" dummy in the growth regressions. These estimates suggest that the indirect effect (through the impact on the risk of a debt crisis), while positive, would have been comparatively small: a change in the value of the dependent variable by one unit (in the case of the FRI dummy, from 0 to 1 or from 1 to 0) would have changed per capita growth in the same direction by about 0.02 percentage points, weakening only marginally the estimated direct effect of 0.6-0.7 percentage points in the opposite direction (Table 13, third and fourth row). In other words, while financial repression seems to have a positive impact on growth by improving economic stability (at least in the short term), this effect is much weaker than the opposite, direct, negative effect on growth. These estimates imply that, in the sample, financial repression may have reduced real per capita growth, on average, by 26-27 basis points (Table 13, last row).

[20] Formally, the *marginal effect* is computed as equal to $b*f(ax^{ave} + b*FRI^{ave})$, where a and b are the estimated coefficients of the Probit equation and FRI^{ave} and x^{ave} are the average values of the FRI variable and the other explanatory variables. The *average impact* is computed by calculating the average across the sample of $\Phi(\alpha x+b*FRI) - \Phi(\alpha x)$ estimated for each observation, where Φ is the cumulative density function of a standard normal distribution.

Table 13. Probability of Crisis—Cumulative Effects on Growth

Measure of financial repression	FRI			IRC
	Lagged	Average of previous three years	Net change in previous three years	Net change in previous three years
Debt crisis coefficient[1]	-2.068 ***	-2.055 ***	-2.034 ***	-2.016 ***
Average impact	-0.010	-0.011	0.001	0.001
Indirect effect	0.021	0.023	-0.002	-0.002
Direct effect[1]	-0.649 ***	-0.669 ***	-0.462 **	0.102
Total marginal effect	-0.628	-0.646	-0.464	0.100
Total effect computed on sample averages	-0.263	-0.280	0.019	0.015

Source: Authors' estimates.

Source: Authors' estimates.

As an alternative approach, the indirect effect of financial repression on growth can be estimated by augmenting the growth regression with the impact of financial repression on the risk of crisis estimated for each observation, using the estimates returned by the Probit regression. This method was used, for instance, by Rancière, Tornell, and Westermann (2006).[21]

More specifically, using the estimated coefficients α and β of the Probit regression, we compute, for each observation, the auxiliary variable $z = \Phi(\alpha x+bI) - \Phi(\alpha x)$, where I is the indicator of financial repression (lagged FRI, FRIante, FRId3, IRCd3), x the other control variables included in the regression, and Φ the cumulative density function of a standard normal distribution. We then add this variable in the growth regression, together with a financial repression variable (to capture the direct effect) and a crisis dummy (to capture the effect of crises not caused by financial repression).

The resulting estimates suggest that financial repression may have reduced growth, on average, by 17-18 basis points (Table 14, last row), of which 11-12 basis points may have been due to the indirect effect through a higher risk of debt crisis (Table 14, row 7).

These results, however, should be interpreted with care owing to the uncertainty about the direction of causality and the possibility of feedback effects. Note that these results, which show the *estimated average impact in the sample*, are comparable with those in the last row of Table 13, which imply a loss of 26-27 basis points. Unlike in Table 13, in these estimates the indirect effect dominates. Indeed, the direct coefficient of the financial repression

[21] Rancière, Tornell, and Westermann (2006) included in the growth regression the *hazard rate* estimated through the Probit regression, which measures the proportional impact of a marginal change in the "latent" variable on the probability of the actual state of each observation (crisis or not crisis); formally, the hazard rate is equal to $\phi(\alpha x+bI)/\Phi(\alpha x+bI)$ when the crisis dummy is equal to 1 and to $-\phi(\alpha x+bI)/(1-\Phi(\alpha x+bI))$ when the crisis dummy is equal to 0. Statistically, the addition of the hazard rate aims at obtaining consistent estimates in the growth regression (Rancière, Tornell, and Westermann 2006); the economic significance of this addition is however unclear; when it is included in our model, its coefficient is not statistically significant and it does not change the other results. In this paper, we used instead the estimated impact of financial repression as discussed in the text.

variable becomes statistically insignificant when the indirect impact is added in the equation (Table 14, row 1).

Table 14. Estimates of Direct and Indirect Effects (Excluding Hazard Term)

Equation	FRI			IRC
	Lagged	Average of previous three years	Net change in previous three years	Net change in previous three years
Financial repression indicator	-0.156	-0.147	-0.416	0.056
Estimated impact from the Probit model	10.92 ***	11.043 ***	6.398	30.099 *
Debt crisis dummy	-1.909 ***	-1.892 ***	-1.887 ***	-1.883 ***
Average value of the financial repression indicator	0.419	0.433	-0.040	0.148
Average estimated impact from the Probit model	-0.010	-0.011	0.001	0.001
Average estimated direct impact	-0.065	-0.064	0.017	0.008
Average estimated indirect impact	-0.109	-0.121	0.006	0.030
Average total impact	-0.175	-0.185	0.023	0.038

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

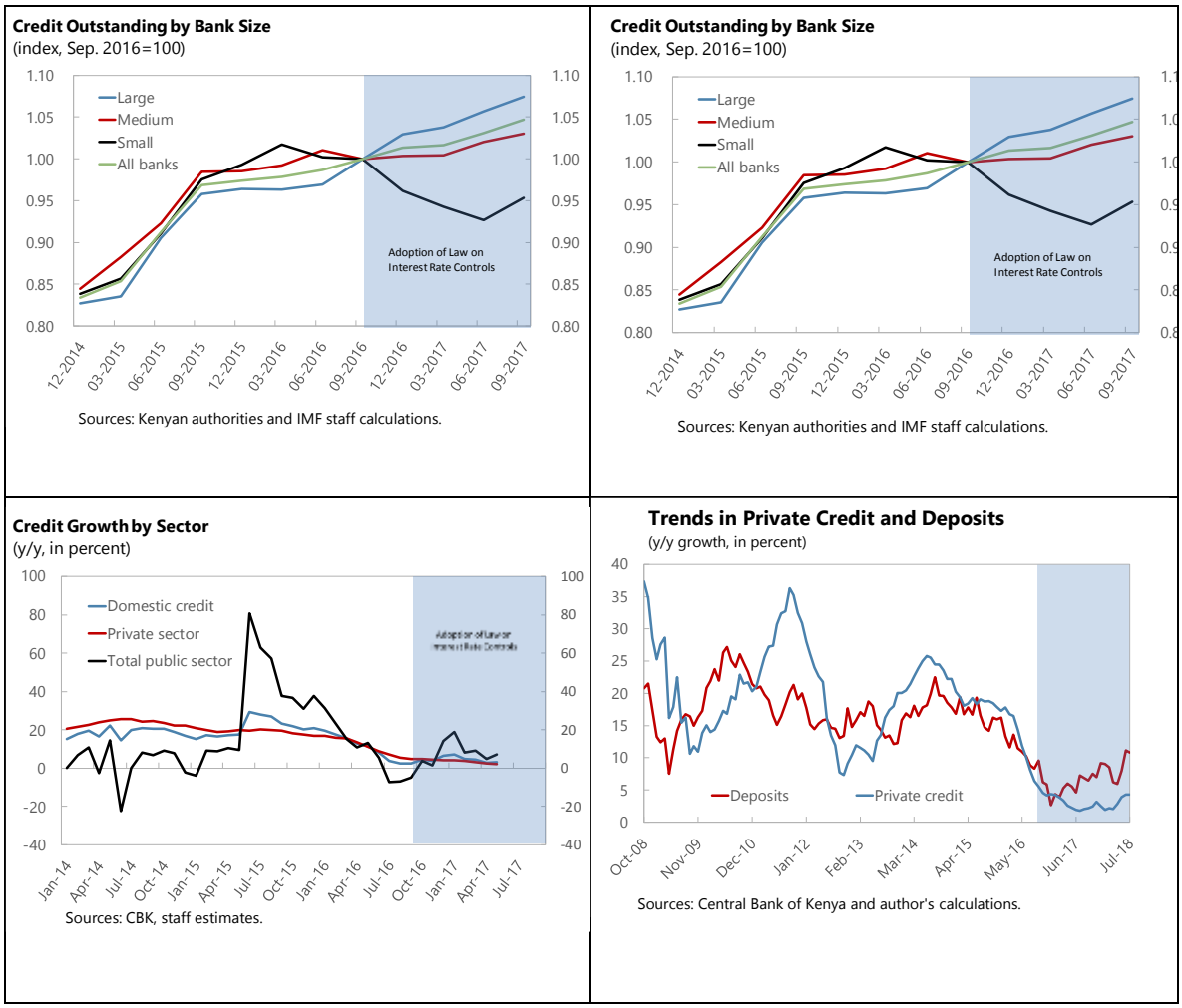
IV. CASE STUDIES

In this section, we investigate the experiences of Kenya and Bolivia in applying interest rate restrictions. While there were some similarities in the applied measures, the results are somewhat different.

In September 2016, Kenya reintroduced interest rate controls aimed at reducing the cost of borrowing, expanding access to financial services, and increasing the return on savings. The relevant law imposed: (1) a ceiling on lending rates offered by "banks or financial institutions" at 4 percent above a reference rate, and (2) a floor on interest rates for time deposits, equal to 70 percent of the reference rate. Alper *et al.* (2019) and Safavian and Zia (2018) document that this policy has induced substantial changes in the lending behavior of banks:

- *A sharp decline in bank credit to micro-, small-, and medium-sized firms.* For example, the stock of credit to SMEs fell by about 10 percent in just one year (Figure 10, left upper panel). On the other hand, banks shored up other types of borrowers, with lending to corporates and households continuing to increase at rates prevailing before the introduction of the controls. This shift might signal that banks, unable to properly price their lending, reallocated their loans toward less risky borrowers.

Figure 10: Kenya: Selected Financial Indicators



Source: Taken from Alper *et al.* (2019).

- *A reduction in lending activity and profitability of small banks.* The stock of credit of small banks declined by about 5 percent within a year of the controls (upper right panel). Reflecting larger exposures of small banks to higher-risk/higher-return borrowers (in relative terms), smaller banks' margins and profitability were affected the most.

- *A shift of credit away from the private sector and toward the public sector* (an example of credit diversion induced by financial repression). As lending to the public sector implies less risk for similar rates, banks increased their exposures to the public sector (lower panel).

- *A shift from time deposits to demand deposits.* This probably reflected banks' desire to restrain their costs while their lending rates were constrained. Nevertheless, Alper *et al*. (2019) explain that "average profit margins on private sector lending activities declined further and turned negative."

- *The policy appears to have contributed to the cyclical increase in non-performing loans by incentivizing banks to issue short-term loans* (Safavian and Zia 2018).

The law is currently being revised. Specifically, on March 14, 2019, the Nairobi High Court ruled that the legislation establishing interest rate controls was unconstitutional, calling the legislation "vague, imprecise, ambiguous, and indefinite." It gave the National Assembly 12 months to reconsider the law's provisions, during which time interest rate controls remain in place.

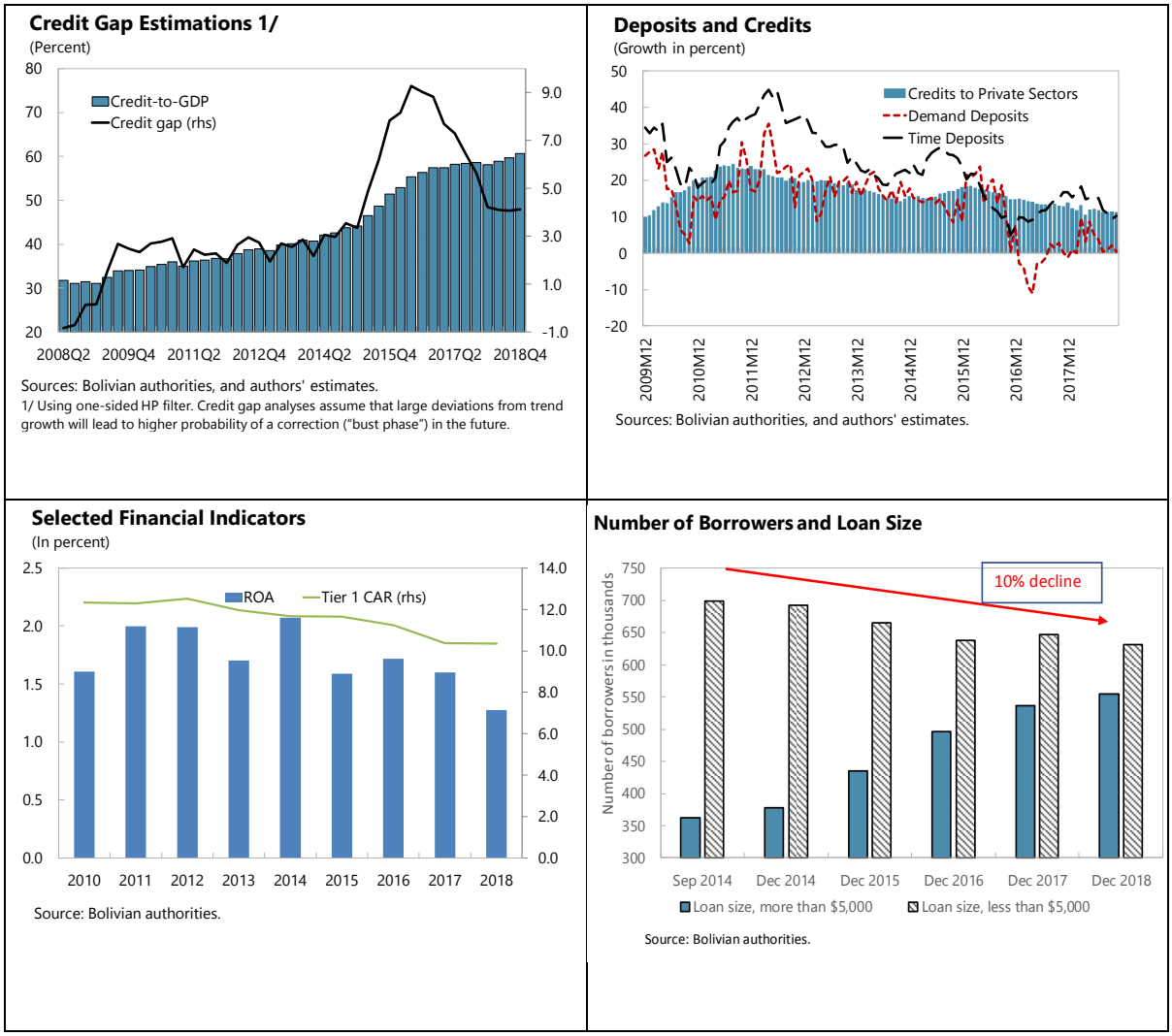
In Bolivia, the 2013 *Financial Services Law* was designed to promote financial inclusion and preserve financial stability. While the law included many positive reforms, such as strengthening crisis management and resolution, it included provisions to regulate lending rates, set lending targets to the productive sectors[23] and social housing, and granted discretionary powers to set floors on deposit rates for savings accounts and fixed-term deposits that do not exceed Bs.70,000 (about $10,000). Implementing decrees introduced ceilings on lending rates in specific sectors, such as social housing (5.5–6.5 percent), loans to the productive sectors (6–7 percent), and microfinance (11.5 percent). Furthermore, full-service banks were directed to commit at least 60 percent of their loan portfolios (50 percent for small and medium enterprises) to social housing and to the productive sectors by the end of 2018.

These requirements led to rapid credit growth in 2015-17 as banks moved to accelerate lending to meet the quotas (Figure 11, upper left panel). While growth in credit to the productive sectors and social housing has remained strong, even after banks met the quota targets, total credit growth has been moderating toward its trend levels. Meanwhile, bank profitability ratios (earnings on assets and equity) have been declining as spreads are squeezed by the interest rate controls. Declining profitability and rapid credit growth, in turn, have led to declining capital adequacy ratios (offset, to some degree, by a requirement that banks retain at least 50 percent of their profits to increase capital). Ratios, however, still appear adequate (lower left panel). While non-performing loans are low and well-provisioned at the moment, recent increases in the share of restructured loans to total loans suggest a need for continued monitoring of the quality of assets (see IMF 2018).

Paradoxically, interest rate controls may reduce access to financing for some small borrowers. For example, the number of borrowers of less than $5,000 decreased by 10 percent from September 2014 to June 2018, and average loan amounts increased (Figure 11, the lower right panel). These suggest that some small borrowers may become excluded from the formal financial system as banks try to increase the share of larger-size loans to the productive sectors.

[23] Productive sectors are defined broadly as non-service sectors, including agriculture, mining, and manufacturing. The tourism sector and intellectual property were added in a 2015 modification to the law. The floor under interest rates applies to 98 percent of bank accounts, which represent only 11 percent of total deposits.

Figure 11. Bolivia: Selected Financial Indicators



Sources: Bolivian authorities, IMF Staff Reports, and authors' estimates.

V. CONCLUSIONS

Financial repression represents a quasi-fiscal operation, where some agents are effectively taxed to finance the pursuit of a public objective. Like all other quasi-fiscal operations, it is rational only if its benefits exceed the costs, and if the costs are lower than under other alternatives.

As illustrated by our stylized model of financial intermediation, the costs of financial repression arise from the various distortions it generates. First, financial repression can compress the rate of return for savers, leading to a suboptimal savings rate, thereby reducing the funds available for investment and hindering financial intermediation, and reducing access to financing. At the same time, by reducing the interest rate charged on loans, it increases demand for credit, leading to rationing based on non-economic criteria, which in

turn results in inefficiencies. If additional costs are placed on banks by putting a floor under deposit rates, this would reduce bank profitability and capacity to increase capital adequacy ratios, and could eventually lead to higher financial stability risks. Second, the analysis shows that, by weakening price signals, financial repression also distorts the allocation of investment, reducing its average quality and rate of return. Third, by awarding rents to a limited number of beneficiaries, it encourages wasteful rent seeking, which may take illegal forms (such as corruption).

These costs have an adverse macroeconomic impact. Our empirical analyses suggest that, on average, financial repression reduces growth by about 0.4-0.7 percentage points. The results are robust to different growth models and are more significant in recent decades after many jurisdictions liberalized their financial sectors. However, the analysis finds that changes in interest rate restrictions short of full liberalization have a limited impact on growth, suggesting that to enhance growth significantly it is necessary to fully reform.

There are significant differences across regions. The effect appears to be the strongest in countries in Africa and the MENA region, in Latin America and the Caribbean, and in transition countries. In Asia and in advanced economies, the impact of restrictions on growth appears to be insignificant.

Alternative estimations using data from the Penn World Tables suggest that the negative impact of interest rate restrictions on growth is partly mitigated when there is a rapid accumulation of physical capital, but intensified when human capital is high. These effects appear significant in all regions except in advanced economies and other economies in Europe and Asia.

We also find that financial repression reduces the probability of a debt crisis in a given period, which indirectly affects growth positively. In fact, loosening restrictions but not liberalizing may increase the probability of a debt crisis. This argues for strengthening financial sector supervision before launching partial reforms. The indirect positive effect of restrictions on growth is dwarfed by the large direct adverse effects noted above.

The case studies suggest that interest rate controls may disrupt financial stability and may reduce access to financing for small enterprises. In Kenya, banks reduced sharply their lending to micro-, small-, and medium-sized firms while shoring up their corporate clients. Furthermore, the policy appears to have contributed to the cyclical increase in non-performing loans by incentivizing banks to issue short-term loans. In Bolivia, credit growth accelerated rapidly for consecutive years as banks sharply increased lending to the productive sectors and social housing. This raises concerns about asset quality that could emerge in coming years. In addition, interest rate controls reduced bank profitability ratios. While capital adequacy ratios appear adequate at the moment, they have been declining. Non-performing loans have remained at low levels, but the rate of increase in restructured loans has risen. These factors suggest the need for close monitoring of the quality of assets. There are also signs that some small borrowers may have been rationed out. This would have an adverse impact on financial inclusion despite authorities' intention to enhance access to financing.

On balance, restrictions have a significant adverse effect on growth. They are likely to reduce access to financing, and, under some circumstances, may lead to financial stability issues. Altogether, in the long term, countries would be better-off without financial repression.

APPENDIX I. Review of the Literature[24]

Economic views on financial repression have evolved over time. Five broad periods stand out: during the 1960s, economists focused on the nexus between finance and growth; the 1970s saw the diffusion of the "McKinnon-Shaw" approach and paradigm; during the 1980s, the experience with early attempts at liberalization spurred a variety of critiques; while in the 1990s research on endogenous growth brought renewed support for liberalization. The most recent studies (since 2000) focused mainly on testing these relations empirically.

A. The 1960s: Early Literature on the Finance and Growth Nexus

During the 1960s, economists' views on financial repression were based on the then-dominant Keynesian approach, based on the theoretical constructs of Keynes (1936) and Tobin (1965), favoring an active, interventionist role for the government in the economy, including in the credit market. Against this framework, many governments adopted (or maintained) controls on interest rates, the supply and composition of credit, and other financial variables, with the aim to support investment and growth through artificially low interest rates. These interventions reflected Keynes' view that efficient markets were not necessarily effective, and that a distinction should be made between capital used for productive purposes and capital used for speculation. Proponents of this view said the experience of the Great Depression had shown that the latter (speculation) had been excessive and the former (productive purposes) inadequate. Keynes also emphasized the distinction between risk (that can be quantified) and uncertainty (that cannot), which contributes to weakening the efficiency of capital markets and private investment decisions.

In the post-war period, Keynesian arguments favoring financial repression became dominant, not only in academic circles, but also among policymakers. Initially, the focus was on reaching full employment; financial repression was also favored (for instance, in Britain) by the need to mobilize resources to repay the large post-war debt. The debate on the relationship between finance and growth was limited to practical and imminent policy implications, such as financing the investment needed to reconstruct the economy and relaunch industry after the devastations of the war. The banking sector provided capital and advice to entrepreneurs to drive these industrialization efforts.

In the 1960s, attention shifted more specifically toward growth. After Gerschenkron (1962), Patrick (1966) also focused on the causal relationships between finance and growth, identifying two distinct patterns, "demand following" and "supply leading," relating them to different stages of development. "Demand following" occurs when economic development generates a demand for financial services, which is passively satisfied by a growing financial sector. This demand is stronger when the variance in growth across sectors or industries is greater. The financial sector channels resources from traditional to modern sectors and promotes entrepreneurship in the latter. The "supply leading" pattern dominates at earlier stages of development when the financial sector takes the lead in providing capital to

[24] We are grateful to Mark Michalski (Catholic University of America and University of Maryland University College) for the precious research and collaboration in preparing this Appendix.

entrepreneurs to help develop growth-enhancing, modern industrial sectors. Initially the causality runs from finance to growth, but at later stages it runs from growth to finance. From a similar perspective, Cameron (1967) argued that financial systems can be both growth-inducing and growth-induced and stressed that the quality and efficiency of financial intermediation play a critical role in promoting growth, as they enable funds from risk-averse savers to flow to risk-prone entrepreneurs. By allocating savings more efficiently among entrepreneurs, and by reducing the dispersion of interest rates among users, regions, and over time, financial intermediation creates the possibility for a more efficient allocation of capital. This is most critical at the early stages of industrialization because it enables the mobilization into productive uses of an otherwise unproductive initial stock of wealth.

B. The 1970s: The McKinnon-Shaw Approach/Paradigm

The mainstream theories favoring financial repression were criticized in the 1970s by the so-called "McKinnon-Shaw school," following seminal studies by McKinnon and Shaw. (McKinnon referred mainly to developing countries whereas Shaw focused on more advanced economies with sophisticated financial systems). This school asserted that financial repression is harmful for long-run growth because it actually reduces the volume of funds available for investment. They define financial repression as the combination of indiscriminate nominal interest rate ceilings and high and accelerating inflation.

Building on the research on the finance-growth nexus of the preceding years, McKinnon (1973) and Shaw (1973) pioneered the critique of policies of financial repression. Shaw in particular emphasized the role of the financial sector in providing incentives to increase the volume of savings. McKinnon stressed the important role of government as a stabilizing agent as well as a potential catalyst of economic growth through consumption. Both economists argued that by removing interest rate ceilings and refraining from collecting seigniorage through inflation, governments could achieve higher savings and investment rates. They thus recommended that real interest rates should be allowed to reach their market clearing level. Many developing countries that followed their advice experienced significant improvements in growth, sometimes accompanied by an increase in real interest rate levels and volatility.

The McKinnon/Shaw paradigm emphasized that keeping nominal interest rates below market clearing values through financial repression would lead to two possible outcomes. First, if only the deposit rate is restrained, then the spread between lending and deposit rates widens, generating rents for financial intermediaries (banks) at the expense of depositors. The rents thus gained by the banks would, in turn, attract new entrants to the banking sector; hence, entry barriers to banking are likely to be raised. Second, ceilings on interest rates on loans generate rents for the (few) borrowers who can obtain credit at the reduced rates, leading to credit rationing – credit is allocated (to some extent, randomly) not on the basis of the expected return on investment but in accordance with other criteria, such as transaction costs, political influence, reputation, loan size, and even corruption, reducing the average efficiency of investment. Moreover, since the banks cannot charge adequately for risk, they become more conservative, investing, for instance, in "safe" government bonds rather than risky loans.

Several studies developed further the ideas promoted by McKinnon and Shaw. Mathieson (1980) and Fry (1980) showed that, when the authorities keep the deposit rate below the market clearing value, real money demand declines, reducing the availability of credit and real GDP growth. In the models of Kapur (1976) and Mathieson (1980) reserve requirements also play a role in reducing money demand by widening the spread between deposit and loan interest rates. Galbis (1977) developed a two-sector model to show how liberalizing interest rates can influence the *average* efficiency of investment. His model features a traditional sector with a low return on investment and a modern sector with a higher rate of return. If financial repression compresses interest rates on deposits, investment is directed mainly to the (self-financed) traditional sector, because banks cannot collect sufficient deposits to fund large investment in the modern sector. Allowing deposit rates to rise, instead, encourages the use of savings, through the intermediation of the banks, to finance investment in the modern sector. Since the modern sector is more productive, this change increases the average efficiency of investment.

In all these models, growth can be enhanced not by keeping interest rates artificially low to encourage investment, but by allowing the market to reach its equilibrium, in order to enhance savings and achieve an efficient allocation of investment. Moreover, these studies showed that financial liberalization would also reduce the short-term contractionary effects of monetary stabilization programs. The authors therefore recommended abolishing interest rate ceilings and directed credit, reducing reserve requirements, and promoting financial sector competition.

C. The 1980s: Critiques of Financial Liberalization Policies

The mixed results of early experiences with financial liberalization in the 1970s inspired the critique of the so-called "neostructuralist school," which criticized financial deregulation from a macroeconomic point of view. In the same period, a series of microeconomic studies promoted a more articulated view of the complexities of financial liberalization.

Taylor (1983) and van Wijnbergen (1982, 1983a, b) argued that, in the presence of "curb" (or unorganized) money markets, an increase in the real deposit interest rate may encourage a shift of assets from the unorganized to the formal credit market. Since the latter is subject to reserve requirements, this shift will produce a decline in financial intermediation. The authors also noted that high interest rates increase the propensity to save and can trigger cost-push inflation; both effects have an adverse impact on demand and short-term growth. The neostructuralist models, however, rest on the assumption that unorganized money markets are competitive, which may not be the case, and do not enhance investment efficiency. In contrast, the microeconomic critique focused on the link between asymmetric information, interest rates, and the selection of the most efficient investment projects.

Stiglitz and Weiss (1981) showed that disequilibria in the credit market may occur even in the absence of government intervention. Credit is inherently prone to the risk of adverse selection, as high market clearing interest rates would attract the riskiest investments while discouraging safer but less profitable investment projects. This risk is compounded by perverse incentive effects stemming from the fact that borrowers with limited liabilities (such as shareholders of joint-stock companies) are willing to undertake more risk when interest

rates are high. Consequently, when interest rates rise, lending becomes riskier. This may induce banks to refrain from raising rates to market-clearing levels, resulting in credit rationing and a preference for large loans. Mankiw (1986) developed these arguments further, showing that if banks are unable to achieve a minimum rate of return on their loans because the pool of applicants is too risky, the entire credit market can collapse, as raising interest rates would only worsen the situation.

These arguments have important policy implications. Since these adverse outcomes stem from intrinsic failures of the market allocation of credit, markets are not inherently efficient and a properly designed public intervention can in principle achieve a second-best efficient outcome.

A related strand of the literature emphasizes the role of banks in overcoming information asymmetries between lenders and borrowers. Diamond (1984) noted that assessing the creditworthiness of potential borrowers and the probability of success of their investment projects is costly for the lenders. These costs encourage delegation of monitoring to specialized intermediaries as well as diversification within each intermediary. As shown by Williamson (1987), these costs may also result in credit rationing in equilibrium, leading to an inefficient level and allocation of investment.

D. The 1990s: Finance and Endogenous Growth

In the 1990s research on the relationship between financial development and growth was inspired by the new theory of endogenous growth, which focuses on productivity as the key factor driving long-term growth. A branch of this stream analyzed whether financial conditions could explain sustained growth in per capita GDP. The central argument is that finance enhances aggregate investment efficiency, which offsets the structural/secular decrease in the marginal product of capital. Financial intermediation enables particularly innovative entrepreneurs to introduce innovations that enhance productivity. By screening borrowers, assessing the potential profitability of projects, pooling financial resources, and diversifying risk, a sound financial system increases the probability of successful innovation.

Bencivenga and Smith (1991) analyze the case where individuals uncertain about future liquidity needs may choose to hold a liquid, unproductive asset or an illiquid asset with high productivity and risk. Bank intermediation allows investors to finance illiquid growth-enhancing assets while maintaining liquid claims, thereby increasing the share of risky (and more growth-enhancing) assets in the overall portfolio.

In Berthélemy and Varoudakis (1996) the financial sector channels savings to more productive uses by collecting and analyzing information about investment opportunities. This induces an economic expansion that in turn increases the volume of savings. The expansion of the financial market induces more competition and technical efficiency through “learning-by-doing” effects. This virtuous cycle may generate a beneficial cumulative process but may also entail multiple equilibria: countries at low stages of financial development may remain trapped in a low growth equilibrium.

Is there thus scope for government intervention? Some studies argued against it, noting that distortions like deposit rate ceilings or high reserve requirements reduce the rate of innovation. Roubini and Sala-i-Martin (1992), for instance, focused on policies of financial repression aimed at generating seigniorage through inflation. Such policies force individuals to maintain large nominal money balances, which forms the base of the inflation tax. As a result, they have less wealth to invest in more productive assets.

Romer (1986) highlighted how investment promotes growth by facilitating the accumulation of knowledge. Since this process is affected by positive externalities, government intervention aimed at subsidizing investment can lead to a socially more efficient outcome.

E. The Most Recent Studies

After the turn of the millennium research on financial liberalization has taken many directions. The Global Financial Crisis of 2008-09, in particular, raised new questions about the impact of financial liberalization on financial stability, and on the role of government in overseeing the functioning and stability of the financial sector. Besides renewed attention to the measurement of financial repression and continued interest in the liberalization-growth nexus, the most recent research has focused in particular on (a) whether financial liberalization should be accompanied by prudential reforms to contain the risk of crisis, (b) whether crises encourage financial reforms, (c) whether financial liberalization reduces or increases the risk of crisis, and (d) whether the large surge of public debt in the wake of the crisis may encourage a return of financial repression.

Measuring Financial Repression

Any empirical analysis of financial repression and its effects requires quantitative measures of financial repression. Such measures are not available directly from official statistics and cannot be easily derived owing to the complexities of financial repression. However, various studies have attempted to address this problem, proposing quantitative indicators derived from various qualitative measures of financial repression.

Earlier studies compiled simple binary indices, whereby a particular country in a particular year is classified as either having or not having financial restrictions along a particular dimension (such as interest rate controls). Some studies focused on a particular aspect of financial repression, such as the presence of interest rate ceilings (e.g., Demirgüç-Kunt and Detragiache 1998). Others covered a variety of measures (ranging from 3 to 8) and sometimes aggregated them in a comprehensive index of financial repression using arithmetic averages or principal component methods (e.g., Jappelli and Pagano 1994; Williamson and Mahar 1998; Bandiera *et al.* 2000).

The advantage of binary indices lies in their simplicity. However, they fail to capture different *intensities* of restrictions across countries and periods. This deficiency spurred new studies (and indices) that recognized different degrees of financial repression. Starting with a qualitative (and unavoidably discretionary) assessment, these studies accounted for the stringency and breadth of the constraints imposed. Hence, Abiad and Mody (2003, 2005) and Abiad, Oomes, and Ueda (2004) compiled indexes of financial repression along five or six

different "components" (credit controls, interest rate controls, entry barriers, regulation, and international capital flows, to which Abiad and Mody added privatizations) that were then combined into an aggregate index. Four years later, Abiad, Detragiache, and Tressel (2008) extended this set by adding two additional components (securities market policy and prudential regulations).

The Liberalization-Growth Nexus

The financial liberalization-growth nexus continues to be the subject of much empirical research. Altogether, the evidence is inconclusive: while several studies highlighted a positive impact of liberalization on growth (Levine, Loayza, and Beck 2000; Tornell, Westermann, and Martinez 2004; Bonfiglioli and Mendicino 2004; Bonfiglioli 2005; Rancière, Tornell, and Westermann 2006*;* Lee and Shin 2008; Romero-Àvila 2009; Burmann 2013), others found a negative impact (Eichengreen and Leblang 2003; Bashar and Khan 2007; Ahmed 2013), and a third group found ambiguous or insignificant results (Arestis and Demetriades 1997; McLean and Shreshta 2002; Dawson 2003; Boot 2000; Bussière and Fratzscher 2008) or highlighted that the impact varied due to specific circumstances, including the intensity of liberalization (Ben Gamra 2009).

Along these lines, Yulek (2017) presented a two-sector model with "traditional" and "modern" sectors, arguing that financial repression can be welfare-improving if it enables governments to make the private sector internalize the positive productivity externalities of investment in the modern sector. His paper did not present empirical evidence.

Some of these studies focused on particular regions or countries (e.g., Menyah, Nazlioglu, and Wolde-Rufael 2014; Nazmi 2005; Bekaert, Harvey, and Lundblad 2005). Others looked at the indirect impact of other variables, such as the efficiency of banks (Hermes and Meesters 2015), the efficiency in the allocation of capital (Bhaduri and Bhattacharya 2018, for India), productivity growth and capital accumulation (Bonfiglioli 2005), or consumer credit (Brissimis, Garganas, and Hall 2014, for Greece).

Financial Liberalization and Prudential Regulations

A fine line separates regulations that enhance the stability of the financial sector (so-called "prudential" regulations) from those that enable governments to intervene directly in this sector, with potentially distortionary effects. A series of studies has examined the relation between financial liberalization and prudential regulation. Several have emphasized that without appropriate prudential safeguards, liberalization could lead to or increase instability, and argued that prudential regulations are a necessary precursor of financial liberalization. Yet, as Walter (2003) and Hlaing and Kakinaka (2018) argued, financial reforms often fail to include proper prudential safeguards, not least because designing and implementing new prudential rules requires advanced technical expertise and can be easily blocked by existing vested interests.

The Impact of Crises on Financial Liberalization

Another area of interest concerns the relationships between crisis and policy reform. This could run both ways: crisis may encourage reforms, but reforms could also increase or reduce the risk of a crisis.

A series of studies explore the first hypothesis. They find that crises tend to encourage financial liberalization – both to remedy the effects of the crisis and to prevent future crises. Historically, many countries have responded to crises with regulatory reforms (Lora and Olivera 2004). Reviewing various country cases, Bates and Krueger (1993)[25] find that frequently reforms are seriously considered only when serious economic difficulties arise, and that crises, in particular, are "the most frequent stimulus to reform."

Waelti (2015) finds that the origin of the crisis determines what type of financial reforms are most likely to be adopted, and Masciandaro and Romelli (2017) determined that financial crises encourage reforms that increase the role of central banks in financial sector supervision. Hlaing and Kakinaka (2018) find that financial crises encourage financial liberalization but these reforms are not generally accompanied by stronger prudential regulation, resulting in "incomplete" reforms that can reduce financial stability and increase the risk of a future crisis.

The Impact of Liberalization on the Risk of Crisis

In turn, financial liberalization could affect the risks of a crisis. This hypothesis has been tested in recent empirical studies, which found that liberalization tends to increase the probability of a crisis (Tornell, Westermann, and Martinez 2004; Rancière, Tornell, and Westermann 2006), although this risk may decline when the institutional environment is strong (Demirgüç-Kunt and Detragiache 1998) or as liberalization proceeds (Hartwell 2017). Other studies found instead that financial liberalization *reduces* significantly the likelihood of a crisis (Loizos, 2018; Lee, Lin, and Zerng 2016; Barrell, Karim, and Ventouri 2017); and that financial liberalization has a destabilizing effect in the short run, but over time promotes institutional improvements and more stable conditions (Kaminsky and Schmuckler 2002).

Financial Repression and Debt

The surge in public debt in the wake of the 2008-09 Global Financial Crisis spurred renewed interest in the role that may be played by financial repression in mobilizing seigniorage, as governments burdened with high debt look for second-best (suboptimal but politically feasible) solutions that could bring public finances on a more sustainable path. Reinhart and Rogoff (2013) argued that historical experience contradicts the claim that advanced countries (unlike emerging markets) do not need to resort to financial repression. In the past, even advanced economies have used financial repression to reduce their debt.

[25] See p. 452.

Along the same lines, Reinhart and Sbrancia (2015) document how financial repression – which is essentially a tax on bondholders and savers in the form of low real interest rates – contributed significantly to reducing public debt in the period after the Second World War, when capital controls and regulatory restrictions forced "captive" investors to finance government debt at low cost. The same authors argued that financial repression could become necessary again – although it might not be sufficient – to bring public debt on a more sustainable path.

Although financial repression crowds out private investment, Chari, Dovis, and Kehoe (2016, 2018) argued that it can be an optimal policy when it enables governments to borrow credibly in difficult circumstances (such as wars).

Other Studies

Some studies focused on specific variables such as the efficiency of banks (Hermes and Meesters 2015), the efficiency in the allocation of capital (Bhaduri and Bhattacharya 2018, for India), or consumer credit (Brissimis, Garganas, and Hall 2014, for Greece).

Numerous empirical studies analyzed financial liberalization in specific countries, most prominently in China. Zhang, Zhu, and Lu (2014), for example, found that in China increasing trade and financial openness improved financial efficiency and competition but had a negative impact on financial sector development, with significant differences across provinces. Other studies focused on developing countries, most notably in Africa (Obademi and Elumaro 2014 for Nigeria; Zhou *et al.* 2018 for Togo).

Other studies have addressed highly specific issues related to financial liberalization. For instance, Norkina (2018) discussed the nexus between financial repression and "populism," and Mertens (2008) assessed the impact of financial repression on disintermediation.

A few studies have provided "meta-analyses" (deep surveys) aimed at summarizing, and taking stock of, the results of a large number of previous studies (Bumann, Hermes, and Lensink 2013; Arestis, Chortareas, and Magkonis 2015; Valickova, Havranek, and Horvath 2015). Loizos (2018) attempted a synthesis of the decade-long debate on these issues and argued that it could be found in the "Post-Keynesian attempt to take an institutional perspective within a globalized financial and economic environment." The jury is still out.

APPENDIX II. A Stylized Model of Financial Repression

Assume a linear demand for bank loans (L^D):

$$L^D = a_L - b_L i_L \tag{A.1}$$

and a linear supply of deposits (D^S):

$$D^S = a_D + b_D i_D\,, \tag{A.2}$$

where i_L is the interest rate on loans, i_D is the interest rate on deposits, and a_L, a_D, b_L, and b_D are constant parameters.

Assume also a constant loan/deposit ratio, independent of volumes or interest rates:

$$L^S = (1-r)D^D = kD^D\,, \tag{A.3}$$

where r is the reserve requirement, as a share of deposits, and k is equal to $1 - r$, and assume that the interest spread follows a linear relation

$$i_L - i_D = p + qL^S\,, \tag{A.4}$$

where p and q are constant parameters.

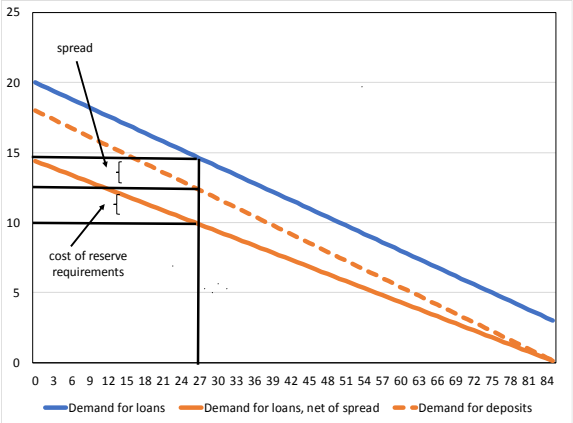
Combining the borrowers' demand for loans function with the interest rate spread relation, the loan market equilibrium requirement that $L^S = L^D$, and the constant loan/deposit relation $L^S = kD^D$ yields the derived deposit demand function of banks in the absence of interest rate restrictions (Appendix Figure II.1):

$$i_D = \left(\frac{a_L}{b_L} - p\right) - k\left(\frac{1}{b_L} + q\right)D^D \tag{A.5}$$

In the same way, combining the savers' deposit supply function with the interest rate spread and loan/deposit relations yields the derived supply of loans by banks in the absence of interest rate restrictions (Appendix Figure II.2):

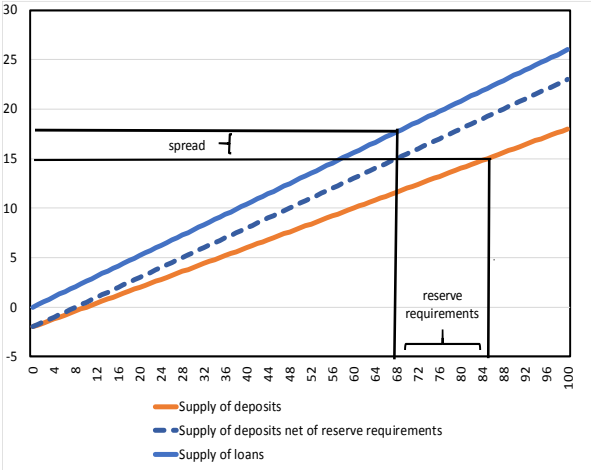
$$i_L = \left(p - \frac{a_D}{b_D}\right) + \left(\frac{1}{kb_D} + q\right)L^S \tag{A.6}$$

Appendix Figure II.1. Demand for Loans and Derived Demand for Deposits



Source: Authors' simulation.

Appendix Figure II.2. Supply of Deposits and Derived Supply of Loans



Source: Authors' simulation.

By equating demand and supply in the deposit market, one can thus derive the *unrestricted* equilibrium volume and interest rate on deposits:

$$D^* = \frac{a_L b_D + a_D b_L - p b_D b_L}{k b_D + b_L + k q b_D b_L} \tag{A.7}$$

and

$$i_D^* = \frac{a_L - a_D k\left(1 + q b_L\right) - p b_L}{k b_D + b_L + k q b_D b_L}\,. \tag{A.8}$$

Similarly, equating demand and supply in the loans market yields the *unrestricted* equilibrium volume and interest rate on loans:

$$L^* = k\frac{a_D b_L + a_L b_D - b_L b_D p}{kb_D + b_L + kb_D b_L q} \tag{A.9}$$

and

$$i_L^* = \frac{a_L\left(1+kb_D q\right) - ka_D + kb_D p}{kb_D + b_L + kb_D b_L q}. \tag{A.10}$$

When the authorities impose a ceiling i_L^C on loan interest rates, the derived demand for deposits, in the area where the ceiling is binding, becomes:

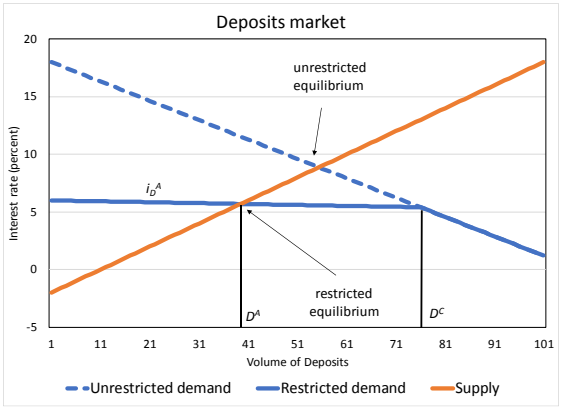
$$i_D^A = i_L^C - p - qkD^D. \tag{A.11}$$

Since the ceiling is binding whenever

$$\left(\frac{a_L}{b_L} - p\right) - k\left(\frac{1}{b_L} + q\right)D^D > i_L^C - p - qkD^D, \tag{A.12}$$

the derived demand for deposits becomes a kinked line, equal to (A.5) when $D < D^C$ (where D^C is the value of D^D that satisfies (A.12) as an equality), and to (A.11) otherwise (Appendix Figure II.3).

Appendix Figure II.3. Deposits Market



Source: Authors' simulation.

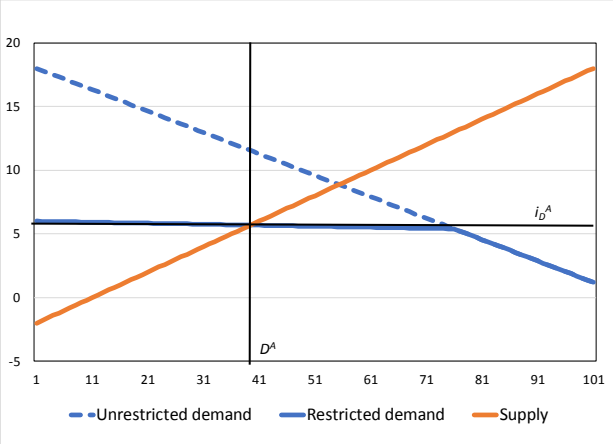
Since the deposit supply function is unaffected by the ceiling on loan interest rates, in the new deposit market equilibrium (Appendix Figure II.4) volumes are equal to

$$D^A = \frac{a_D + b_D\left(i_L{}^C - p\right)}{1 + b_D kq} \tag{A.13}$$

and interest rates to

$$i_D{}^A = \frac{1}{1 + b_D kq}\left(i_L{}^C - p - \frac{a_D kq}{b_D}\right). \tag{A.14}$$

Appendix Figure II.4. Restricted Equilibrium in the Deposit Market



Source: Authors' simulation.

It can be easily verified that, since $i_L{}^C < i_L{}^*$, both the new volume and the new interest rate are lower than in the free market equilibrium. Hence, a binding ceiling on interest rates in the loan market induces financial disintermediation, reducing the amount of savings that is conveyed through the banking system and made available to borrowers for investment.[26]

If instead a ceiling $i_D{}^C$ is imposed on deposit interest rates, the supply of deposits is capped at

[26] Under interest rates restrictions, the borrowers who obtain a loan gain a surplus equal to equal to $(i_L{}^A - i_L{}^C)L^A$ (where $i_L{}^A$ is the interest rate at which the demand for loans is equal to L^A), which exceeds by $(i_L{}^A - i_L{}^* - i_L{}^C)\, L_A$ the surplus that they were already gaining in the free-market equilibrium. How is this net increase in surplus covered – in other words, where do the resources that finance this gain come from? In part, they come from a reduction in the costs (of intermediation and reserve requirements) faced by the banks. As the volume of the loans diminishes, so does the costs of intermediation – defined as the product of the spread demanded by banks by the volume of the loans – which declines by $p(L^* - L^A) + q(L^{*2} - L^{A\,2})$), In addition, as the volume of deposits declines, banks can hold lower reserve requirements, saving an additional amount equal to $k(D^C - D^A)$ in costs. All these are savings of real resources that are captured by the borrowers. The rest, however, consists of a net transfer of resources from the savers who remain in the market and gain lower interest rates on their deposits. The net surplus of these savers declines by $(i_D{}^* - i_D{}^A)D^A$ and is effectively transferred to the borrowers.

$$D^C = a_D + b_D i_D{}^C \tag{A.15}$$

and the supply of loans is therefore capped at

$$L^C = kD^C = ka_D + kb_D i_D{}^C . \tag{A.16}$$

The interest rates that clears the loans market at this volume is equal to

$$i_L{}^B = \frac{a_L - L^C}{b_L} = \frac{a_L - ka_D - kb_D i_D{}^C}{b_L} , \tag{A.17}$$

which is higher than the minimum rate demanded by banks:

$$i_L{}^{B\min} \equiv i_D{}^C + p + qkD^C = p + qka_D + \left(1 + qkb_D\right) i_D{}^C \tag{A.18}$$

Banks thus earn a rent equal to

$$R\left(i_D{}^C\right) \equiv \left(i_L{}^B - i_L{}^{B\min}\right) L^C . \tag{A.19}$$

If instead the authorities impose a (binding) ceiling $i_D{}^C$ on the interest rates that can be paid on deposits, banks experience some form of rationing in the deposits market, because their demand for deposits exceeds savers' supply.[27] The reduced supply of deposits translates into a reduced supply of loans, raising interest rates and reducing volumes in the loans market. Banks – not borrowers – earn a rent on the loans, as they are free to impose a high interest rate on borrowers while paying a low interest rate to depositors. Hence, they compete with one another in the deposit market to secure the (limited) amount of deposits available, offering non-interest benefits to depositors (such as free checks or other perks).

The costs are paid by: (a) depositors who receive a lower (capped) interest rate on their deposits; (b) depositors who withdraw from the market as they are unable to get sufficiently high interest rates; (c) borrowers who pay higher interest rates on their loans; and (d) borrowers who withdraw from the market as they are unable to secure loans at sufficiently low rates. Of these, (a) and (c) finance the rent earned by banks (again, a quasi-fiscal operation, this time on behalf not of borrowers/investors but of banks/intermediaries), while (b) and (d) are deadweight losses.

Since banks earn a rent and deposits are scarce at the restricted rate, this measure is likely to be accompanied by other measures aimed at restricting entry – and limiting size – in the banking sector.

[27] Banks may engage in non-interest competition to attract deposits, offering other types of benefits to the borrowers; in some cases, these benefits may enable banks to effectively circumvent the legal cap on deposit rates.

If the authorities impose ceilings on both loan and deposit interest rates, both of these ceilings are binding only if the ceiling on loan interest rates, i_L^C, lies within the range

$$\left(i_L^{B\min}, i_L^B\right). \tag{A.20}$$

Below this range, demand for deposits falls below D^C and the ceiling on deposit rates ceases to be binding; above this range, the ceiling on loan rates exceeds the rate that borrowers are willing to pay for that amount of loans and therefore is not binding. Rates within this range effectively split the rent $R(i_D^C)$ (defined above) into two components, one (equal to $(i_L^C - i_L^{B\min})L^C$) still accrued by banks and the other (equal to $(i_L^B - i_L^C)L^C$) accrued by the borrowers whose loan applications are approved. This rent is paid in part by the depositors who earn a lower interest rate on their loans than they would in market equilibrium.[28]

[28] The amount paid by depositors is equal to $(i_D^* - i_D^C)L^w/k$; of this; a fraction $1-k$ is used by the bank to maintain prudential liquidity buffers. Another amount results from the lower spread demanded by banks on the lower amount of loans, equal to $q(L^* - L^w)L^w$. The rest, namely $(i_L^w - i_L^*)L^w$, would have also been accrued by the borrowers as consumer surplus in the market equilibrium.

APPENDIX III. Description of Variables

Variable Code	Description
IRC	Interest Rate Control index (takes 4 possible integer values from 0 to 3; 0 denotes the most restrictive regime and 3 the most liberalized regime)
FRI	Financial restrictions index (binary indicator equal to 1 if IRC < 3 and to 0 if IRC = 3)
FRIante	Average value of FRI in the preceding three years
FRId3	Net change in FRI in the previous three years
crisis	Jurisidiction in a debt crisis that year (dummy)
indirect impact	Impact on growth from an increased risk of crisis
inflation	Inflation (annual change in the CPI, in percent)
dpop	Population growth
nfigdp	Net foreign investment (in percent of GDP)
fiscal balance	Fiscal balance (in percent of GDP)
govdebt	Government debt (in percent of GDP)
openness	Openness (measured as the sum of exports and imports, in percent of GDP)
extdebtgdp	External debt (in percent of GDP)
rbondintr	Bond interest rates
moneygrowth	Money growth (annual change in percent)
bmgdp	Broad money (in percent of GDP)

APPENDIX IV. Robustness Analyses

We begin by running a two-way fixed-effects regression including year as well as country fixed effects. Since most jurisdictions liberalized interest rates during the twelve-year period between 1984 and 1996, adding time fixed effects can weaken the results as the latter will capture a large share of the effects of liberalization. In fact, the coefficients of the financial repression variables in the equations become less statistically significant when time fixed effects are added; nevertheless, they remain significantly different from zero at a 10 percent confidence level (Appendix Table IV.1).

Appendix Table IV.1. Models with Jurisdiction and Time-Fixed Effects

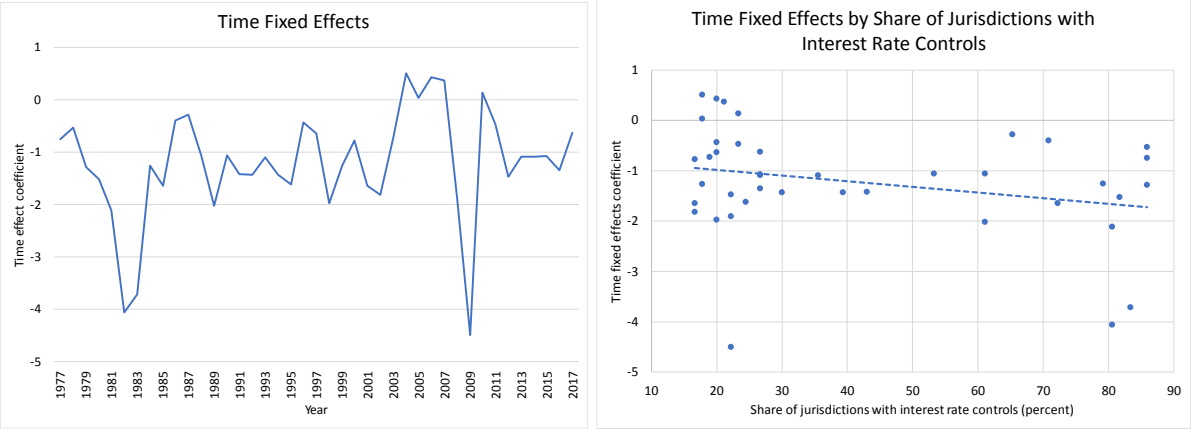
Variable	Jurisdiction fixed effects	Jurisdiction and year fixed effects
FRI (lagged)	-0.648 ***	-0.415 *
FRIante (average FRI in preceding 3 years)	-0.669 ***	-0.432 *
FRId3 (net change in FRI in the past three years)	-0.462 **	-0.435 *
IRCd3 (net change in IRC in the past three years)	0.102	0.108

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.
See Appendix III for variable description.

A graphic examination of time fixed effects suggests that they may be largely capturing the effects of the strong worldwide recessions of 1982 and 2008. There is, actually, a visible negative correlation between the fixed effect coefficient of each year and the share of jurisdictions that maintained interest rate controls in that year (Appendix Figure IV.1).

Appendix Figure IV.1. Time-Fixed Effects



Source: Authors' estimates.

We also compared fixed effects estimates with estimates obtained using random effects and using a dynamic model that includes one or two lags of the dependent variable (applying the Arellano-Bond procedure). The various estimation techniques reveal a qualitatively similar picture, although the coefficients and statistical significance of different indicators of financial repression vary across methods. In particular, dynamic models highlight a weaker impact of the financial repression index lagged one period and a stronger impact of its net change in the previous three years. The net change in the IRC (capturing changes between various degrees of financial repression) and the interaction of financial repression with the size of the banking sector also become significant in dynamic models (Appendix Table IV.2).

Appendix Table IV.2. Financial Repression and Growth—Alternative Dynamic Specifications

Specification	Varriable(s) of interest	Fixed effects	Random effects	Arellano-Bond (1 lag)	Arellano-Bond (2 lags)
(1)	Lagged FRI	-0.649***	-0.335*	-0.403	-0.505*
(2)	FRI (previous 3 years)	-0.669***	-0.328*	-0.451	-0.615**
(3)	FRI (net change in past three years)	-0.462**	-0.517**	-0.711***	-0.596**
(4)	IRC (net change in past three years)	0.102	0.193*	0.283**	0.232*
(5)	lagged FRI	-0.427	-0.643*	1.065***	1.147***
	lagged FRIm	-0.005	0.006	-0.029***	-0.033***

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

See Appendix III for variable description.

To reduce the noise stemming from business cycles and other sources of short-term fluctuations, we run the same regressions using, in place of annual data, the average values of annual data for nine successive five-year periods (1973-77, 1978-82, 1983-87, 1988-92, 1993-97, 1998-2002, 2003-07, 2008-12, and 2013-17). This reduces significantly the number of observations (to about 600). The results are qualitatively similar, but not statistically significant (see Appendix). [29]

We also checked the robustness of the results to changes in the definition of the FRI binary variables that signals the presence of interest rate controls: instead of setting FRI = 1

[29] These and other results not reported in this paper are available from the authors upon request.

whenever interest rates are not completely liberalized (i.e., when IRC < 3), we tried using two alternative indicators, FRI2 and FRI3, equal to 1, respectively, only when IRC < 2 and only when IRC = 0. The results are qualitatively similar, with the important exception that the coefficients of the *net change in the previous three years* of the FR2 and FR3 variables are not statistically significant (Appendix Table IV.3). This might suggest that an easing of interest rate restrictions that falls short of a full liberalization does not have a significant impact on growth.

Appendix Table IV.3. Models with Alternative Measures of Interest Rate Controls

Variable	FRI	FRI2	FRI3
Lagged	-0.648 ***	-0.795 ***	-0.859 ***
Average of the preceding three years	-0.669 ***	-0.833 ***	-0.961 ***
Net change in the preceding three years	-0.462 **	-0.221	0.320

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

As an additional robustness check, we run an alternative regression (on data from the Penn World Tables) relating real GDP growth to the real growth rates in physical and human capital and in the labor force, plus their interactions with the index of interest rate controls (Appendix Tables IV.4 and IV.5). This is essentially a growth-accounting model, run separately on periods where interest rate controls were or were not in place. Penn World Tables data are available only until 2014, but the simpler model can be run on 86 jurisdictions, compared with 78 jurisdictions of the (more data intensive) model discussed above. The results highlight a significant, negative effect of interest rate controls on growth (Table 16), which are partly mitigated when there is a rapid accumulation of physical capital but are intensified when human capital growth is high.

These effects appear significant in all regions except European and advanced countries and Asia (excluding Korea and Japan), and are most significant in more recent decades when most jurisdictions had already liberalized their interest rates.

Essentially, interest rate restrictions enter the equation as a multiplicative factor that, in a growth accounting relation, signals a (negative, in this case) impact on total factor productivity. This seems to be in line with the often-reiterated argument that a financial sector free of restrictions is more conducive to productivity growth. These results are consistent with those discussed above.

Finally, we estimated the relation between financial repression and growth using a "treatment effect" matching model (instead of panel data regression), whereby the effect of the "treatment" (in this case, the presence of controls on interest rates) is assessed by comparing

the different values of the target variable (real per capita growth) between two otherwise similar members of a "pair." The observations in the sample are first divided in two groups depending on whether or not they received the treatment (FRI= 1 or FRI = 0); then each observation in each group is matched with one observation in the other group that is as close as possible on the basis of a set of variables, excluding of course the treatment variable and the target variable. The next step entails measuring the difference between the values of the target variable within each pair and computing the mean and variance of the distribution of these differences in the sample. The mean is considered as a measure of the impact of the "treatment" on the target variable, and the variance provides information on whether this impact is statistically significant. The mean (and variance) can be computed across *all* pairs ("average treatment effect," ATE), or by considering only one pair for each "treated" observation ("average treatment effect among the treated," ATET).

Two different methods were used to match the observations: the "nearest neighbor," which minimizes the Euclidean distance between the vectors of variables associated to each observation in the pair; and the "propensity score" method, which runs a Logit regression on these variables to assess an observation's "propensity" to receive the treatment, and then selects the pairs by minimizing the difference in this unidimensional prediction (the "score"). The variables included in the vector (for both methods) were the same explanatory variables used in the panel data fixed effects regression in Table 8.

The results obtained using either method do not exhibit a significant effect of financial repression on per capita growth. However, this effect appears significant and negative if the analysis is run using a reduced set of variables (excluding the stock of external and public debt, FDI, and real interest rates) that includes *per capita* income (Appendix Table IV.6).

Appendix Table IV.4. Panel Data Estimates (entire sample, Penn World Tables data)

VARIABLES	(1) All sample FE	(2) All sample RE	(3) EUR and ADV FE	(4) Asia and LAC FE	(5) non transition FE	(6) SSA/MENA FE	(7) Asia FE	(8) LAC FE
Interest rate controls (FRI)	-0.0098***	-0.0081***	-0.0022	-0.0101***	-0.0076***	-0.0089**	0.0005	-0.0150***
	(0.0016)	(0.0014)	(0.0021)	(0.0022)	(0.0015)	(0.0040)	(0.0033)	(0.0029)
Growth of real physical capital	0.5773***	0.5799***	0.3545***	0.6843***	0.5638***	0.4909***	0.5085***	0.7795***
	(0.0285)	(0.0248)	(0.0444)	(0.0436)	(0.0270)	(0.0554)	(0.0587)	(0.0631)
Growth of employment	0.4506***	0.4293***	0.7166***	0.3567***	0.3721***	0.2579***	0.1551***	0.5906***
	(0.0261)	(0.0244)	(0.0415)	(0.0390)	(0.0264)	(0.0565)	(0.0466)	(0.0611)
Growth of human capital	0.0436	0.0818	0.6459**	0.0212	0.0654	-0.0474	0.0180	0.0938
	(0.1264)	(0.1120)	(0.2797)	(0.1490)	(0.1231)	(0.3210)	(0.1685)	(0.2570)
Interactions with the FRI index								
growth of real physical capital	0.0012**	0.0011**	-0.0007	0.0005	0.0003	-0.0007	0.0001	0.0008
	(0.0005)	(0.0005)	(0.0009)	(0.0008)	(0.0005)	(0.0013)	(0.0013)	(0.0012)
growth of employment	-0.0007	-0.0005	-0.0001	0.0001	0.0001	0.0001	0.0011	-0.0011
	(0.0015)	(0.0015)	(0.0019)	(0.0022)	(0.0014)	(0.0040)	(0.0031)	(0.0031)
growth of human capital	-0.0182***	-0.0181***	0.0129	-0.0022	0.0007	0.0287	-0.0011	-0.0038
	(0.0061)	(0.0061)	(0.0103)	(0.0094)	(0.0059)	(0.0250)	(0.0133)	(0.0146)
Constant	0.0061***	0.0054***	0.0020	0.0035	0.0059***	0.0160***	0.0171***	-0.0091**
	(0.0018)	(0.0016)	(0.0021)	(0.0027)	(0.0017)	(0.0057)	(0.0036)	(0.0040)
Observations	3,244	3,244	902	1,247	2,944	772	559	688
R-squared	0.2182		0.3918	0.2375	0.2075	0.1409	0.1708	0.3132
Number of jurisdictions	86	86	22	31	73	19	14	17
r2_w	0.218	0.218	0.392	0.238	0.208	0.141	0.171	0.313
r2_b	0.682	0.695	0.823	0.762	0.725	0.619	0.799	0.829
r2_o	0.278	0.279	0.470	0.314	0.277	0.158	0.269	0.339

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
FE = fixed effects; RE = random effects

Source: Authors' estimates; data from Feenstra, Inklaar, and Timmer (2015).

See Appendix III for variable description.

Appendix Table IV.5. Panel Data Estimates (entire sample, Penn World Tables data)

VARIABLES	(1) All years	(2) Post 1990	(3) Until 1990	(4) Post 1995	(5) Until 1995	(6) Post 2000	(7) Until 2000
Interest rate controls (FRI)	-0.0098***	-0.0077**	-0.0080**	0.0022	-0.0107***	0.0052	-0.0128***
	(0.0016)	(0.0033)	(0.0040)	(0.0042)	(0.0026)	(0.0052)	(0.0021)
Growth of real physical capital	0.5773***	0.4961***	0.6371***	0.4063***	0.6697***	0.3977***	0.6347***
	(0.0285)	(0.0420)	(0.0518)	(0.0475)	(0.0456)	(0.0608)	(0.0407)
Growth of employment	0.4506***	0.4908***	0.3772***	0.5060***	0.3609***	0.5400***	0.4169***
	(0.0261)	(0.0325)	(0.0470)	(0.0374)	(0.0370)	(0.0469)	(0.0329)
Growth of human capital	0.0436	0.0735	-0.4735*	0.2839	-0.1763	0.3415	0.0081
	(0.1264)	(0.1726)	(0.2567)	(0.1798)	(0.2102)	(0.2307)	(0.1874)
Interactions with the FRI index							
growth of real physical capital	0.0012**	0.0015*	0.0004	-0.0004	0.0012**	0.0028	0.0012**
	(0.0005)	(0.0009)	(0.0007)	(0.0014)	(0.0006)	(0.0023)	(0.0006)
growth of employment	-0.0007	0.0010	-0.0002	0.0019	-0.0017	-0.0013	-0.0009
	(0.0015)	(0.0028)	(0.0018)	(0.0039)	(0.0017)	(0.0056)	(0.0016)
growth of human capital	-0.0182***	-0.0375***	-0.0001	-0.0052	-0.0118*	-0.0408*	-0.0169**
	(0.0061)	(0.0095)	(0.0081)	(0.0150)	(0.0068)	(0.0231)	(0.0067)
Constant	0.0061***	0.0094***	0.0065	0.0093***	0.0044	0.0085***	0.0052*
	(0.0018)	(0.0025)	(0.0046)	(0.0026)	(0.0034)	(0.0031)	(0.0028)
Observations	3,244	2,051	1,193	1,634	1,610	1,204	2,040
R-squared	0.2182	0.2135	0.1819	0.1808	0.1885	0.1853	0.1985
Number of jurisdictions	86	86	72	86	86	86	86
r2_w	0.218	0.214	0.182	0.181	0.189	0.185	0.198
r2_b	0.682	0.702	0.561	0.605	0.550	0.612	0.626
r2_o	0.278	0.297	0.259	0.263	0.303	0.294	0.279

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates; data from Feenstra, Inklaar, and Timmer (2015).
See Appendix III for variable description.

Appendix Table IV.6. Estimates of Treatment Effect Models

	Nearest neighbor		Propensity score	
	ATE	ATET	ATE	ATET
Standard set of variables	0.144	-0.116	0.193	0.336
Reduced set, plus per capita income	-0.463 **	-0.614 **	-0.851	-0.609 **

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

APPENDIX V. Additional Tables

Appendix Table V.1. Episodes of Liberalization and Introduction of Controls, 2006-17

Country	Year
Liberalization	
Bulgaria	2007
Cote d'Ivoire	2012
Zimbabwe	2014
Cameroon	2015
Uruguay	2015
Sri Lanka	2017
Introduction of controls	
Venezuela	2006
Vietnam	2006
South Africa	2007
Uruguay	2007
Ecuador	2008
Sri Lanka	2010
Bolivia	2013
El Salvador	2013
Kyrgyz Republic	2013
Turkey	2013
Indonesia	2014
Nigeria	2015
Paraguay	2015
Kenya	2017

Source: IRC index compiled by the authors.

Appendix Table V.2. Causality Tests (p-values of variable-deletion F-tests)

Variable of interest	Direct causality	Reverse causality
FRI	0.0052	0.0026
FRI (three-year average)	0.02	0.0004
FRI (net change in the previous three years)	0.7626	0.0188
IRC (net change in the previous three years)	0.4796	0.0032

Source: Authors' estimates.

Appendix Table V.3. Probit Estimates, 1973-2017

(dependent variable: binary indicator of debt crisis)

VARIABLES	(1) Lagged FRI	(2) FRIante	(3) FRId3	(4) IRCd3
FRI (binary indicator; lagged)	-0.6033***			
	(0.1225)			
FRIante (average FRI in preceding 3 years)		-0.5927***		
		(0.1274)		
FRId3 (net change in FRI in the past three years)			-0.2410*	
			(0.1294)	
IRCd3 (net change in IRC in the past three years)				0.0827
				(0.0560)
Growth in the previous three years	-0.0669***	-0.0685***	-0.0581***	-0.0587***
	(0.0160)	(0.0159)	(0.0157)	(0.0157)
Inflation (percent)	0.0003***	0.0003***	0.0003**	0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Fiscal balance	-0.0521***	-0.0501***	-0.0478***	-0.0478***
	(0.0157)	(0.0157)	(0.0154)	(0.0153)
Public debt	0.0080***	0.0080***	0.0104***	0.0105***
	(0.0017)	(0.0017)	(0.0016)	(0.0016)
Current account balance	0.0107	0.0092	0.0134	0.0129
	(0.0106)	(0.0105)	(0.0106)	(0.0106)
External debt	0.0073***	0.0073***	0.0073***	0.0073***
	(0.0014)	(0.0014)	(0.0014)	(0.0014)
Liquid assets to total assets (percent)	-0.0120***	-0.0128***	-0.0105***	-0.0106***
	(0.0037)	(0.0038)	(0.0038)	(0.0038)
Initial per capita income (ln)	-0.4208**	-0.4213**	-0.3491*	-0.3492*
	(0.2008)	(0.2006)	(0.2007)	(0.2010)
Distance from the Equator (degrees)	0.0002	0.0003	0.0010	0.0010
	(0.0138)	(0.0138)	(0.0139)	(0.0139)
Constant	0.2086	0.2312	-0.6269	-0.6320
	(1.1785)	(1.1787)	(1.1719)	(1.1733)
Observations	2,977	2,977	2,977	2,977
Number of jurisdictions	75	75	75	75

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.
See Appendix III for variable description.

Appendix Table V.4. Growth Estimates, 1973-2017

(dependent variable: annual real per capita growth)

VARIABLES	(1) Lagged FRI	(2) FRIante	(3) FRId3	(4) IRCd3
FRI (binary indicator; lagged)	-0.1559			
	(0.2203)			
FRIante (average FRI in preceding 3 years)		-0.1467		
		(0.2341)		
FRId3 (net change in FRI in the past three years)			-0.4164	
			(0.2743)	
IRCd3 (net change in IRC in the past three years)				0.0557
				(0.1221)
Marginal impact	10.9200***	11.0425***	6.3976	30.0989*
	(3.4949)	(3.5165)	(13.0674)	(17.1425)
Crisis dummy (binary indicator)	-1.9094***	-1.8923***	-1.8867***	-1.8830***
	(0.2529)	(0.2527)	(0.2528)	(0.2526)
Inflation (percent)	-0.0031***	-0.0031***	-0.0030***	-0.0031***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Population growth (percent)	-1.1299***	-1.1226***	-1.1565***	-1.1703***
	(0.0994)	(0.0996)	(0.0995)	(0.0997)
Fixed capital formation	0.1409***	0.1412***	0.1453***	0.1451***
	(0.0146)	(0.0146)	(0.0146)	(0.0146)
Fiscal balance	0.1689***	0.1684***	0.1802***	0.1807***
	(0.0237)	(0.0238)	(0.0236)	(0.0236)
Public debt	0.0089***	0.0091***	0.0077***	0.0073***
	(0.0028)	(0.0028)	(0.0026)	(0.0026)
Openness	0.0324***	0.0323***	0.0333***	0.0330***
	(0.0048)	(0.0048)	(0.0048)	(0.0048)
FDI (average of previous three years)	0.0229	0.0250	0.0019	-0.0025
	(0.0320)	(0.0321)	(0.0317)	(0.0317)
External debt	-0.0060***	-0.0059***	-0.0070***	-0.0072***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)
Real interest rate on bonds (percent)	0.0054	0.0052	0.0076	0.0081
	(0.0281)	(0.0281)	(0.0282)	(0.0282)
Stock of money	0.0034***	0.0033***	0.0028***	0.0028***
	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Stock of money (annual growth in percent)	-0.0385***	-0.0388***	-0.0372***	-0.0368***
	(0.0041)	(0.0042)	(0.0041)	(0.0042)
Constant	1.2209**	1.2145**	0.9621**	1.0071**
	(0.4763)	(0.4810)	(0.4522)	(0.4528)
Observations	2,578	2,578	2,578	2,578
R-squared	0.1889	0.1888	0.1855	0.1858
Number of jurisdictions	73	73	73	73
r2_w	0.189	0.189	0.185	0.186
r2_b	0.141	0.140	0.157	0.161
r2_o	0.131	0.130	0.134	0.136

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimates.

See Appendix III for variable description.

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