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Capital Account Controls, Bank's Efficiency, Growth and Macroeconomic Volatility in the FLAR's Member Countries[1]?

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Abstract

This paper evaluates the effects of capital account controls adopted in the past years by the FLAR's member countries (Bolivia, Colombia, Costa Rica, Ecuador, Perú and Venezuela) on the efficiency of the banking sector, the economic growth and the volatility of output, consumption, and investment. The findings on efficiency show that the degree of the monopoly power in the loans and deposits markets are positively correlated with capital controls. The findings also indicate that, in general, capital controls neither reduce growth nor reduce macroeconomic volatility. On the contrary, and as it is expected, the capital account openness promotes growth.

JEL Classification: F32, F33, F36, F41, G14, G18, G21, C51, C52

Keywords: Capital account controls; Efficiency of the banking sector; Economic growth; Macroeconomic volatility; SUR; Cointegration; Arellano and Bond estimator; Instrumental variables

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1. Introduction

The purpose of this paper is to evaluate the effects of capital account controls that have been adopted in the past by the FLAR's member countries (Bolivia, Colombia, Costa Rica, Ecuador, Perú and Venezuela) with varying degrees of intensity, on the efficiency of the banking sector, on the one hand, and on their economic growth and volatility of output, consumption, and investment.

The adoption of capital account controls usually is made on behalf of such worthy goals as to isolate the country from the pervasive effects of short term capital flows that disrupt the normal pace of economic activity, affects the well being of the population and, some times, (capital flights) deepens the level of poverty for long periods of time. The expected benefits of capital controls are thus seen in terms of greater macroeconomic stability, mainly in terms of lower volatility of output, employment, and consumption. The costs are related to the administrative difficulties in managing the regime and also, especially in this paper, with the protectionism provided to the financial sector. Of course, the realization of those benefits and costs corresponds to situations when capital controls are effective in terms of isolating the economy from capitals flows, which is not always the case.

In theory, capital mobility increases efficiency and productivity (Grossman and Helpman, 1991; Stulz, 1999), permits smooth consumption and investment through international risk sharing (Fisher, 1930; Sach, 1981; Stockman, 1988; Obstfeld and Rogoff, 1996), reduces macroeconomic volatility (Razin and Rose, 1994; Sutherland; 1996; Caballero and Krishnamurthy, 2000) and, as consequence, promotes growth (Borts and Stein, 1964; MacDougall, 1968; Kemp and Liviatan, 1973; McKinnon, 1973; Hanson, 1974; Frenkel, 1976; Levine, 1997; Klein, 2005).[3]

Competitive banking sectors contribute to growth through a more efficient intermediation of savings. In particular, ceteris paribus, a higher degree of competition in the banking sector should translate into a lower spread between the loans and the deposits interest rate. The smaller the spread that the banks charge for the intermediation of funds, the lower the costs agents, both producers and consumers, have to pay for access to credit and, consequently, the greater their possibilities of production and demand. The overall economy then benefits with higher levels of efficiency in its banking sector.

[3] Two recent broad theoretical and empirical discussions on financial integration and its macroeconomic effects are Eichengreen (2003) and Prasad et. al. (2004). Notice that here we will mean the same when we use the categories 'capital account liberalization', 'capital account openness', 'financial liberalization', 'financial integration', or 'financial globalization'.

In developing countries, with lower levels of funds available from domestic and external savings, more efficient financial systems are an especially important element in the determination of their possibilities of economic growth. However, the empirical evidence shows that in these countries spreads are higher than in the developed countries.[4]

The results of the voluminous empirical literature on the potential benefits (costs) on economic growth of the capital account liberalization (control) are mixed.[5] The Rodrik's (1989) paper, maybe the most known and cited study on this issue, shows no relationship between capital account liberalization and growth. On the contrary, the Quinn's (1997) paper, another well cited study, finds a positive relationship between the change in his measure of the capital account liberalization and growth. Among the twelve papers reported by Edison *et al.* (2004, Table 6), six out of twelve found that the capital account liberalization significantly raises growth. The others do not support this hypothesis.

Many findings are different depending on whether data refer to high income countries or to low income ones. For example, Klein and Olivei (1999) and Edwards (2001) found support for the hypothesis for the former countries while reject it for the later countries. On the contrary, Quinn (1997) and Bekaert *et al.* (2001) show evidence that capital account liberalization endorses growth in low income countries. Edison (2004, p. 1-2) and Klein (2005) showed that when institutional variables are included in growth regression models, the effect of the capital account openness is washed out. However, they argued, when regression models allow for institutional and nonlinearities on the explanatory variables, the responsiveness of growth to capital account liberalization rises. Their results are poor, though. For example, Klein found that only for about one-quarter of the countries in his sample, there is a statistically significant effect of capital account openness on economic growth. Besides, the positive evidence is for middle income countries, though nor for poorer o richer countries.[6] "In short, while financial globalization can, in theory, help to promote economic growth through various channels, there is as yet no robust empirical evidence that this causal relationship is quantitatively very important" (Prasad *et al.*, 2004, p. 5).

[4] See Catao (1998).

[5] Excellent reviews on this topic are Edison *et al*. (2002), Edison *et al*. (2004), and Prasad *et al*. (2004). Notice that we will mean the same when we use the categories 'capital account liberalization', 'capital account openness', 'financial liberalization', 'financial integration', or 'financial globalization'.

[6] Except for Bolivia, the other FLAR members are classified by Edison *et al*. (2004, Table 10) as middle-income countries.

With respect to the effects of the capital account liberalization on macroeconomic volatility, the empirical literature is limited. Moreover, it has been dedicated mostly to study output volatility and little to consumption volatility. The recent evidence provided by Prasad *et al.* (2004, Table 4) shows that liberalizations of the capital account seems to have declined, on average, output and consumption volatility for industrial economies and "less financially integrated (LFI)" developing economies, but a they have a modest decline in the "more financially integrated (MFI)" developing economies. Even, for the MFI countries, the volatility of private consumption raised in the 1990s relative to the 1980s.[7]

The remainder of the paper is organized as follows. The second section answers the question of what is the relation between capital controls and the degree of monopoly power in the banking sector in the FLAR's member countries. With this purpose, it first describes the evolution of capital controls in these countries. In order to measure the degree of competitiveness in the banking sector, a model with sound microeconomic principles for the determination of the spread of a banking firm is estimated. The results on the degree of monopoly power in the loans and deposits markets are shown to be positively correlated with capital controls. Bolivia, Colombia, Ecuador and Perú have the largest spreads and it is found the other facts explaining the differences in spreads, besides the varying degrees of monopoly power, are the marginal operating costs; the probabilities of liquidity shortfalls; the cost of capital; the proportion of non performing loans, and the ratio of reserve requirements.

The third section estimates standard empirical specifications of growth models to evaluate the consequences of the capital account controls on economic growth and macroeconomic volatility (of output, consumption, and investment) in the FLAR's member countries. Yearly data covering the period from 1983 to 2003 is used. The econometric techniques are cointegration *á la* Johansen, dynamic panel data models, and instrumental variables procedures. The findings also indicate that, in general, capital account controls neither improve growth nor decreases macroeconomic volatility. On the contrary, the openness of the capital account promotes growth. Finally, the fourth section summarizes the conclusions and discusses some of the polcy implications.

2. Capital account controls and efficiency of the banking system

This chapter evaluates how controls on the capital account affect the efficiency of the banking system. Even if the original intention for imposing those controls may be thought of reaching higher macroeconomic stability, like the reduction of the impact of capital outflows on the level and the volatility of output and consumption, the instruments usually used to implement those controls have a strong impact on the protection provided to the domestic financial markets and, particularly, to the banking sector.

[7] The positive productivity and output shocks that faced developing countries during the late 1980s and 1990s, as well as the procyclicality nature of capital flows, "appear [s] to have had an adverse impact on consumption volatility" in these countries (*Ibid*., p. 23).

A typical example is the prohibition for domestic residents to constitute deposits in foreign currency within the local financial system. In face of a situation of massive international capital flows, at first glance it may contribute to reduce the magnitude of their impact on deposits in the local financial sector, the soundness of the system, the level of loans provided for productive activities and consumption, and the aggregate level of economic activity. However the imposition of these barriers also implies that the local financial system becomes isolated from the competition of foreign financial intermediaries in the market for deposits in foreign currency. The resulting protectionism is even larger when that measure is accompanied by the prohibition for foreign banks to offer deposits to domestic residents in the local market, as is usually the case.

In order to measure the importance of the capital account controls or, equivalently, the restrictions to financial liberalization, two different sets of indicators will be used in the second section, as in Prasad, et.al. (2004). The first one consists of official, or *de jure* restrictions on the capital account. The second set corresponds to *de facto*, or observed indicators of effective financial integration. It is important to mention that differences in the enforcement of the law between two countries may contribute to explain differences in the level of *de facto* indicators even for the same level of *de jure* indicators, since agents may evade the regulation if the enforcement is weak. However, *de jure* indicators are useful to explain the intentions of polices adopted with regard to the liberalization of the financial markets. In addition, even in the absence of formal restrictions to capital flows, some developing countries may present low indices of *de facto* liberalization due to the relatively low degree of effective financial integration to the rest of the world.

2.1 Basic facts about capital controls

In order to measure the official restrictions to the capital account, a set of *de jure* indicators constructed from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) will be used. In particular, the disaggregated indices (dummies with values 1 if a restriction exist and 0, otherwise)[8] for twelve different categories of restrictions on payments for the capital account and for the period 1983-2000 constructed

[8] Notice that the dummy nature of the restrictions makes that averaging them is equivalent to divide the number of transactions subject to controls by the total number of transactions considered in the analysis, which is a proxy for the degree of intensity of the controls, as it is understood by von Hagen and Zhou (2005).

by Miniane (2004), and extended to cover also the years 2001-2003, will be used.[9]

Figure 1 shows the evolution of a total index that corresponds to the average over the values adopted by each of the twelve categories for three groups of countries,[10] namely, FLAR's, emerging markets and developing countries. It may be observed that the index for developing countries and emerging markets increased sharply since 1997, after the Asian crises, indicating the adoption of more restrictions on capital flows. However, in the FLAR's group, it continued with its declining tendency along all the period and only as recently as 2001 increased again smoothly. A decomposition of the total index in the twelve subcategories shows that the main driving forces of these different paths correspond to the changes adopted in capital market securities, collective investment, derivatives, and provisions specific to institutional investors, as shown in Figure 2, even though, in this case, new restrictions are adopted in the FLAR's group in 2003.

Among the FLAR countries, Figures 3 and 4 show that with the exception of Colombia, the other countries loosened controls in 1991-1997, but after 1998, Bolivia, Ecuador and Venezuela started imposing new restrictions. Colombia has maintained full restrictions on these capital flows along the period.

[9] These twelve categories refer to purchase and sales by residents and nonresidents of the following assets: 1) capital market securities which includes shares and other participating securities, as well as bonds with maturity of more than one year; 2) money market instruments like certificates of deposit, treasury bills, with an original maturity of one year or less; 3) collective investment securities, like mutual funds; 4) derivatives and other instruments; 5) commercial credits from private and multilateral financial institutions and governments, linked to trade transactions; 6) financial credit; 7) guarantees, sureties, and financial backup facilities through authorized intermediaries; 8) direct investment; 9) liquidation of direct investment and repatriation of profits; 10) real estate transactions; 11) provisions specific to commercial banks and other credit institutions like reserves requirements in local and foreign currency, lending from abroad to residents, lending locally in foreign exchange to non-residents and residents, investments abroad by banks and in banks by nonresidents; 12) provisions specific to institutional investors, like the share of foreign assets in a portfolio.

[10] The indexes are weighted average of the countries total index of capital controls, where the weighting variable is the GDP in USA dollars.

Figure 1

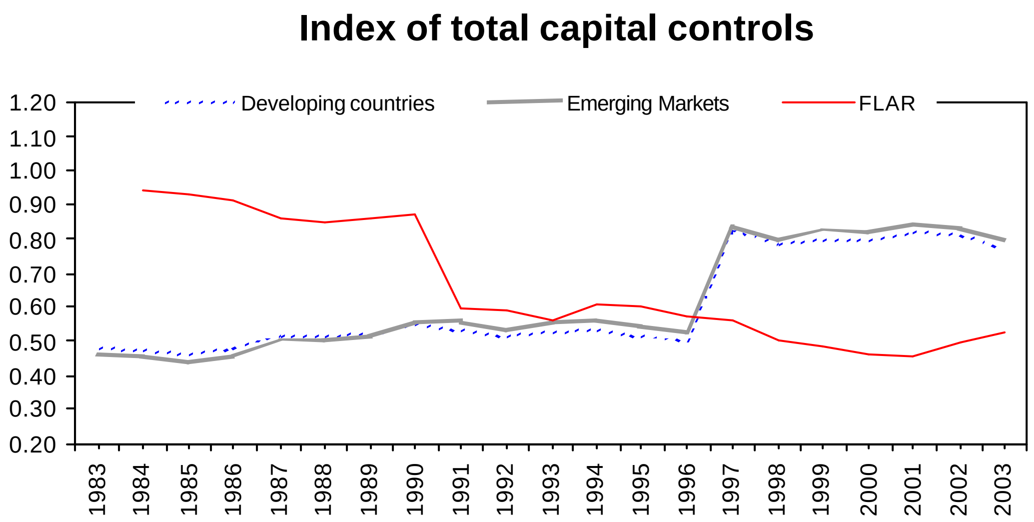


Figure 2

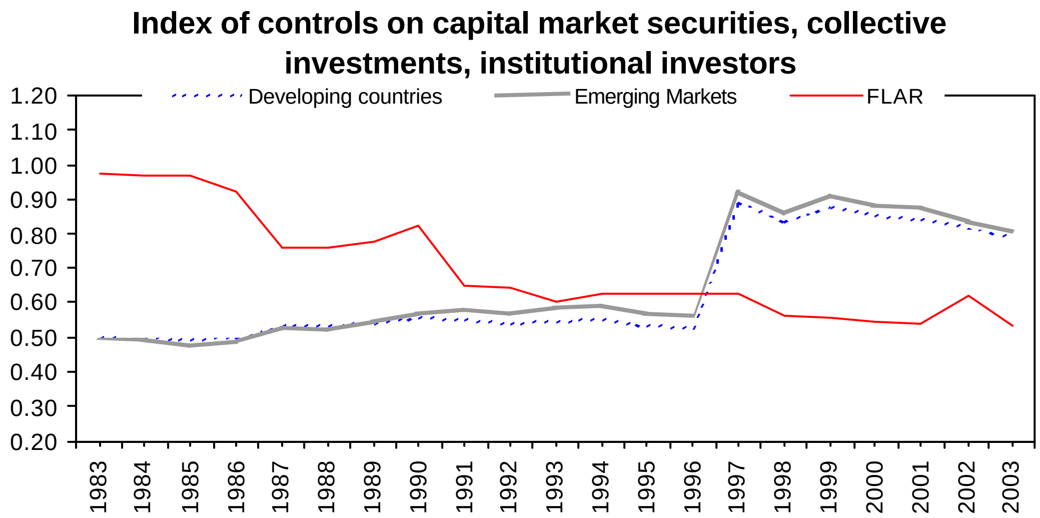


Figure 3

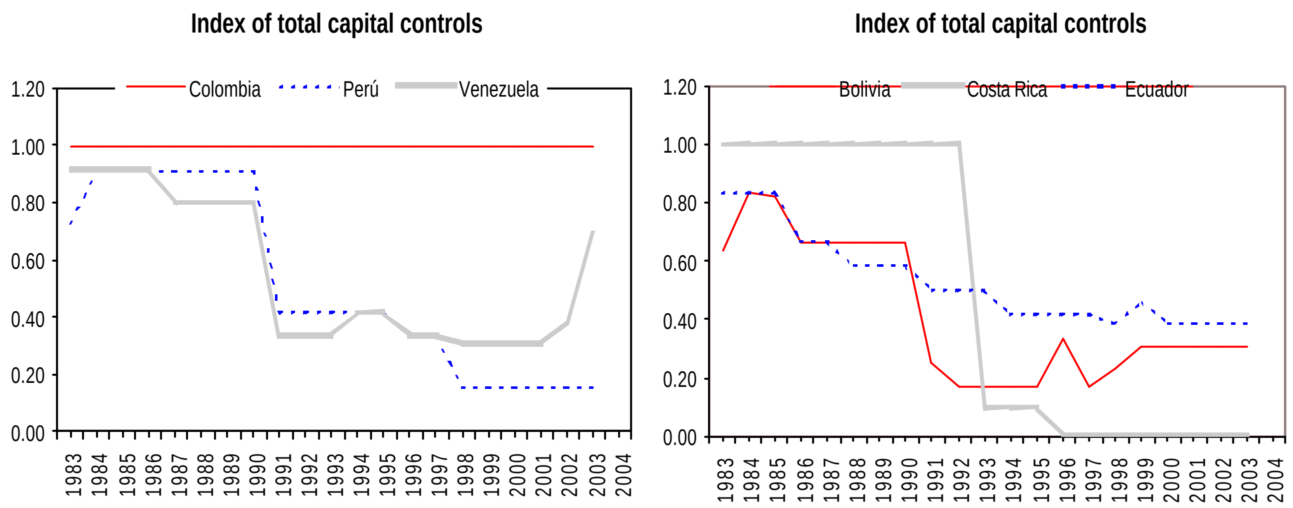
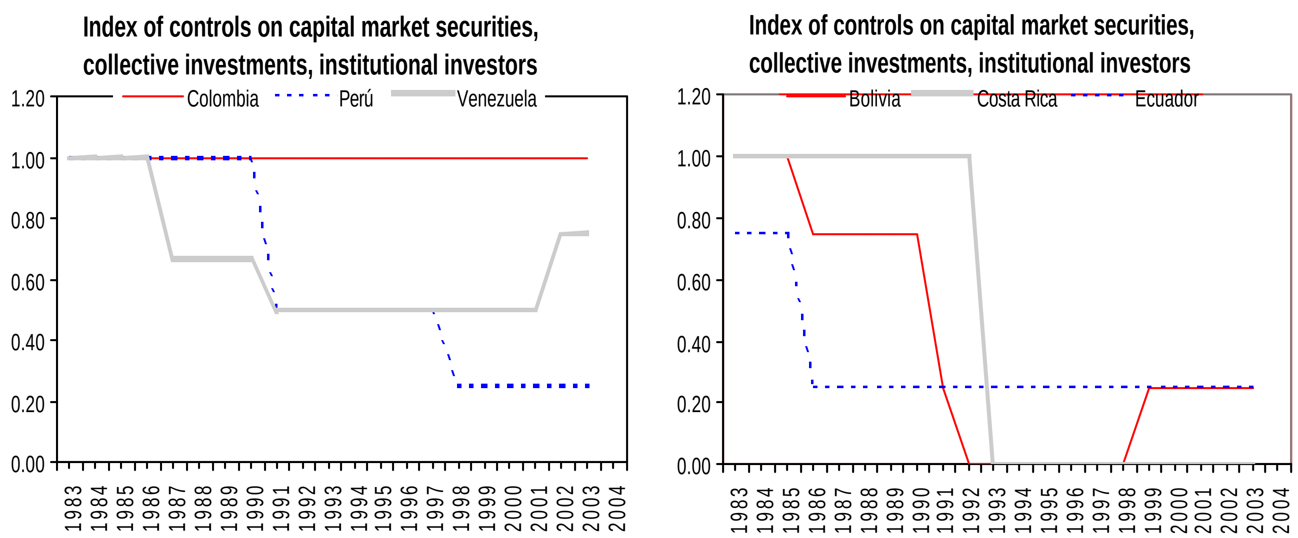


Figure 4



As explained, the previous indexes show the official restrictions to capital flows. However, even with a full *de jure* restriction, countries may be financially integrated with the rest of the world if the enforcement of the law is weak and agents evade those restrictions; and countries with no official restrictions may have a low degree of effective financial integration (globalization) if competition in the local market from foreigners is limited due to the lack of proper financial regulations, market risk or other institutional reasons. Therefore, the previous indicators need to be complemented with other measures of effective financial integration. With this purpose, the departure from uncovered real interest rate parity condition will be used, similarly to the indicator proposed by Frankel (1992), as a measure of capital mobility.[11]

It is important to mention that this real differential between the domestic and foreign interest rate includes, among other things, the risk premium associated with specific country risk, as well as differences due to protectionism of the domestic financial sector. However, the country risk may also be endogenous to the degree of globalization of the financial sector, since a higher integration allows not only access to foreign savings, but also, better opportunities of risk diversification. For this reason, there is no need to estimate the risk premium in order to discount that component from the interest rate differential.

Figure 5 shows that this differential has exhibited a much lower variance since the second half of the nineties and, also, that the mean value in this period is smaller, consistent with a higher degree of integration of the financial markets for these groups of countries[12] in the last ten years. However, for the FLAR group this differential does not show the constant pace of liberalization that was observed for most of the sample period with the indicator of official restrictions. This may be related to the large macroeconomic imbalances that faced some of these economies during the eighties and that might had contributed to isolate their financial markets from the rest of the world. On the other hand, between 1993 and 1996, the differential shows a much lower degree of effective integration in developing and emerging markets, but not in the FLAR group.

In the case of the individual countries within the FLAR group, Figure 6 shows a sharp contrast in the level and the volatility of the differential between the eighties and the nineties, especially in the cases of Bolivia and Perú. These two countries presented the

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[11] In particular, the following differential is estimated: $\frac{(1+i_t)-(1+i_t^*)(1+dev_t^e)}{(1+\pi_t^e)}$, where i and i* denote, respectively, the annual domestic, and foreign nominal interest rate, π the inflation rate and dev the devaluation of the exchange rate. It is assumed that there is perfect foresight of the exchange rate and the level of prices, so that the devaluation and inflation expected at time t for the following twelve months are exactly equal to the observed rates: $(1+\pi_t^e)=P_{t+12}/P_t$ and $(1+dev_t^e)= E_{t+12}/E_t$, where E denotes the exchange rate and P the level of prices. In this sense, the real interest rate (domestic and foreign) measures the effective real rate paid on term deposits after twelve months.

[12] The share of each country's GDP in USA dollars within the total GDP for each group was used as a weighting variable. Since for some countries there is no information on GDP available for the first years of the sample, their weight for those years was zero.

Figure 5

Real interest rate differential (domestic - foreign)

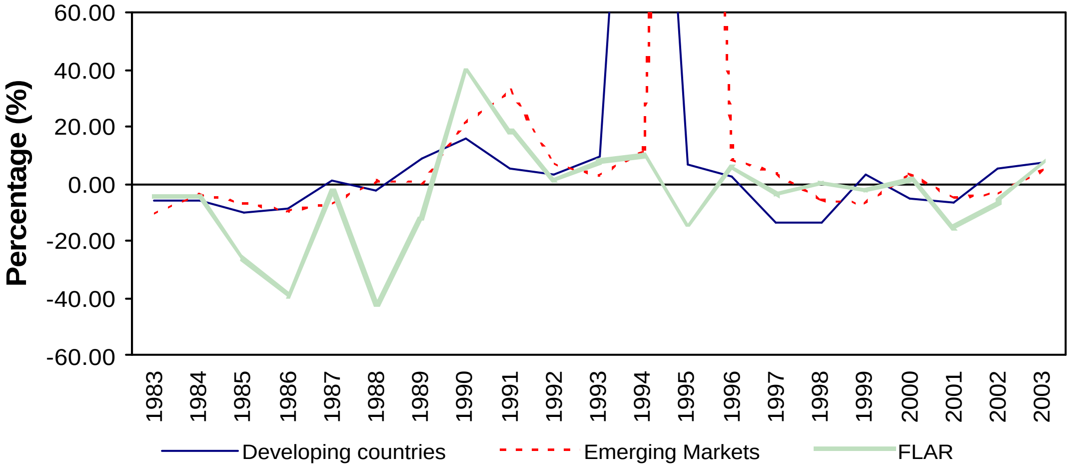
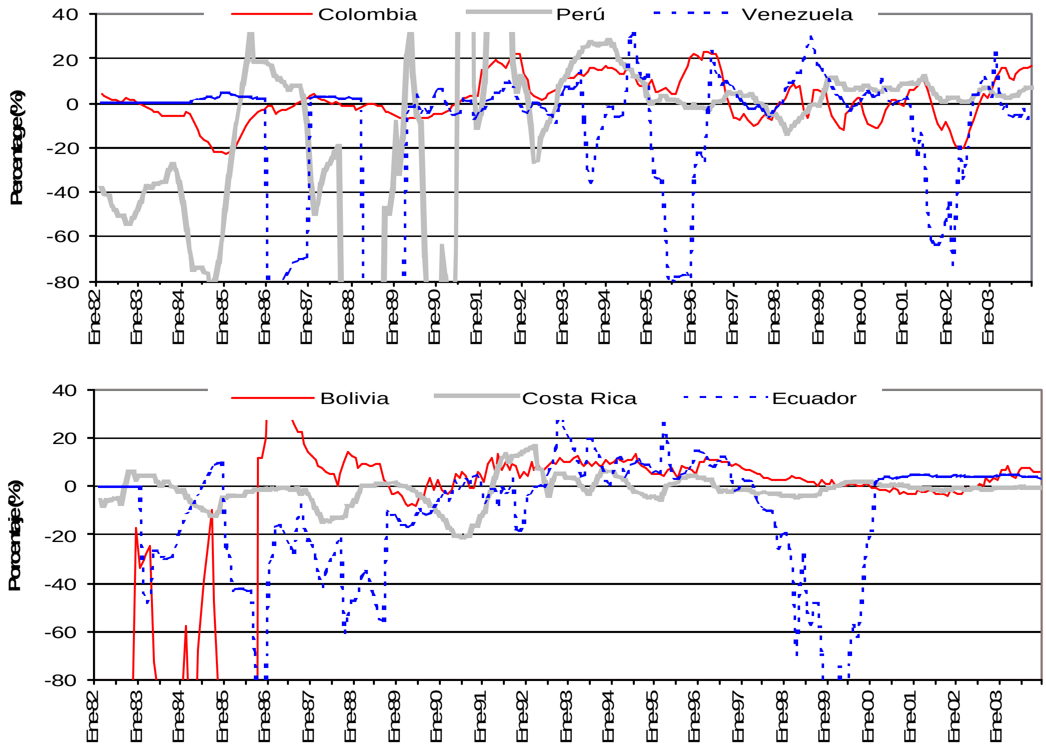


Figure 6

Real interest rate differential (domestic - foreign)



differentials with the largest variance and levels (positive and negative) in the eighties, and the most stable ones since the mid of the nineties. On average, the differential for Colombia and Costa Rica has fluctuated within a more stable band between 20 and minus 20 percentage points, but only Costa Rica presents a larger degree of *de facto* financial integration since the mid the nineties. Along the entire sample, Ecuador and Venezuela have exhibited large fluctuation of the differential, but the first country stabilizes since 2001. Therefore, out of the six countries, Bolivia, Costa Rica, Ecuador and Perú, present a higher degree of financial integration in the last years of the sample than Colombia and Venezuela.

2.2 The degree of competitiveness in the banking sector

Measuring the degree of competition in the markets for services provided by a banking system is not a straightforward procedure, since it requires modeling the behavior of the individual banking firm in those markets.

Appendix 1 presents the complete model used for this purpose. The econometric estimation of its parameters, using monthly information for the individual banks in each of the FLAR's member countries for the period 1997:2 to 2004:12 will provide an estimate of the monopoly power in the deposits and loans markets. This coefficient measures the degree of competition in those markets. In a further step it will be analyzed the relation between the degree of competition and the different indexes of financial liberalization. It will be shown that there exists a sound positive statistical correlation between the restrictions imposed on capital flows and the lack of competition in the banking sector.

2.2.1 Main characteristics of the model used to measure the degree of competition in the banking sector

To measure the degree of competition in the markets for loans and deposits a set up relating the spread between the interest rate charged on loans and the one paid on deposits will be defined. The spread is useful to evaluate the efficiency of the financial system in the economy. The reason is that the smaller the spread that the banks charge for intermediation of funds, the lower the costs that agents, namely, producers and consumers, have to pay for access to credit and, consequently, the greater their possibilities of production and demand. The overall economy then benefits with higher levels of efficiency in its financial system.

It is assumed that the purpose of the banking firm is to maximize profits, net of the cost of capital, ρ:

(1) $$\mathrm{E}[p] = r(G) * G - i(D) * D - C(D, E, b) - L(A, D, E) - S(A, D, E) + rW$$

Where r(G) indicates that the interest rate, r, charged by the bank for its well performing loans, G, is a function of their level, because the credit market may not be perfectly competitive. Similarly, i(D) indicates that the rate that the bank effectively pays for deposits, D, is not necessarily determined in a perfectly competitive market. Also, C(.), L(.) and S(.) correspond to the operating costs, the costs of liquidity and the costs of solvency, respectively, and are a function of the scale of the bank, or total assets, A, and of the composition of the liabilities and assets. Total assets, A, are composed of liquid assets, R, well performing loans, G, and bad loans, B, ($A\equiv R+G+B$) and, by the balance sheet constraint, must be equal to the sum of deposits and equity, W. The share of bad loans in the total portfolio of loans, E, is denoted by b (b=B/E). The cost of capital, ρ, is equal to the rate at which the bank must remunerate the shareholders so that they invest their savings in the bank.

The bank incurs in operating costs to provide services, and consists of labor and depreciation of the durable goods used in the productive process. The services provided by the bank are deposits and loans. It is assumed that the nonperforming loans impose operating costs in addition to the normal ones. Therefore, besides D and E, the share of bad loans, b, which is exogenously determined, enters as an argument of the respective cost function. As explained in the appendix, the parameters of this function are estimated from a translogarithmic specification using as explanatory variables E, D, B, and the price of a composite factor of production.

The liquidity costs are those incurred by the bank for holding a fraction of its assets in a liquid form in order to be able to face unexpected reductions of deposits and (contingent) enlargements of the loans portfolio. The uncertainty about these possible events constitutes a basic characteristic of the banking firm, in contrast with firms in other sectors, like manufactures. The liquidity cost has two components. The first one corresponds to the opportunity cost of holding liquid assets, instead of allocating those resources to loans with higher yields. The second component corresponds to the expected value of the sanction that the banks has to pay if the level of reserves, R, or liquid assets, turns out to be smaller than the requirement imposed by the authorities (in relation to deposits), after a given realization of the reduction of deposits or a contingent expansion of loans. The Appendix 1 explains how the joint density function of the future reductions of deposits plus expansions of loans, and the requirements of reserves, is estimated by the kernel method, and how this function is used to estimate the liquidity costs associated with a specific level of reserves.

The solvency costs are those associated with the provision of equity in order to cover eventual losses or negative cash flows arising from a level of obligations, namely, deposits plus operational costs, larger than the sum of assets and revenues. These costs have also two components; the opportunity cost in which the bank incurs for paying the shareholders the cost of capital, instead of paying for an increase of deposits, and the expected cost of a capital shortfall. The Appendix 1 describes the procedure to estimate the solvency costs function on the basis of the empirical joint density function for future flows of revenues and variations of assets.

In order to solve the problem of profit maximization, it is useful to define α as the ratio of total loans to assets (α≡E/A), δ as the ratio of deposits to assets (δ≡D/A), and to write equation (1) in the form:

$$(2) \qquad \mathrm{E}[p] = r(a(1-b)*A)*a(1-b)*A - i(d*A)*d*A - C(A,d,a,b) - L(A,d,a) - S(A,d,a) + r(1-d)A$$

Then, in general, the first order conditions for profit maximization are derived from the partial derivatives of the expected profit function with respect to A, α, and δ, and corresponds to equations (A26i-A26iii) in Appendix 1. However, in practice, regulations on the banking sector may constraint the set of variables that the bank can set at their optimal value in order to maximize profits. Thus, for example, regulations on the minimum equity requirements in relation to risk weighted assets; or the minimum liquidity levels in relation to the level and composition of deposits; or the minimum capital needed to operate a bank, may imply that in practice the bank, after selecting, for example, the level of assets, must adjust α and δ to the requirements established by the authorities; or that after selecting the optimum levels of A and α, it must adjust δ to that regulation; or that after A and δ are selected, it adjusts α. Each of these situations defines a different set of variables that the bank can effectively set at their optimal level.

On the basis of the results obtained in a previous work by Mora (2004) with a similar model, except for the incorporation of bad loans and the longitude of the sample period, in this paper two models will be considered for econometric estimation, since they are better suited to make comparisons of the degree of competition between different countries.

The first model assumes that the bank selects α and δ, in which case a combination of the first order conditions (A26.ii) and (A26.iii) gives the following equation for the spread between the real interest rate charged on loans and the real interest rate paid on deposits by the bank j and time t:

$$(3) \qquad r_{j,t} - i_{j,t} = \frac{1}{2}\left\{ \begin{aligned} &\left(\frac{l_j}{h^E}\right)\frac{e_{j,t} r_{j,t}}{a_{j,t}(1-b_{j,t})} - \left(\frac{q_j}{h_D}\right)(1-2d_{j,t}) d_{j,t} i_{j,t} + p(1+k_{j,t})\Phi_{j,t} + (C_D + C_E) + \\ &+ a(1+i_{j,t} + C_E + C_D)\Psi_{t,t} + a\left(\frac{q_j}{h_D}\right) d_{j,t} i_{j,t}\Psi_{t,t} + 2r_t \end{aligned} \right\}$$

where the term (l_j/η_E) corresponds to the coefficient measuring the monopoly power in the market for loans and (q_j/η_D) to the monopoly power in the market for deposits.[13] These coefficients are larger, the lower the degree of competition in those markets. Since l_j (q_j) measures the response of the market's total loans (deposits), when bank j decides to increase its own loans (deposits), and η_E (η_D) correspond to the elasticity of the demand function for loans (supply of deposits) in the market, then perfect competitive markets l_j and q_j tend to zero and η_E and η_D tend to infinity. The lower the degree of competition in the market for loans, the larger the spread, according to equation (3). In the case of the market for deposits, the corresponding coefficient that measures the monopoly power multiplies a composite variable that adopts a negative value if the ratio of deposits to total assets is larger than 0.5. Under these circumstances, the lower the degree of competition in the market for deposits, the larger the spread.[14] These two are the main coefficients of interest in this paper, since they measure the degree of competition in those markets.

In addition, in equation (3), $e_{j,t}$ ($d_{j,t}$) represent the share of bank j's loans (deposits) within the total of loans (deposits) in the market; $\alpha_{j,t}$ ($\delta_{j,t}$) , the ratio of loans (deposits) to total assets for bank j; $k_{j,t}$ the ratio of liquid assets to deposits; C_D and C_E the marginal operating cost of deposits and loans; $f_{j,t}$ and $?_{j,t}$, the probabilities of a liquidity or solvency shortfall, respectively; and ρ_t the cost of capital in the market.

According to equation (3), the real spread is positively related to the probabilities of liquidity or solvency shortfalls ($f_{j,t}$ and $?_{j,t}$); the ratio of reserve requirements ($k_{j,t}$); the operational marginal costs (C_D and C_E); the cost of capital (ρ_t); the share of bad loans in the portfolio of loans ($b_{j,t}$); the relative size of the bank within the market ($e_{j,t}$ or $d_{j,t}$); and the level of the real interest rate ($i_{j,t}$ or $r_{j,t}$).

The second equation for the spread that will be estimated is obtained from the first order condition corresponding to equation (A26.iii) in Appendix 1:

$$(4)\qquad r_{j,t} - i_{j,t} = -\left(\frac{q_j}{h_D}\right)(1-2d_{j,t})d_{j,t}i_{j,t} + pk_{j,t}\Phi_{j,t} + C_D + a(1+i_{j,t}+C_D)\Psi_{t,t} + 2r_t + a\left(\frac{q_j}{h_D}\right)d_{j,t}i_{j,t}\Psi_{t,t} + (r_{j,t}+i_{j,t})$$

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[13] In turn the terms l_j, η_E, q_j, η_D are defined as: $l_j \equiv \frac{\partial E^T}{\partial E^j}; h_E \equiv -\frac{\partial E^T}{\partial r_j}\frac{r_j}{E^T}; e_j \equiv \frac{E^j}{E^T}; q_j \equiv \frac{\partial D^T}{\partial D^j}; h_D \equiv \frac{\partial D^T}{\partial i_D{}^j}\frac{i_D{}^j}{D^T}; d_j \equiv \frac{D^j}{D^T}$

[14] In fact, in the monthly data used for econometric estimation, that composite variable, $(1-2\delta_{j,t})d_{j,t}\, i_{j,t}$, adopts negative values in 78% of the observations of individual banks in Bolivia; 80% in Colombia; 74% in Costa Rica; 75% in Ecuador; 80% in Perú, and 9% in Venezuela.

where all the variables have already been defined. In this case the spread increases with the relative size of the bank in the market for deposits, the level of the interest rates, the proportion of liquid assets, the marginal operating costs, and the probabilities of liquidity and solvency shortfall. In addition, for ratios of deposits to total assets larger than 0.5, the spread is larger, the lower the degree of competition.

2.2.2 The behavior of the variables explaining the spread

The information used in this study to estimate the previous two models is taken from the balance sheets and monthly income statements of the individual banks published by the respective banking superintendences from January 1997 to December 2004 for Colombia, Costa Rica, Ecuador, Perú and Venezuela. In the Bolivian case, this information could only be obtained from January 1998.[15]

The spread was defined as the difference between the monthly rate of return on productive assets and the rate paid on deposits, both deflated by the gross rate of monthly inflation of the consumer price index (CPI).[16] The former corresponds to the ratio of financial income received in one month[17] to productive assets at the end of the previous month.[18] The latter is the ratio of the sum of interest payments and financial payments other than interest, to the sum of the deposits and other liabilities subject to reserve requirements.

Figure 7 shows the weighted average spread for the FLAR member countries.[19] In Perú and Costa Rica the spread, in real terms, has been relatively more stable, but in the second country it has been negative along the whole sample period. In Bolivia and Colombia increased significantly in the last two years, but in the first country the ascending path has extended along all the sample period. By the end of the sample, Colombia's has reached a similar level to Perú's and Ecuador's, while Bolivia´s is almost twice as large as the one corresponding to these three countries. Since mid 2002, Venezuela's becomes negative and Costa Ricas' presents a declining tendency with even larger negative values. In general, four, out of the six countries have presented high spreads, namely, Bolivia, Ecuador, Perú and Colombia.

[15] This information was supplemented with data on liquidity reserve requirements which is also recorded by the banking regulators (Superintendencias). In general, the information is available for the same period as the information taken from the balance sheets, except in the cases of Costa Rica where it only exists since September 1997. For Venezuela, where the reserve information is not available, we decided to construct it by applying the reserve requirement rates to the liabilities subject to reserve requirements, although their degree of aggregation in the balance sheet only allows approximate estimations of the true values for the reserve requirements.

[16] The gross inflation rate is defined as 1 plus the inflation rate of the period.

[17] Financial income is the sum of interest income (current and default) and financial income other than interest, such as valuation of investments, dividends, commissions, foreign-exchange income, income from derivatives, and financial income from lease operations.

[18] The productive assets consists of the sum of loans (performing and bad loans); investments in fixed and variable income securities; and trustee rights.

[19] The weighting variable is the share of each bank's revenues in the total of revenues in the banking sector.

The probabilities of liquidity and solvency shortfalls were estimated as described in section 2.1 of the Appendix 1, for each bank. Figures 8 and 9 show the weighted average of those probabilities, using as a weighting variable the share of each bank total reserves (or liquid assets), and equity, respectively, within the total banking sector in each country.

The probability of liquidity shortfall has declined since 2002 in almost all countries, with the only exception of Perú which has experienced a substantial increase and reached the highest level of the six countries during 2004. Along the whole sample, Perú and Colombia have presented the highest probabilities of illiquidity; even though Venezuela reached similar levels during 2002 and 2003, but then declined sharply. Bolivia and Costa Rica exhibit a constant declining path to very low levels by the end of 2004. Ecuador's increased during the period of large macroeconomic imbalances but has decreased substantially since then.

As expected, the probability of insolvency (Figure 9) has been much smaller than the probability of illiquidity in all countries, but with some peaks in periods of macroeconomic imbalances, specially in Ecuador. As in the case of the probability of illiquidity, Colombia has presented the highest levels.

It is worthy to emphasize that Colombia presents the highest probability of liquidity and solvency shortfalls; while at the same time their indexes of official restrictions to capital flows are also the highest, suggesting that those controls do not isolate the banking sector in this country from the disturbances they attempt to address.

Figure 7

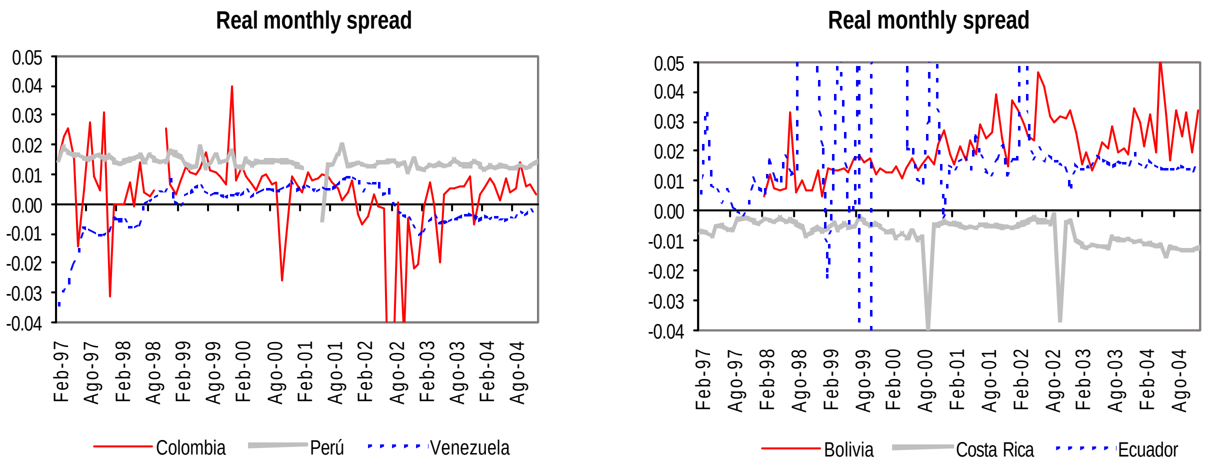

Figure 8

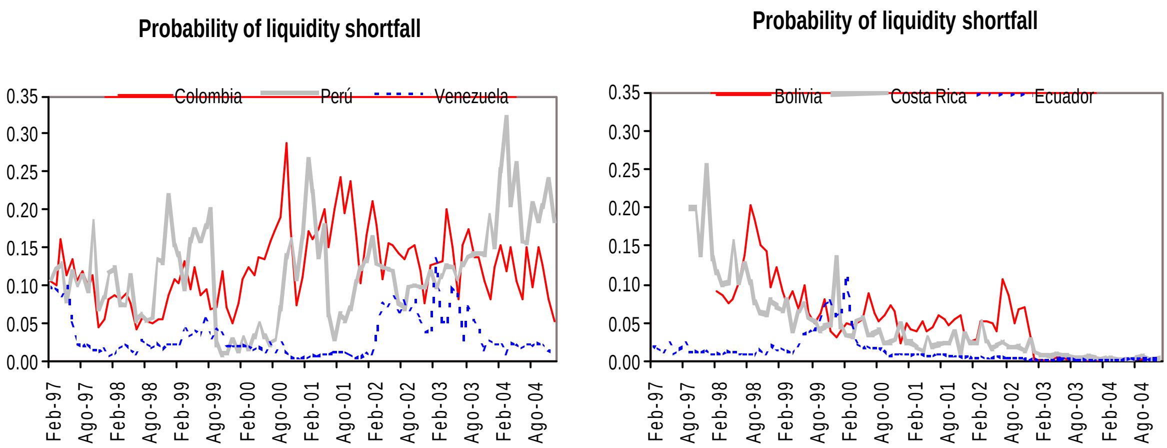

Figure 9

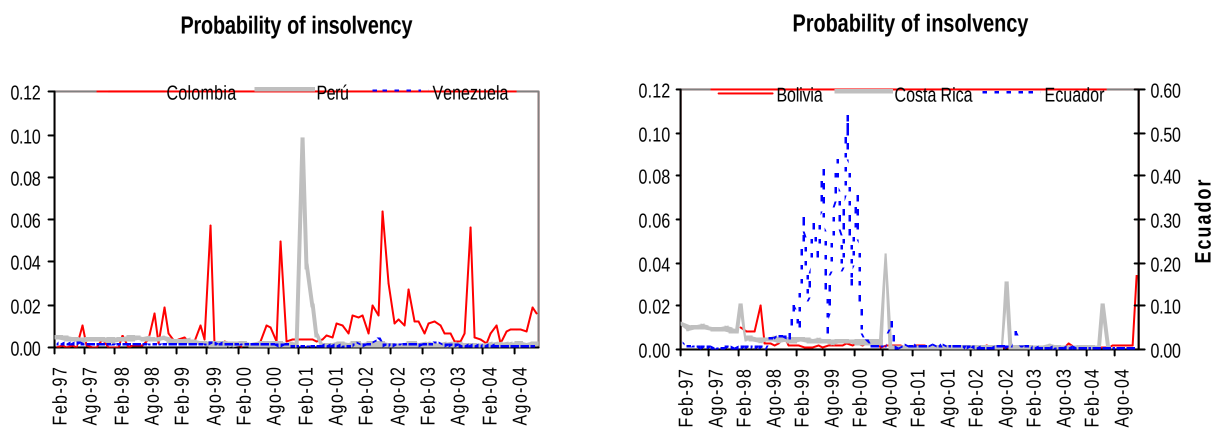

Figure 10 presents the average weighted ratio of observed required reserves to deposits and liabilities.[20] Required reserves are those reported by the banking superintendences[21] and their behavior over time is the result of both, the regulation on legal required reserve rates imposed for different types of liabilities, and the decisions on the composition of these liabilities, adopted by the banks. It may be observed that in contrast with the cases of the probabilities of illiquidity and solvency shortfalls, Colombia reduced considerably the required reserves ratio since 1998, to almost the lowest level in the region. Only Ecuador presents a slightly lower ratio since 2001. This measure must have contributed to outweigh the positive effects on the spread originated in the larger probabilities of shortfalls in this country. Even though Perú presents a declining path for the required ratio until 2000, and Costa Rica until 2002, the first country stabilized at the highest level of the group afterwards, only similar to Venezuela's, while Costa Rica started and ascending path since then. Bolivia is the only country in the group that has maintained an increasing path since 1998, but at the end of the sample its level is still lower than Perú's and Venezuela's and similar to Costa Rica's.

It is interesting to note that not necessarily countries with the highest required reserves ratios (Figure 10) are the ones with the smallest probability of illiquidity (Figure 8), as illustrated by the case of Perú, where exactly the opposite occurs.

Other group of variables affecting the spread is the marginal operating costs. These were estimated as explained in section 2.3 of Appendix 1. Figures 11 and 12 show the weighted average of the marginal operating costs of deposits and loans, respectively.[22] There is a large variation across countries. In both cases, Ecuador presents by far the largest marginal costs, while Perú and Costa Rica, the lowest. Colombia's and Bolivias' marginal costs of loans has been as eight times as large, on average, than those for Perú; while in the case of the marginal costs of deposits that proportion is 5 times for Colombia and 2 times for Bolivia. However, in Colombia the marginal cost has decreased constantly, along the sample period, while Bolivia's has increased. Venezuela's marginal costs of deposits increased sharply in 2004 and had been, in general, twice those of Colombia.

The cost of capital is the rate that must be paid to shareholders in order for them to invest their savings in an specific firm, which varies across firms of different sectors. However, given the constraints of information on the capital market of each country, it is not possible to use at this moment estimates of the capital cost of individual banks. It will be necessary to use a *proxi*, common to all banks in the same country, instead of specific estimates for

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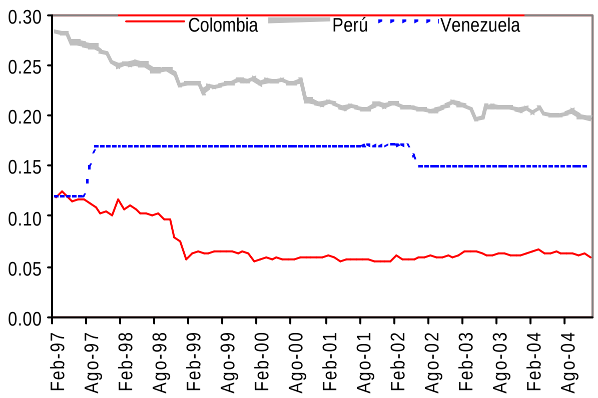
[20] The weighting variable is the share of the deposits in each bank in the total of deposits in the banking sector.

[21] Except for Venezuela, as explained in a previous footnote, where the data of required reserves is not available in the Superintendencia and, therefore, the ratio was estimated by applying the reserve requirement rates to the liabilities subject to reserve requirements. Unfortunately, the degree of aggregation in the balance sheet only allows approximate estimations of the true values for the reserve requirements.

[22] In both cases the weighting variable corresponds to the share of each bank's operating costs within the total of operating cost of the banking system.

Figure 10

Reserve requirements / Deposits and liabilities



Reserve requirements / Deposits and liabilities

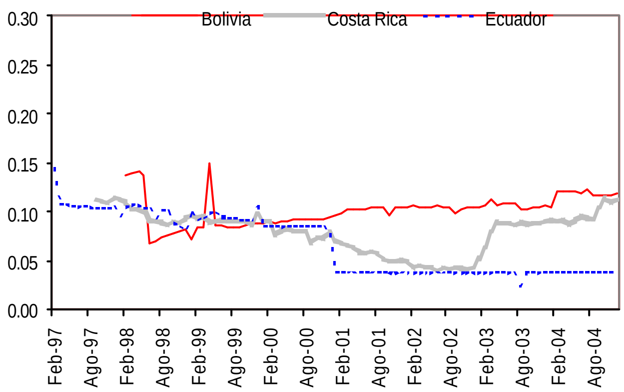
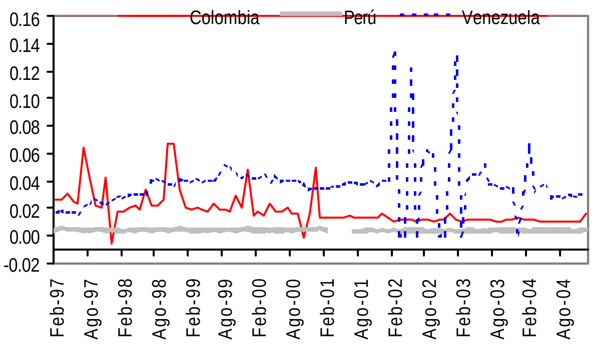


Figure 11

Marginal operating costs of deposits



Marginal operating costs of deposits

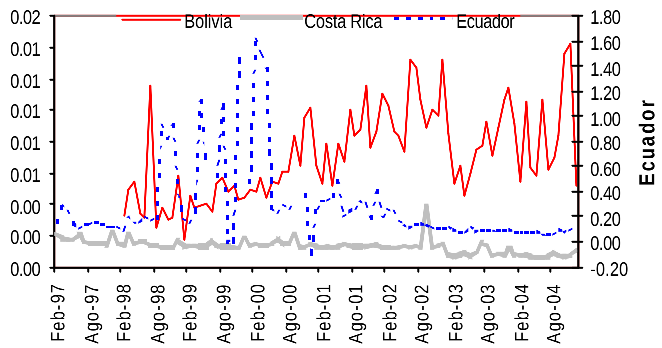
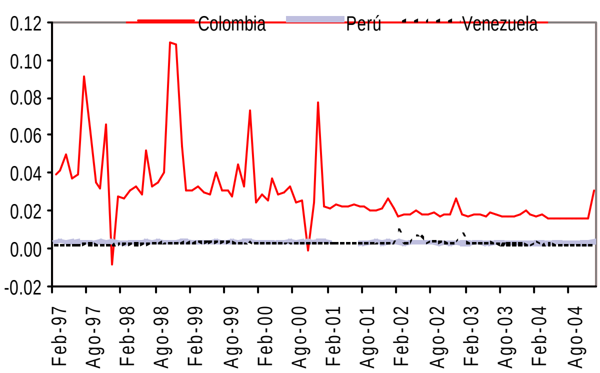
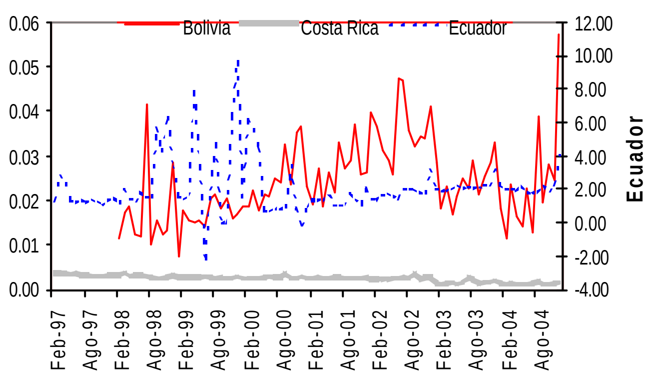


Figure 12

Marginal operating costs of loans



Marginal operating costs of loans



individual banks. This *proxi* corresponds to the maximum of two variables. The first one corresponds to rate of USA treasury bills with maturity three months of maturity increased by the spread of sovereign country bonds and expressed in domestic currency. The second variable is the deposits interest rate in each market. Both variables are measured in real terms. Figure 13 shows the *proxi* for the cost of capital. It has been substantially higher for Ecuador, relatively stable and small for Perú and Costa Rica, since 1997; and highly volatile for Ecuador and Venezuela. In Bolivia and Colombia the range of variation has been wider than in Perú and Costa Rica, but narrower than in Ecuador and Venezuela, with an average level larger than in the other four countries. In the last years of the sample period it has decreased slightly in all countries.

Figure 14 shows the percentage of bad loans in the total portfolio of loans.[23] It increased substantially for Colombia and Perú for the period 1998-2001, but has decreased substantially since then, to levels similar to the other countries by 2004, of around 2%-4%. In Ecuador it reached the highest level (22%) among the six countries in the period of macroeconomic imbalances, but has also reduced since then. Bolivia and Costa Rica has shown a more stable proportion of bad loans, of about 3%-5%, on average, while those of Colombia and Perú rose up to 12% in 2000.

Finally, in order to measure the degree of concentration of the banking sector in each country, Figure 15 shows the proportion of total loans that is held by the 20% of banks with the largest shares in each country. The relative size of the banks varies broadly between countries. In general, it is much larger in Venezuela, Perú, Ecuador and, recently, Costa Rica, than in Colombia and Bolivia. However, it decreased until 2000 in Venezuela and Perú and then started rising again; while in Costa Rica has been increasing continuously since 1998 in a very significant way and in Colombia has increased slightly since 2000. Only in Bolivia the degree of concentration fell in the recent years.

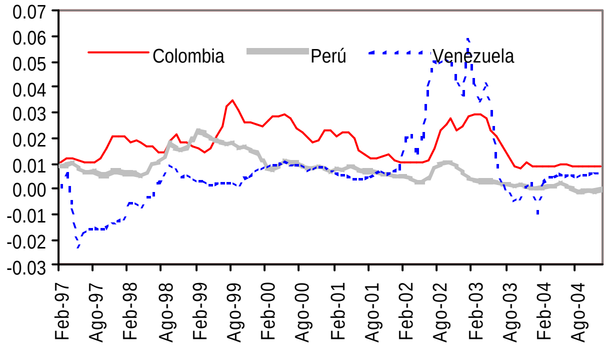
In synthesis, the previous descriptions suggest that behind the relatively large spread in Bolivia, Colombia, Ecuador and Perú lie different reasons. Colombia and Perú have presented large probabilities of liquidity shortfalls, a high cost of capital and a large share of non performing loans. Colombia has also had relatively large marginal operating costs, the same as Bolivia and Ecuador. However, Colombia and Ecuador has presented the lowest ratio of reserve requirements, while Perú the highest. In Bolivia, the relatively largest cost of capital might had also contributed to high spreads.

A formal test of the incidence of those variables in the spread is provided in the next section.

[23] For each country the weighting variable is the share of each bank's loans in the total value of loans for the banking sector.

Figure 13

Proxy for the cost of capital



Proxy for the cost of capital

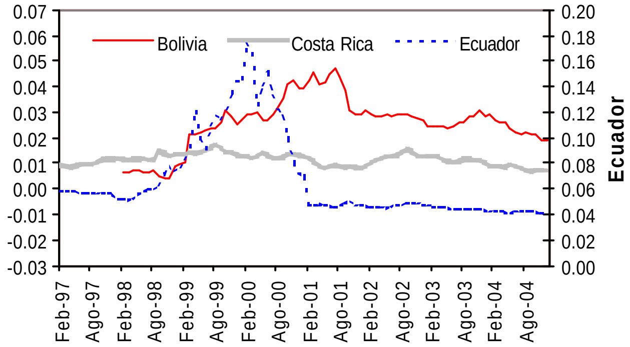
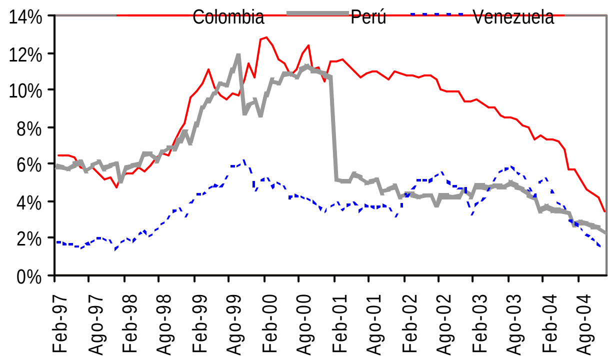


Figure 14

Non performing loans / Total loans (%)



Non performing loans / Total loans (%)

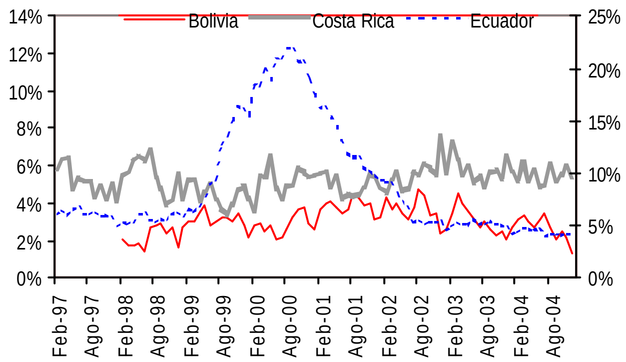
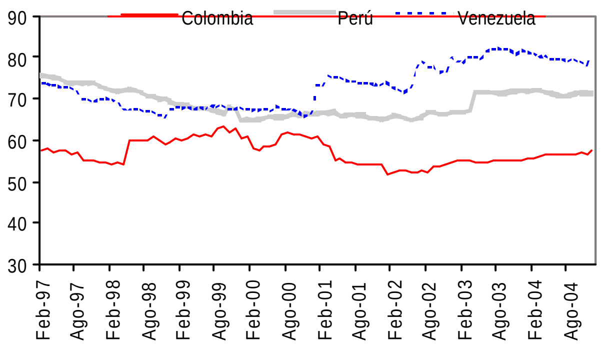
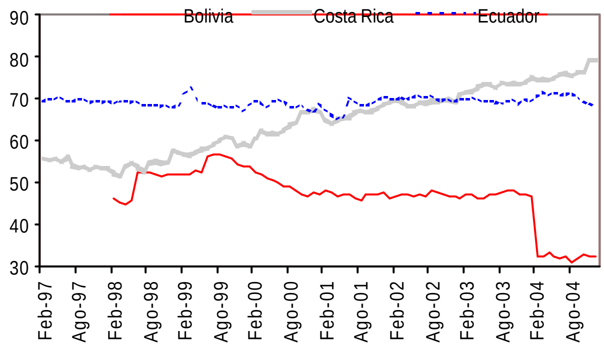


Figure 15

Share of loans held by the 20% largst banks (%)



Share of loans held by the 20% largst banks (%)



2.2.3 Econometric estimation of the models for the spread: the monopoly power in different countries

The model of equation (3) was estimated for each country as a system of seemingly unrelated regressions (SUR) in order to capture the effect of the cross section covariances of the disturbances between individual banks, given that they are subject to common shocks.

To estimate the parameters l_j/η_E and q_j/η_D it was assumed that each of them was equal among the banks within the same country.[24] All other coefficients in the model were allowed to differ between banks.[25] Table 1 presents the results. Since for most variables we estimated one coefficient for each bank, in those cases the table reports the range of values of the estimated coefficients, as well as the range of the t-student statistics.

In general, for the majority of countries only the coefficients measuring the monopoly power in the loans and deposit markets are statistically significant for the whole sample from 1997.2 to 2004.12. However, in the case of the deposits market, the corresponding coefficient is not significant for Bolivia[26], while in the case of Colombia it is significant and with the expected sign for 63% of banks; for Costa Rica 89%; Ecuador and Perú 90%; and Venezuela 100%. As will be shown latter on, the specification in the model of equation (3) seems better suited to measure competition in the loans market, since in this case the coefficient has the desired properties of significance and expected sign for 100% of the banks. Out of the other explanatory variables in Table 1, only in Colombia are the marginal operating costs significant for the majority of banks, while other variables in any country are either significant or have the expected sign but for a small proportion of banks.

For the previous reasons, the results of Table 1 will be used to compare the degree of competition only in the loans market. The ranking, according to the size of the coefficient of the second variable, from the most competitive country to the least, and for the whole sample period, is the following: Perú, Venezuela, Bolivia, Colombia, Costa Rica and Ecuador.

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[24] In order to be able to identify the parameters of main interest, namely l/η_E and q/η_D, the observed values $\alpha_{j,t}$ and $\delta_{j,t}$ were taken as part of the explanatory variable, instead of estimating $l/\alpha\eta_E$ and $q/(1\text{-}2\delta)\eta_D$. The problem of identification arises from the fact that given N banks, we would have had, N estimated coefficients of $l/\alpha\eta_E$ and N+1 unknowns. Apart from the problem of identification, the logic for including α in $l/\alpha\eta_E$ is that the estimated coefficient would correspond to the optimal level α, instead of the observed ratio.

[25] In the case of the coefficient of the opportunity cost of capital (ρ), for which the functional specification imposed a specific value of 2, the coefficient was permitted to be different from 2, since this specification achieves a better adjustment of the regressions by country, and because a proxy for the cost of capital, instead of the true variable is being used.

[26] Even though, it is statistically significant and with the expected sign for the samples up to 2003:12.

Table 1
Econometric estimation of Model-equation (3)
(The bank selects alpha y delta)

Explanatory variable	Bolivia	Colombia	Costa Rica	Ecuador	Perú	Venezuela
$d_j i_j (1-2d_j)$	-1.03	20.29	38.04	24.32	6.59	10.23
t-Student statistics	-1.03	26.56	182.28	13.36	20.86	18.33
expected sign	no	sí	sí	sí	sí	sí
% banks with statistically significance and expected sign	0.0	62.5	88.9	90.0	90.0	100.0
$e_j r_j / a_j$	4.95	5.02	12.58	14.82	3.14	4.70
t-Student statistics	58.55	38.65	28.22	63.30	50.60	31.58
expected sign	sí	sí	sí	sí	sí	sí
% banks with statistically significance and expected sign	100.0	100.0	100.0	100.0	100.0	100.0
$d_j r_j y$		-16.74	-146.17	-16.00	-187.05	-309.42
t-Student statistics		-4.20	-4.61	-13.82	-148.80	-9.01
expected sign		no	no	no	no	no
% banks with statistically significance and expected sign		0.0	0.0	0.0	0.0	0.0
$(C_E + C_D)$	-0.04 a 0.49	0.06 a 0.96	-6.52 a 2.29	0 a 0.003	-0.94 a 1.43	-0.06 a 0.26
t-Student statistics	-0.85 a 10.73	2.81 a 25.19	-12.32 a 5.36	3.15 a 3.15	-5.82 a 335.17	-4.85 a 8.49
expected sign	sí	sí	no	no	no	no
% banks with statistically significance and expected sign	58.3	87.5	11.1	10.0	40.0	25.0
$(1+k)f$	-0.003 a 0.04	-0.0002 a 1.69	-0.01 a 0.02	-0.03 a 0.15	-0.0005 a 0.01	-0.01 a 0.01
t-Student statistics	-1.6 a 3.09	-0.07 a 3.28	-1.39 a 2.85	-5.92 a 3.12	-0.39 a 6.17	-0.68 a 3.45
expected sign	no	no	no	no	no	no
% banks with statistically significance and expected sign	25.0	6.3	22.2	10.0	40.0	6.3
$(1+i+C_D+C_E)y$	0.04 a 0.04	-1 a 0.07	0.02 a 2.7	0.01 a 0.01	0.04 a 0.09	0.02 a 0.6
t-Student statistics	0.92 a 0.92	-44.67 a 2.81	0.36 a 4.43	0.48 a 10.96	2.1 a 3.41	2.72 a 2.98
expected sign	no	no	no	no	no	no
% banks with statistically significance and expected sign	0.0	6.3	11.1	10.0	20.0	12.5
RHO (ρ)	-0.001 a 0.15		0 a 0.84	-0.11 a 0.28		
t-Student statistics	-0.03 a 2.11		0 a 3.72	-3.68 a 4.87		
expected sign	no		no	no		
% banks with statistically significance and expected sign	0.0		0.0	10.0		

Source: Author's estimations

Table 2
Econometric estimation of Model-equation (4)
(The bank selects delta)

Variable explicativa	Bolivia	Colombia	Costa Rica	Ecuador	Perú	Venezuela
$d_j i_j (1-2d_j)$	33.44	21.64	16.97	38.83	13.17	14.98
t-Student statistics	41.48	92.53	15.97	14.99	26.66	24.13
expected sign	sí	sí	sí	sí	sí	sí
% banks with statistical significance and expected si	81.8	100.0	100.0	100.0	100.0	100.0
$(r+i)$	0.73 a 1.05	-0.46 a 1.01	-0.79 a 1.01	0.25 a 0.75	0.22 a 1.38	-0.5 a 0.97
t-Student statistics	53.63 a 190.85	-16.87 a 146.23	-30.63 a 14.5	6.14 a 51.51	5.43 a 46.81	-8.92 a 29.62
expected sign	si	si	si	si	si	sí
% banks with statistical significance and expected si	81.8	85.7	66.7	100.0	100.0	87.5
kf	-0.001 a 0.22	-0.35 a -0.02	-0.03 a -0.03	-12.44 a 0.12	-0.01 a 0.03	-0.07 a 0.14
t-Student statistics	-0.09 a 5.76	-3.9 a -0.55	-0.65 a -0.65	-8.21 a 2.07	-2.28 a 7.47	-2.8 a 3.26
expected sign	no	no	no	no	no	no
% banks with statistical significance and expected si	9.1	0.0	0.0	10.0	10.0	18.8
C_D		0.08 a 1.63	0.64 a 1.51	-0.89 a 0.25	-1.02 a 1.17	-0.01 a 0.19
t-Student statistics		2.39 a 14.75	0.47 a 2.26	-6.41 a 12.36	-2.91 a 11.84	-1.04 a 5.87
expected sign		sí	no	no	no	no
% banks with statistical significance and expected sign		57.1	16.7	20.0	20.0	31.3
$(1+i+C_D)y$	-0.99 a 0.03	-0.08 a 0.04	-0.02 a 0.31	-0.89 a 0.04	0.07 a 0.07	-0.29 a -0.02
t-Student statistics	-2.37 a 2.45	-1.03 a 4.75	-5.4 a 0.3	-2.09 a 12.82	6.67 a 6.67	-4.97 a -2.63
signo esperado	no	no	no	no	no	no
% bancos donde es significativa y signo esperado	9.1	7.1	0.0	10.0	10.0	0.0
$d_j i_j y$	1477.98	-48.63	62.79	-58.52	-585.67	-946.98
t-Student statistics	1.93	-6.72	11.83	-29.23	-13.68	-7.89
expected sign	sí	no	no	no	no	no
% banks with statistical significance and expected si	18.2	28.6	33.3	40.0	40.0	25.0
RHO (ρ)	0.01 a 0.24	-0.35 a 0.32	0.22 a 1.29	0.07 a 0.22	-0.2 a 0.11	0.04 a 0.26
t-Student statistics	0.62 a 3.51	-1.85 a 2.52	1.07 a 2.26	1.78 a 2.83	-1.99 a 2.86	0.9 a 2.81
expected sign	no	no	no	no	no	no
% banks with statistical significance and expected si	0.0	0.0	0.0	0.0	10.0	0.0

Source: Author's estimations

Table 2 reports the results of estimating the model in equation (4). In this case, and in contrast with the previous results in Table 1, the coefficient measuring the monopoly power in the market for deposits is significant and with the expected sign for 100% of the banks in almost all countries, with the only exception of Bolivia where the percentage of banks for which those two desired characteristics are met is 82%. Out of the other explanatory variables, only the level of the interest rate, (i+r), has those characteristics for the majority of banks. According to the size of the coefficient of the first variable, the ranking of competition from the most competitive country to the least, and for the whole sample period, is the following: Perú, Venezuela, Costa Rica, Colombia, Bolivia, and Ecuador. As in the case of the loans market, Perú and Venezuela are the most competitive, and Ecuador the least. Other countries are in between.

However, the degree of competition may vary along time. For this reason, the coefficients l/η_E and q/η_D were estimated along the sample period by means of rolling estimations[27] of the system for each country, using equations (3) and (4), respectively, for the reasons explained above. Figure 16 shows the resulting estimate of the monopoly power in the market for loans, and Figure 17, the one corresponding to the monopoly power in the market for deposits.[28]

It can be observed in Figure 16 that the largest monopoly power in the loans market corresponds, by far, to Ecuador. With the only exceptions of Perú and Bolivia, the degree of competition has declined in the last two years. In the case of Costa Rica it increased substantially in 2002, above Bolivia, Colombia, Venezuela and Perú, changing completely the previous ranking of countries according to the monopoly power in that market. Before 2002 this ranking, from less to more competitive, was: Ecuador, Bolivia, Colombia, Venezuela and Perú, while by the end of 2004 it is: Ecuador, Costa Rica, Bolivia, Colombia, Venezuela and Perú. Out of the largest markets, Colombia has been the less competitive, and has maintained a relatively constant degree of monopoly power in that market, as well as Venezuela and Perú. In the group of smaller markets, only Ecuador has been relatively constant, while the monopoly power in Bolivia and Costa Rica has varied significantly.

The degree of competition in the market for deposits (Figure 17) has evolved in a different way. In this case three countries present an increasing tendency of monopoly power along time, namely, Ecuador, Bolivia and Venezuela; while Colombia, Perú and Costa Rica are slightly more competitive in recent years than in the past. However, there are two groups clearly defined in terms of the degree of competition: the least competitive group is

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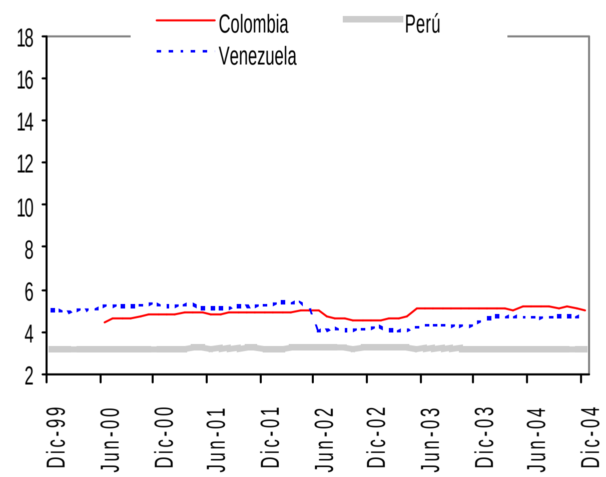
[27] This method consists of expanding the sample of estimation, month after month, from an initial sample long enough as to allow for the initial estimation.

[28] The t-student statistics indicate that the coefficients shown in Figures 16 and 17 are significant even at the 0.00001% level of significance.

Figure 16

Monopoly Power in the Loans Market



Monopoly Power in the Loans Market

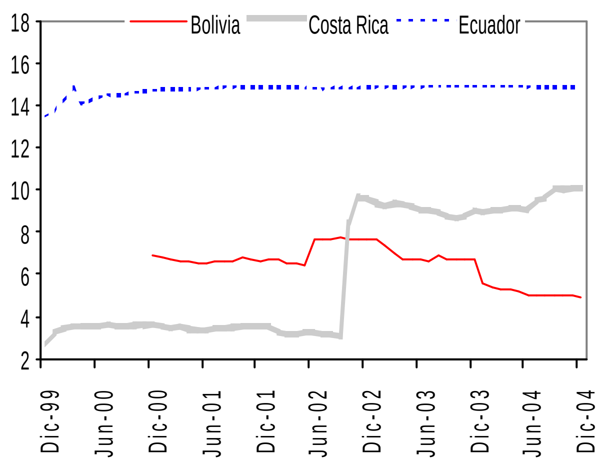
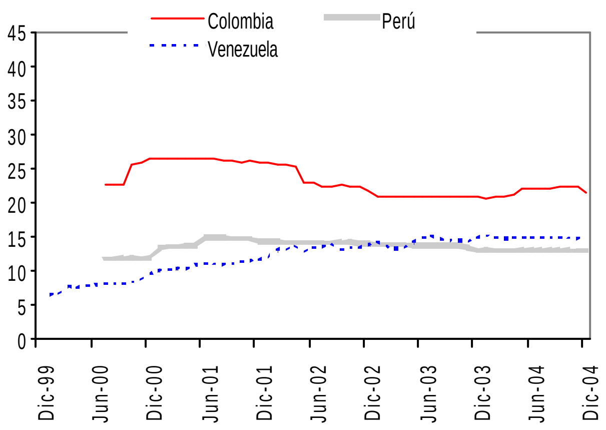


Figure 17

Monopoly power in the market for deposits



Monopoly power in the market for deposits

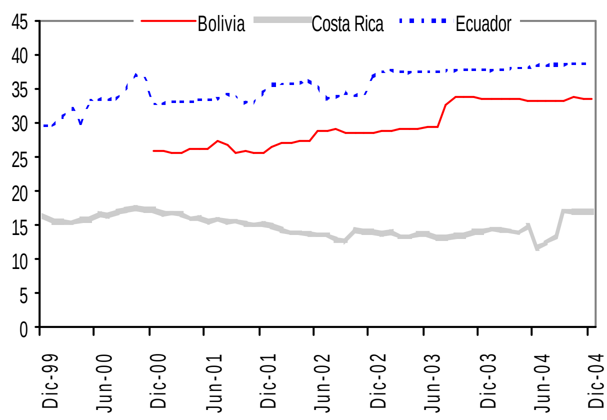


Table 3
Econometric estimation of model in equation (3)
(The bank selects alpha y delta)
Cross section results imposing restrictions on coefficients among banks within the same country and restrictions on coefficients among countries
(Country specific restrictions on the coefficients of monopoly power in the loans and deposits market)

Explanatory variable with equality restrictions on coefficients among banks of the same country	**Bolivia**	**Colombia**	**Costa Rica**	**Ecuador**	**Perú**	**Venezuela**
$d_j i_j (1-2d_j)^*$	33.44	21.64	16.97	38.83	13.17	14.98
t-Student statistics	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
expected sign	yes	yes	yes	yes	yes	yes
% banks with statistically significance and expected sign	100.00	100.00	100.00	100.00	100.00	100.00
$\left({}^{e_j r_j}/_{a_j} \right)^*$	4.95	5.02	12.58	14.82	3.14	4.70
t-Student statistics	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
expected sign	yes	yes	yes	yes	yes	yes
% banks with statistically significance and expected sign	100.00	100.00	100.00	100.00	100.00	100.00
$d_j i_j y$		-97.35	-263.57	-12.18	435.91	-163.35
t-Student statistics		-24.99	-13.40	-5.47	61.14	-9.32
expected sign		no	no	no	yes	no
% banks with statistically significance and expected sign		0.00	0.00	0.00	100.00	0.00
Explanatory variable with equality restrictions on coefficients among countries	**Bolivia**	**Colombia**	**Costa Rica**	**Ecuador**	**Perú**	**Venezuela**
$(1+i+C_D+C_E)y$	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
t-Student statistics	-9.82	-9.82	-9.82	-9.82	-9.82	-9.82
expected sign	no	no	no	no	no	no
% banks with statistically significance and expected sign	0.00	0.00	0.00	0.00	0.00	0.00
$(1+k)f$	0.0039	0.0039	0.0039	0.0039	0.0039	0.0039
t-Student statistics	18.82	18.82	18.82	18.82	18.82	18.82
expected sign	yes	yes	yes	yes	yes	yes
% banks with statistically significance and expected sign	100.00	100.00	100.00	100.00	100.00	100.00
(C_E+C_D)	0.0220	0.0220	0.0220	0.0220	0.0220	0.0220
t-Student statistics	17.29	17.29	17.29	17.29	17.29	17.29
expected sign	yes	yes	yes	yes	yes	yes
% banks with statistically significance and expected sign	100.00	100.00	100.00	100.00	100.00	100.00
RHO (ρ)	0.3070	0.3070	0.3070	0.3070	0.3070	0.3070
t-Student statistics	23.03	23.03	23.03	23.03	23.03	23.03
expected sign	no	no	no	no	no	no
% banks with statistically significance and expected sign	0.00	0.00	0.00	0.00	0.00	0.00

(*) Coefficients obtained from country specific model regressions of equation (3)

composed, in descending order of monopoly power, by Ecuador, Bolivia and Colombia. The other group, also in descending order of monopoly power, is conformed by Venezuela, Costa Rica and Perú.

On the other hand, it is important to mention that even though in Tables 1 and 2 the coefficients for the other variables, different from the ones measuring the monopoly power, are not statistically significant for the majority of banks, they are up to certain degree significant across countries. In fact, Table 3 shows that the explanatory variables, in which the probability of liquidity shortfalls, the marginal operating costs, and the cost of capital enter as a multiplicative factor, are strongly significant.

The difference between Tables 1 and 2, on the one hand, and Table 3, on the other, is that in the first two tables the models are estimated for each country, with the mentioned variables varying only along time; while in Table 3 the estimation captures also the variance across countries of those variables. In estimating the model reported in Table 3, the monopoly power in the loans market was constrained for each country to the values of Table 1, and the monopoly power in the deposits market, to the values of Table 2.

Therefore, the results shown in Table 3 confirm the hypothesis mentioned in section 2.2.2, that differences in the level and the variance of the spreads between countries are explained, in a very important way, by differences across countries in the probability of liquidity shortfalls, the marginal operating costs, and the cost of capital, besides the monopoly power in the loans and deposits markets. The only variable that does not have the expected sign in Table 3 is the one associated with the probability of solvency shortfalls.

2.2.4 Monopoly capital controls power in the banking sector and

From the results of the previous sections of this chapter it may be formally tested what is the relation between the degree of monopoly power in the markets for loans and deposits, and the degree of integration of the financial system with the rest of the world.

With this purpose the statistical relation between the previous coefficients of monopoly power and the indicators of capital liberalization will be tested. As explained, *de jure* indicators of capital controls have annual periodicity, while *de facto* indicators as well as the estimates of monopoly power obtained by rolling regressions have monthly periodicity. In order to make the best possible use of all available information, the test will be made with the two sets of data, monthly and annual. The annual data may allow to control for the incidence of other variables on the monopoly power, which are not available in monthly frequency. Even though the main interest will be to estimate the correlation between monopoly power and capital controls, standard regressions will be used to test this relationship in order to be able to verify the stationarity of the residuals obtained from these regressions and, then, to test for the true statistical significance of the coefficients. In other words, in this way it will be possible to tests weather the correlation between those two variables is robust or merely spurious.

Table 4 uses monthly data and presents the coefficients as well as the t-student statistic of a regression between the coefficients of monopoly power obtained by rolling regressions from the estimation of equations (3) and (4), described in the previous section, and the measure of capital controls, which in this case corresponds to the real interest rate differential. It may be observed that the coefficients of monopoly power in the loans and deposits markets estimated in equation (3) are statistically significant. It is worthy to mention that the dependent and explanatory variables are integrated of degree one. However, the residuals obtained in the regressions reported in Table 4 are, in both cases, stationary. Therefore, it is possible to conclude that the correlation between monopoly power and *de facto* indicator of capital controls is significant and robust, and of the type of a long term relation. On the other hand, the coefficient of the regression in which the monopoly power in the deposits market is estimated from equation (4) is not significant.

To provide a basis of comparison for the regressions using *de facto* (monthly) and *de jure* (annual) indicators of capital controls, the simple average of the monthly series for the twelve months in each year was estimated for the variables of monopoly power and real interest rate differential. The results of the regressions are shown in Table 5[29] It may be observed that the interest rate differential, either in nominal or real terms, is significantly correlated with the measures of monopoly power obtained from the estimation of equation (3). However, these indices are not correlated with the measure of monopoly power obtained from equation (4). In the case of this model, it is the general *de jure* indicator of capital controls the one that is correlated significantly with the index of monopoly power in the deposits market; while none of *de jure* indices are correlated with the index of monopoly power obtained from the estimation of equation (3).

Table 4
Monopoly Power and Capital Controls
(Monthly Data in Levels)

Dependent Variable: Monopoly power in the loans market - Model Eq. (3)

Explanatory Variable: Capital Controls	Coefficient	t-stat
Real Interest Rate Differential	0.0069	5.7178

Dependent Variable: Monopoly power in the deposits market - Model Eq. (3)

Explanatory Variable: Capital Controls	Coefficient	t-stat
Real Interest Rate Differential	0.0604	8.7397

Dependent Variable: Monopoly power in the deposits market - Model Eq. (4)

Explanatory Variable: Capital Controls	Coefficient	t-stat
Real Interest Rate Differential	0.0080	1.4057

Source: Author's estimations

[29] Unfortunately, in the case of the residuals of the regressions in Table 5, it was not possible to check for stationarity, since the time series are very short, from 1997 to 2004.

Table 5
Monopoly Power and Capital Controls
(Anual Data in Levels)

Dependent Variable: Monopoly power in the loans market - Model Eq. (3)

Explanatory Variable: Capital Controls	**Coefficient**	**t-stat**
De facto measures		
Real Interest Rate Differentials	0.0162	2.5825
Nominal Interest Rate Differentials	0.0098	2.6037
De jure measures (AREAR)		
Index of total capital controls	0.0935	0.0448
Index of control on capital markets securities, collective investment and institutional investors	0.5857	0.3111

Dependent Variable: Monopoly power in the deposits market - Model Eq. (3)

Explanatory Variable: Capital Controls	**Coefficient**	**t-stat**
De facto measures		
Real Interest Rate Differentials	0.1171	2.4598
Nominal Interest Rate Differentials	0.0666	2.3927
De jure measures (AREAR)		
Index of total capital controls	0.0487	0.0213
Index of control on capital markets securities, collective investment and institutional investors	9.1299	0.8331

Dependent Variable: Monopoly power in the deposits market - Model Eq. (4)

Explanatory Variable: Capital Controls	**Coefficient**	**t-stat**
De facto measures		
Real Interest Rate Differentials	0.0376	1.2790
Nominal Interest Rate Differentials	0.0275	1.6577
De jure measures (AREAR)		
Index of total capital controls	8.9299	2.1422
Index of control on capital markets securities, collective investment and institutional investors	6.9805 **	1.8189

Source: Author's estimations

In summary, the results in Tables 4 and 5 show that there exists a clear correlation between the indicators of effective controls on capital flows and the degree of monopoly power in the markets for loans and deposits, when these two indices are estimated from the specification in equation (3). The indicators of official restrictions do not present the same significant correlation with monopoly power, except when this measure is obtained by the estimation of equation (4), for the deposits market. This may suggest that official controls are not as good indicators of effective protectionism to the banking sector as the indices of effective, or *de facto*, financial liberalization are.

3. Capital account controls, growth and macroeconomic volatility

Fist of all, this section estimates a standard growth regression, based on theoretical grounds and empirical findings, to evaluate the effects of the capital account controls on economic growth for the FLAR's member countries.[30]

Four alternative measures, two in addition to those two used in section 2, of capital account controls are used as the interest explanatory variables in the estimable growth equation. That is, we use the extension of the *de jure* measure built by Miniani (2004) and the *de facto* indicator of the real interest rate differential proposed by Frankel (1992). The other two *de facto* measures, which are indicators of effective financial integration, are the net capital flows (summation of net foreign direct investment, net portfolio equity and net debt), and the net foreign assets (stock), the latter following the methodology indicated by Lane and Milesi-Ferretti (2001).[31] Secondly, this section estimates a specification, in the spirit of Razin and Rose (1994), Easterly et al. (2001), and Kose et al. (2003), to quantify the effects of the capital account controls on the volatility of output, consumption, and investment in the FLAR's member countries.

The data cover the period from 1983 to 2003 [$t = 1, \ldots, T = 21$] and the countries (individuals) are Bolivia (BOL), Colombia (COL), Costa Rica (CRA), Ecuador (ECU), Perú (PER) and Venezuela (VEN) [$i = 1, \ldots, N = 6$].[32]

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[30] Some of the recent theoretical and empirical references on growth models are Romer (1986), Lucas (1988), Barro (1991), Rebelo (1991), Levine and Renelt (1992), King and Levine (1993), Barro and Lee (1996), Barro and Sala-i-Martin (1995), Sach and Warner (1995), Levine (1997), Rodrick (1998), Frankel and Romer (1999), Easterly and Levine (2003), and Klein (2005).

[31] Their methodology consists on accumulating the different net components of the capital account of a country's balance of payments. We transform the calculations in such a way that an increase in the indicator means that country's net foreign liabilities increase (net foreign assets decrease).

[32] Appendix A.2 describes the data, the sources, and the units of measurement.

Before running the estimations, some recalls are needed given the available data. First, the sample size of the time series for each of the countries is not as long as desirable for econometric purposes, so that the individual estimations for each of the countries might face sample size problems. Second, and as a result of the small sample size, rather than using quinquennal or decade intervals, as in the standard growth regressions, we use yearly intervals for the estimations. This might create a "noise" introduced by business cycle variation in the GDP, as argued by Rodriguez and Rodrick (1999).[33] Third, if the data is pooled, the number of time series available is higher than the number of individuals, which challenges the results and the asymptotic analysis of the standard panel data approach (assumes *N*>*T*), as discussed by Wooldridge (2002, ch. 10) and Hsiao (2003, section 10.2). Fourth, the panel data procedure chosen needs to take care of: (1) endogeneity problems, (2) nonstationarity nature of the time series, and (3) possible presence of serial correlation along the time series.

3.1 Capital account controls and economic growth: Econometrics and estimations[34]

In order to deal with the first issue discussed above, individual regressions using cointegration techniques *á la Johansen*, given the endogenous and nonstationary behavior of some of the time series, were carried out.[35] Here there is a trade-off between the possible statistical weaknesses of the results and the benefits of having some information about the possible effects for each of the countries in the sample. The growth model regression for each of the countries (that is, for each *i*), normalized by the variable measuring economic growth, is represented by:

(5) $$Gy_{t-1} = f(\underset{(+/-)}{Ca_j}, \underset{(-)}{Gpop}, \underset{(+)}{Inv}, \underset{(+)}{Literate}, \underset{(+)}{Fd_l}, \underset{(+)}{Open}, \underset{(+)}{Icrg}, \underset{(-)}{Pdebt}, \underset{(+)}{Q})_{t-1},$$

[33] Also, standard "state" variables were not included.

[34] We use STATA V.8.2 for all the calculations, except for the pool unit root tests, where we use EViews V.5. The outputs not reported in the paper are available upon request from authors.

[35] Appendix A.3 shows the results of the pool unit rot tests. The individual unit root tests are available upon request.

where *Gy* is the change in the (natural) logarithm of real GDP per capita; Ca_i is the *i-th* indicator, our variable of interest, of the capital account controls, where *i*=1, .., 4, as explained above; G*pop* is the change of the logarithm of the country's population; *Inv* is the investment as a percentage of GDP; *Literate* is the logarithm of the literacy rate (percentage of people ages 15 and above), Fd_l is the *l-th* domestic financial depthness indicator, *i*=1, .., 3. Thus, three alternative indicators are used: the bank liquid reserves to bank assets ratio, the liquid liabilities (M3) as a percentage of GDP, and the domestic credit provided by the banking sector as a percentage of GDP; *Open* is an indicator of trade openness, defined as the ratio of exports plus imports to GDP; *Icrg* is an indicator of the country's institutional quality; *Pdebt* is the public debt as a percentage of GDP, which is used as an indicator of the country's risk; and *Q* is the log of the real exchange rate, as a proxy of the terms of trade. The function *f*(.) is assumed linear in the parameters, and *t* is the time index. The expected signs are in parentheses.[36]

Table 6-1 and 6-2 show the results for each of the FLAR's member countries under one cointegrating relationship and using alternatively two of the indicators of the capital account controls. Table 6-1 indicates that in the cases of Ecuador and Perú de capital account indicator, our variable of interest, is statistical significant; however, in the former case capital controls decrease economic growth while in the latter one increase economic growth. With respect to the standard explanatory variables in this type of regression models, in many cases they show the expected signs but only a few resulted statistically significant. For example, it is clear that financial depthness promotes economic growth in the cases of Ecuador and Venezuela; and that investment does the same in the cases of Costa Rica and Ecuador. When the net foreign assets (stock) indicator is used, Table 6-2 shows that in two (Bolivia and Ecuador) out of three statistically significant cases, capital account openness improves economic growth. Also, notice that in cases of Bolivia and Ecuador investment reduces instead of promoting growth.

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[36] *Ca* has two expected signs: (-), when indicator Ca_1 (*de jure* measure) or Ca_2 (that *de facto* measure corresponding to the real interest rate differentials) are used, that is, increases in the capital account controls or higher levels (or variability) of the differentials, should have negative effects on growth. (+), when either indicator, Ca_3 or Ca_4, is used, which means that increases in the financial integration should promote growth.

Table 6-1
Growth cointegrating regressions using the *de jure* Ca_1 1/

Dependent variable: *Gy*	**BOL**	**COL**	**CRA**	**ECU**	**PER**	**VEN**
Ca_1	0.82	-0.36	-0.02	**-1.35****	**0.65****	0.13
	(0.68)	(0.24)	(0.13)	**(0.00)**	**(0.01)**	(0.16)
Gpop	0.01	-0.02	-0.14	-0.87	-0.01	-0.10
	(---)	(---)	(---)	(---)	(---)	(0.99)
Inv	-1.02	-0.10	**0.79****	**0.69***	-0.57	0.22
	(0.38)	(0.74)	**(0.01)**	**(0.09)**	(0.83)	(---)
Literate	0.24	0.24	0.11	3.03	0.00	0.18
	(0.96)	(0.96)	(0.96)	(0.01)	(1.00)	(0.86)
Fd_1	0.01	0.01	0.00	**0.02****	-0.01	**0.00****
	(0.64)	(0.39)	(0.67)	**(0.00)**	(0.25)	**(0.03)**
Open	0.00	**0.02****	0.00	**-0.01****	0.02	**-0.01***
	(0.91)	**(0.01)**	(0.23)	**(0.00)**	(0.42)	**(0.06)**
Icrg	**0.03****	0.00	**0.01***	**-0.02****	0.00	0.00
	(0.00)	(0.31)	**(0.05)**	**(0.00)**	(0.94)	(0.64)
Pdebt	0.01	-0.00	0.00	0.00	0.00	0.00
	(0.27)	(0.58)	(0.14)	(0.29)	(0.94)	(0.19)
Q	**0.84****	0.03	**-0.19***	**0.52****	**-0.20****	-0.05
	(0.01)	(0.87)	**(0.07)**	**(0.00)**	**(0.00)**	(0.63)
c^2 for joint statistical significance	16.09**	20.09**	697.00**	1323.3**	65.07**	84.02**
	(0.04)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)

1/ Numbers in parenthesis are the *p-values*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant term is not reported.

Table 6-2
Growth cointegrating regressions using the *de facto* indicator Ca_3 1/

Dependent variable: *Gy*	**BOL**	**COL**	**CRA**	**ECU**	**PER**	**VEN**
Ca_3	**0.00****	**-0.00****	0.00	**0.00****	0.00	0.00
	(0.00)	**(0.00)**	(0.46)	**(0.00)**	(0.88)	(0.20)
Gpop	0.02	-0.15	0.11	-0.39	-0.08	0.03
	(---)	(---)	(---)	(---)	(---)	(---)
Inv	**-1.10****	**2.67****	-0.49	**-2.16****	-2.39	-1.61
	(0.00)	**(0.00)**	(0.38)	**(0.01)**	(0.10)	(0.22)
Literate	0.63	1.40	-0.18	**2.24***	-0.43	**-6.38****
	(0.53)	(0.71)	(0.89)	**(0.09)**	(0.97)	**(0.03)**
Fd_1	**0.01****	0.01	-0.00	**0.01****	0.01	-0.00
	(0.03)	(0.29)	(0.44)	**(0.00)**	(0.32)	(0.25)
Open	**-0.01****	0.00	-0.00	**-0.01****	**-0.01****	-0.02
	(0.03)	(0.33)	(0.40)	**(0.00)**	**(0.00)**	(0.12)
Icrg	**0.01****	**-0.01***	-0.00	**-0.00****	0.01	0.02
	(0.00)	**(0.00)**	(0.40)	**(0.03)**	(0.51)	(0.14)
Pdebt	**0.01****	0.00	0.00	0.00	0.00	0.00
	(0.01)	(0.66)	(0.92)	(0.91)	(1.00)	(0.99)
Q	**0.11****	**0.42***	**-0.37****	-0.03	-0.03	-0.32
	(0.03)	**(0.08)**	**(0.00)**	(0.55)	(0.88)	(0.20)
c^2 for joint statistical significance	87.62**	103.4**	379.59**	135.5**	195.53**	18.03**
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.02)

1/ Numbers in parenthesis are the *p-values*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant term is not reported.

In order to face the third and fourth issues discussed above, a dynamic panel data approach is used, specifically, the Arellano and Bond's (1991) procedure. This derives a generalized method of moments estimator for the parameters using lagged levels of the dependent variable and *predetermined* variables and differences of the *strictly* exogenous variables as explanatory variables (*covariates*).[37]

Following Arellano and Bond (1991), our economic growth regression is written as:

(6) $$gy_{it} = \sum_{j=1}^{P} a_j gy_{i,t-j} + \boldsymbol{x}_{it} b_1 + \boldsymbol{w}_{it} b_2 + u_i + e_{it},$$

where i=1,…,6 and t=1, …, 21, a_j are the p parameters to be estimated, $\boldsymbol{x}_{it}$ is a 1x4 vector of the *strictly* exogenous variables Ca_1, *Icrg*, *Literate*, and *Fd* (the second variable is first differenced in the estimation process and the others enter in levels); b_1 is a 4x1 vector of parameters to be estimated; $\boldsymbol{w}_{it}$ is a 1x5 vector of the predetermined variables G*pop*, *Inv*, *Open*, *Pdebt*, and *Q*, which are differenced and lagged in the estimation process;[38] b_1 is a 5x1 vector of parameters to be estimated; u_i are the random effects, or country-specific error components, which are assumed *i.i.d.* with variance s^2_u; and e_{it} are the combined time series and cross-section (idiosyncratic) error component, which area assumed *i.i.d.* with variance s^2_e. It is also assumed that u_i and e_{it} are independent for each country over all period t.

Table 7 shows the results of the panel data regressions, which clearly indicates the improvement in the estimations results when time series and cross-section data are pooled. It is interesting to see that capital controls, measured through indicator Ca_1, decreases growth. On the contrary, effective capital integration, measured by Ca_4, increases economic growth. Most of the other covariates that resulted significant present the expected signs. It is worth nothing that robustness of the results for variables investment, institutional quality, which promotes growth, and public debt, which reduces economic growth.

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[37] Some excellent books in panel data analysis are Hsiao (1986, 2003), Baltagi (1995, 2001), and Wooldridge (2002). STATA (2003) is illustrative on the subject and it contains many examples on the different topics on panel data.

[38] Notice the following: (1) The lagged values of the predetermined variables are used as instruments in the estimation process. (2) When either Ca2, Ca3, or Ca4 is used, it will be treated as a predetermined variable. (3) Variable *gpop* is included as a predetermined variable to capture, on contrary to Solow type of hypotheses, possible feedback from economic growth towards population growth.

Table 7
Growth dynamic panel data regressions using alternative capital account control and domestic financial depthness indicators 1/

Dependent variable: *Gy*	1	2	3	4	5	6
*L*1.*Gy*	**0.93****	**0.82****	**0.92****	**0.86****	**0.84****	**0.77****
	(0.00)	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**
*D*1.Ca_1	**-0.04***	----	----	----	-0.03	----
	(0.08)				(0.12)	
*D*1.Ca_2	----	0.00	----	----	----	----
		(0.14)				
*D*1.Ca_3	----	----	0.00	----	----	----
			(0.20)			
*D*1.Ca_4	----	----	----	0.00	----	**0.00****
				(0.15)		**(0.04)**
D1.Gpop	3.61	-1.01	2.75	**9.14****	0.99	**5.45***
	(0.28)	(0.74)	(0.44)	**(0.02)**	(0.72)	**(0.09)**
*D*1.*Inv*	**0.55****	**0.62****	**0.55****	**0.38****	**0.56****	**0.38****
	(0.00)	**(0.00)**	**(0.00)**	**(0.02)**	**(0.00)**	**(0.01)**
Literate	0.03	0.02	0.03	**0.06***	**0.03***	**0.06****
	(0.31)	(0.52)	(0.40)	**(0.05)**	**(0.09)**	**(0.00)**
Fd_1	-0.00	0.00	-0.00	-0.00	----	----
	(0.25)	(0.83)	(0.67)	(0.18)		
Fd_2	----	----	----	----	**0.00****	**0.00****
					(0.00)	**(0.00)**
D1.Open	0.00	0.00	0.00	0.00	0.00	0.00
	(0.34)	(0.11)	(0.26)	(0.78)	(0.18)	(0.39)
*D*1.*Icrg*	**0.00****	**0.00****	**0.00****	**0.00****	**0.00****	**0.00****
	(0.02)	**(0.00)**	**(0.00)**	**(0.02)**	**(0.01)**	**(0.00)**
*D*1.*Pdebt*	**-0.08****	**-0.05****	**-0.07****	**-0.07****	**-0.09****	**-0.08***
	(0.00)	**(0.01)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**
Number of observ.	108	108	108	108	108	108
Sargan test of over-identifying restrictions	103.81	94.90	100.29	99.48	104.76	101.14
	(0.32)	(0.90)	(0.82)	(0.83)	(0.30)	(0.80)
Arellano-Bond (no autocorrel. of order 1)	z=-4.43	z=-5.25	z=-4.54	z=-4.52	z=-4.43	z=-4.43
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Arellano-Bond (no autocorrel. of order 2)	z=-0.70	z=0.27	z=-0.84	z=-0.84	z=-0.83	z=-0.97
	(0.48)	(0.79)	(0.40)	(0.40)	(0.41)	(0.33)

1/ It uses the Arellano and Bond's (1991) procedure. "*L*1" and "*D*1" mean that the variable is lagged or differenced once, respectively. The number in parenthesis is the *p-value*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. Both the constant term and lags or differences of higher order than one are not reported.

3.2 Capital account controls and macroeconomic volatility: Econometrics and estimations

To evaluate the effects of the capital account controls on macroeconomic volatility of output, consumption, and investment, instrumental variables techniques for single equations (time series IV regressions) and for panel data models are used.

Tables in Appendix A.4 show the results for each of the FLAR's member countries. Again, the findings indicate that capital account controls does not reduce macroeconomic volatility in any of the countries, except Costa Rica, where the coefficient of the capital controls indicator resulted statistically significant and negative for output volatility. It is worth nothing that for the case of Bolivia capital account controls increase output volatility. Trade openness reduces output volatility but increases total consumption volatility in the case of Bolivia. On the contrary, in the case of Ecuador, trade openness reduces total consumption volatility. Also, for this country volatility of the real exchange rate consistently increases macroeconomic volatility. Un unexpected result is that in the case of Bolivia inflation reduces output and investment volatility.

To evaluate jointly the effects on volatility, the regression model to be estimated has the form:

(7) $$y_{it} = \boldsymbol{Z}_{it}\boldsymbol{d} + m_i + \boldsymbol{u}_{it},$$ [39]

[39] The *overall* constant term is reported in Table 8.

where i=1,…,6 and t=1, …, 21; y represents the dependent variable, which will be alternatively, the volatility of the real GDP (output), consumption, investment, and the ratio of the volatility of total consumption (private and public) to output;[40] $\boldsymbol{Z}_{it}=[\boldsymbol{Y}_{it}\ \ \boldsymbol{X}_{it}]$, a matrix of explanatory variables, where $\boldsymbol{Y}_{it}$ is a 1x2 vector of observations on the endogenous variables (covariates), which are either Ca_2 (+), Ca_3 (-) or Ca_4 (-) indicator of the capital account controls, with their respective expected sign in parenthesis, and the variable *Open* (+/-);[41] $\boldsymbol{X}_{it}=[\boldsymbol{X}_{1it}\ \ \boldsymbol{X}_{2it}]$ is a matrix, where $\boldsymbol{X}_{1it}$ is a 1x5 vector of observations on the exogenous explanatory variables Ca_1 (when it is being used), volatility of the l-th indicator of the domestic financial depthness (+), inflation rate p (+), volatility of the real exchange rate Qv (+), and an indicator of fiscal policy volatility (+), which is measured by the volatility of the government real expenditures Vge; $\boldsymbol{X}_{2it}$ is a 1xk vector of observations on the k instruments, which are levels and the lags of the exogenous variables; $d=[g\ \ b]$ is a vector of coefficients where g is a 2x1 vector of parameters of the endogenous variables to be estimated; and b is a 5x1 vector of parameters of the exogenous variables to be estimated; m_i are the country-specific fixed effects, which may be correlated with the variables in $\boldsymbol{X}_{it}$, and u_{it} are the combined time series and cross-section error component, which it is assumed to have cero mean and to be uncorrelated with the variables in $\boldsymbol{X}_{it}$.

Thus, a G2SLS fixed-effects model is used for the estimations because it adjusts better to our data, in the sense they exhaust the population (there are six countries that belongs to FLAR and they are those we took).[42] Besides we have small number of cross-sectional units, which would produce a poor estimate of the variance of the specific random effects in case that the random-effects model were used. From the point of view of asymptotic theory, the justification for fixed effects model is that the number of time periods T grows, as it is our case.

[40] As explained in the appendix, the volatility of a variable is calculated as the standard deviation of the growth rate of such a variable, using a rolling window of order four.

[41] The more open the economy, the more vulnerable to external shocks. However, the more open the economy, the less volatile consumption should be.

[42] Hsiao (2003, chapter 3) fully discusses why one should use fixed-effects models in cases where data exhaust the population.

Table 8-1
Effects of the capital account controls on macroeconomic volatility (use Ca_1) 1/

Dependent variable: Volatility of growth rate of:	Output	Private consumption	Investmen t	Ratio of total consumption volatility to output volatility 2/
Ca_1	0.02	**-5.99***	3.40	-1.16.
	(0.98)	**(0.08)**	(0.43)	(0.57)
Open	0.03	**-0.49****	0.21	-0.13
	(0.46)	**(0.01)**	(0.36)	(0.25)
VFd_1	**0.04****	**0.11****	**0.16****	-0.02
	(0.00)	**(0.02)**	**(0.00)**	(0.44)
p	**0.01****	0.02	0.02	-0.00
	(0.00)	(0.10)	(0.17)	(0.82)
VQ	**0.06****	0.16	-0.08	0.01
	(0.01)	(0.07)	(0.34)	(0.71)
Vge	0.01	0.06	----	----
	(0.38)	(0.31)		
(Overall) Constant	-010	**24.05****	0.01	8.67
	(0.96)	**(0.01)**	(1.00)	(0.10)
Number of observ.	102	102	102	102
R^2: Within =	0.48	0.36	0.08	0.07
c^2 for joint statistical significance	709.86**	232.78**	427.76**	81.47**
	(0.00)	(0.00)	(0.00)	(0.00)
F test that all m_i=0	11.14**	8.61**	4.50**	4.63**
	(0.00)	(0.00)	(0.00)	(0.00)

1/ It used instrumental variables (the G2SLS implementation of Balestra and Varadharajan-Kishnakumar (1987)) to estimate the two-stage least squares fixed-effects estimators. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors, "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Table 8-1 and 8-2 show the results of the panel data regressions using the Ca_1 and Ca_4 indicators, respectively. Clearly, capital controls does not reduce macroeconomic volatility in the FLAR's member countries, as they are meant. Effective financial integration increase output volatility, but the estimate is practically cero. Both the volatility of domestic financial depthness and inflation consistently increases the macroeconomic volatility. Opening the economy consistently reduces private consumption volatility.

Table 8-2
Effects of the capital account controls on macroeconomic volatility (use Ca_4) 1/

Dependent variable: Volatility of growth rate of:	Output	Private consumption	Investment	Ratio of total consumption volatility to output volatility 2/
Ca_4	**0.00***	-0.00	0.00	-0.00
	(0.09)	(0.92)	(0.77)	(0.53)
Open	0.03	**-0.32****	0.11	-0.09
	(0.31)	**(0.02)**	(0.50)	(0.24)
VFd_1	**0.04****	**0.11****	**0.15****	-0.02
	(0.00)	**(0.01)**	**(0.00)**	(0.45)
p	**0.01****	0.02	0.02	-0.00
	(0.00)	(0.17)	(0.12)	(0.67)
VQ	**0.06****	0.13	-0.07	0.01
	(0.01)	(0.12)	(0.39)	(0.77)
Vge	0.01	0.07	----	----
	(0.43)	(0.24)		
(Overall) Constant	-0.40	**14.53****	5.24	**7.09****
	(0.78)	**(0.01)**	(0.46)	**(0.03)**
Number of observ.	102	102	102	102
R^2: Within=	0.46	0.36	0.09	0.06
c^2 for joint statistical significance	119.34**	231.84**	435.12**	80.84**
	(0.00)	(0.00)	(0.00)	(0.00)
F test that all m_i=0	7.46**	8.23**	2.05*	4.31**
	(0.00)	(0.00)	(0.08)	(0.00)

1/ It used instrumental variables (the G2SLS implementation of Balestra and Varadharajan-Kishnakumar (1987)) to estimate the two-stage least squares fixed-effects estimators. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors, "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid*., p. 8). Here the real GDP is used as a proxy of the GNP.

4. Conclusions

On average, the FLAR member countries has maintained a tendency of liberalization of the official, or *de jure*, restrictions on capital flows, even after the international financial crisis that started in 1996, in contrast with other developing countries and emerging markets that tighten those controls since then. However, there are differences between these members. While

Colombia has maintained a constant level of full restrictions according to our indicators, all other countries liberalized the capital account until 1996. After this year, Bolivia and Venezuela has increased controls, while Costa Rica, Ecuador and Perú either continued loosening these controls, or kept them at a low and constant level.

Using as an indicator of effective financial liberalization the difference between the domestic and the foreign real interest rates, the FLAR group also shows a larger degree of financial integration in the nineties than in the eighties, sharing this tendency, in general, with other developing and emerging economies. However, there are also large discrepancies between the countries within the group due, in part, to the presence of huge macroeconomic imbalances in some of them. By the end of the nineties, Colombia and Venezuela presents a lower degree of effective financial liberalization than the other four countries.

Since the main interest in one part of this study is to evaluate the relation between capital controls and the degree of competitiveness of the banking sector, the monopoly power in the loans and deposits market were measured by means of the econometric estimation of two models with sound microeconomic principles. The results show that for the whole sample period (1997.1 - 2004.12), the ranking of countries, from the most competitive to the least in the loans market is: Perú, Venezuela, Bolivia, Colombia, Costa Rica and Ecuador; while in the deposits market is: Perú, Venezuela, Costa Rica, Colombia, Bolivia, and Ecuador. However, the degree of monopoly power has changed along time and between countries, as shown by the results of the estimation of these parameters by means of rolling estimates on the sample period. Along time it has increased in Bolivia, Ecuador and Venezuela and decreased, even though very slightly in Colombia, Costa Rica and Perú.

There exists a strong statistical correlation between the degree of financial liberalization and the degree of competitiveness of the banking sector, indicating that countries with lower degree of international financial integration are, in fact, paying larger costs through larger spreads on financial intermediation.

Besides the effect derived from the degree of monopoly power of the banking sector, other variables that increase the spread are the probability of liquidity shortfalls (associated with larger macroeconomic volatility), the size of the marginal operating costs, the cost of capital, the level of reserve requirements and the share of non performing loans. Behind the relatively large spread in Bolivia, Colombia, Ecuador and Perú lie different reasons. Colombia and Perú have presented large probabilities of liquidity shortfalls, a high cost of capital and a large share of non performing loans. Colombia has also had relatively large marginal operating costs, the same as Bolivia and Ecuador. However, Colombia and Ecuador has presented the lowest ratio of reserve requirements, while Perú the highest. In Bolivia, the relatively largest cost of capital might had also contributed to high spreads.

From the macroeconomic point of view, the results from the economic growth regressions indicate, for example, that in the cases of Ecuador and Perú de capital account indicator is statistical significant; however, in the former case capital controls decrease economic growth while in the latter one increase economic growth. With respect to the standard explanatory variables in this type of regression models, in many cases they showed the expected signs and resulted statistically significant. It is worth nothing that robustness of the results for variables investment, institutional quality, which promotes growth, and public debt, which reduces economic growth. For example, domestic financial depthness promotes economic growth in the cases of Ecuador and Venezuela, and investment does the same in the cases of Costa Rica and Ecuador. The effective financial integration improves economic growth in the cases of Bolivia and Ecuador.

With respect to macroeconomic volatility, the findings indicate that capital account controls does not reduce it in any of the countries, except Costa Rica, where the coefficient of the capital controls indicator resulted statistically significant and negative for output volatility. In the case of Bolivia capital account controls increase output volatility. As for the other explanatory variables, trade openness reduces output volatility but increases that of consumption in the case of Bolivia. On the contrary, in the case of Ecuador, trade openness reduces total consumption volatility. Effective financial integration increase output volatility, but the estimate is practically cero. Both the volatility of domestic financial depthness and inflation consistently increases the macroeconomic volatility.

In summary, concerning macroeconomics, the document concludes that, in general, capital account controls neither decrease (or improve) growth nor decrease macroeconomic volatility. On the contrary, and as it is expected, the capital account liberalization promotes economic growth for the FLAR's member countries.

This paper can be extended in several ways. First, to build additional capital account control indicators to capture better the intensity of controls, a common criticism in the literature that studies the economic effects of capital account controls (liberalizations). Second, to expand the sample in order to face those possible weaknesses of our results discussed in the introduction of Section 3.

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Appendixes

A.1 The complete model of the banking firm

The theoretical framework used in this paper consists of an extension of the synthesis made by Baltensperguer (1985) on the treatment of the banking firm and that was developed in Mora (2004) in order to allow for functional specifications appropriate for empirical testing. The only difference with that previous work is the treatment of nonperforming loans explicitly in the present analysis.

According to this conceptual framework, the banking firm has to decide the scale of its operations and the composition of its assets and liabilities. The assets are formed by the liquidity reserves and the productive assets. The liabilities include the deposits and current liabilities with the public, and equity.

When deciding the structure of its assets, the bank must establish the level of liquid assets that it requires to minimize the cost of liquidity associated with unexpected reductions in deposits or unexpected loan expansions. Similarly, when deciding the structure of its liabilities, the bank has to define the level of equity it requires to minimize the cost of solvency related to the negative cash flows in its operation.

Given equations (1) and (2) explained in the main part of this paper, this Appendix explains the concepts of liquidity and solvency costs and describes how these two functions, as well as the operating costs are estimated for the individual banks in each country. Additionally, the development of the first order conditions in order to derive the equation for the spread in alternative models is included in the last section.

1. Liquidity Costs

At time t a bank has to decide the level of liquid assets, R_t,, at which it can meet the liquidity requirements established by the authorities, as proportion of deposits, while at the same time allows it to cover the reductions in deposits, $X_{D,t+1}$. At the end of period $t+1$ there will be a deficiency in the liquidity position of a bank if:

$$(A1) \qquad R_t - X_{D,t+1} < k(D_t - X_{D,t+1})$$
$$\Leftrightarrow \frac{R_t - kD_t}{(1-k)} \equiv \hat{X}_{D,t+1} < X_{D,t+1}$$

where k is the proportion of deposits and current liabilities that must be held as liquid assets according with the regulation established by the authorities. The left hand side of the preceding inequality relates to the effective availability of liquid assets held by the bank at the end of period *t+1*; and the right side to the availability of liquidity required by the authorities at the end of that period. The previous expression shows that, at the time of taking the decision on the level of liquid assets that the bank must hold, there is uncertainty about the magnitude of the reductions of the deposits in the following period and, therefore, about the value of the deposits at the end of *t+1*, as well as about the value of the liquidity requirements, and about the value of the effective availability of liquidity.

If a liquidity deficiency occurs, its magnitude will be equal, according to (A1), to:

$$(A2) \qquad k(D_t - X_{D,t+1}) - (R_t - X_{D,t+1})$$
$$\Leftrightarrow (1-k)(X_{D,t+1} - \hat{X}_{D,t+1}); \qquad \hat{X}_{D,t+1} \equiv \frac{R_t - kD_t}{(1-k)}$$

case in which the bank must pay a sanction, at the rate *p*, on the value of the liquidity shortfall; therefore, the expected value of the sanction for the bank is:

$$(A3) \qquad F(R_t) = \int_{\hat{X}_{D,t+1}}^{\infty} p\left[(1-k)X_{D,t+1} - (R_t - kD_t)\right] f(X_{D,t+1})dX_{D,t+1}$$

However, in practice and compared with the previous specification, the source of uncertainty for the banks comes from the fall in deposits, and also from the unexpected expansions of loans (or productive assets). This is because an important part of banking activity is formed by contingent operations, such as the granting of letters of credit, bank acceptances or credit card limits. The decision to enforce a guarantee or to use a credit limit is not controlled by the bank but by its customers. For this reason, the effective level of liquidity is also a function of these variables, which determine expected and unexpected loan expansions.

Incorporating into the analysis the unexpected loan expansions, $X_{C,t+1}$, as was done in Julio, J. and Mora, H. (1990), the inequality (A1) becomes:

$$(A4) \qquad R_t - (X_{D,t+1} + X_{C,t+1}) < k(D_t - X_{D,t+1})$$

Which brings the magnitude of the liquidity shortfalls to:

$$(A5) \qquad k(D_t - X_{D,t+1}) - \left[R_t - (X_{D,t+1} + X_{C,t+1})\right]$$
$$\Leftrightarrow X_{t+1} - \left[R_t - k(D_t - X_{D,t+1})\right]$$
$$\Leftrightarrow X_{t+1} - \left[R_t - RR_{t+1}\right]; \qquad X_{t+1} \equiv X_{D,t+1} + X_{C,t+1}; \qquad RR_{t+1} \equiv k(D_t - X_{D,t+1})$$
$$\Leftrightarrow X_{t+1} - \hat{X}_{D,t+1}; \qquad \hat{X}_{D,t+1} \equiv R_t - RR_{t+1}$$

and the expression for the cost of liquidity shortfalls is now:

$$(A6) \qquad F(R_t) = \int_{\hat{X}_{D,t+1}}^{\infty} p\left[X_{t+1} - \hat{X}_{D,t+1})\right] f(X_{t+1}) dX_{t+1}$$

However, in period t the variable $\hat{X}_{t+1}$ is not deterministic in the previous expression, but a random variable, because the liquidity reserve requirements for the end of period $t+1$, RR_{t+1}, are random in t. Therefore, in t only the joint distribution of X_{t+1} and RR_{t+1} can be known, hence expression (A6) is written as:

$$(A7) \qquad F(R_t) = \int_{0}^{\Omega_t} \int_{R_t - RR_{t+1}}^{\infty} p\left[X_{t+1} - \hat{X}_{D,t+1})\right] g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}$$

as long as $RR_{t+1}=kD_{t+1}$ and k take values between 0 and 1, the maximum value that the reserve requirements can take in period $t+1$ is the value of the deposits in that period, therefore the upper bound of RR_{t+1} is:

$$(A8) \qquad \Omega_t = E_t\left[D_{t+1}\right] = \int_{0}^{\infty} h(D_{t+1}) D_{t+1} dD_{t+1}$$

The bank's total liquidity cost for holding reserves is:

$$(A9) \qquad L(R_t) = F(R_t) + rR_t$$

where r is the opportunity cost of holding liquid reserves, instead of granting loans. Replacing (A8) in (A7), and the resulting expression in (A9), we obtain:

$$(A10) \qquad F(R_t) = rR_t + \int_{0}^{E_t D_{t+1}} \int_{R_t - RR_{t+1}}^{\infty} p\left[X_{t+1} - \hat{X}_{D,t+1})\right] g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}$$

According to the previous specification, seven variables determine the liquidity cost function, namely: level of liquid assets (R_t), falls in deposits ($X_{D,t+1}$), loan expansions ($X_{C,t+1}$), required reserves (RR_{t+1}), opportunity cost of liquid assets (r), expected value of deposits (E_tD_{t+1}), as the upper limit of one of the integrals in (A10); and the sanction rate for reserve shortfall (p). The liquid assets include cash and bank balances and other assets with maturity of less than 30 days. The deposits include current liabilities at all maturities and other liabilities subject to legal reserve; their falls are calculated month by month. Total loans and their expansions are also calculated month by month. The average lending rate in the banking system was taken as a proxy of the opportunity cost. The latter variable does not enter into the determination of the spread in any of the four models presented, but it is important in the estimate of the magnitude of the liquidity costs.

The rate announced by the authorities for lower liquidity positions than those required was used as proxy for the sanction rate for reserve shortfall. The reason why this is only a proxy is the incidence of the form of accounting of the legal reserve position on liquidity cost. There are important differences between countries in this form of accounting. For example, in Bolivia, Colombia, and Costa Rica the reference period for accounting for the daily legal reserve positions is two weeks; in Ecuador weekly; in Peru monthly. The lags between the required amount of legal reserve and the deposits used to calculate the reserve position are also different between countries, as is the sanction rate on the amounts of reserve shortfall. Chart 2 shows the effective sanction rates for shortfall applied in the six countries.

To determine the expected value of the cost of liquidity, the kernel method was used to estimate the joint density function of RR_{t+1} and the sum of the falls in deposits and loan expansions (X_{t+1}). This is a non-parametric method that assumes that N observations of the vector of variables whose joint density function is to be estimated constitute a sample of independent and identically distributed observations. The kernel estimator of the multivariate density function of dimension *d* is defined as (see Silverman (1993)):

$$(A11) \qquad \hat{f}(x) = \frac{1}{Nh^d} \sum_{i=1}^{N} K\left\{ \frac{1}{h}(x - X_i) \right\}$$

where K(x) is the kernel function that must satisfy:

$$(A12) \qquad \int_{R^d} K(x)dx = 1$$

and which is usually a symmetrical function. In (A11) *h* represented the band width and is chosen from a size such that the mean squared error between the density function to be estimated and the true density function is minimal, approaching zero as the size of the sample increases.

2. Costs of solvency for the banks

In each period $t+1$ the bank must cover its obligations, $D_t(1+i_{D,t+1})$, and its operating costs, $C(A_t,a(1-b),d)$, with its assets A_{t+1}, and with the income generated by them, Y_{t+1}, where $A_{t+1}=A_t+X_{A,t+1}$. There is a problem of solvency if this condition is not met, that is, if:

$$(A13) \qquad Y_{t+1} + A_{t+1} < D_t(1 + i_{D,t+1}) + C(A_t, a(1-b), d)$$

$$\Leftrightarrow Y_{t+1} < \hat{Y}_{t+1}; \qquad \hat{Y}_{t+1} \equiv D_t(1 + i_{D,t+1}) + C(A_t, a(1-b), d) - A_{t+1}$$

taking into account the balance constraint, $D=A-W$, the expected cost of incurring a situation of insolvency is:

$$A(14) \qquad G(W_t) = \int_{-\infty}^{\hat{Y}_{t+1}} a\left[(A_t - W_t)(1+i_{D,t+1}) + C(A_t, a(1-b), d) - Y_{t+1} - A_{t+1}\right] g(Y_{t+1})\, dY_{t+1}$$

where a indicates that the cost is proportional to the capital shortfall. But at time t, when the bank decides the level of capital W_t, the variable $\hat{Y}_{t+1}$ is random because A_{t+1} is unknown at that time, so, given the joint density function of Y_{t+1} and $X_{A,t+1}$, the expression (A14) becomes:

$$(A15) G(W_t) = \int_{0}^{E_t A_{t+1}} \int_{-\infty}^{\hat{Y}_{t+1}} a\left[A_t i_{D,t+1} - W_t(1+i_{D,t+1}) + C(A_t, a(1-b), d) - Y_{t+1} - X_{A,t+1}\right] f(Y_{t+1}, X_{A,t+1})\, dY_{t+1}\, dX_{A,t+1}$$

where:

$$(A16) \qquad E_t\left[A_{t+1}\right] = A_t + \int_{0}^{\infty} h(X_{A,t+1}) X_{A,t+1}\, dX_{A,t+1}$$

If $?_{t+1}$ is the cost of capital stock, then $?_{t+1}$-$i_{D,t+1}$ is the marginal cost of increasing the capital stock instead of increasing deposits. The total cost function of solvency is therefore:

$$(A17) \qquad S(W_t) = G(W_t) + (r_{t+1} - i_{D,t+1}) W_t$$

However in relation to the cost of solvency, it is important to distinguish between the rate that the bank offers to pay for deposits, $i_{D,t+1}$, and the interest rate that it effectively pays, which it is assumed equals the rate the depositors expect to receive, which we denote by $i_{h,t+1}$. This distinction is necessary because in the absence of perfect competition, demand for a bank's deposits is a function of the interest rate that depositors expect to receive. The interest payments that depositors receive is equal to:

$$(A18) \qquad \begin{cases} i_{D,t+1} D_t & \rightarrow si \quad Y_{t+1} \geq \hat{Y}_{t+1} \\ i_{D,t+1} D_t - (1+a)\left[\hat{Y}_{t+1} - Y_{t+1}\right] & \rightarrow si \quad Y_{t+1} < \hat{Y}_{t+1} \end{cases}$$

therefore, using (A15), the expected value of the interest rate that the depositors receive is given by:

$$(A19)\qquad i_{h,t+1}D_t = \int_0^{E_tA_{t+1}}\int_{-\infty}^{\hat{Y}_{t+1}}\left[i_{D,t+1}D_t - (1+a)(\hat{Y}_{t+1}-Y_{t+1})\right]f(Y_{t+1},A_{t+1})dY_{t+1}dA_{t+1} +$$

$$+\int_0^{E_tA_{t+1}}\int_{\hat{Y}_{t+1}}^{\infty}\left[i_{D,t+1}D_t\right]f(Y_{t+1},A_{t+1})dY_{t+1}dA_{t+1}$$

$$\Leftrightarrow\qquad i_{h,t+1}D_t = i_{D,t+1}D_t - (1+a)\int_0^{E_tA_{t+1}}\int_{-\infty}^{\hat{Y}_{t+1}}\left[(\hat{Y}_{t+1}-Y_{t+1})\right]f(Y_{t+1},A_{t+1})dY_{t+1}dA_{t+1}$$

$$\Leftrightarrow\qquad i_{h,t+1}D_t = i_{D,t+1}D_t - (1+a)\frac{G(W_t)}{a}$$

from which results:

$$(A20)\qquad i_{h,t+1} = i_{D,t+1} - (1+a)\frac{G(W_t)}{aD_t}$$

Taking into account this difference between the interest rate offered by the bank and the rate effectively paid, equation (A14) becomes:

$$(A21)G(W_t) = \int_0^{E_tA_{t+1}}\int_{-\infty}^{\hat{Y}_{t+1}} a\left[A_t i_{h,t+1} - W_t(1+i_{h,t+1}) + C(A_t, a(1-b), d) - Y_{t+1} - X_{A,t+1}\right]f(Y_{t+1}, X_{A,t+1})dY_{t+1}dX_{A,t+1}$$

From the previous equation, the variables that determine a bank's cost of solvency are the bank's total income (Y_{t+1}), changes between periods ($X_{A,t+1}$) of the value of assets (A_{t+1}), operating costs $C(A_t,\alpha(1\text{-}b),\delta)$, equity ($W_t$), effective interest rate paid on deposits ($i_{h,t+1}$), sanction rate for incurring capital shortfalls (a), and the opportunity cost of capital, (ρ_{t+1}-$i_{D,t+1}$). The assets and their changes month by month, as well as total income and equity (which includes capital contributions and reserves), were taken from the information on the monthly balance sheets and income statements published by the national superintendencies for all the banks in operation in each month of the period analyzed. To estimate the interest rate effectively paid on deposits, the sum of interest payments and financial expenses other than interest[43] was divided by the sum of the deposits and the other liabilities subject to legal reserve requirements.

The operating costs correspond, as stated earlier, to the sum of labor costs and the depreciation of durable goods. The cost of accessing credit in the international capital market was taken as proxy for the sanction rate, represented by the maximum between the interest rate on 3-month US Treasury bonds, plus the value of the sovereign bond spread of the country in question expressed in national currency, and the domestic interest rate. The difference between the sanction

[43] In some periods and for some banks this sum was negative, in which case it was considered that no (valid) information was available at that time.

rate and the average domestic deposit rate was taken as proxy for the opportunity cost of capital. As this difference was sometimes negative, we increased the proxy of the sanction rate described previously, and the proxy of the opportunity cost in the absolute value of the minimum observed during the time of the difference, so that the minimum value of the proxy of the opportunity cost was 0.

To determine the expected value of the cost of solvency, the kernel method was used to estimate the joint density function of Y_{t+1} and the sum of the falls in deposits and loan expansions $X_{A,t+1}$, as explained above for the case of the expected liquidity cost.

3. Operating costs

The bank incurs in operating costs, $C(A_t,a,b,d) = C(E_t,D_t,B)$ to perform its functions. These costs include labor and depreciation of the durable goods used in the productive process. If w is the price of the compound productive factor whose total payment per period corresponds to the operating costs, the translogarithmic cost function is given by $ln(C_t)=f(ln(E_t),ln(D_t), ln(B_t),ln(w_t))$, where ln represents the natural logarithm of the variable in question, corresponds to the Taylor expansion of second order around point $(ln(E_t), ln(D_t),ln(B_t), ln(w_t)) = (0,0,0,0)$:

$$(A22)\; f\left(\ln(E),\ln(D),\ln(B),\ln(w)\right) \cong f\left(0,0,0,0\right) + \left[\frac{\partial(\ln(C))}{\partial(\ln(E))},\frac{\partial(\ln(C))}{\partial(\ln(D))},\frac{\partial(\ln(C))}{\partial(\ln(B))},\frac{\partial(\ln(C))}{\partial(\ln(w))}\right]\begin{bmatrix}\ln(E)\\ \ln(D)\\ \ln(B)\\ \ln(w)\end{bmatrix} +$$

$$+\frac{1}{2}\left[\ln(E),\ln(D),\ln(B),\ln(w)\right]$$

$$\begin{bmatrix}\frac{\partial^2(\ln(C))}{\partial(\ln(E))\partial(\ln(E))},\frac{\partial^2(\ln(C))}{\partial(\ln(E))\partial(\ln(D))},\frac{\partial^2(\ln(C))}{\partial(\ln(E))\partial(\ln(B))},\frac{\partial^2(\ln(C))}{\partial(\ln(E))\partial(\ln(w))}\\ \frac{\partial^2(\ln(C))}{\partial(\ln(D))\partial(\ln(E))},\frac{\partial^2(\ln(C))}{\partial(\ln(D))\partial(\ln(D))},\frac{\partial^2(\ln(C))}{\partial(\ln(D))\partial(\ln(B))},\frac{\partial^2(\ln(C))}{\partial(\ln(D))\partial(\ln(w))}\\ \frac{\partial^2(\ln(C))}{\partial(\ln(w))\partial(\ln(E))},\frac{\partial^2(\ln(C))}{\partial(\ln(w))\partial(\ln(D))},\frac{\partial^2(\ln(C))}{\partial(\ln(w))\partial(\ln(B))},\frac{\partial^2(\ln(C))}{\partial(\ln(w))\partial(\ln(w))}\end{bmatrix}\begin{bmatrix}\ln(E)\\ \ln(D)\\ \ln(B)\\ \ln(w)\end{bmatrix}$$

where the partial derivatives are evaluated at the point of expansion, which is why they are constant, so the previous expression can be written as:

$$(A23)\ f\left(\ln(E),\ln(D),\ln(B),\ln(w)\right)=a_0+a_1\ln(E)+a_2\ln(D)+a_3\ln(B)+a_4\ln(w)+\frac{1}{2}\{d_{11}(\ln(E))^2+$$
$$+(d_{12}+d_{21})\ln(E)\ln(D)+(d_{13}+d_{31})\ln(E)\ln(B)+(d_{14}+d_{41})\ln(E)\ln(w)+$$
$$+d_{22}(\ln(D))^2+(d_{32}+d_{23})\ln(D)\ln(B)+(d_{42}+d_{24})\ln(D)\ln(w)+$$
$$+d_{33}(\ln(B))^2+(d_{43}+d_{34})\ln(B)\ln(w)+d_{44}(\ln(w))^2\ \}$$

since the cost function must be homogeneous of degree one in prices, and in our case there is a single price, $\partial(\ln C)/\partial(\ln(w))=1$ must be satisfied, therefore:

$$(A24)\frac{\partial(\ln(C))}{\partial(\ln(w))}=a_4+\frac{1}{2}(d_{41}+d_{14})\ln(E)+\frac{1}{2}(d_{42}+d_{24})\ln(D)+\frac{1}{2}(d_{43}+d_{34})\ln(B)+d_{44}\ln(w)=1$$
$$\Rightarrow\begin{Bmatrix}a_4=1 \qquad and \\ (d_{41}+d_{14})=(d_{42}+d_{24})=(d_{43}+d_{34})=d_{44}=0\end{Bmatrix}$$

Taking into account these restrictions, equation (23) becomes:

$$(A25)\ f\left(\ln(E),\ln(D),\ln(B),\ln(w)\right)=a_0+a_1\ln(E)+a_2\ln(D)+a_3\ln(B)+a_4\ln(w)+\frac{1}{2}\{d_{11}(\ln(E))^2+$$
$$+(d_{12}+d_{21})\ln(E)\ln(D)+(d_{13}+d_{31})\ln(E)\ln(B)+d_{22}(\ln(D))^2$$
$$+(d_{32}+d_{23})\ln(D)\ln(B)+d_{33}(\ln(B))^2\ \}$$

Table A1 shows the econometric results of estimating equation (A25) for the six countries, under the assumption that the banks of one country share the same productive technology, and therefore, that the observations are realizations of the same cost function[44]. This assumption was represented by the imposition of the restriction of equality between the coefficients for the same variable, for all banks in one country, with the exception of the intercept which could differ between banks.

In all countries, loans and deposits, or products of these variables, are highly significant but the corresponding coefficients are of different magnitude. It is interesting to note that the variable bad loans or products of this and other variables were only significant in Bolivia, Ecuador and Venezuela. In particular, in the case of Colombia, where marginal operating costs are relatively high, in comparison with other countries, nonperforming loans (which has been also relatively high) do not constitute a factor explaining this situation, even though bad loans do affect marginal costs in Bolivia, the other country with high marginal operating costs of loans, as well as of deposits.

[44] Because the series required for the estimate, in one of the countries and for a few banks, did not always reject the unit root null hypothesis, according to one of the five tests used (Augmented Dickey Fuller, Phillips-Perron, Zevot-Andrews, Birens, KPSS), equation (25) was estimated as differences of logarithms.

Table A1
Econometric Results of estimating the Operating Costs Functions

Explanatory Variable	Bolivia	Colombia	Costa Rica	Ecuador	Perú	Venezuela
First Order Difference of the Logarithm of Productive Assets	0.093596	0.744971	0.508685	0.408220	0.364502	0.523730
t-statistic	26.41229	7.46599	9.93922	3.83550	28.23995	18.22546
First Order Difference of the Logarithm of Deposits	0.650172	0.989409		0.568261	0.622949	0.617230
t-statistic	63.41924	2.08302		8.53119	54.10613	21.55590
First Order Difference of the Logarithm of Non Performing Loans	0.020965					-1.347616
t-statistic	3.59630					-4.58746
First Order Difference of the Squared Logarithm of Productive Assets	0.379809				0.063039	
t-statistic	47.66612				12.76140	
First Order Difference of the Squared Logarithm of Deposits	0.298605	0.041245		-0.211269	0.090336	
t-statistic	40.19059	3.35721		-5.49749	22.72013	
First Order Difference of the Squared Logarithm of Non Performing Loans	0.003066			-0.289522		0.145841
t-statistic	3.73827			-4.68593		4.48414
First Order Difference of the product of the Logarithm of Productive Assets and the Logarithm of Deposits	-0.640048		0.043434	0.273290		-0.027672
t-statistic	-41.18760		6.91229	4.04865		-4.475249
First Order Difference of the product of the Logarithm of Deposits and the Logarithm of Non Performing Loans	0.008523			-0.356255		
t-statistic	5.45923			-3.48512		
First Order Difference of the product of the Logarithm of Deposits and the Logarithm of Non Performing Loans	-0.008389			0.500040		0.261437
t-statistic	-5.51210			3.98430		5.240337

Source: Author's estimations

4. The spread

The spread is derived from the first order conditions of the maximization of profits (eq. (2)), namely:

$$(A26) \qquad (i) \qquad \frac{\partial E(p)}{\partial A} = 0 \Leftrightarrow \boldsymbol{a}\,(ar_E A + r) - \boldsymbol{d}\,(di_D A + i) - C_A - L_A - S_A + \boldsymbol{r}\,(1 - \boldsymbol{d}) = 0$$

$$(ii) \qquad \frac{\partial E(p)}{\partial a} = 0 \Leftrightarrow A(ar_E A + r) - C_a - L_a - S_a = 0$$

$$(iii) \qquad \frac{\partial E(p)}{\partial d} = 0 \Leftrightarrow A(di_D A + i) + C_d + L_d + S_d - rA = 0$$

where the subindexes indicate the variable with respect to which the partial derivative of the corresponding function is being taken. In the preceding expression the time subindexes were eliminated for simplicity. In turn, the partial derivatives included in (A26) are developed below.

Since the cost function is C(E_t,D_t,B)= $C(aA,dA, baA)$, then the partial derivatives are:

$$(i) \qquad \frac{\partial C}{\partial A} = \frac{\partial C}{\partial D}\frac{\partial D}{\partial A} + \frac{\partial C}{\partial E}\frac{\partial E}{\partial A} + \frac{\partial C}{\partial B}\frac{\partial B}{\partial A} = C_D d + C_E a + C_B ba$$

$$(ii) \qquad \frac{\partial C}{\partial a} = \frac{\partial C}{\partial E}\frac{\partial E}{\partial a} + \frac{\partial C}{\partial B}\frac{\partial B}{\partial a} = C_E A + C_M bA$$

$$(iii) \qquad \frac{\partial C}{\partial d} = \frac{\partial C}{\partial D}\frac{\partial D}{\partial d} = C_D A$$

Also, the partial derivatives of the liquidity cost function defined in (A10) are:

$$(iv) \qquad \frac{\partial L}{\partial A} = r(1-a(1-b)) + r_E a(1-b)(1-a(1-b))A +$$
$$+ p[kd - (1-a)] \int_0^{E_t D_{t+1}} \int_{R_t - RR_{t+1}}^{\infty} g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}$$

$$(v) \qquad \frac{\partial L}{\partial a} = -rA + r_E(1-a(1-b))A^2 + pA \int_0^{E_t D_{t+1}} \int_{R_t - RR_{t+1}}^{\infty} g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}$$

$$(vi) \qquad \frac{\partial L}{\partial d} = pkA \int_0^{E_t D_{t+1}} \int_{R_t - RR_{t+1}}^{\infty} g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}$$

Finally, the partial derivatives of the solvency cost function defined in (A17) are:

$$(vii) \qquad \frac{\partial S}{\partial A} = (r-i)(1-d) - (1-d)i_D dA +$$
$$+ a\left[d(1+i) - 1 + d^2 i_D A_t + C_D d + C_E a(1-b)\right] \int_0^{E_t A_{t+1}} \int_{-\infty}^{\hat{Y}_{t+1}} f(Y_{t+1}, X_{A,t+1}) dY_{t+1} dX_{A,t+1}$$

$$(viii) \qquad \frac{\partial S}{\partial a} = aC_E A_t \int_0^{E_t A_{t+1}} \int_{-\infty}^{\hat{Y}_{t+1}} f(Y_{t+1}, X_{A,t+1}) dY_{t+1} dX_{A,t+1}$$

$$(ix) \qquad \frac{\partial S}{\partial d} = -(r-i)A - (1-d)i_D A^2 +$$
$$+ aA_t\left[(1+i) + di_D A_t + C_D\right] \int_0^{E_t A_{t+1}} \int_{-\infty}^{\hat{Y}_{t+1}} f(Y_{t+1}, X_{A,t+1}) dY_{t+1} dX_{A,t+1}$$

Additionally, we define:

$$(A27)\qquad \Phi_t \equiv \int_0^{E_t D_{t+1}} \int_{\hat{X}_{D,t+1}}^{\infty} g(X_{t+1}, RR_{t+1}) dX_{t+1} dRR_{t+1}; \qquad \Psi_t \equiv \int_0^{E_t A_{t+1}} \int_{-\infty}^{\hat{Y}_{t+1}} f(Y_{t+1}, X_{A,t+1}) dY_{t+1} dX_{A,t+1}$$

that is, f_t and $?_t$, relate to the probabilities, at time t, of a liquidity or solvency shortfall, respectively.

Different combinations of the first order conditions in (A26) provide different models for the spread. As explained in the main body of the text, those combinations depend on which are the set of selecting variables available for the bank's manager, which is directly related to the regulation of reserve requirements; solvency requirements; minimum amount of equity required to create a bank; and anti monopoly standards; among others.

A.2 Data and sources

Description	Units	Source	Observations
Nominal GDP	Millions units of National Currency (MUNC)	IMF – IFS	
Real GDP	MUNC	IMF – IFS	GDP Deflator (2000=100)
Population	Millions	IMF – IFS	
Real GDP growth volatility	Standard Deviation (%) (4 period moving window)	Own Calculations	GDP in National Currency
Real government consumption expenditure growth volatility	Standard Deviation (%) (4 period moving window)	Own Calculations	Government Consumption in MUNC deflated by CPI
Real Private Consumption Expenditure Growth Volatility	Standard Deviation (%) (4 period moving window)	Own Calculations	Private Consumption in MUNC deflated by CPI
Real Gross Fixed Capital Formation Growth Volatility	Standard Deviation (4 period moving window) (%)	Own Calculations	GFKF in MUNC deflated by GDP deflator
Nominal Government Consumption Expenditure	MUNC	IMF - IFS	
Real Government Consumption Expenditure	MUNC	IMF - IFS	CPI (2000 = 100)
Nominal Private Consumption	MUNC	IMF - IFS	
Real Private Consumption	MUNC	IMF – IFS	CPI (2000 = 100)

Nominal Gross Fixed Capital Formation Real Gross Fixed Capital Formation	MUNC MUNC	IMF - IFS IMF - IFS	 GDP Deflator (2000=100)
Current Account Balance	% of GDP	IMF - IFS	NGDP in Millions of US Dollars
de jure capital account closeness (openness) [ca_1]	Average (0-1)	Juan P. Fernandez – Carlos Patiño	Miniane (2004), Indicator 1
Interest Rates Differential Indicator [ca_2]	Rates differential	J.P Fernandez	Frankel (1992), Indicator 2
Public and Publicly Guaranteed Debt	% of GDP	IFS & WDI	NGDP in Millions of US Dollars
Bank Liquid Reserves to Bank Assets Ratio [fd_1]	Ratio	WDI	Financial Depthness
Liquid Liabilities (M3) [fd_2]	% of GDP	WDI	Financial Dephtness
Domestic Credit Provided by Banking Sector [fd_3]	% of GDP	WDI	Financial Depth
ICRG Composite Risk Rating	0-100	WDI	Institutional Quality
Literacy Rate (% People ages 15 and above)	% People	WDI	Schooling
Net capital flows [ca_3]	Mill. of US Dollars	BOP - Own Calculations	Summation of net foreign direct investment + net portfolio equity + net debt
Net Foreign Assets (Stock) [ca_4]	Mill.of US Dollars	BOP - Own Calculations	Following Lane and Milesi-Ferretti (2001).
Exports FOB (X)	Mill. of US Dollars	IMF - IFS	
Imports CIF (M)	Mill. of US Dollars	IMF - IFS	
Trade openness indicator	((X+M)/GDP)*100	Own Calculations	
Consumer Price Index	Index (2000 = 100)	IMF - IFS	
GDP Deflator	Index (2000 = 100)	IMF - IFS	
Real Effective Exchange Rates	Index (2000 = 100)	IMF - IFS	
School Enrollment, tertiary	% gross (school age population)	WDI	

A.3 Pool unit root tests 1/

Variable	Levin, Lin and Chu (2002) t* *H_o : U.R.* *Assumes common U.R. process*		Im, Pesaran and Shin (1997) W-stat *H_o : U.R.* *Assumes individual U.R. process*		PP-Fisher Chi Square *H_o : U.R.* *Assumes individual U.R. process*	
	Statistic	**Probability**	**Statistic**	**Probability**	**Statistic**	**Probability**
y	**-1.8****	0.04	-0.91	0.18	9.5	0.66
Gy	**-5.4****	0.00	**-5.72****	0.00	79.7**	0.00
Lpop	1.67	0.95	7.7	1.00	1.9	0.99
Gpop	**-2.1****	0.02	**-1.4***	0.08	**21.0****	0.04
Pdebt	1.4	0.92	-0.8	0.22	12.6	0.40
Ca_3	**-2.6****	0.00	-1.0	0.16	**25.9****	0.01
Ca_4	0.5	0.67	0.9	0.82	3.9	0.98
Open	**-4.9****	0.00	**-4.5****	0.00	15.4	0.22
Literate	4.6	1.00	7.1	1.00	0.03	1.00
Inv	1.1	0.87	**-1.9****	0.03	**29.4****	0.00
Q	1.2	0.88	0.3	0.63	6.8	0.87
gQ	-1.1	0.14	**-2.6****	0.00	**60.3****	0.00

1/ *y* is the (natural) logarithm of real GDP per capita; *Gy* is the change in the (natural) logarithm of real GDP per capita; *Lpop* is the logarithm of the country's population; G*pop* is the change of the logarithm of the country's population; *Pdebt* is the public debt as a percentage of GDP, which is an indicator of the country's risk; Ca_3 is the capital account closeness (openness) indicator 3; Ca_4 is the capital account closeness (openness) indicator 4; *Open* is an indicator of trade openness; *Literate* is the logarithm of the literacy rate (percentage of people ages 15 and above); *Inv* is the investment as a percentage of GDP; *Q* is the log of the real exchange rate; and *gQ* is the change of the log of the real exchange rate. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively.

A.4 Effects of the capital account controls on macroeconomic volatility for each of the countries

Bolivia 1/

Dependent variable: Volatility of growth rate of:	**Output**	**Private consumption**	**Investment**	**Ratio of total consumption volatility to output volatility 2/**
Ca_1	**3.88***	-0.02	6.44	-8.72
	(0.06)	(0.99)	(0.45)	(0.16)
Open	**-0.41***	0.09	-0.93	**0.79***
	(0.07)	(0.67)	(0.50)	**(0.07)**
VFd_1	-0.03	0.02	0.02	**0.11***
	(0.21)	(0.34)	(0.92)	**(0.05)**
p	**-0.09***	0.00	**-0.83****	0.05
	(0.05)	(0.97)	**(0.02)**	(0.55)
VQ	-0.04	**0.16****	-0.19	**0.17***
	(0.35)	**(0.04)**	(0.40)	**(0.06)**
Vge	**0.03****	0.01	----	----
	(0.00)	(0.35)		
Number of observations	17	17	17	17
R^2:	0.90	0.96	0.57	0.48

1/ It uses instrumental variables (IV 2SLS) and the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant terms are not reported.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Colombia 1/

Dependent variable: Volatility of growth rate of:	**Output**	**Private consumption**	**Investment**	**Ratio of total consumption volatility to output volatility 2/**
Ca_1	-0.63	7.52	-1.42	41.23
	(0.88)	(0.40)	(0.98)	(0.27)
Open	-0.09	-0.53	-3.08	-2.27
	(0.70)	(0.40)	(0.10)	(0.14)
VFd_1	**0.05***	-0.05	-0.56	-0.32
	(0.08)	(0.57)	(0.21)	(0.16)
p	-0.05	-0.29	-1.84	-1.33
	(0.67)	(0.39)	(0.21)	(0.18)
VQ	0.04	-0.11	**-1.56***	-0.36
	(0.41)	(0.62)	**(0.09)**	(0.31)
Vge	-0.01	**0.18****	----	----
	(0.78)	**(0.05)**		
Number of observations	17	17	17	17
R^2:	0.87	0.74	0.36	0.40

1/ It uses instrumental variables (IV 2SLS) the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value*. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant terms are not reported.

2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Costa Rica 1/

Dependent variable: Volatility of growth rate of:	Output	Private consumption	Investmen t	Ratio of total consumption volatility to output volatility 2/
Ca_1	**-1.07***	-8.18	-1.89	-0.14
	(0.05)	(0.27)	(0.64)	(0.96)
Open	-0.07	1.03	0.49	0.49
	(0.34)	(0.38)	(0.43)	(0.32)
VFd_1	-0.00	0.47	**0.38***	0.18
	(0.98)	(0.17)	**(0.07)**	(0.20)
p	-0.13	1.58	0.66	0.91
	(0.17)	(0.35)	(0.38)	(0.22)
VQ	-0.16	5.64	1.44	1.97
	(0.40)	(0.16)	(0.54)	(0.22)
Vge	-0.05	1.18	----	----
	(0.73)	(0.38)		
Number of observations	17	17	17	17
R^2:	0.62	0.49	0.07	0.21

1/ It uses instrumental variables (IV 2SLS) and the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The symbol "*" means statistical significance at the 5% level. The constant terms are not reported.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Ecuador 1/

Dependent variable: Volatility of growth rate of:	**Output**	**Private consumption**	**Investmen t**	**Ratio of total consumption volatility to output volatility 2/**
Ca_1	15.14	-13.80	-23.44	-0.34
	(0.14)	(0.78)	(0.67)	(0.61)
Open	0.19	0.26	-0.38	**-37.38***
	(0.50)	(0.85)	(0.67)	**(0.08)**
VFd_1	0.07	0.21	0.14	-0.23
	(0.13)	(0.35)	(0.38)	(0.24)
p	0.01	-0.09	0.18	-0.04
	(0.73)	(0.57)	(0.19)	(0.69)
VQ	**0.13****	**0.51****	**0.49****	0.21
	(0.01)	**(0.03)**	**(0.01)**	(0.19)
Vge	0.02	0.23	**----**	**----**
	(0.70)	(0.25)		
Number of observations	17	17	17	17
R^2:	0.91	0.78	0.68	0.77

1/ It uses instrumental variables (IV 2SLS) and the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value.* The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant terms are not reported.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Peru 1/

Dependent variable: Volatility of growth rate of:	Output	Private consumption	Investmen t	Ratio of total consumption volatility to output volatility 2/
Ca_1	19.58	58.10	-23.44	-18.72
	(0.49)	(0.49)	(0.67)	(0.72)
Open	1.65	4.28	-0.38	-3.21
	(0.46)	(0.55)	(0.67)	(0.72)
VFd_1	0.03	0.25	0.14	-0.29
	(0.83)	(0.62)	(0.38)	(0.61)
p	-0.02	-0.06	0.18	0.01
	(0.67)	(0.60)	(0.19)	(0.88)
VQ	0.25	0.93	**0.49****	-0.51
	(0.49)	(0.43)	**(0.01)**	(0.61)
Vge	0.39	0.76	----	----
	(0.37)	(0.57)		
Number of observations	17	17	17	17
R^2:	0.16	0.30	0.68	0.87

1/ It uses instrumental variables (IV 2SLS) and the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value.* The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant terms are not reported.
2/ This ratio is introduced as dependent variable following Kose *et. al.* (2003). According to these authors "this [ratio] can be considered a measure of the efficacy of consumption smoothing, at the national level, relative to income volatility" (*Ibid.*, p. 8). Here the real GDP is used as a proxy of the GNP.

Venezuela 1/

Dependent variable: Volatility of growth rate of:	Output	Private consumption	Investmen t	Ratio of total consumption volatility to output volatility 2/
Ca_1	-1.98	4.24	-55.04	4.42
	(0.67)	(0.45)	(0.59)	(0.60)
Open	0.54	0.26	4.69	-0.29
	(0.32)	(0.61)	(0.57)	(0.67)
VFd_1	-0.07	-0.01	-0.75	0.06
	(0.56)	(0.90)	(0.67)	(0.69)
p	-0.09	-0.05	-0.78	0.04
	(0.28)	(0.49)	(0.54)	(0.68)
VQ	-0.06	-0.21	0.40	-0.08
	(0.40)	(0.14)	(0.81)	(0.58)
Vge	0.25	0.07	----	----
	(0.16)	(0.77)		
Number of observations	17	17	17	17
R^2:	0.56	0.59	----	----

1/ It uses instrumental variables (IV 2SLS) and the *Huber/White/sandwich robust estimator* for the variance. "*V*" preceding the name of the variable means volatility, as defined in the text. The number in parenthesis is the *p-value.* The symbols "*" and "**" mean statistical significance at the 10% and 5% level, respectively. The constant terms are not reported.
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