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A Review of Capital Account Restrictions in Chile in the 1990s

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Abstract

This paper examines the Chilean experience with capital controls and reviews studies on controls on capital inflows. Controls on Chile's inflows had only a temporary impact in reducing specific inflows because they were affected by avoidance. There is some evidence that controls increased interest rates and altered the composition of capital inflows. The studies, however, contain important methodological problems in measuring flows and significant econometric weaknesses, which cast doubt on the robustness of the estimates. No study has assessed the political economy of the controls. It seems premature to view the Chilean experience as supportive of controls on capital inflows.

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I. THE PROBLEM

Nearly two decades ago, Tobin aired in his presidential address to the Eastern Economic Association the idea of taxing international capital flows to reduce exchange rate volatility and to preserve and promote the autonomy of national macroeconomic policy.[2] The crises of the European Monetary System in 1992 and 1993, of Mexico in 1994–95 together with the recent Asian crisis, have prompted calls from policy making circles and from some members of the economic profession to control cross-country capital flows.[3] The renewed interest in taxing capital flows follows from growing preoccupation on the costs and benefits of capital flows and of government policies designed to limit or modify their composition. The Bank for International Settlements (BIS) indicates that more than 40 percent of all foreign exchange transactions have a maturity of two days or less with about 80 percent of all foreign exchange transactions involving "round trips" of seven days or less. Many observers, e.g., Eichengreen and Wyploz as well as Frankel (1996), believe that much of that trade has little to do with "fundamentals," is destabilizing, and reduces welfare.[4] Therefore, following that argument, a Tobin tax that curbs welfare-reducing short-term capital flows without affecting welfare-enhancing long-term flows, should represent a Pareto improvement.

The reasons generally advanced for restricting capital flows fall into three categories:[5]

- As indicated by the Mundell-Fleming model, monetary policy efficacy (in creating a wedge between domestic and foreign interest rates) is much reduced in a world of fast asset-market adjustment and high substitutability between domestic and foreign currency-

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[2]According to Tobin, the tax rate could be a fixed percent per year (proposals in the literature range from 0.5 percent to 0.05 percent) which falls as maturity increases.

[3]Eichengreen, Tobin, and Wyplosz (1995) resurfaced Tobin's arguments for a global tax on currency transactions as a way of coping with possible speculative attacks during Stage II of the Maastricht process toward European monetary union.

[4]One major reason for that belief is that current models of exchange rate determination based on fundamentals do not outperform "naive models" such as the random walk model. The reasons for that poor performance are to be found in both specification and estimation problems (Meese, 1990). Nadal-De Simone and Razzak (1998) show that once some of those problems are addressed, the performance of a standard model of exchange rate determination improves significantly both in sample and out of sample. See Folkerts-Landau and Garber (1998) for an account on the volatility of fundamentals during the 1998 financial turbulence.

[5]In Haq et al. (1996), it is also argued that the globalization of trade and production is eroding the tax base of national governments at the same time that more problems are becoming global. This problem could be addressed by taxing international economic activities to generate an international flow of revenue to deal with those global problems.

denominated assets. Capital controls would preserve and perhaps expand the autonomy of monetary policy.

- Given the distortions to the competitive equilibrium such as those traditionally encapsulated under "asymmetric information" (i.e., private investors motivated by noise trading, band wagons, and bubbles—what Frankel calls pathological speculation), or implicit government guarantees of banks' external liabilities, or even distortions in the real sector, capital flows can be welfare-reducing. Controlling them would increase welfare.

- Given that a sequence of multiple equilibria are possible (this clearly encompasses arguments favoring transitory capital controls to put prudential regulations in place), capital controls could help either in keeping the "good" equilibrium, or in moving the economy to a relatively higher welfare equilibrium.

Therefore, arguments for "throwing sand in the wheels of international finance" will invariably have as common elements among them the assumption of departure from the competitive equilibrium or "market failure," and the assumption that restrictions on capital flows will thus be welfare-enhancing.

Like other countries in Latin America and Asia, Chile faced a surge in capital inflows at the beginning of the 1990s. According to Zahler (1997), the most important dilemma faced by policy makers in the 1990s in Chile was that internal balance required interest rates higher than abroad—at a time in which Chile faced a decreasing country risk and expectations of currency revaluation—while external balance was inconsistent with the appreciation of the currency. The authorities favored the introduction of controls on capital inflows to offset, or at least moderate, the appreciation of the currency while keeping the interest rate differential required for reducing the excess of desired expenditure over output. Thus, Chilean controls on capital flows have the objectives of "reducing potential effects on macroeconomic stability, increasing the effectiveness of monetary policy, and imposing prudential regulations on banks and institutional investors" (Le Fort and Budnevich, 1996), and as such their rationale is to be found in the three usual reasons advanced for capital controls discussed above. Chilean controls on capital flows in the 1990s were unrelated to the central issue in the on-going debate of whether controls would allow countries to forestall crises.

In the 1990s, regulations in Chile affecting both capital inflows and capital outflows were significantly altered. The main control on inflows has been an asymmetric Tobin tax, the one-year unremunerated reserve requirement (URR), or *encaje*, imposed in 1991 on foreign loans and fixed-income securities. Although the URR was initially aimed at debt-instruments, its coverage was later extended to certain portfolio and some foreign direct investment (FDI) flows. Between 1991 and 1997, the coverage of the URR was widened and the rate of the URR increased. In 1998, the authorities suspended the URR—its rate is currently zero percent—with the objective of stimulating capital inflows and reducing pressures on the currency. In contrast, controls on capital outflows were relaxed during the 1990s. The authorities reduced the minimum stay period for foreign investment in Chile; increased the

maximum share of foreign assets in total assets that commercial banks, pension funds and mutual funds are allowed to hold; and liberalized outward FDI rules.

This paper has two objectives. First, to review the evolution of regulations affecting capital flows in Chile, their impact on specific flows, and to discuss methodological problems in measuring net inflows and short-term capital inflows. Second, to survey and critically assess the most recent empirical evidence on the effectiveness of the Chilean URR in achieving four policy objectives: to increase the effectiveness of monetary policy; to reduce total net capital inflows; to reduce both the rate of real exchange rate appreciation and its variance; and to alter the composition of net capital inflows against short-term net capital inflows.[6] Sections II and III cover those two objectives. Section IV concludes the paper indicating directions for future research and drawing policy implications.

II. Evolution of Capital Account Restrictions in Chile in the 1990s

Chile's gradual approach to the opening of the capital account in the 1990s was influenced both by macroeconomic policy concerns in a small open developing economy, and Chile's first unhappy experience with rapid opening of the capital account in the early 1980s.[7] In the early 1990s the main concern of policy makers with the opening strategy was to (i) maintain monetary policy independence; (ii) prevent excessive appreciation of the real exchange rate; and (iii) moderate the buildup of speculative short-term liabilities. As fiscal policy in Chile was assumed to have a small overall impact on spending (Massad (1998)), monetary policy became the main tool for stabilization. Some controls on capital flows were judged to be needed to prevent interest rate arbitrage with capital mobility and limited exchange rate flexibility. Controls on short-term flows were hoped to prevent potentially large adjustment costs to the real economy from real exchange rate volatility associated with sudden reversals of capital flows.

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[6]This categorization of the objectives of the URR is dictated by the objectives that the authorities have said they pursued with it and the available empirical evidence on its effectiveness. It does not imply that other objectives could not have been pursued with the URR, such as reducing the extent to which short-term capital flows go to government insured institutions.

[7]Chile's first full liberalization of the capital account in 1979 was linked to the subsequent debt and currency crisis in 1982. This was largely the result of liberalizing capital flows when the domestic financial sector had not been reformed, and in the presence of an unsustainable fixed exchange rate, and backward-looking indexation of wages (see e.g., Edwards and Cox, 1997).

To achieve the above objectives Chile used three main instruments to regulate capital flows.[8] These were a gradual liberalization of outflows, a one-year nonremunerated reserve requirement (URR) to be deposited at the central bank on inflows of certain short-term capital, and minimum rating and maturity requirements for the issuance of bonds or equity abroad by Chilean residents. The rules were enforced by requiring that most inflow- and many outflow-related foreign exchange transactions take place in the formal foreign exchange market.[9]

This section discusses the evolution of capital account restrictions in Chile over the 1990s and the behavior of the various components of capital flows. It also reviews a number of methodological issues related to assessing the impact of the controls on capital flows and their treatment in the literature on Chile. The main findings are: (i) the URR has been constantly tightened as a result of avoidance and shifts of capital inflows to flows not subject to the URR; and (ii) there are serious methodological problems related to the measurement of net capital inflows and short-term capital flows into Chile in many of the reviewed studies, which may undermine some of their conclusions on the effect of the URR on total capital flows, the interest rate differential and the term-structure of the flows. Thus more work seems to be needed to establish the effectiveness or ineffectiveness of the URR in reaching its stated policy objectives.

A. Restrictions on Capital Outflows

Restrictions on capital outflows in Chile were gradually reduced over the decade (Table 1). Outward foreign direct investment (FDI) was liberalized at an early stage in 1991–92, which was accompanied by a gradual liberalization of bank lending abroad. Since 1992, institutional investors' ability to invest abroad has also been gradually liberalized. Finally, the minimum holding period of capital was reduced from three to one year in 1995, which in 1999 is the main remaining control on capital outflows.[10] The rationale for maintaining the minimum-stay requirement is related to concerns of volatility of capital flows. Some limits also exist on banks' and institutional investors' ability to invest in foreign securities, which are justified mainly for prudential reasons.

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[8]There is an ample literature describing Chilean capital account restrictions, see e.g. Eichengreen et al, (1998), Le Fort-Sanhueza (1997), Massad (1998), Quirk-Evans (1995), Soto (1997), and Laurens-Cardoso (1998).

[9]The formal market consists of commercial banks and exchange houses and other entities licensed by the central bank. The remainder takes place in the informal market. In practice, the exchange rate in both markets is virtually the same. See Annex I for a summary of current regulations on foreign exchange transactions.

[10]This applies to foreign investment except Foreign Capital Investment Funds (FICEs) (five years), and primary and secondary American Depository Receipts (ADRs).

Table 1. Chile: Evolution of Restrictions on Capital Flows in the 1990s

	1991	1992	1993	1994	1995	1996	1997	1998
Inflows								
URR - rate	20% (Jun) of inflows to be deposited at the CB with no interest denominated in the currency of the credit, or payment of an up-front fee (a promissory note at discounted repurchase at LIBOR).	30% (May, Aug) deposit of inflow or an up-front fee of LIBOR+2.5%; LIBOR+4% (Oct)			Increase in the implicit cost of URR (Jan) by requiring it to be constituted in US$ only, compared to any currency before.			10% (Jun) deposit; 0% (Sep) deposit.
- coverage	+ New credits except trade credits (Jun). + Renewals of credits (Jul).	+ Foreign currency deposits (Jan) in commercial banks.			+ Secondary ADRs (Jun). - New borrowing for old debt exempt (Dec).	+ 1-yr limits on renewal of credits (May). + Speculative FDI excluded from FDI exempt from URR. - Small credits excluded (<US$200 million) (Dec).	+ Small credits exemption reduced (<US$100 million).	
Minimum rating - bonds - ADRs		Foreign issuance allowed for A-rated companies (May). Issuance of convertible bonds allowed (Oct). A-	Foreign credit rating required for residents to issue bonds abroad at or above the country's rating.	BBB+ (companies) BBB (banks) BBB-				A/B (banks) BB (companies) BB- (companies) BBB- (banks)
Minimum amount and maturity - bonds - ADRs - banks	Foreign issuance bonds limited. Foreign issuance of ADRs limited.	US$50 million. US$50 million. Limits on forex holdings increased.		US$25 million - 4yr minimum maturity. US$25 million; US$10 million for prior issuers.				Minimum amount to 0 (Jun). 0 (Jun).

Table 1. Chile: Evolution of Restrictions on Capital Flows in the 1990s

	1991	1992	1993	1994	1995	1996	1997	1998
FDI			US$1 million.					
Outflows								
- minimum stay for FDI	5 (FICES) years; 3 years for.				1 yr (other) (Aug).			
- pension fund rules		For. asset ownership allowed up to 1.5% of assets (Jan).		For. asset ownership increased to 6% (Nov).	For. asset ownership increased to 9% (May).	For. asset ownership limit can be increased to 12% (Apr).		
- commercial banks	25% of forex deposits can be inv. abroad (Feb). Trade financing included in above. Forex deposit limit increased to 40% (Apr).	For. inv. limit increased to 80% (Mar) of forex deposits.		Can invest in for. banks 20% of capital and reserves; risk weighted assets should be 10 times total equity (Sep).				FDI limit increased to 40% of capital in one country to 70% of capital overall.
- outward FDI	Procedures eased; and FDI allowed with own foreign exchange or via informal market							
- mutual funds and other				Insurance companies foreign inv. allowed up to 10% of resources if BBB+rating Mutual funds to 30%.				Mutual fund foreign inv. limit eliminated (Jun).

Notes: CB = central bank; + = increase in coverage; - = decrease in coverage; unless stated to the contrary, empty boxes mean that a measure remains in place.

The impact of outflow liberalization on net inflows of capital can be ambiguous. Outflow liberalization has been suggested in the literature as one way of reducing the potentially adverse macroeconomic consequences of large inflows of capital (Quirk-Evans 1995, Schadler et al. 1993). Liberalization of outflows should increase residents' holdings of foreign assets reducing net inflows of capital, which in turn should diminish exchange rate and monetary pressures. Available data indicate that in Chile outflows of capital have gradually increased after the liberalization of outflows, which should have reduced net inflows. For example, after the liberalization of outward FDI and portfolio investment, these outflows from Chile increased over the decade, reaching nearly 3–5 percent of GDP in recent years (Figure 1). This figure and Figure 2 also show that capital outflows from Chile have been important in comparison to gross inflows of capital—in some years outflows reached nearly 13 percent of GDP while inflows have been up to 20 percent of GDP. This means that studies assessing the impact of the URR on net inflows that do not control for the impact of outflows liberalization can overestimate the effect of the URR on net inflows. However, outflows liberalization may also lead to larger inflows of capital. A number of authors including Williamson (1991) in general, and Labán and Larraín (1998) and Laurens and Cardoso (1998) in the case of Chile, have argued that liberalization of outflows by reducing perceived uncertainty of investing in the country and by lowering domestic asset prices can also increase capital inflows. Failure to control for this factor in turn could lead to an underestimation of the effect of URR on net inflows. None of the reviewed studies controlled for the impact of the outflow liberalization in their analysis of the impact of the URR on net inflows of capital.[11]

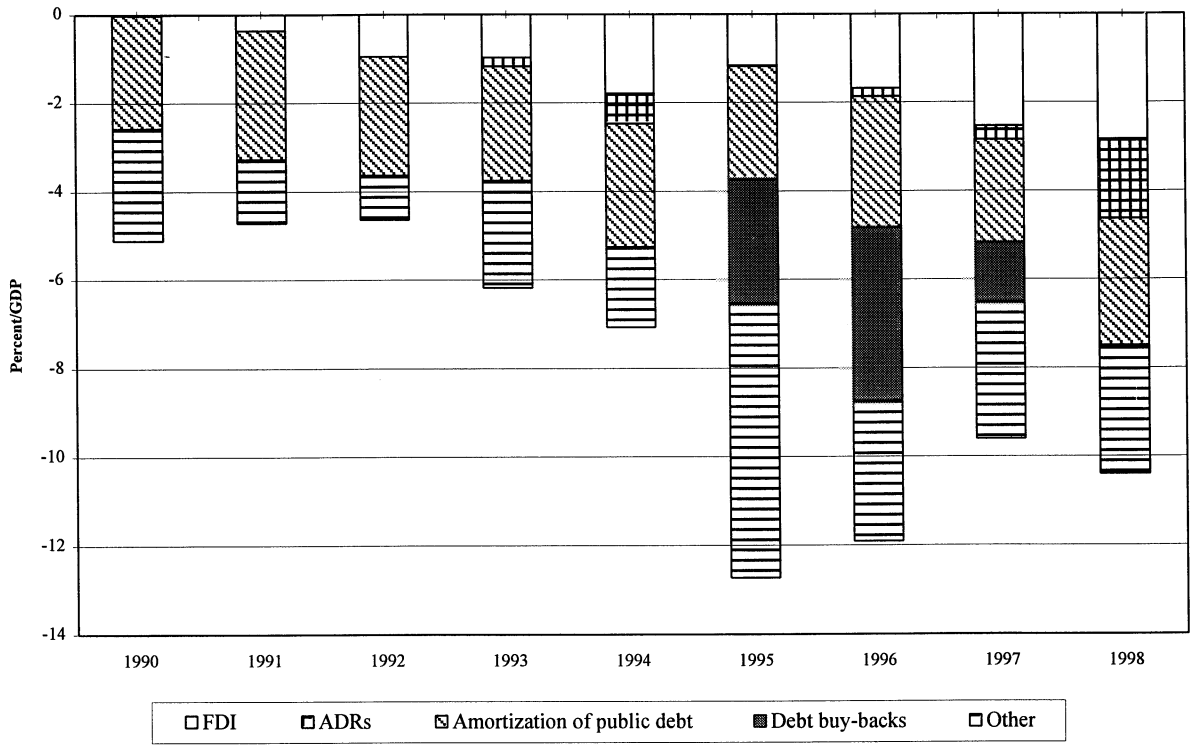
B. Restrictions on Inflows of Capital

Controls on inflows such as minimum risk classifications, maturity, and amount for the issuance of securities abroad were gradually relaxed over the decade (see Table 1). In bonds, the minimum amounts were gradually eliminated, but a four-year minimum maturity and a certain minimum rating remain. For ADRs a minimum rating remains but minimum amounts have been eliminated. These rules aim mainly at preventing adverse effects on country risk by potentially insolvent resident borrowers abroad. Most of these rules are of a prudential nature.

The main instrument for restricting capital flows in Chile has been the URR on capital inflows. The URR is an indirect, price-based measure in the form of a one-year compulsory deposit at the central bank of a fraction of certain capital inflows. Its purpose is to reduce certain capital inflows by increasing their cost. The URR was initially to cover all foreign loans except trade credits, but its coverage has been extended over time to non-debt creating capital flows as

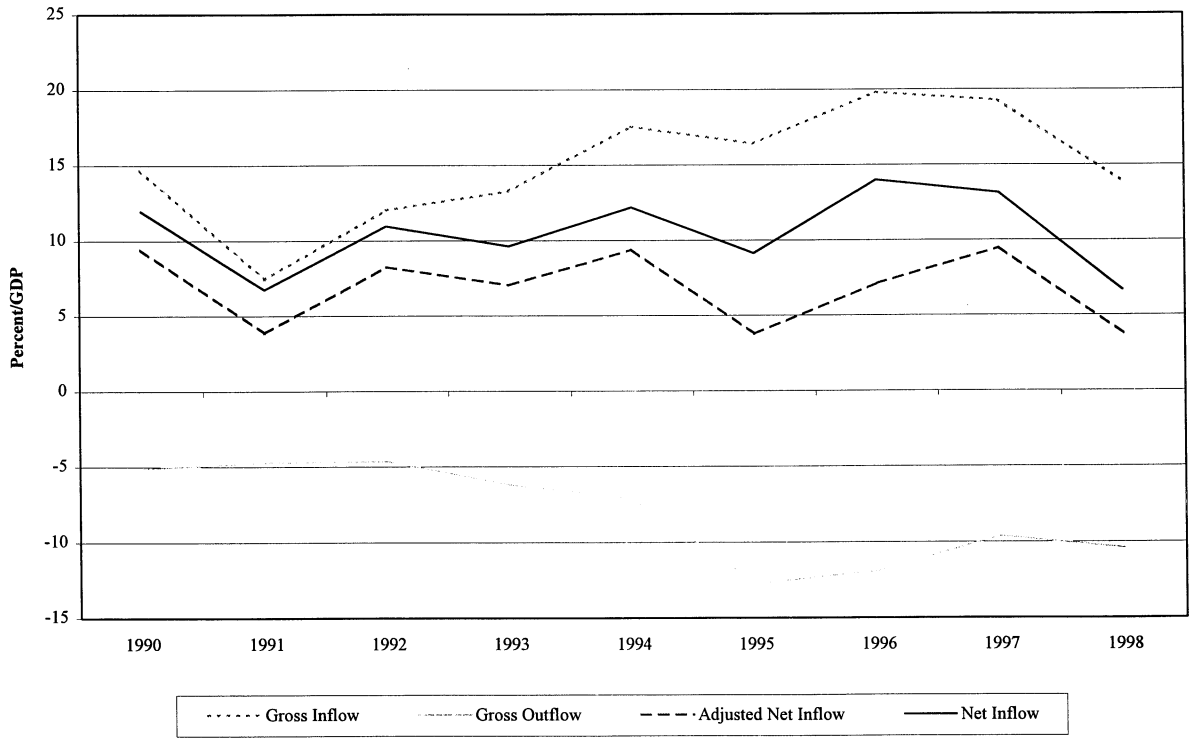
[11]Labán-Larraín (1994) did investigate the impact of outflow liberalization on net inflows and found a positive impact, but the data used is quite dated as it ends in 1992.

Figure 1. Chile: Components of Gross Capital Outflows in Chile



Source: Central Bank of Chile; and Fund staff estimates.

Figure 2. Chile: Different Definitions of Capital Inflows



Source: Central Bank of Chile.
Note: Adjusted net inflows=Net inflow less debt pre-payments.

well. It was set initially in 1991 at 20 percent and importers of capital could either make the deposit at the central bank or pay an up-front fee equivalent to the interest cost of the URR[12]. Initially, importers of capital were free to choose the currency of the deposit, but since 1995 it had to be made in dollars[13]. Its implicit cost varies according to the maturity of the inflow (see below for an alternative calculation). For example, the 30 percent URR has been estimated to increase the cost of borrowing by about 26 percent (annualized) for one-month maturities, or 2 to 3 percentage points for one-year maturities[14] (for more details see Cardoso-Laurens 1998 or Le Fort-Sanhueza 1998). The net or perceived cost of the URR during most of the decade may have been lower due to the continued appreciation of the real exchange rate. Le Fort and Budnevich (1996) note that the expectations of an appreciating exchange rate and high returns to capital in Chile rapidly compensated any impact of the URR especially on portfolio inflows—the financial cost of the URR of 1–3 percentage points per annum was easily offset by an expected appreciation of the exchange rate. Both the coverage and the rate of the URR have been subject to change over the decade (see Table 1).[15] The URR was reduced to zero in 1998 in response to more adverse conditions in world financial markets in the aftermath of the Asian crisis.

C. Implementation of the URR and Effectiveness

The effectiveness of the URR has been subject of an intense debate in and outside Chile. Dooley (1996) and Quirk and Evans (1995) note that studies in general on the effectiveness of capital controls have suffered from the lack of a widely accepted definition of effectiveness. A number of studies have empirically analyzed the effectiveness of the URR in reaching its macroeconomic objectives in Chile, which will be discussed in more detail in Section III. This section instead examines the effectiveness of the URR in terms of implementation and avoidance of the controls by looking at how the various capital flows responded to the URR and how the restrictions evolved over time. The literature (summarized in Dooley 1996) in

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[12]This took the form of promissory notes at discounted repurchase rates.

[13]The use of yen as the deposit currency had reduced the implicit cost of the URR.

[14]This assumes a spread-inclusive international interest rate of 5 percent.

[15]In 1992 the rate was increased to 30 percent and coverage extended to foreign currency deposits. In 1995 the coverage was extended to secondary ADRs and in 1996 flows of potentially speculative nature also included FDI. The "speculative nature" of the inflows was to be judged by the *Comité de Inversión Directa*, which approves FDI incentive applications, and is defined as nonproductive investments. In 1995 the method of calculating the URR was changed so that it would need to be in dollars in contrast to any currency previously. Estimates of the implied increase in the cost the URR as a result of this change range between 50–100 percent (Le Fort and Sanhueza (1997) and Valdés-Prieto and Soto (1997)).

general points out that controls can be effective in the short run while in the longer-run market participants find ways to evade the controls.

The discussion of the evolution of the URR in this section follows closely Le Fort-Sanhueza, 1997. Coverage of the URR has been partial in Chile, which may have undermined its effectiveness by allowing substitution possibilities with uncovered flows. Important potentially volatile short-term flows such as trade credits and other non-debt creating capital flows were excluded from the scope of the URR. This was either for constitutional (strong support to export development in the Constitution led to exemption of trade credits from the URR) or practical reasons (difficulty of directly controlling informal flows as only formal market transactions are notified to the monetary authorities). Portfolio flows were initially exempt, but subsequently covered. Exempt longer-term flows are government credits, FDI benefitting from special incentives and other capital-creating flows such as primary issuance of ADRs (Le Fort-Sanhueza, 1997).

Controls on capital inflows were frequently tightened in Chile over the 1990s. This may suggest reduced effectiveness over time either due to avoidance or as a result of poor deterrence effects. It may also reflect a need to tighten controls in response to large exogenous increases in capital flows to Chile. There were three major tightenings of the URR either in terms of extension in the coverage or increase in the rate during the decade. The first tightening took place in 1992 when the rate was increased from 20 to 30 percent. Data from the central bank show that initially in 1992 the URR covered about half of total gross inflows,[16] but in the subsequent years its coverage declined to 24 percent (Figure 3). This can suggest that while the URR may initially have been effective in reducing capital inflows, participants may soon have found ways to circumvent the restrictions over time. It may also indicate that the controls were effective. After further tightening in 1995 (extension to ADRs and change in base to U.S. dollars) and 1996 (exclusion of speculative investment from FDI) the share of URR covered flows in total gross inflows increased again to 30–40 percent. Similar estimates of coverage are given by Le Fort and Sanhueza (1997).

Many of the reviewed studies and the actual behavior of the individual components of capital inflows in Chile suggest a pattern of migration between covered and uncovered inflows in response to the various tightenings of the URR. For example, Figure 4 seems to indicate that when the URR was extended to secondary ADRs in 1995, another exempt inflow (FDI) started to grow faster.[17] While some of the increase is likely to coincide with the start of large

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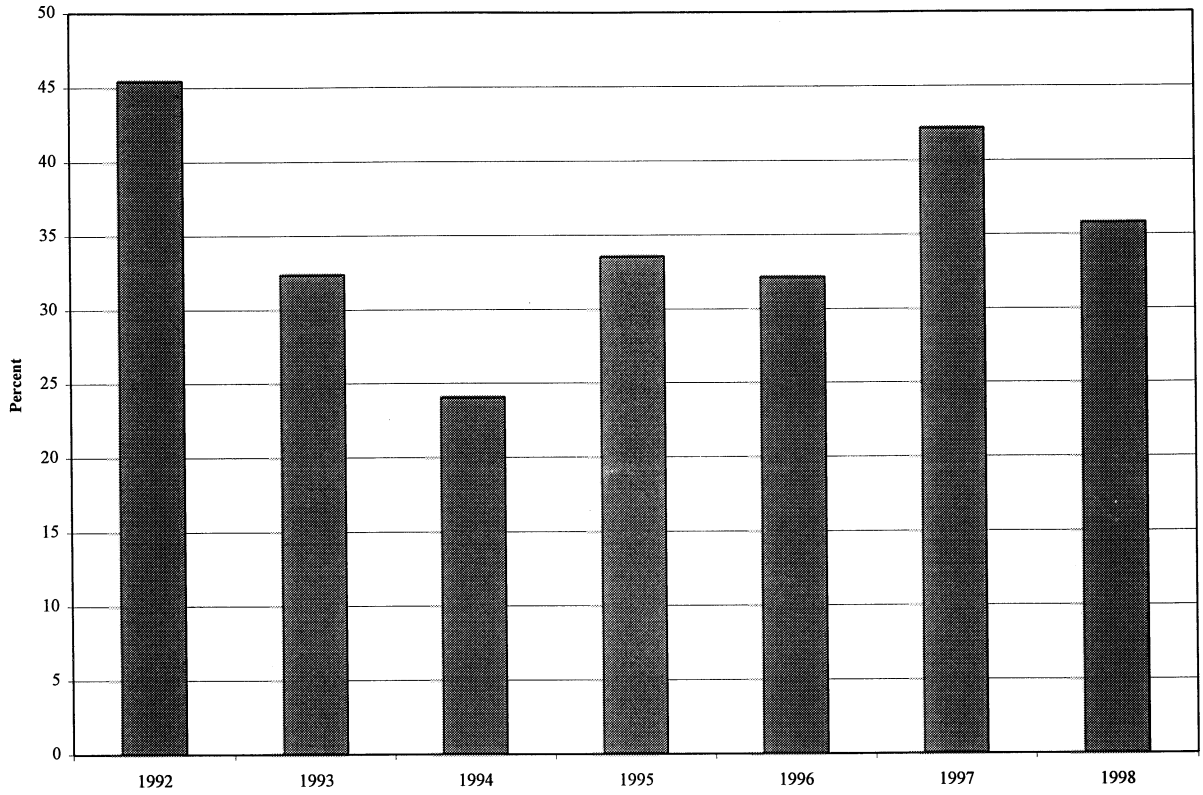
[16]Gross inflows of capital in Chile are difficult to estimate due to the inclusion of many flows (especially short term) on a net basis in the balance of payments and are thus subject to some measurement error. This explains the negative numbers for "gross" inflows in certain years.

[17]Much of this can also be due to the Tequila crisis. Quarterly data might show better the exact timing of the changes in inflows in response to changes in regulations.

Figure 3. Chile: Share of URR-covered Flows in Gross Capital Inflows



Source: Central Bank of Chile; and Fund staff estimates.

Figure 4. Chile: URR Tightening (1991, 1995, 1996) and Behaviour of Affected Gross Inflows

Source: Central Bank of Chile.
DL600 =FDI receiving special incentives.

investment projects in the mining sector, Le Fort and Sanhueza (1997) and Labán and Larraín (1998) note that in 1995–96 FDI became a major channel for portfolio inflows after the URR was extended to ADRs in 1995.[18] Once the rules on FDI were tightened in 1996 to exclude speculative capital, again another flow, trade credits, started to increase in 1998 as markets may have found a new channel for exempt inflows. This may have led to migration of capital flows via the disintermediation of the taxed domestic banking system.[19] This would be supported by the fact that since 1995 despite increased trade flows, domestic financing of foreign trade in Chile declined each year lowering the share of foreign trade credits in total credits substantially.

Another way to evade the URR may have been misinvoicing of trade. Among the reviewed studies, Labán-Larraín (1998) mention over-invoicing of exports and under-invoicing of imports[20] as possible forms of avoidance of the URR, but offer no estimates of this. Estimates by Quirk-Evans (1995) suggest that misinvoicing of trade in Chile may have increased after the introduction of the URR. The estimates, which are subject to a number of caveats,[21] would imply "hidden" annual capital inflows reaching nearly 2 percent of GDP in certain years[22] suggesting some possibility for avoidance of the controls via this channel. If true, these estimates can imply that current account deficits and short-term capital flows may have been underestimated. One implication of this is that the capital controls would have led to reduced transparency in Chile's macroeconomic indicators.

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[18]One indicator of this is a rapid increase in the share of investments into the financial sector in total FDI (Le Fort and Sanhueza 1997) suggesting that the URR-exempt FDI flows contained a large amount of speculative capital inflows into the financial sector instead of capital actually invested in real assets of enterprises.

[19]It has been argued that capital controls can be appropriate to give time to institutional reform in countries with badly regulated banking systems. In Chile, however, substantial reform in prudential regulation was already instituted in the 1980s making it among the best regulated among emerging markets.

[20]This has the additional advantage of lower tariff and VAT payments.

[21]Apart from misinvoicing a country's and world trade figures may differ due to differences in shipping dates, changes in exchange rates, etc.

[22]Trade misinvoicing is calculated as Chile's exports to the rest of the world minus the rest of the world's imports from Chile plus the rest of the world's exports to Chile minus Chile's imports from the rest of the world. Import data are converted from c.i.f. basis using c.i.f./f.o.b. factors from IFS. Similar estimates for the United States suggest a divergence of 0.01-0.4 percent of GDP.

Another indicator of effectiveness of the URR in slowing down capital inflows can be the responsiveness of capital issued by Chilean residents in international capital markets to the evolution of the URR. Figure 5 shows that despite the various tightenings of the URR, issuance of new capital abroad by Chilean residents exploded between 1995 and 1997. In GDP terms, Chile was among the largest issuers (bonds, equity, and loans) in Latin America during that period. The fact that inflows to the region increased in general during this period may suggest that compared to external factors, the effect of the URR on capital inflows in Chile may have been small. Only Edwards (1998a) and Laban-Larrain (1998) among the studies reviewed discuss this factor in any detail.

In sum, the above analysis, although it does not offer empirical proof, suggests that the implementation of the URR has not been straightforward in Chile as agents seem to have found ways of avoiding the restrictions. This is not without costs and can imply distortions in the efficiency of resource allocation as resources are diverted to avoiding the controls. Furthermore, the avoidance of the controls and substitution between the flows may have led to reduced transparency in the country's macroeconomic indicators giving a misleading picture of the country's macroeconomic vulnerability. This can e.g. be manifested in underestimation of current account deficits or the short-term debt burden. One could also argue the counter factual that without the URR macroeconomic management would have been more difficult with adverse consequences for the real economy.

D. Methodological Issues with the Measurement on Capital Flows in Chile

The estimates of the impact of the URR on net capital inflows may be biased if the analysis does not take into account the possible effect of other factors which may affect the amount of net inflows of capital. In the case of Chile these factors include, in particular, the liberalization of outflows and the government's debt pre-payment and debt conversion program in the 1990s.[23] The effect of the liberalization of capital outflows was discussed above and it was mentioned that none of the studies controlled for this factor. Regarding the government's debt pre-payment and debt-conversion programs, Figure 1 shows that those programs resulted in large capital outflows amounting to 2–3 percent of GDP especially in the years that the URR was tightened.[24] Thus net inflows may have declined due to factors other than the URR after its tightening and failure to control for this can result in overestimates of the effectiveness of the URR. Figure 2 suggests that the amounts of net inflows, and net inflows adjusted for the above two government programs are quite different. In several years the adjusted net inflow is

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[23]There are naturally many other factors such as the conditions of supply of funds to Chile in international capital markets, perceived risk premiums of Chilean borrowers, which to a large extent are influenced by the country's macroeconomic policy environment. These and other factors are discussed in more detail below.

[24]The 1995 numbers are also likely to be influenced by the Tequila crisis, which in Chile resulted especially in large outflows of portfolio capital (Labán and Larraín 1998).

only about half of the non-adjusted one. Only two of the reviewed studies have controlled for this effect. Laurens and Cardoso (1998) made an attempt to take account of this problem by using net (private) inflows of capital, which excludes the impact of the public debt payments on net inflows. Valdés-Prieto and Soto (1997) also include only short-term credits to the private sector in their estimation (Table 2).

Another important measurement problem that can bias the analysis of the impact of the URR on net capital inflows or on their term structure is related to the definition of short-term capital flows used in the studies. This in the Chilean case raises three issues: (i) the role of non-debt creating flows in short-term capital; (ii) inclusion of portfolio flows in short-term capital; and (iii) differing definitions of short-term debt in Chile.

First, given the partial coverage of the URR, the possibility of substitution between different liabilities and avoidance, the results of any analysis that exclude short-term non-debt creating capital from total short-term flows are likely to be biased. Claessens-Dooley-Warner (1995) analyzed different types of capital flows in 10 countries and found that substitution between and interaction among various flows make analysis of capital flows based on the behavior of a single flow misleading. Furthermore, in the Chilean case, the focus on short-term debt and exclusion of other short-term capital flows to assess the effectiveness of the URR may be particularly misguided as even the aim of the government seems to have been a reduction in "speculative"[25] short-term flows (Massad 1998) and not only debt flows. As discussed above, inflows of non-debt creating short-term capital[26] not covered by the URR have been important (Le Fort and Sanhueza 1997 and Figure 6). In several years the non-debt creating short-term capital flows have been more than double the short-term debt flows. This includes transactions reflected in errors and omissions and other non-debt creating short-term capital (*otro capital*) categories of the balance of payments. For example, in 1992 net short-term debt flows were about 4 percent of GDP while total net short-term flows were 6.5 percent.

Many of the reviewed studies use either short-term debt or another partial measure of net short-term capital inflows to measure the effectiveness of the URR in reducing short-term capital inflows to Chile; which may result in an overestimation of the effectiveness of the

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[25]Speculative flows are defined as "operations that focus on the short-term prospective of rates and asset prices, regardless of whether those rates are consistent with the fundamentals and are therefore unsustainable."

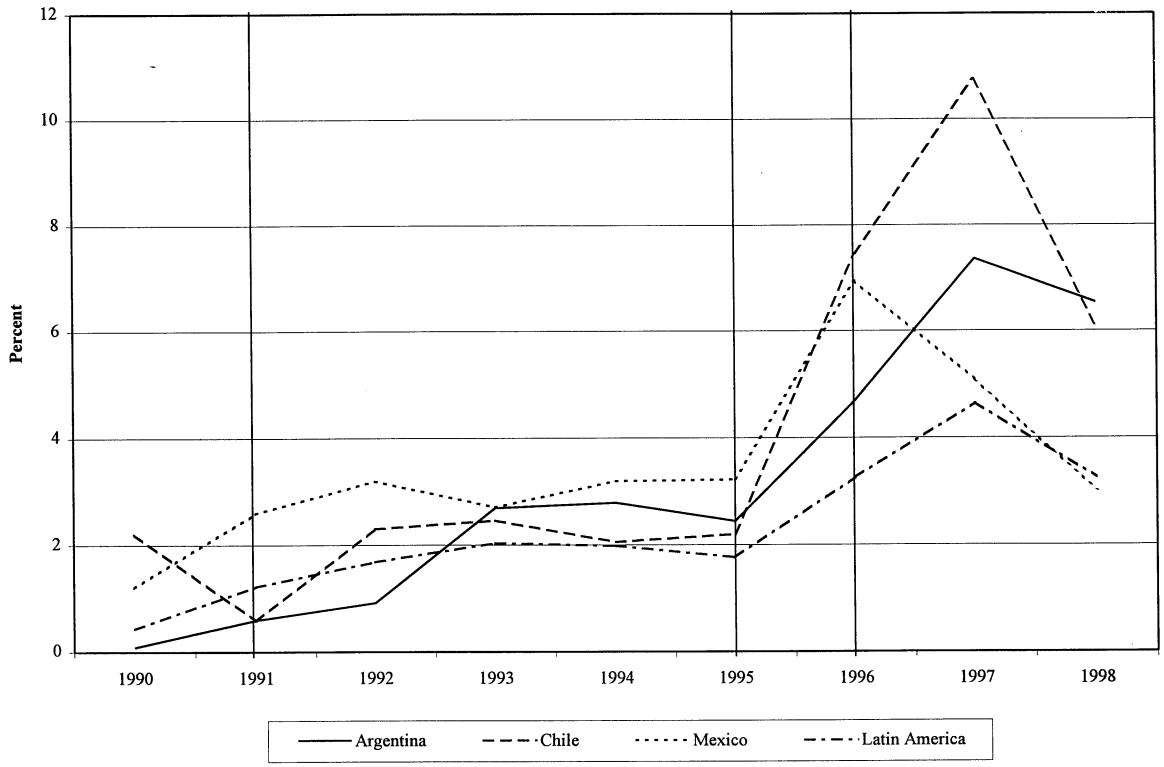
[26]These categories in some papers are called informal market flows, see e.g. Le Fort and Sanhueza (1997). According to some observers, the effectiveness of the URR is not reduced because transactions performed in the informal market are not taxed. This is because any excess supply of funds in the informal market must be channeled through the formal market where it is necessarily taxed. In contrast, other observers argue that the effectiveness of the URR will be reduced if the volume of gross transactions in the informal market grows over time even though a small net supply of funds is transferred to the formal market.

Table 2. Chile: Summary of Selective Quantitative Studies on the Effects of the URR on Capital Inflows ½/

Author	Data	Capital Flow Measure Used	Domestic Interest Rate - Interest Rate Differential (1)	Magnitude of Net Capital Inflows (2)	Real Exchange Rate (3)	Composition of Capital Inflows (4)
1. Eyzaguirre & Schmidt-Hebbel (1997)	Monthly 1991/1–1996/6	a) Changes in central bank reserves less cumulated net foreign liabilities of the capital account b) Ratio of short-term to medium- and long-term gross foreign liabilities		Positive (Indirect)		Negative
2. Herrera & Valdés-Prieto (1997)	Monthly 1991/1–1996/8		Positive			
3. Valdés-Prieto & Soto (1997)	Quarterly 1987/4–1996/4	Net short-term credit inflows to the private sector plus errors and omissions				Negative 3/
4. Soto (1997)	Monthly 1991/1–1996/6	a) Total net capital flows b) Ratio of short-term net debt to medium- and long-term net debt	Positive (In the medium term)	Positive (On impact) Negative (In the short term)	0 (Level) Negative (Volatility)	Negative (In the medium term)
5. Edwards (1998)	Quarterly 1981/1–1996/6	Changes in reserves of the central bank	Positive (In the short term)		0	
6. Laurens & Cardoso (1998)	Quarterly 1985/1–1994/4	Net private short-term and medium- and long-term capital inflows		Negative 3/ (In the short term)		Negative 3/ (In the short term) Positive 3/ (In the medium term) Negative 4/ (In the medium term)

1/ This table reports only those results that the authors consider to be robust.
2/ The words "positive" and "negative" refer to the sign of the effect of the URR on the variable analyzed in the corresponding column.
3/ The variable used is short-term capital inflows.
4/ The variable used is medium- and long-term capital inflows.

Figure 5. International Capital Flows/GDP to Latin America



Source: IFC Emerging Markets Data Base.
Note: Includes new issues of bonds, equity and loans.

Figure 6. Chile: Net Short-term Capital Flows - Total, Debt and Non-Debt Flows

Source: Central Bank of Chile.

controls. Le Fort and Budnevich (1996) discuss the impact of the URR on short-term debt and find that it has declined as share of total debt. Eichengreen et al. (1998) discuss the impact of tightening of the controls in 1995 on short-term debt only. They conclude that the impact of the controls on the term-structure of debt is ambiguous. Only Valdés-Prieto and Soto (1997) include errors and omissions in addition to short-term private credit in their estimate of short-term capital but even they exclude *otro capital*. They find some impact of the URR in reducing short-term capital flows.

Second, the exclusion of portfolio flows from short-term capital can bias the results of the studies assessing the impact of the URR on short-term flows resulting in an overestimation of its effects. By extending the coverage of the URR to portfolio flows in 1995, the authorities implicitly seem to have considered that portfolio flows are to be included in the category of "undesirable" or speculative short-term flows, or that they contain capital inflows that are evading the URR. Figure 4 indicates that portfolio flows in Chile have been volatile and responded rapidly to changes in market sentiment in contrast to FDI suggesting that they behave more like short-term capital. Given that one of the objectives of the URR was to reduce "speculative" capital flows, and that a large part of portfolio flows are likely to fall in the "speculative" category, we would argue in favor of including portfolio flows in short-term flows and not in long-term FDI in Chile.[27] Thus it is somewhat surprising that all of the reviewed studies have included portfolio flows in long-term capital. Edwards (1998) mentions the volatility of portfolio flows as an issue but goes no further in addressing it in his estimation. The inclusion of portfolio flows in short-term liabilities in Chile is likely to increase further the share of short-term capital in total. An illustrative calculation with a broader measure of the term structure of the stock of foreign liabilities (estimated stocks of all short- and medium-term liabilities including debt, portfolio, and FDI) in Chile shows that the share of short-term liabilities in the total increased slightly until 1995 and regained the pre-URR levels in recent years at about 20 percent of total[28] (Figure 7).

Third, official statistics on short-term debt in Chile exclude trade credits, which by underestimating the amount of short-term debt may affect the results of studies on the

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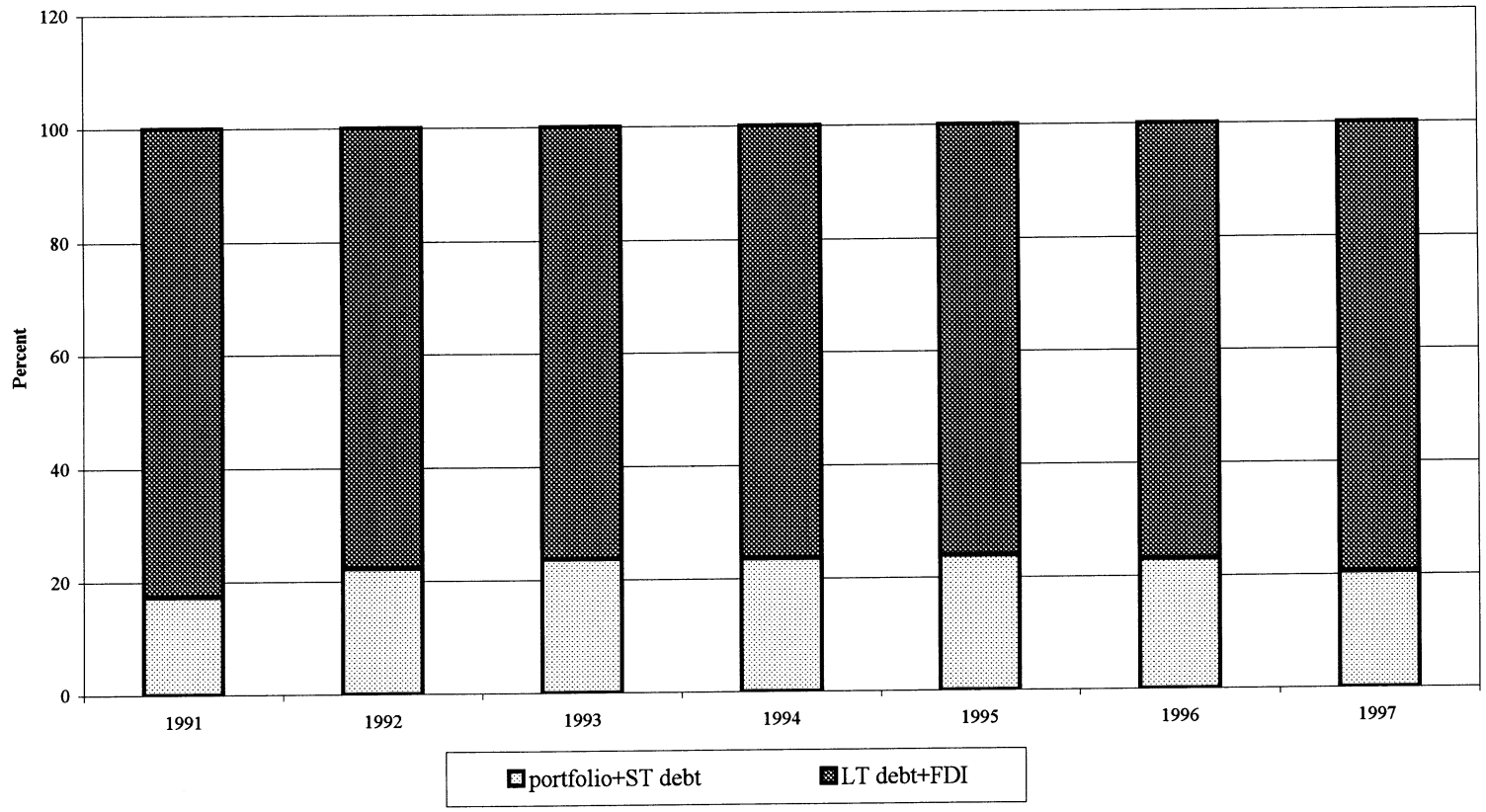
[27]In practice, the volatility or "speculative" nature of various especially investment-related capital flows can be hard to establish and is subject to some debate in the literature. Portfolio flows have been listed in many studies of emerging markets as part of "hot money" that can aggravate a crisis by rapidly leaving the country (e.g., Merryll Lynch Daily). The share of portfolio flows to reserves is at times also used as an indicator of a country's vulnerability to changes in financial conditions. Quirk and Evans (1995) and Claessens, Dooley, Warner (1995) cite evidence that even long-term capital flows are not necessarily more stable than flows through instruments with nominally short maturities.

[28] The stocks of FDI and portfolio are presented at historical values and are subject to well known measurement problems. FDI according to the balance of payments manual is defined as holding over 10 percent of assets in an enterprise.

Figure 7. Chile: Structure of Foreign Capital



Source: Central bank of Chile and staff estimates.

effectiveness of the URR on the term structure of debt. Given that these credits have increased especially in recent years, when other short-term debt has declined, any analysis based on the evolution of the official stock of Chile's short-term debt with official data from the central bank that excludes trade credits is likely to overestimate the decline in short-term debt. The inclusion of trade credits in 1997, for example, increases the stock of short-term debt from US$1.2 billion to US$5.2 billion. The amount can be even larger if some of the misinvoicing of trade or other short-term transactions hide credit transactions.

In Chile the analysis of short-term debt is further complicated as estimates of the amount of short-term debt vary between the central bank, the Bank for International Settlements (BIS), and the World Bank.[29] For example, for end-1997 the BIS estimate of short-term debt owed to commercial banks alone (on a residency basis) was about US$10 billion—nearly 10 times the official short-term debt figure. World Bank data (Figure 8a), that includes BIS estimates of debt, show that the ratio of short-term debt to total debt in Chile increased sharply in the 1990s and is among the highest ratios in Latin America. If one were to use this data base, it would be difficult to reach the conclusion that the URR was effective in lengthening the term structure of debt in Chile. On the contrary, short-term debt in total would have increased during the life of the URR. One explanation for this can be that avoidance of the URR may have led to disguising short-term debt transactions in misinvoicing of trade and in other types of short-term flows (ADRs until 1995, *otro capital* or errors and omissions) not covered by the URR. Although these transactions are not captured by official debt statistics in Chile, they may be captured by statistics on debt collected from creditor sources such as the BIS. Figure 8b depicts the short-term debt to total debt ratio for Chile based on official data on debt from the central bank. The difference with the World Bank data is striking. While official data shows a decline in the ratio, World Bank data shows a sharp increase in the 1990s. It is also notable that the difference appears only after the introduction of the URR in 1992. This makes it urgent to clarify the difference with the BIS on the amount of short-term debt in Chile.

In sum, given the above, the generally held view that most studies of the Chilean URR on the structure of inflows show some impact in favor of longer term capital inflows (Massad 1998) may need further research and more debate. The various measurement problems of short-term capital flows discussed above and the potential impact of avoidance of the URR on officially reported short-term debt cast some doubt on these conclusions and suggest that most studies of the URR may have underestimated the amount of short-term capital flows (debt or non-debt creating) in Chile.

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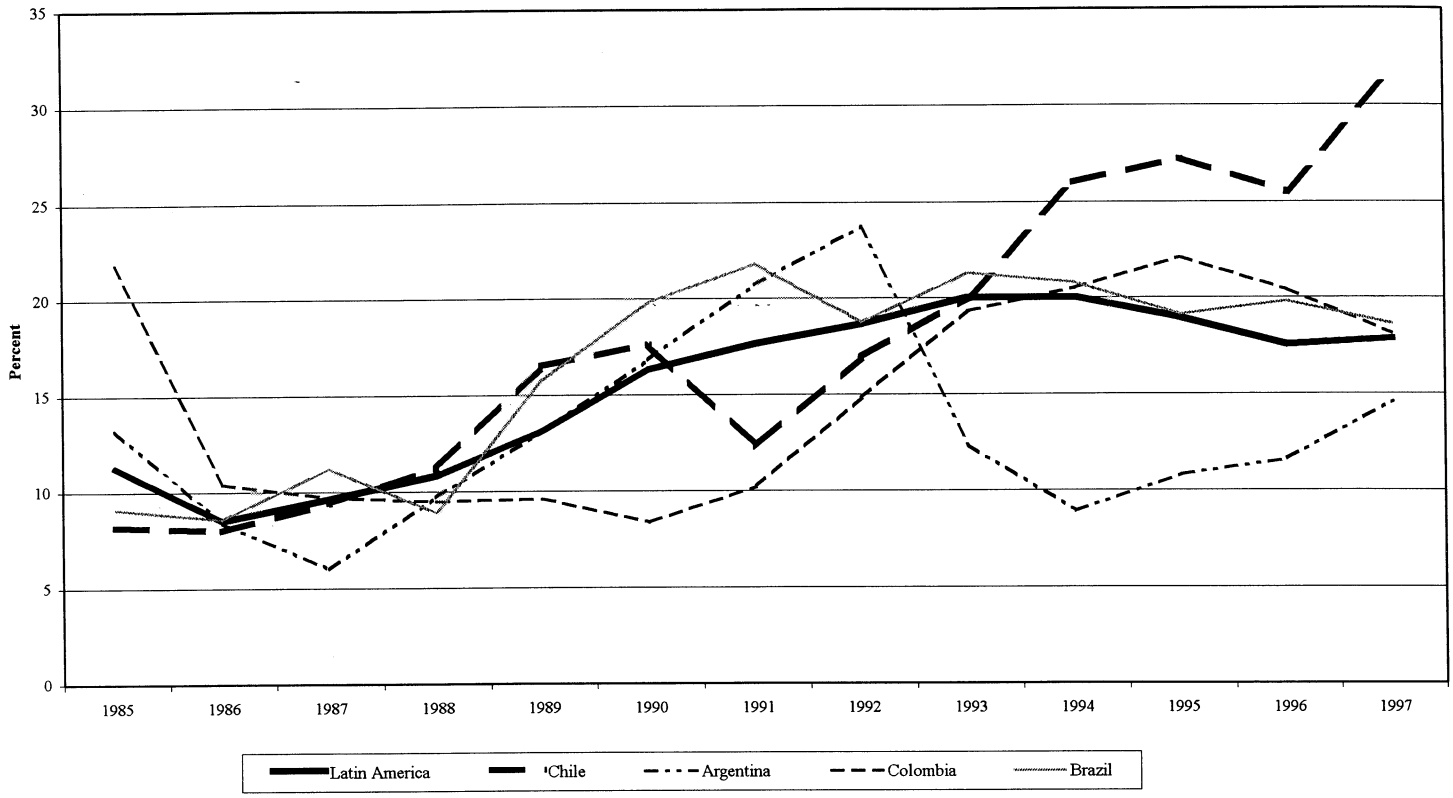
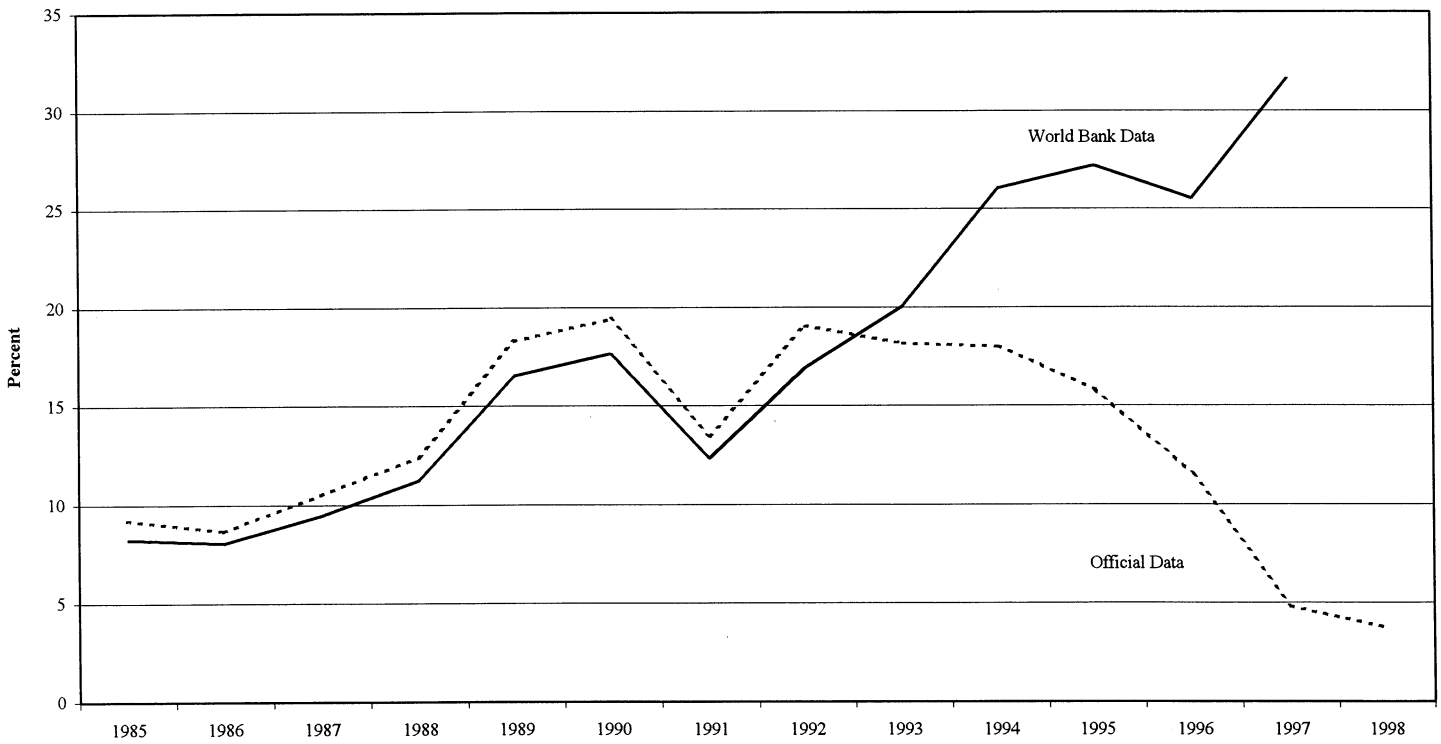
[29]The differences between official and BIS statistics are currently under investigation by the authorities.

Figure 8a. Share of Short-term Debt in Total Debt in Selected Latin American Countries



Source: World Bank Debt Reporting System.

Figure 8b. Chile: Share of Short-term Debt to Total Debt



Source: World Bank Debt Reporting System and the Central Bank of Chile.

III. A CRITICAL SURVEY OF THE LITERATURE ON THE URR IN CHILE

The literature on capital controls is vast. There is a large number of surveys on the theoretical arguments for and against capital controls so that they will not be repeated here.[30] Instead, this section relates the specific objectives of the Chilean program of controls on capital inflows to the evidence on their performance. It is asked whether or not those controls had a measurable effect on the economic variables that the program intended to affect.

Following Soto (1997) closely, we evaluate the URR in four dimensions that correlate well with the objectives of the measure: (i) its effect on the short-term real interest rate differential between Chile and its trading partners (or on the domestic real interest rate); (ii) its effect on total net capital inflows; (iii) its effect on the path of the real exchange rate;[31] and (iv) its effect on the composition of capital inflows. The summary of the reviewed studies is presented in Tables 2 and 3. Table 2 contains the main results that the reviewed papers' authors consider to be robust, and Table 3 contains a critical review of estimation and specification issues referring to the studies included in Table 2.

The studies reviewed conclude that: there is some evidence that the URR has been successful in increasing domestic interest rates; there is a relatively weaker evidence that the URR has altered the composition of capital inflows in favor of medium- and long-term capital inflows; there is mixed and weak evidence that the URR has reduced the magnitude of capital inflows into Chile, and actually no evidence that the URR affected the level of the real exchange rate. The studies reviewed, however, contain both important methodological problems in measuring net capital inflows and short-term capital inflows into Chile as well as significant econometric weaknesses. Also, most of the econometric estimates suffer from misspecification problems because they have not controlled for the relaxation of regulations affecting capital outflows during the 1990s, for the effect of sterilization operations by monetary authorities on domestic real interest rates, or for foreigners' willingness to lend to Chile, or developments in international capital markets from both the instrument side and the investor side. While the econometric weaknesses cast doubts on the robustness of the estimates, the specification problems may have biased the estimates either in favor or against the hypothesis that controls have been effective. Moreover, as no study has assessed empirically the eventual welfare benefits and costs of the controls or the political economy of the controls, it is not possible to judge the net effect of the URR on welfare.

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[30]Obstfeld (1995) has a review of the literature. The book by Haq et al. (1996) and its review by Nadal-De Simone (1997) summarize the microeconomic and macroeconomic issues involved.

[31]An upward movement in the exchange rate implies a real appreciation of the domestic currency.

Table 3. Chile: Assessment of Selective Quantitative Studies on the Effects of the URR on Capital Inflows ½/

Author	Model		Unit-root		Cointegration		Estimator	Goodness of Fit (R^2)	Serial Correlation Test		Robustness of Estimation	Specification Issues	Comments
	Uni-variate	Multi-variate	Testing	Reporting	Testing	Reporting			Result	Biased			
1. Eyzaguirre & Schmidt-Hebbel (1997)		Yes	Yes	Yes	Yes	No	(1) (2) (4) Two-stage least squares (1) (3) Error-correction maximum in likelihood	(1) 0.67-0.98 (2) 0.79-0.82 (3) 0.27-0.30 (4) 0.86-0.99	Yes Yes No Yes	No Yes Yes Yes	(1) Inefficient (2) Biased (3) Inefficient (4) Biased	(1) No explicit control for the effect of sterilization operations on domestic interest rates. (2) No control for the availability of foreign funds or the liberalization of capital outflows on total capital inflows.	- In (1) and (2), dependent and independent variables have different orders of integration - Possible multicollinearity in (1), (2), and (4).
2. Herrera & Valdés-Prieto (1997)	Yes		Yes	No	No	–	Ordinary least squares. Maximum likelihood	0.83–093 Likelihood ratio accepts all regressors are not zero for weekly data; rejects it for monthly data	No test		Yes	(1) No control for the effect of sterilization operations on domestic interest rates.	
3. Valdés-Prieto & Soto (1997)	Yes		Yes	No	No	–	Instrumental variables	0.36–0.56	No	Yes	Biased		- Variables are likely to be of different orders of integration - Possible multicollinearity.

Table 3. Chile: Assessment of Selective Quantitative Studies on the Effects of the URR on Capital Inflows ½/

Author	Model		Unit-root		Cointegration		Estimator	Goodness of Fit (R^2)	Serial Correlation Test		Robustness of Estimation	Specification Issues	Comments
	Uni-variate	Multi-variate	Testing	Reporting	Testing	Reporting			Result	Biased			
4. Soto (1997)		Yes	No	–	No	–	Ordinary least squares		No test		No	(1) No control for the effects of sterilization operations on domestic interest rates. (2) No control for the availability of foreign funds or the liberalization of capital outflows on total capital inflows. (3) No control for the possible effect of the cyclical component of the central government budget balance on the cyclical component of the real exchange rate.	- Systems in (1) (2) and (3) are under-identified - No information on the number of regressors in each equation - No test of block exogeneity - No test of effect of changes in ordering of regressors on the relationship among the variables - No allowance for cointegration; possible misspecification problems
5. Edwards (1998)		(1) (2) Yes	No	–	No	–	Ordinary least squares		No test		(1) (2) No	(1) No control for the effects of sterilization operations on domestic interest rates. (3) No control for the possible effect of the cyclical component of the central government budget balance on the cyclical component of the real exchange rate.	- VARs use the cyclical part of the series obtained by a Hodrick- Prescott filter with unspecified smoother - Ordering does not affect results - System is not identified - No information on lag-length choice - No information on number of regressors in each equation - No allowance for cointegration
	(1) Yes		No	–	N.A.	–	Ordinary least squares		Yes	No	(1) Yes		
	(1) Yes		No	–	N.A	–	Rolling regression	0.23	Yes	Yes	(1) No		

Table 3. Chile: Assessment of Selective Quantitative Studies on the Effects of the URR on Capital Inflows ½/

Author	Model		Unit-root		Cointegration		Estimator	Goodness of Fit (R^2)	Serial Correlation Test		Robustness of Estimation	Specification Issues	Comments
	Uni-variate	Multi-variate	Testing	Reporting	Testing	Reporting			Result	Biased			
6. Laurens & Cardoso (1998)	Yes		No	–	No	–	Ordinary least squares	(2) 53.1–61.0 (4) 53.1–71.5	No test		No	(2) - Possible simultaneity bias between interest rate differentials and capital flows. - No control for the availability of foreign funds or the liberalization of capital outflows on total capital inflows.	- Unclear alternative hypothesis (the null hypothesis is that the URR affects total net inflows and short-term inflows negatively) - Variables are possibly of different levels of integration - Low R^2

1/ Numbers (1), (2), (3) and (4) refer to the four dimensions in which the effectiveness of capital controls on inflows is discussed in the text and summarized in Table 2: (1) domestic interest rate - interest rate differential; (2) magnitude of net capital inflows; (3) real exchange rate; and (4) composition of capital inflows.

2/ A (?) Indicates that there is not enough information provided to assess the issue.

As discussed in section II, an important reason behind the evolution of the URR during the 1990s was the authorities' objective of closing loopholes in the regulation. This fact poses measurement problems in statistical work which have not been properly addressed by the studies analyzed in this review. The measurement problem that arises would tend to bias the estimated effectiveness of the URR toward zero. This should be kept in mind in assessing the empirical results.

A. Selective Quantitative Results on the Effectiveness of the URR in Chile

Evidence on the effect of the URR on the real interest rate differential/domestic interest rate

Using statistics of the balance of payments components and of major macroeconomic variables, Le Fort and Budnevich (1996) argue that given the sound economic policies followed during the 1990s in Chile, the URR has allowed to keep the real interest rate differential in favor of Chile, as desired by the authorities. They do not provide any econometric test of the effectiveness of the tax.

Herrera and Valdés-Prieto (1997) use monthly data from January 1994 to August 1996 to estimate the maximum interest rate differential that the URR has generated in Chile. Their work stands out from the rest because it does not calculate the effects of the URR on Chilean interest rates under the assumption that the duration of the foreign investment in Chile is fixed a priori—what the authors refer to as the myopic version of the model.[32] Instead, entry and exit decisions in the Chilean market are viewed as the result of an optimization process in which the duration of the investment is a function of the state of the economy and the stochastic processes followed by the domestic and foreign interest rates[33] and the URR itself.

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[32]The implicit myopic tax rate is calculated as follows:

$$TAX = \frac{(i*+s)\ URR\ Rate}{(1\ -\ URR\ Rate)}\ \frac{Holding\ Period}{Loan\ Maturity}$$

where i* is the foreign real interest rate and s is a measure of the risk premium. This implies that the cost of the URR is the tax cost divided over the fixed maturity of the investment. The formula assumes no taxes and that the proceeds of the URR are invested at i*.

[33]The authors perform their analysis in continuous time and make different assumptions about the statistical properties followed by the interest rate processes. They start with a simple Brownian motion (the equivalent of a random walk process in discrete time), then they assume

(continued...)

As a result, the cost of investing in Chile (the cost of maintaining a licence to invest in Chile), is compared with the expected future interest rate differential which, in turn, is affected by future entry and exit decisions.

The main result is that the URR generates an interest rate differential which is significantly more modest than the usually calculated under the myopic alternative. As a way of comparison, the maximum interest rate differential a 30 percent URR can generate is 2.3 percent in three-month investments and 1.25 percent in one-year investments relative to 10.5 percent and 2.5 percent, respectively, under the myopic alternative. When the authors add other costs of investing in Chile such as the tax treatment or the stamp tax, the differential increases to 3 percent in three-month investments and to 1.7 percent in one-year investments.

Soto (1997) uses monthly data from January 1991 to June 1996 to estimate a 5-variable VAR in the rate of change[34] of the U.S. dollar LIBOR rate, the domestic interest rate, total capital flows, the real exchange rate, and the implicit tax. The author imposes two contemporaneous restrictions on the VAR: first, the foreign interest rate is exogenous and second, the monetary authority changes the URR tax only in response to past fluctuations in total capital flows and in the real exchange rate. Therefore, only shocks to LIBOR and to the URR are identified. Given the objective of this review, only shocks to the URR are considered.[35]

Soto (1997) finds that the URR tax has a statistically significant effect on the domestic interest rate in the medium term (about a year) but this effect is transitory and of small size. For example, a URR of 30 percent increases the domestic interest rate by 30 b.p. after a year. This results are confirmed by another VAR that comprises the LIBOR rate, the domestic real interest rate, the tax, and the nominal interest rate.

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[33](...continued)
an Ornstein-Uhlenbeck process (the equivalent of an AR (1) process in discrete time), and finally, they combine the Ornstein-Uhlenbeck process with a regime change that follows a Markov 1 process. The regime change refers to the stances of monetary policy over the cycle.

[34]Soto does not explicitly say whether his VAR is in levels or in first differences. However, it is assumed here that as most variables used (or at least the LIBOR rate) are integrated processes of order one, hereafter I (1) processes, the VAR is in first differences. An I (1) process contains a unit root and is therefore nonstationary. In contrast, an I (0) process is stationary.

[35]As stated above, results that Soto considers not to be robust on the basis of the impulse-response functions, are excluded. For example, results that are sensitive to the number of lags used in the estimation such as the effect of the URR on the real exchange rate are excluded from the discussion.

Edwards (1998a and 1998b) performs a number of tests of the proposition that controls on capital inflows have had an statistically significant effect on the real interest rate in Chile. Firstly, he uses an AR(1) model with monthly data and an ARMA(2,1) model with quarterly data on interest rate differentials in order to calculate the expected rate of devaluation.[36] The interest rate differential adjusted for this "expected" exchange rate change is used as a proxy for the equilibrium real interest rate differential.

An unrestricted VAR is estimated with quarterly data for a period without capital controls (1981/I–1992/II) and for a period with capital controls (1992/III–1996/IV). The variables included are the cyclical components of the following HP-filtered[37] series: a bilateral real exchange rate relative to the United States, quarterly changes in international reserves as a proxy of capital flows, domestic credit growth, the rate of inflation, the real interest rate differential adjusted by a proxy for expected devaluation as described above, and a measure of the importance of capital controls.

The impulse response functions of the VAR show that deviations of real interest rate differentials form their equilibrium values tend to last longer in the period with capital controls, i.e., they last more than four quarters in the period with controls while they last two quarters in the period without controls.

Secondly, using monthly data on real interest rate differentials, Edwards estimates a number of alternative ARMA processes for four different time periods. For the periods January 1988–June 1991 as opposed to July 1991–December 1996, the real interest rate differential did not seem to follow a different statistical process. This is true either when allowance is made for a changing country-risk or not. However, changing the starting date of the estimation period from 1991 to 1992 or to 1993 when the URR was strengthened, did have an effect. It seems that the persistence of interest rate differentials indeed increased after those dates supporting the idea that the restrictions gave the monetary authorities greater control over interest rates.

Thirdly, Edwards used a rolling regression technique to estimate the degree of persistence of interest rate differentials during the period with capital controls. The results suggest again that the degree of persistence of real interest rate differentials increased slightly although rolling estimates of the steady state differentials declined gently after 1995. The latter may indicate

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[36]There is no offshore forward market in Chilean pesos and the domestic forward market started only in 1994.

[37]The value for smoothing the growth component of the series used by Edwards, what Hodrick-Prescott refers to as λ, is not reported. Note that a value of λ that is "too large" smooths the stochastic trend of the series "too much," and as a result the volatility of the cyclical component is "too little." If Edwards used the value of 1600 suggested by Hodrick-Prescott for quarterly series, and this is "too "large,"it may explain some of his results.

that Chile's ability to control interest rate differentials over the longer run may not have been that much.

Evidence on the effect of the URR on total capital flows

Le Fort and Sanhueza (1997) argue that the URR has been effective in the sense that at least for some time after a change in the regulation was made, total capital inflows fell and there was no clear upward trend in total capital inflows during their sample period (1990–96). They do not provide econometric test of their hypothesis.

Eyzaguirre and Schmidt-Hebbel (1997) estimate the effect of the URR tax on capital flows using as dependent variable net changes in foreign assets of the central bank deflated by the U.S. CPI. The regressors are the terms of trade, the real exchange rate, the ratio of net financial wealth to GDP, the domestic real interest rate, and net foreign interest receipts.[38] Only the effect of the real interest rate on the net changes in foreign assets held by the central bank is reported.

If the URR tax affects the domestic interest rate positively, it will affect capital flows as well. However, the only statistically significant variable, i.e., the interest paid on net foreign assets, has the wrong sign. None of the other regressors, in particular the interest rate or the real exchange rate, has an effect that is statistically different from zero. When the lagged dependent variable is included among the regressors, all regressors become statistically insignificant. The authors conclude that there is some weak evidence that the increase in the domestic real interest rate has contributed to increase the stock of net foreign assets in Chile (improved the current account).

Soto (1997) uses the 5-variable VAR described previously to estimate the effect of the URR on total capital flows in Chile. He finds that the impact effect is positive, i.e., the URR increases capital inflows on impact, but it reverses itself after two months. After six months, the effect becomes statistically insignificant. The magnitude of the effect is always small, i.e., the introduction of a 30 percent tax reduces net capital inflows by approximately US$400 million in total.

Laurens and Cardoso (1998) try to assess empirically the effectiveness of the URR on net capital inflows as well as on their composition using an index that measures the restrictiveness of the capital controls in Chile. The index is constructed by multiplying the tax base (estimated by a series of flows taken from the balance of payments and added from 1985 onwards) by the

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[38] The authors report that the dependent variable is an I (0) variable, i.e., a stationary variable, while the regressors are all I (1) variables, i.e, they contain a unit root and are therefore nonstationary. This makes the interpretation of the regression difficult.

tax rate and using quarterly data from 1985/I to 1994/IV.[39] Net private inflows are regressed on the real interest rate differential between Chile and the rest of the world, Chilean GDP in U.S. dollars, the index measuring restrictiveness (using linear, quadratic and cubic functional forms), and some quarterly dummies.

The authors find that the introduction of the URR and the broadening of its base over time had a negative effect on the level of capital inflows independently of the functional form. However, the functional form does matter for the duration of the effect of the URR index on the change in net private capital inflows. A linear form provides a statistical significant effect on the slope of the control index only at the 10 percent confidence level. Thus, the authors argue that the effect of capital controls on net private capital inflows seems quite persistent (a zero slope coefficient implies a permanent effect in Laurens and Cardoso's model). When a cubic form is used instead, the slope is statistically different from zero, and thus the tax seems to affect net private capital inflows only temporarily. After two quarters of the introduction of the URR, the index seems to indicate that capital controls are ineffective.

Evidence on the effect of the URR on the path of the real exchange rate

Le Fort and Budnevich (1996) and Le Fort and Sanhueza (1997) argue that the URR allowed Chile to keep an interest differential in favor of the domestic economy without generating an increase in the expectations of a currency depreciation to fulfill the interest rate arbitrage condition. The URR was successful in preventing a currency appreciation followed by a depreciating trend. They do not provide an econometric test of their hypothesis.

Soto (1997) finds that increases in the URR do not affect the path of the equilibrium real exchange rate because the URR is not cointegrated with the real exchange rate. Similarly, the tax does not seem to depreciate the real exchange rate in the short run.

Edwards (1998a and 1998b) re-estimates his VAR described before for a period without capital controls (1981/I–1991/II) and for a period with capital controls (1991/III–1996/IV) and evaluates the real exchange rate response to capital flows innovations. Similarly, he uses the longer period VAR (1987–96) estimates to evaluate the impulse response to a shock to the tax equivalence of the URR. Two results are noteworthy: first, the effects of a capital inflow innovation on the real exchange rate are similar across periods suggesting that the impact of the URR on the behavior of the real exchange rate has not been statistically significant and second, the variance decomposition of the forecast errors of the real exchange rate confirms that the URR has not been effective in affecting the real exchange rate behavior.

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[39]Actually, Laurens and Cardoso calculated two versions of the index that differ only in that Index I assumes that all of the effect of the introduction of the URR was responsible for the fall in net capital inflows in 1991/II while Index II assumes that all of the effects were felt from 1991/III onwards.

The capital account restriction variable explains no more than 3 percent of the forecast error variance.

Soto (1997) is the only study on the effect of the URR on the volatility of the real exchange rate. He uses a bivariate VAR with the tax rate and an estimated measure of the standard deviation of the real exchange rate. Although the URR does not seem to explain more than 6.5 percent of the variance in the real exchange rate volatility, the impulse-response function shows that a standard deviation shock in the tax contributes to the reduction of the volatility of the real exchange rate after the second month by 10 percent, and that effect declines to 4 percent in the medium and long run. A 30 percent tax can reduce the volatility of the real exchange rate by about 20 percent.

Evidence on the effect of the URR on the composition of capital flows

Le Fort and Budnevich (1996) and Le Fort and Sanhueza (1997) argue that the change in the composition of capital flows in favor of relatively more FDI and more medium- and long-term debt is one of the outcomes of the URR. They do not provide econometric evidence.

Eyzaguirre and Schmidt-Hebbel (1997) estimate the ratio of short- to medium- and long-term stock of liabilities as a function of the domestic real interest rate and the tax. The best estimate of the equation excludes the interest rate and includes a lagged dependent variable together with a summation of the lags 10 to 13 of the tax. The summation is significant and the authors conclude that the tax is effective in affecting the composition of capital flows to Chile but its effect is felt only after about a year.

Valdés-Prieto and Soto (1997) use quarterly data for the period 1987/IV to 1996/IV to estimate the effect of the implicit tax on the ratio to GDP of total short-term foreign credits to the private sector plus errors and omissions of the balance of payments. Additional regressors are the domestic real interest rate used by the monetary authority to set policy, the U.S. dollar LIBOR rate minus WPI inflation, a proxy for expected real exchange rate devaluation,[40] a dummy variable for the country rating according to Standard and Poor's, a proxy for market

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[40]The proxy includes 3 steps: first, a model for the level of the real exchange rate is estimated using a time trend, the share of government expenditure in GDP, the terms of trade, and the risk rating of the country. Second, a model for the rate of change of the real exchange rate is estimated based on the lagged change in the nominal exchange rate, the nominal interest rate, the URR, the foreign currency purchases of the central bank, and two lagged residuals of the first equation. The first two steps form a sort of error-correction model in order to account for the unit root in the real exchange rate. Third, the devaluation predicted in the second step is smoothed using a weighted average of the current and past values with optimal weights.

access of emerging markets, a ratio of imports to GDP, a ratio of exports to GDP, and net foreign exchange purchases of the central bank.[41]

Valdés-Prieto and Soto find that in the period 1987/IV–1994/IV, the URR was ineffective in altering the composition of capital inflows. However, when they extend the sample to 1996/IV and thus include the nearly doubling of the tax rate of the URR in early 1995, the coefficient of the higher tax is significantly different from zero and negative as expected. The authors warn that their results may be biased because they do not take into account the effect of tax avoidance that substitutes taxed short-term flows for exempt flows not classified as short-term credit (e.g., the URR was not applied to the hedging of secondary ADR operations). The authors conclude that although the much higher tax rate of the URR in 1995 seemed to affect the composition of the short-term flows they measure, the fact that other categories of short-term inflows increased makes it unclear what the effect of the URR on the composition of capital inflows was.[42]

Soto (1997) estimates a VAR comprising a LIBOR rate, the domestic interest rate, the tax rate, and a measure of short-term capital flows to assess the impact of the URR on short-term capital flows.[43] The effect of the tax on short capital flows is found to be significant but of small magnitude. Soto also estimates a bivariate VAR of the tax rate and the ratio of net short-term debt to net medium- and long-term debt and finds that the URR affects the composition of capital flows significantly after 15 to 20 months and the magnitude of that effect is important.

Laurens and Cardoso (1998) use their index of restrictiveness and the same regressors described above to test whether the URR affected the composition of capital inflows in Chile. The dependent variables used are short-term capital flows and medium- and long-term capital flows. They find that the URR tax had a negative effect on short-term flows. However, the effect is short lived as it lasts for less than a year. They also find that the tax has no impact effect on medium- and long-term capital flows but a negative effect develops over time, i.e., an effect contrary to what the authors' model predicted, and that effect seems to increase with time. The authors think this anomaly may be due to the fact that their measure of capital flows did not include FDI and portfolio investment.

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[41] The authors mention (no test is reported) that all variables are I (0).

[42] Valdés-Prieto and Soto (1997) also find that the elasticity of capital flows to changes in the interest rate used by the monetary authorities is not affected by the URR.

[43]The VAR has the same restrictions described above.

B. Assessment of Selective Quantitative Studies on Chile's URR

Table 3 contains a summary of the major econometric features of the studies reviewed in this selective survey. As mentioned in the introduction of section III, the main general conclusion that can be drawn from Table 3 is that available empirical studies contain enough econometric problems to cast doubts on their conclusions about the effectiveness of controls on capital inflows in Chile. The possible exception could be the positive effect of the URR on domestic interest rates. However, specification issues such as the lack of control for the relaxation of regulations affecting capital outflows during the 1990s, for the effect of sterilization operations by monetary authorities on domestic real interest rates, for foreigners' willingness to lend, or the possible non-linear effects of tax incentives on inward FDI flows, may have biased the estimates both ways. Whenever possible, the direction of the econometric bias will be stated.[44]

Besides the simultaneity bias[45] affecting some studies on the effectiveness of capital controls in Chile (Eichengreen et al. 1998), there are a number of other econometric problems: (i) studies do not normally test for the nonstationarity of the variables used in the regressions; (ii) with two exceptions, there is no test of the possibility of common trends in nonstationary variables, or cointegration; (iii) serial correlation (possibly of different orders) in the residuals is pervasive; and (iv) misspecification problems (e.g., the omission of relevant variables and possible non-linearities) are clear in some cases, and should have been tested in others.

With the help of Table 3, let us briefly summarize our assessment of the studies from the perspective of the four dimensions of the problem.

The positive effect of the URR on the real interest rate differential/domestic interest rates

As stated above, Le Fort and Budnevich (1996) argue that the URR had a positive effect on domestic interest rates without providing an econometric test. However, as argued by Valdés-Prieto and Soto (1997), in the case of a fixed or predetermined exchange rate regime, when a tax on capital inflows generates revenue, it is *relevant* in the sense that it is not avoided fully.

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[44]The direction of the econometric bias affecting some regressions could not always be determined. This was the case, for example, when the source of the bias in the estimates was the presence of serial correlation in the residuals of a regression including the lagged dependent variable among the regressors. In contrast, for example, when the source of the bias in the estimates was the lack of control for the fact that changes in the URR tax occurred in part as a response to capital inflows, it was possible to say that the econometric bias was against the effectiveness of the URR.

[45]Simultaneity bias and the possibility of cointegration among the variables are formally illustrated in Appendix 1.

In that case, however, the interest rate differential between the taxed sector and foreign interest rates by itself is uninformative regarding the *effectiveness* of the URR. Econometric work is needed to estimate the degree of effectiveness of the capital control, i.e., the effect of the URR on the sum of changes in the net demand for credit of the exempt group and the net demand for credit of the taxed group, as well as the effect of the URR on the real interest rate differential.

Herrera and Valdés-Prieto (1997), Soto (1997), and Edwards (1998b) find that the positive effect of the URR on domestic interest rates is small and does not last for more than a year. Herrera and Valdés (1997) convincingly show why the effect is likely to be smaller than usually suggested in the literature.[46] This implies that the increase in monetary policy autonomy may not have been as much as indicated by other studies. In other words, episodes of monetary policy tightening may have been an important driver of capital inflows more often than suggested by other studies.

The conclusion on the effectiveness of the URR in affecting domestic real interest rates has to be qualified, however, because none of the reviewed studies (with the possible exception of Eyzaguirre and Schmidt-Hebbel, 1997) controls for the impact of the sterilization operations of the monetary authorities in Chile during the 1990s. A regularity discussed in Calvo et al (1993) is that the reduction in interest rates in Latin America has been much slower in countries that have sterilized than in those that have not.[47] Labán and Larraín (1997) argue this for Chile as well. Therefore, part of the positive effect that studies have found that the URR had on Chilean interest rates during the 1990s may be due to the sterilization operations of the central bank. The implication is that the reviewed studies may be subject to a misspecification bias in favor of the effectiveness of the URR. This clearly is a topic for further research.

The negative effect of the URR on total net capital flows

The negative effect of the URR on total net capital flows reported by Soto (1997) and Laurens and Cardoso (1998) is small and lasts for two quarters. Soto, however, does not assess the robustness of his estimates by reversing the ordering of the variables in the VAR. It

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[46]Herrera and Valdés' (1997) study allows for a change in the monetary policy regime between a contractionary and an expansionary monetary policy stance. Nevertheless, data availability does not allow the testing of changes in the stochastic process followed by domestic interest rates before and after the introduction of the URR.

[47]Eyzaguirre and Schmidt-Hebbel (1997) use the first lag of the PRBC rate—short-term real paper rate—until May 1995, and the interbank rate thereafter, to proxy the main instrument of monetary policy. Note that the first lag of that variable captures (probably among other things) the effect of monetary policy sterilization operations on interest rates. The variable is statistically significant in explaining the covered interest rate differential.

is well known that the ordering of the variables in a VAR affects the impulse response functions and the variance decomposition results in a significant way if the correlation between the variables is "large." Given that a rule of thumb in practical work is that correlation is large when it is over 20 percent and that the correlation between the real LIBOR rate and the tax rate in Soto's sample was 62 percent, testing the robustness of results for changes in the ordering of the variables seems relevant.

An additional problem also mentioned by Soto is the possibility of misspecification. However, no test for block exogeneity and Granger causality to detect whether to incorporate or not a variable into the VAR is reported.

Finally, the short-term nature of the effects of the URR on total capital flows may result from not allowing in the VAR for the possibility of a long-lasting relation between the URR—which the authorities clearly said they viewed as a permanent measure—and capital flows. Figure 9 shows the trend and the cyclical part of the ratio to GDP of the capital account. Although it seems that the introduction of the URR did not affect the upward trend of total net capital flows in Chile during the sample period, non-cointegration should be tested rather than assumed.[48]

Laurens and Cardoso's (1998) regression of net private inflows on the real interest rate differential between Chile and the rest of the world, on Chilean GDP in U.S. dollars, on the index of restrictiveness, and on some quarterly dummies, is difficult to interpret. This is because our unit-root tests indicate that net capital inflows are I (0), the real interest rate differential between Chile and the rest of the world (i.e., the U.S., Germany, and Japan) is likely to be I (0), and domestic GDP is I (1).

Another problem with Laurens and Cardoso's (1998) results is that they do not control for the possibility of simultaneity bias in their regressions despite that it is likely that changes in the URR tax may occur as a response to capital inflows. This may have biased their results against effectiveness of the URR. Moreover, it is difficult to tell what the alternative hypothesis is in Laurens and Cardoso (1998). The authors indicate that a statistically significant negative intercept suggests that the URR had a negative effect on the level of capital flows. A slope coefficient statistically equal to zero suggests that the control has had a permanent effect on total capital flows. If the slope coefficient is instead positive, the control can have an effect on capital flows that is positive or negative depending on the magnitude of the slope relative to the magnitude of the intercept.

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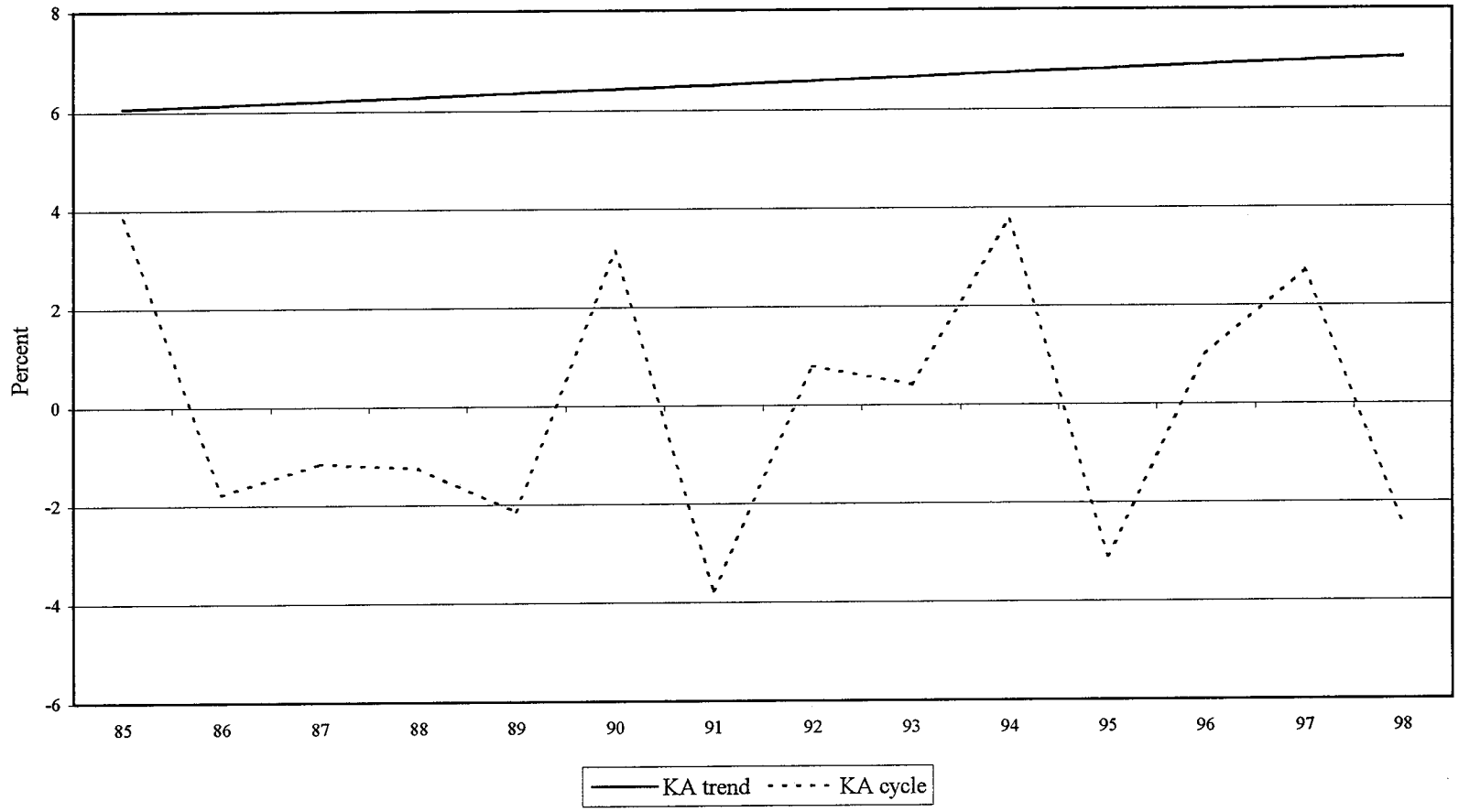
[48] The smoothing of the series uses a version of the Hodrick-Prescott filter—which allows for a stochastic trend—with a degree of smoothing driven entirely by the data and using a cross-validation criterion (see Ullah and Vinod, 1993, for a description of the automatic method of cross-validation). The program was used by Coe and McDermott (1996) and was kindly provided by the authors.

Figure 9. Chile: Capital Account Ratio to GDP:
Trend and Cyclical Components



Sources: Central Bank of Chile; and Fund staff estimates.

None of the studies reviewed in this survey controls for the effect of the liberalization of capital outflows in Chile which has been suggested as one of the causes responsible for the increase in net capital inflows (Labán and Larraín, 1997, and Laurens and Cardoso, 1998). This may have biased results against the effectiveness of the URR. Therefore, it seems necessary to control adequately for the removal of controls on capital outflows in order to disentangle the effect of the URR from the effect of the liberalization of capital outflows on total capital flows in the 1990s. Figure 10 shows that both the trend in capital inflows and the trend in capital outflows increased by nearly 7 percent of GDP between 1990 and 1998. Moreover, the cyclical behavior of both types of capital flows is sufficiently different to justify taking them into account separately when analyzing the impact of the URR on capital flows in Chile. The drop of nearly 7 percent of GDP in the cyclical part of total capital flows in 1995 (see Figure 9), can be decomposed into a 5 percent of GDP increase in capital outflows and a 2 percent of GDP fall in capital inflows (see Figure 10).

Finally, no study controls for the increased availability of funds in the 1990s as opposed to the 1980s due to financial innovation, further economic integration, and the effect of successful Chilean reforms on foreigners' willingness to lend.[49] This may have biased results against the effectiveness of the URR. Similarly, the external environment such as the massive reshuffling of portfolios as a result of the Mexican crisis of 1994/95, should be part and parcel of a comprehensive analysis of the impact of the URR. This may have biased results in favor of the effectiveness of the URR.

The negative effect of the URR on the real exchange rate

In general, studies have not found a negative effect of the URR on the level of the real exchange rate in Chile.[50] Eyzaguirre and Schmidt-Hebbel (1997) conclude that the indirect effect of the URR on the real exchange rate via affecting first the domestic real interest rate is not robust to changes in specification or in estimation techniques. Similarly, Soto (1997) indicates that his results of the effect of the URR on the level of the real exchange rate are not robust to the number of lags used in the VAR indicating thereby the possibility that the use of ordinary least squares may not be appropriate to generate consistent and efficient estimates. A SUR (seemingly unrelated equation) technique may be necessary instead.

Soto (1997) reports a significant negative impact of the URR on the volatility of the real exchange rate. However, given the high correlation between the URR and the foreign real interest, it is difficult to separate the effect of changes in the foreign real interest rate and their

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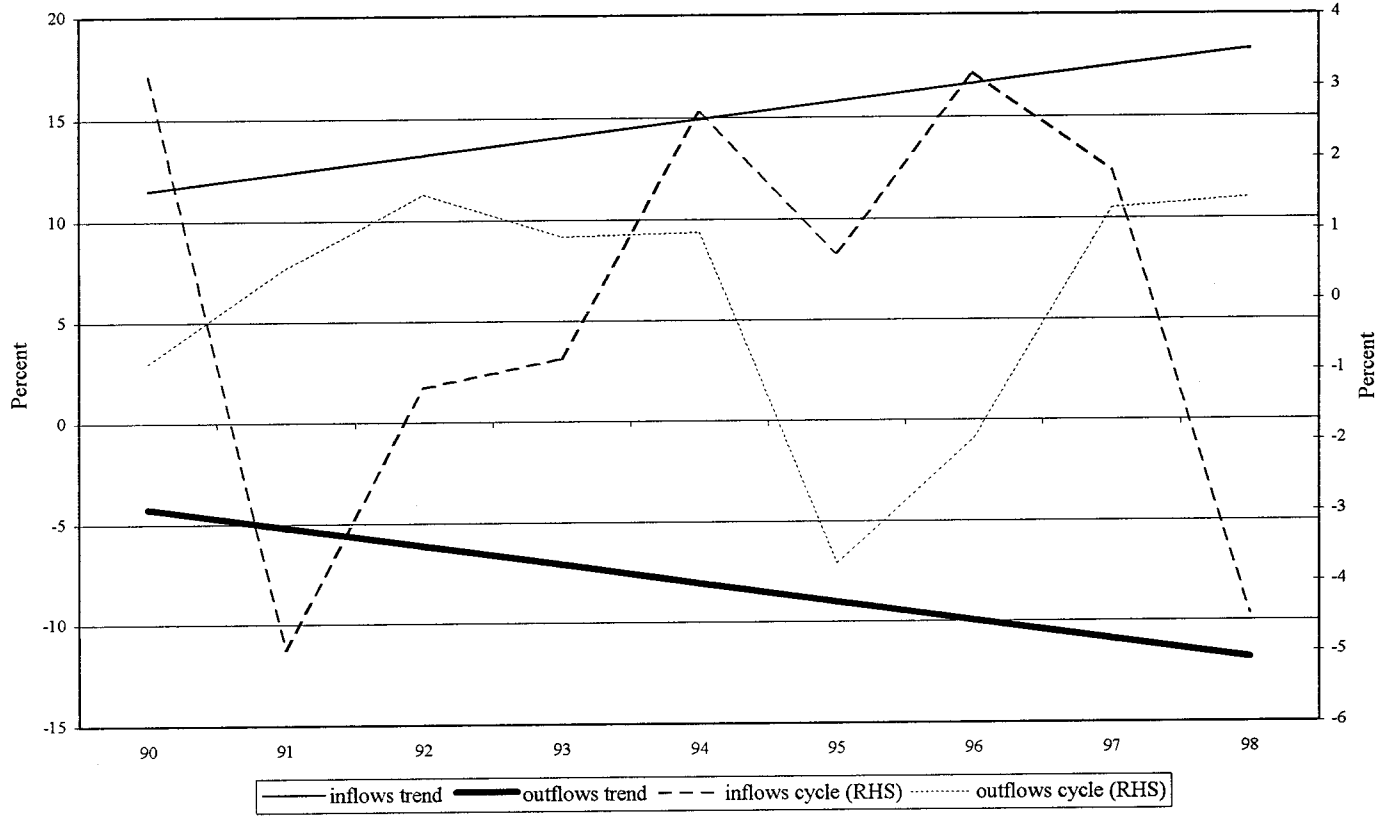
[49]As stated above, Valdés-Prieto and Soto (1997) use the country's rating according to Standard and Poor's to proxy Chilean market access and Edwards (1998) uses a country risk proxy in his regressions.

[50]This result also applies to other studies not reviewed here but reported in Table 4.1 of Eyzaguirre and Schmidt-Hebbel (1997).

Figure 10. Chile: Capital Inflow and Outflow Ratios to GDP:
Trend and Cyclical Components



Sources: Central Bank of Chile; and Fund staff estimates.

impact on the volatility of the real exchange rate from the pure tax effect.[51] As changes in the ordering of the shocked variables are not reported, it is difficult to assess the robustness of the results. It would be interesting to test for the non-inclusion of the foreign real interest rate.

As Edwards' (1998b) results are from an unrestricted VAR, it is not possible to obtain a reliable picture on the interaction between the variables. This is especially important because the objective is to test whether the introduction of the URR tax affected the structure of the economy. Figure 11a shows that the *cyclical components* of the weighted[52] real interest rate differential between Chile and the United States, Germany, and Japan and changes in the real effective exchange rate (lagged one year) seem to follow real interest rate parity quite closely. It actually seems that it takes about one year for changes in the real effective exchange rate to arbitrage any real interest rate differential. Visual inspection of Figure 11a may suggest that the URR did not have a strong and lasting effect on real interest rate parity in Chile during the 1990s.[53] On the other hand, as argued above, the liberalization of capital outflows during the life of the URR may have offset the efficacy of the tax in altering the path of the real exchange rate.[54] However, this has still to be tested econometrically.

It is also interesting to look into the other component of changes in the real effective exchange rate in Chile, the *trend component*. Figure 11b points to an alternative, or complementary

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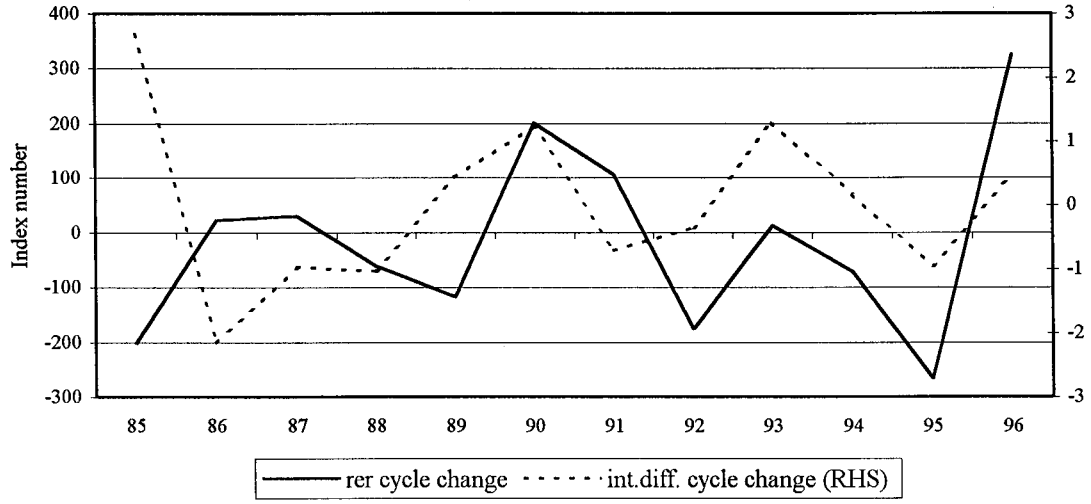
[51]Most of the variance of the URR tax rate is explained by the foreign interest rate variance.

[52] The weights used for the real interest rate differential are the same as those used for the real effective exchange rate.

[53]Nadal-De Simone and Razzak (1998) expand the work of Baxter (1994) and show that real interest rate parity holds between the United States and Germany and the United States and the United Kingdom during the period 1980 and 1997 *at the business cycle frequency band.* Figure 11a for Chile and its major trading partners provides a very similar picture indeed.

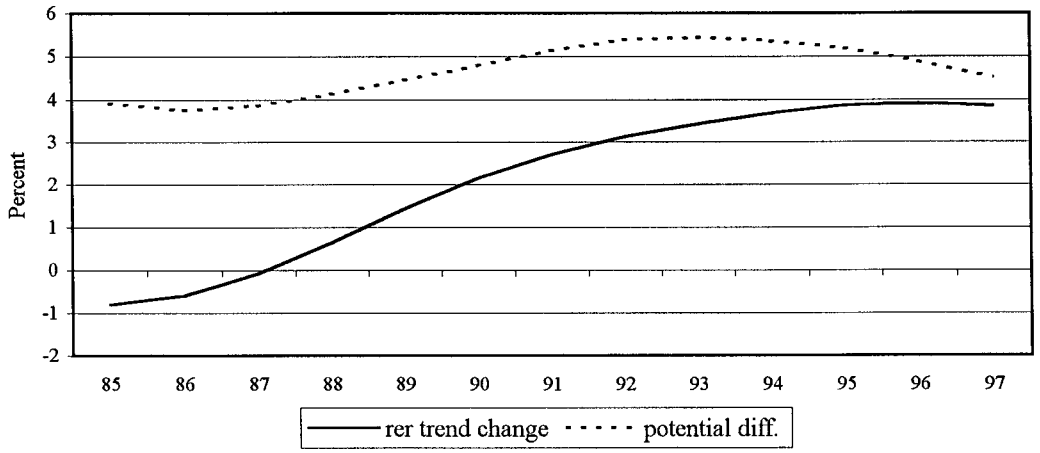
[54]In contrast to most studies (e.g., Frankel, 1991), Rojas (1997) finds that measures of country and currency risk built on the basis of uncovered interest rate parity (UIP) correlate better with alternative measures than those built on the basis of covered interest rate parity (CIP). The URR is suggested as one possible explanation of these results. Two points are noteworthy. First, as indicated by Frankel, measures of country risk should use the interest rate differential between assets denominated in the same currency at home and abroad, which is what Rojas uses for UIP. This may explain his results on country risk. Second, his graphs show that the differential between CIP with and without the URR is nearly constant over time. Given that most economists would agree that a test of UIP amounts to a joint test of CIP and zero risk premium, and that risk premium has more to do with the currency in which the interest rate is denominated than with institutional restrictions on capital flows, it is surprising that UIP performs better than CIP in Chile where it is found at the same time that currency risk is high and volatile.

Figure 11a. Chile: Domestic Minus Foreign Real Interest Rates and Changes in the Real Effective Exchange Rate Lagged One Year: Cyclical Components



Sources: Central Bank of Chile; and Fund staff.

Figure 11b. Chile: Domestic Minus Foreign Potential Output Growth and Changes in the Real Effective Exchange Rate: Trend Components



Sources: Central Bank of Chile; and Fund staff.

hypothesis, to explain the steady appreciation of the peso which may be fruitful to investigate further. If the microeconomic and macroeconomic reforms in Chile produced an increase in total factor productivity *relative* to the rest of the world, it is to be expected that, at least for some time, the real exchange rate of Chile will display an appreciating *trend*. We proxy the productivity differential between Chile and the United States, Germany and Japan by a weighted differential in potential output growth. The transformed data seem to point to the Harrod-Balassa-Samuelson effect which predicts a tendency for countries with higher productivity in tradables compared with nontradables to have higher relative price levels, and thus, to have an appreciation of their equilibrium real exchange rates. Capital inflows into economies that have produced sound reforms may be also partly a response to the increase in productivity that the reforms sought. It seems thus important to disentangle the effects on the real exchange rate in Chile stemming from a possible increase in relative productivity as a result of structural reforms from those deriving from capital inflows.

Finally, the studies assessing the impact of the URR on the path of the real effective exchange rate do not attribute any role to fiscal policy on the behavior of the real exchange rate; there is no explicit proxy for the fiscal policy stance in equations of real exchange rate behavior. Given that most available models of exchange rate determination do reserve some role for the fiscal policy stance, this is most surprising. Figure 12 shows the trend and the cyclical components of the *change* in the central government budget balance to GDP, and the cyclical component of the change in the real effective exchange in Chile.[55] It seems that the significant variance of the cyclical component of changes in the central government budget balance and the cyclical component of changes in the real exchange rate (lagged one year) comove as predicted by standard models of exchange rate behavior: expansionary fiscal policy tends to appreciate the real exchange rate with a lag and viceversa. Therefore, when assessing the impact of the URR on the path of the real exchange rate, it would seem prudent to control for the significant changes in the cyclical component of fiscal policy in Chile during the sample period and their possible effect on the real exchange rate.

The negative effect of the URR on the share of short-term flows in total capital flows

Le Fort and Budnevich (1996) and Le Fort and Sanhueza (1997) argue the URR changed the composition of capital flows in favor of relatively more FDI and more medium- and long-term debt. However, because the Chilean macroeconomic policy framework was sound during the same period and the country continued to buy back foreign debt and liberalize capital

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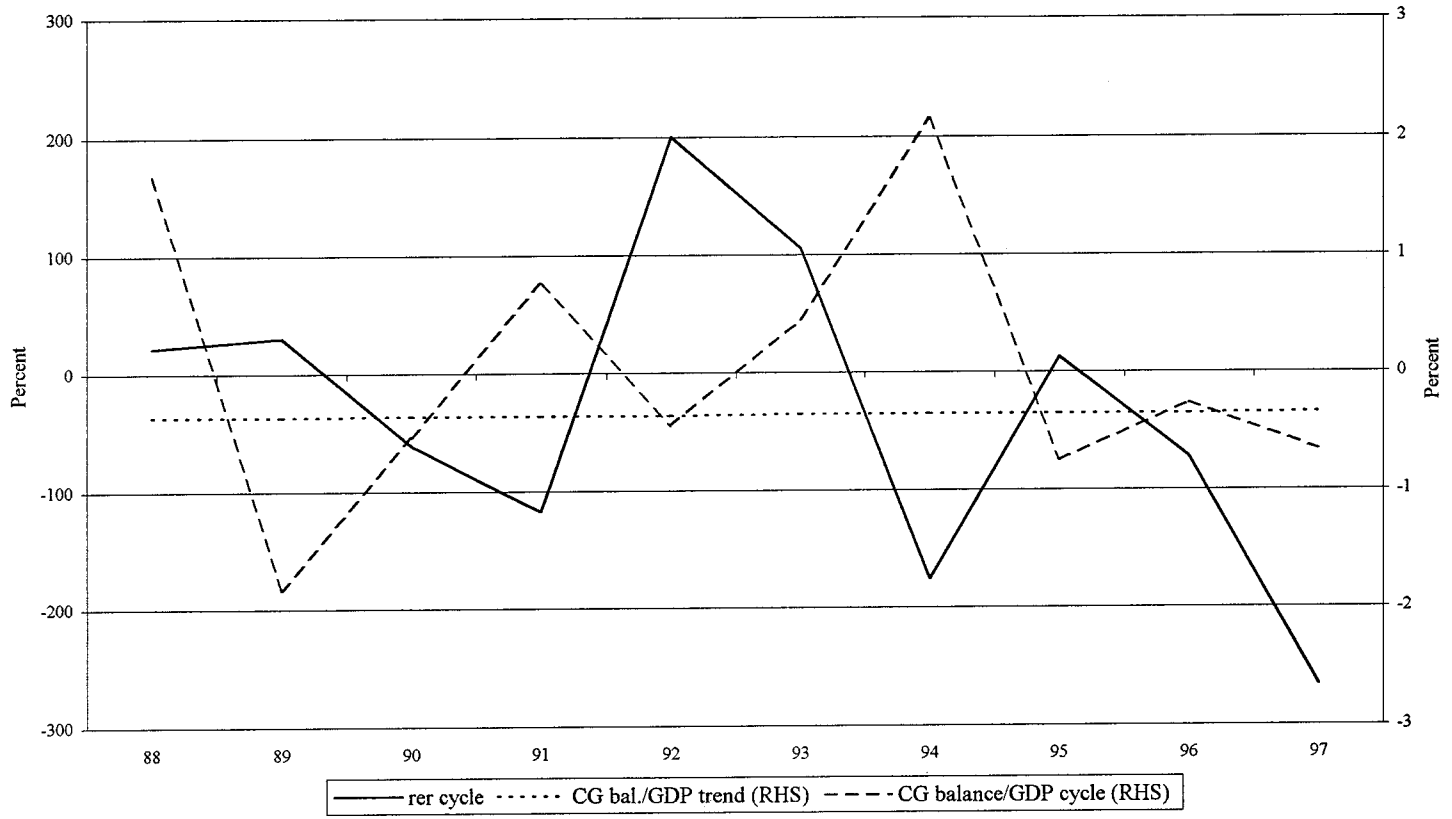
[55]The central government budget balance includes deposits and withdrawals from the Copper Stabilization Fund (*Estadísticas de las Finanzas Públicas*, various issues). Note that the contemporaneous correlation between the cyclical components of changes in that measure of the central government budget balance (with respect to GDP) and changes in the price of copper is 11 percent. The correlation between changes in the cyclical components of the central government budget balance and changes in the real exchange rate is 18 percent during the same period and becomes minus 18 percent when the exchange rate is lagged one year.

Figure 12. Chile: Changes in the Central Government Budget Balance Ratio to GDP (Trend and Cycle) and in the Real Effective Exchange Rate Lagged One Year (Cycle)



Sources: Central Bank of Chile; and Fund staff estimates.

outflows, it is difficult to assess their hypothesis of the effectiveness of the URR without formal econometric work.[56]

Eyzaguirre and Schmidt-Hebbel (1997) and Soto (1997) test the effect of the URR on the composition of capital flows using the ratio of short- to medium- and long-term capital flows. There are methodological problems in both studies. Eyzaguirre and Schmidt-Hebbel use a two-stage least squares estimator to account for the possible endogeneity of the regressors. However, because their unit-root tests cannot reject the null of nonstationarity for all the regressors, and because there is serial correlation in the residuals, the parameter estimates are biased.[57] On the other hand, if the residuals contained a unit root, the regression would be spurious.[58]

Issues of ordering and estimation techniques affecting Soto's (1997) estimates were discussed before and are, thus, not repeated here.

A more fundamental difficulty with studies that test the negative effect of the URR on the ratio of short- to medium- and long-term capital flows is the unclear definition of the null hypothesis. The ratio of short- to medium- and long-term capital flows may fall due to a whole range of different reasons. For instance, the ratio of short- to medium- and long-term capital flows may fall because short-term flows decline due to the introduction of the URR, while medium- and long-term flows remain unaffected. Alternatively, despite that the URR may be ineffective in reducing short-term capital flows, that ratio may fall because developments in the term structure of interest rates in Chile which are entirely unrelated to the URR create incentives for a reallocation of investors' portfolios away from short-term capital. Studies using the ratio of short- to medium- and long-term capital flows should control for factors possibly affecting not only the numerator but also the denominator of that ratio. Otherwise, it is unclear what is being tested.

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[56]Johnston and Ryan (1994) use a sample of industrial countries to show that FDI flows are very responsive to the liberalization of capital flows. Labán and Larraín (1997) show that liberalizing capital outflows increases net capital inflows because it reduces the irreversibility of investments. The same conclusion is obtained in the Herrera and Valdés-Prieto's (1997) paper where a reduction in exit costs reduces the feasible maximum interest rate differential or alternatively, reduces the minimum rate demanded for entering the country.

[57]This becomes clear after the DW test reported is corrected because the lagged dependent variable is included among the regressors (i.e., the Durbin h statistics).

[58] The authors report that all the variables are I (1). Because the estimator used is two-stage least squares, and the variables are in levels, a test for the nonstationarity of the residuals would be important to determine whether the regression results are spurious or not. However, no test on the nonstationarity of residuals is reported.

Valdés-Prieto and Soto (1997) use instead a measure of short-term capital flows while Laurens and Cardoso (1998) use both short-term capital flows and long-term capital flows to test the effectiveness of the URR in affecting the composition of capital flows. Valdés-Prieto and Soto's (1997) use instrumental variables to account for the possible endogeneity of some of their regressors. The authors mention that all variables in their regressions are stationary although no tests for nonstationarity are reported. It is likely, however, that further tests for nonstationarity are necessary at least for the URR variable. Eyzaguirre and Schmidt-Hebbel (1997) as well as Edwards (1998) report that their measure of the URR variable is nonstationary.

Valdés-Prieto and Soto's regressions are also affected by serial correlation in the residuals. This becomes obvious once the reported DW statistics are adjusted to take into account that the lagged dependent variable is included among the regressors. Therefore, the parameter estimates are biased.

Laurens and Cardoso's (1998) results are difficult to assess because the issue of nonstationarity is not addressed nor any test for serial correlation in the residuals is reported. Moreover, as suggested by Johnston and Ryan (1994), as programs of capital controls respond to capital flows, it is not rare to find that new controls over capital inflows are associated with increased capital inflows. Because the authority responds to increases in short-term capital flows by increasing the tax of the URR, it is possible that the equation is subject to simultaneity bias, a bias against effectiveness of the URR.

A large range of policy changes as well as non-policy changes (e.g., terms of trade shocks) may affect the capital account and, in turn, capital account developments may generate policy changes. This makes the estimation of the impact of controls on capital inflows difficult. Figures 13a–d show the behavior of the short-term capital flow ratios to GDP for Chile, Colombia, Brazil, and Mexico, four countries that adopted quite different policy approaches to the capital account in the 1990s.[59]

As discussed above, Chile liberalized capital outflows, introduced the URR in 1991, strengthened the URR during the 1990s, and modified tax incentives for FDI inflows. From Figure 13a, it is clear that the trend in the ratio of short-term capital flows to GDP in Chile started to fall after 1991. To cope with large capital inflows, Colombia introduced in 1991 a system combining foreign exchange market intervention with sterilization operations. It also introduced reserve requirements similar to those in Chile as well as taxes on short-term capital inflows (Agosin and Ffrench-Davis, 1996). During the first half of the 1990s, the Colombian authorities increased the taxes on capital inflows as well as the tax rate and the coverage of the reserve requirement. Limits on lending interest rates were set in order to further restrict interest rate arbitrage. The maturity of the credits affected by the reserve requirement was raised from credits of less than 18 months' maturity in 1993, to credits of up to 60 months'

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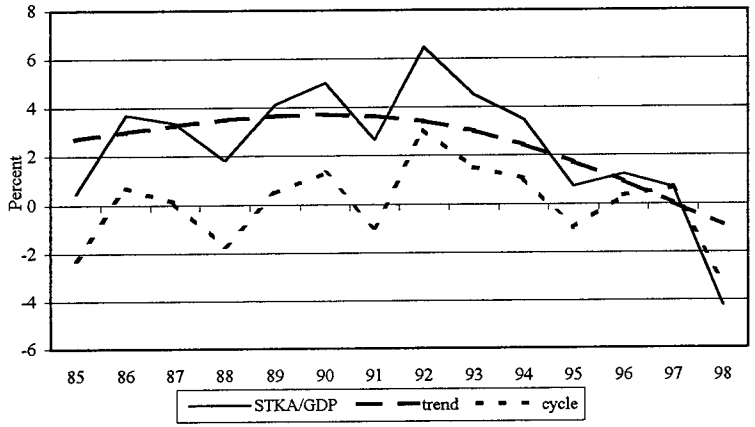
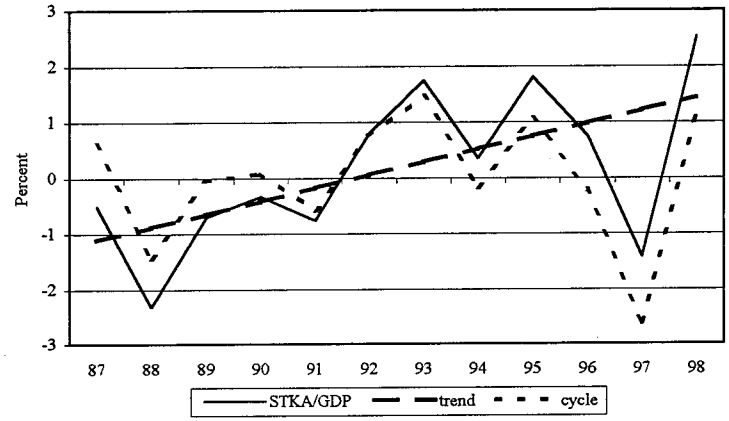
[59]Data availability restricted the analysis for Mexico to the period starting in 1990.

Figure 13a. Chile: Short-term Capital Flows/GDP: Trend and Cyclical Components



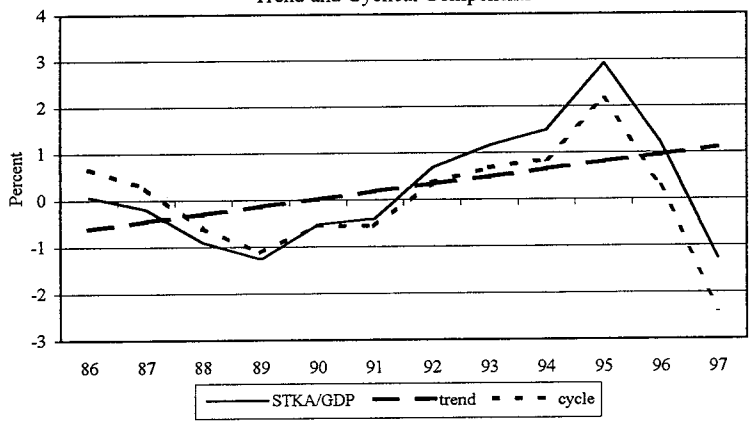
Sources: Central Bank of Chile; and Fund staff estimates.

Figure 13b. Colombia: Short-term Capital Flows/GDP: Trend and Cyclical Components



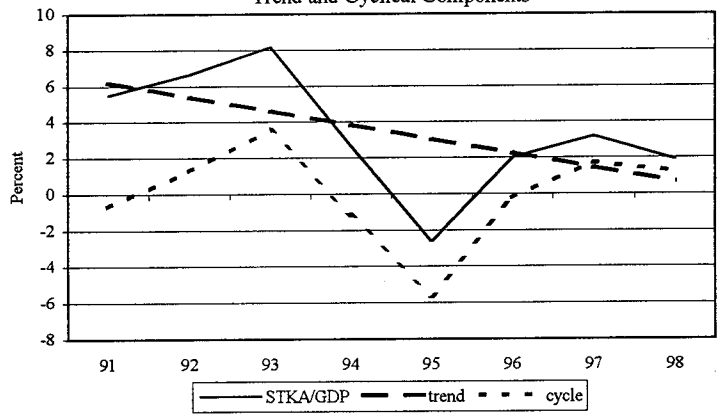
Sources: Central Bank of Colombia; and Fund staff estimates.

Figure 13c. Brazil: Short-term Capital Flows/GDP: Trend and Cyclical Components



Sources: Central Bank of Brazil; and Fund staff estimates.

Figure 13d. Mexico: Short-term Capital Flows/GDP: Trend and Cyclical Components



Sources: Central Bank of Mexico; and Fund staff estimates.

maturity in August 1994. As in Chile, Colombian authorities simultaneously liberalized rules affecting FDI flows and introduced prudential measures affecting the net foreign asset positions of commercial banks during the 1990s. Figure 13b shows an upward trend in the ratio of short-term capital inflows to GDP in Colombia during the period 1987–98.

In contrast to the steady increase in controls on capital inflows in Chile and in Colombia during most of the 1990s, Brazil underwent many shifts in policy with regard to capital flows. For example, in 1991 several policies were adopted to stimulate capital inflows at the same time that voluntary access to foreign capital resumed. Large privatizations were mostly responsible for the capital inflows of 1992. In 1993 taxes on capital inflows along with minimum-length maturity requirements on foreign borrowing were imposed. However, capital inflows continued increasing until 1995. In mid-1995 several restrictions on inflows were imposed. Despite all those policy changes, Figure 13c shows that the trend in the ratio of short-term capital flows to GDP in Brazil remained upward sloping during the period.[60] Note, however, that there are just two data points after 1995.

The fourth country, Mexico, stands out because in contrast to the other three countries of the sample, it adopted a more *laissez-faire* policy to the capital account since the mid-1980s. A downward trend in short-term capital flows in the 1990s is obvious in Mexico (see Figure 13d).[61]

To summarize, Figures 13a–d illustrate that more research is needed before the downward trend in the ratio of short-term capital flows to GDP in Chile in the 1990s can be attributed to the introduction of the URR with a moderate degree of confidence. In Colombia, with perhaps a more severe framework of restrictions to capital inflows than in Chile, the upward trend in short-term capital flows to GDP continued unabated during the 1990s. On the other hand, a more liberal approach to the capital account in Mexico seems to be consistent with a falling trend in the ratio of short-term capital flows to GDP during the 1990s. In the Brazilian case, restrictions to capital inflows put in place in 1993 do not seem to have affected the upward trend in the ratio of short-term capital flows to GDP while the short sample available after the restrictions to capital inflows put in place in 1995 makes the assessment difficult. At a minimum, Figures 13a–d illustrate the need to disentangle the effects of the URR on short-term capital flows from the effects of other policy and non-policy changes (such as investors' willingness to lend to a particular country or developments in international capital markets from the instrument side as well as from the investor side) on short-term capital flows.

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[60]Short-term capital flows include the categories portfolio (net), and other capital inflows (which includes errors and omissions) from the balance of payments statistics.

[61]Short-term capital flows include the categories short-term borrowing, equity investment, and other capital (which includes errors and omissions) of the balance of payments statistics.

IV. CONCLUSIONS , SUGGESTIONS FOR FUTURE RESEARCH, AND POLICY IMPLICATIONS

The main findings of this review are:

- In many of the studies reviewed, there are important methodological problems in measuring net inflows and short-term capital inflows into Chile, which may undermine some of their results on the impact of the URR on capital flows.

- Many studies on the effect of the URR on the structure of capital flows are likely to have underestimated the amount of short-term debt and the amount of short-term capital flows in Chile due to substitution between flows and differences in debt reporting. Official data excludes trade credits and avoidance of the URR may disguise debt flows in other short-term capital or in the current account. All studies exclude portfolio capital from short-term flows.

- Looking at the evolution of the various components of capital inflows, it seems that the impact of the URR in reducing specific inflows had only a short-term impact before a shift of transactions on the capital account to untaxed inflows occurred.

- Rigorous banking supervision and good overall asset quality makes the Chilean financial system one of the strongest in Latin America. Yet, avoidance of the URR by migration via the disintermediation of the taxed domestic banking system may have also been important in reducing the URR effectiveness.

- The studies reviewed conclude that: there is some evidence that the URR has been successful in increasing domestic interest rates; there is a relatively weaker evidence that the URR has altered the composition of capital inflows in favor of medium- and long-term capital inflows; there is mixed and weak evidence that the URR has reduced the magnitude of capital inflows and actually no evidence that the URR affected the level of the real exchange rate.

- However, the empirical studies reviewed contain significant econometric problems that cast doubts on the robustness of the estimates. Also, most estimated equations suffer from misspecification problems largely due to the omission of possibly important variables which may bias their conclusions either in favor or against the hypothesis of effectiveness of controls on capital inflows in Chile.

- Because no study has yet assessed empirically the possible benefits and welfare costs of the Chilean URR, it is not possible to judge the net effect of the URR on welfare.

Future research on the effectiveness of capital controls in Chile could take into account the following issues:

- When studying the effectiveness of the URR in increasing domestic real interest rates, the impact of the sterilization operations of the monetary authority on domestic real interest rates should be controlled for. Otherwise, it is not possible to determine which part of the increase in interest rates during the life of the URR may have been due to it, and what part may have

been due to the sterilization operations of the monetary authority. Therefore, not controlling for this factor may bias results in favor of the URR.

- Studies should also control for the increase in the availability of capital to Latin America in the 1990s as well as for the change in foreigners' willingness to lend following the successful reform of the Chilean economy. Those factors may have increased capital inflows above, and reduced domestic interest rates below the levels that would have otherwise prevailed. Those factors may have introduced a bias against the effectiveness of the URR.

- In Chile as in industrial countries, the removal of controls on capital outflows seems to have influenced the overall volume and structure of net private flows. Direct investment and long-term portfolio investment may have been quite sensitive to changes in control programs. In Chile, changes in regulations affecting capital outflows during the 1990s may have affected the empirical results reviewed against or in favor of the hypothesis of the effectiveness of the URR. As a result, future research trying to assess the impact of the URR on capital inflows requires explicit consideration of changes in those regulations.

- Studies on the effectiveness of the URR in affecting the path of the real effective exchange rate should control for the effects of the cyclical component of fiscal policy on the cyclical component of the real exchange rate. Changes in the fiscal policy stance during the 1990s may have biased results in favor or against the effectiveness of the URR.

- Given the relevance of governance issues in the assessment of any control program, it would be important to address the effectiveness of capital controls in Chile from the viewpoint of political economy considerations.

The major policy implications raised by this study are:

- The history of regulation of capital inflows in Chile suggests that capital controls, by changing the structure of agents' incentives, require continuous monitoring and adaptation to counter the dynamic response of optimizing agents.

- It seems important to recall that any lesson to be drawn from the Chilean experience with capital controls—as well as with any other country's—is conditional on the institutional history of the country and on issues of governance. Chile has a long history of controls on capital flows as well as well known excellence in governance.

- In general, the structure of incentives facing agents and policy makers depends on the objectives pursued with the controls and on the initial conditions of the country introducing them. Chile's experience with capital controls in the 1990s has not been one of using regulations to keep capital in the country amidst a foreign exchange crisis, but rather one of attempting to reduce capital inflows. Policy implications should be interpreted accordingly.

- Overall, we conclude that it seems premature to point at the Chilean experience as supportive of the effectiveness of controls on capital inflows in achieving the objectives of the control program.

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Endogeneity of Regressors and Cointegration

The endogeneity of some regressors and the possible presence of cointegration are problems often found in the reviewed literature. Given the importance of those issues for assessing the effectiveness of the URR, let us discuss them here in more detail. Assume the following co-integrated system of equations:

$$Y_t = \alpha X_t + \beta \Delta X_t + u_t \tag{1}$$

$$X_t = \gamma \Delta Y_{t-1} + \delta(Y_{t-1} - \alpha X_{t-1}) + v_t \tag{2}$$

where, for instance, Y represents the domestic real interest rate and X represents the real exchange rate. In an equation used to test, say, the impact of the URR on domestic real interest rates, there are usually other right-hand side variables such as the URR and the foreign real interest rate. They are excluded here for simplicity.

If in the system (1)-(2) $\beta = \gamma = \delta = 0$ or if $\delta = 0$, using ordinary least squares to estimate equation (1) will give the best unbiased estimate of α and the distribution of the parameters will be normal. If instead $\beta = \gamma = 0$, using ordinary least squares to estimate either equation (1) or (2) will be inappropriate and the distribution of parameters will be nonnormal. A systems technique will be necessary because X (i.e., the real exchange rate in our example) is a predetermined variable.

The second problem often found is made clear when $\delta \neq 0$. In that case, there is co-integration among the variables Y and X; Y and X have an error-correction representation. The use of instrumental variables in Equations 1 and 2, or the estimation of the system in first differences is, therefore, inappropriate. The omission of the expression $(Y_{t-1} - \alpha X_{t-1})$ in Equation 2 entails a misspecification error. Parameter estimates will be biased and inconsistent.

Summary of Rules onTransactions in the Different Foreign Exchange Markets			
A - Formal market	**B - Informal Market**	**C**	**D**
Current account - all trade payments, - transfer of profits with CBC approval. **Capital account** *Outflows related to:* - amortization of loans with CBC approval,. - capital repatriation with CBC approval, - export advances and supplier credits, - outward foreign direct investment (FDI) with CBC approval, - purchase of bonds abroad, - financial credits to non-residents. *Inflows related to:* - purchase of bonds and debt securities by non-residents, - purchase by non-residents of MM instruments, - purchase of securities---ADR sales, - issues of bonds and equity abroad, - commercial credits from abroad, - financial credits from abroad, - FDI.	**Capital account** *Outflows by non-financial agents of:* - purchase of fixed income assets and deposits abroad , - purchase of MM instruments abroad , - purchase of collective securities abroad , - purchase of derivatives abroad , - commercial credits to non-residents. *Other outflows:* - outward FDI by informing the CBC, - purchase of real estate abroad, - settlement of debts abroad by immigrants.	**Capital account** Investment of Chilean banks abroad - currency to be obtained from the formal market.	**Capital account** Flows related to exporters sales abroad, if the money is kept abroad.

Note: If the Central Bank of Chile (CBC) is not informed of inflows of capital, repatriation of capital is subject to all rules governing capital inflows. All capital account transactions are regulated by *Capitulo XII* of Exchange Regulations.