

CAPITAL CONTROLS IN CHILE: WERE THEY EFFECTIVE?

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Controls on international capital flows have no place in a world without policy distortions and market failures. Capital controls can only be justified as second-best measures to compensate for nonremovable policy distortions, including inadequate regulation and supervision of the financial and corporate sectors and excessive insurance against exchange rate risk under limited exchange rate flexibility, among others. However, even in the presence of policy distortions and market failures, it is difficult to argue for imposing second-best measures such as capital controls. Here the conventional argument applies that a better alternative to capital controls is to address directly the distortions that cause “excessive” capital flows. Finally, the argument has been made that international distortions affecting the supply of capital—ranging from contagion and bandwagon effects in private markets to moral hazard problems caused by international rescuers of last resort—are

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The authors are very grateful to Pamela Mellado for excellent research assistance and to María T. Cofré for kindly providing the raw data used in this study. The authors also thank Mario Blejer, Salvador Valdés-Prieto, and Rodrigo Valdés for their comments on earlier drafts, and Miguel Fonseca and Angel Salinas for explaining crucial aspects of capital account regulations in Chile. The findings and conclusions presented in this paper do not necessarily represent the views of the Central Bank of Chile, the International Monetary Fund, or their boards of directors.

Banking, Financial Integration, and International Crises, edited by Leonardo Hernández and Klaus Schmidt-Hebbel, Santiago, Chile. ©2002 Central Bank of Chile.

not removable by recipient countries. Therefore, according to this argument, international distortions in the supply of capital should be offset by domestic capital controls aimed at limiting excessive capital inflows in good times, in order to reduce the likelihood of a crisis or, worse, a twin (currency and financial) crisis in bad times.

Chile's long experience with capital controls—of both the administrative and the quantitative sort—has caught the interest of policymakers and academic economists in a world of highly volatile capital flows, especially since Mexico's crisis in 1994-95. An increasing number of recent studies provide an empirical evaluation of the macroeconomic effects of Chile's quantitative restrictions on capital inflows. This took the form of an unremunerated reserve requirement (URR) imposed by the Central Bank of Chile on selective (mostly short-term and financial) capital inflows during 1991-98. This study extends this literature in four directions. First, it provides an alternative measure of the financial cost of the reserve requirement, one that differs significantly in both magnitude and effects from conventional measures used in previous research. Second, this paper broadens the study of capital controls to include other administrative controls on capital flows and their effects. Third, it extends the study of the URR by assessing its determinants as well as the determinants of other capital controls, identifying the central bank's motives in setting these controls. Finally, the paper covers a significantly extended time period, adding two years before and two years after the operation of the URR—an important extension to include relevant control periods.

The rest of the paper is organized as follows. Section 1 provides a brief review of existing empirical studies on Chile's URR. In section 2 we describe both quantitative and administrative controls on capital flows in Chile. Section 3 reports results for both the determinants and macroeconomic and financial effects of all categories of capital controls in Chile using monthly data for 1989-2000. The paper concludes with a brief summary of the benefits and costs of Chile's capital controls.

1. PREVIOUS FINDINGS AND REMAINING QUESTIONS

Chile's controls on capital inflows adopted in the early 1990s—mostly in the form of an unremunerated reserve requirement—

have been studied extensively. This section summarizes this literature and its main findings, and raises some of the questions that have not been answered yet and hence will be addressed in the next sections of this paper.

A detailed summary review of the studies on the Chilean URR is provided in appendix A. This literature has addressed four related questions, namely:

1. Has the URR raised the effectiveness of monetary policy, under conditions of limited exchange-rate flexibility?¹
2. Has the URR contributed to a more depreciated real exchange rate?
3. Has the URR reduced total capital inflows or changed their composition from short-term (or financial) to long-term (or nonfinancial) inflows?
4. In the context of the 1997-99 international turmoil, has the URR diminished contagion from international shocks to the Chilean economy?

These questions are directly related to the policy objectives pursued by the Central Bank of Chile in imposing the URR in June 1991 and maintaining it through September 1998.

The existing empirical research on this subject has addressed these questions adopting a variety of econometric approaches that range from single-equation models (SEM, including OLS and instrumental variable techniques) to multiequation models, including vector autoregressive (VAR) models and generalized auto regressive conditional heteroskedasticity (GARCH) models.

1.1 Single Equation Models

Using quarterly data for 1987-96, the seminal paper by Soto and Valdés-Prieto (1996) concludes that the imposition of the URR did not change the trend appreciation of the real exchange rate during the 1990s. In that paper and two subsequent papers (Valdés-Prieto and Soto, 1998 and 2000), they conclude that the URR did lead to a change in the composition of capital flows, reducing the share of taxed

1. An exchange rate band was in place until September 1999, when a free float was adopted.

short-term flows and raising the share of exempt flows.² Hence total short-term flows were not affected by the URR.

Using monthly 1991-96 data, Eyzaguirre and Schmidt-Hebbel (1997) reach a different conclusion regarding the composition of inflows. They find that the URR did lead to a reduction of total short-term flows but did not have any statistically significant effect on total flows. They also find that the URR increased the effectiveness of monetary policy (by increasing the wedge between domestic and foreign parity interest rates) and led to a temporary real exchange rate depreciation. However, the latter two effects are rather weak and not robust to different specifications for the estimated equations.

Regarding the impact of capital controls on the effectiveness of monetary policy, Edwards (1998) uses monthly 1988-96 data to estimate an equation for the domestic-foreign interest rate differential. He finds that during the post-1992-93 period, when the URR increased in importance, there was no direct effect of the URR on the level of the interest rate differential, but it affected the degree of inertia of the differential. Consequently, Edwards concludes that the URR allowed the central bank a higher degree of policy autonomy only on a temporary basis.

Using quarterly 1985-94 data, Laurens and Cardoso (1998) conclude that the URR had no effect on the composition of inflows. The authors also conclude that the URR affected neither the real exchange rate nor the interest rate differential. However, the way the model is estimated in this study casts doubts on the authors' conclusions.³

Larraín, Labán, and Chumacero (2000) use quarterly data from 1986 to 1997. They study separately the behavior of long-term, exempt short-term, and taxed short-term flows. Using a threshold model technique (which allows differentiating the determinants of capital flows during different endogenously determined regimes), they find that the URR has a negative, permanent effect on taxed short-term flows (operating through an increase in the relevant interest rate differential), a positive transitory effect on exempt short-term flows,

2. Valdés-Prieto and Soto (2000) state that taxed flows could be associated with those that use legal channels and have secure access to the interbank foreign exchange rate.

3. The capital control—or URR—index used here is positively correlated with the dependent variable (inflows) by construction, biasing the estimated coefficient on the URR variable upwards. In addition, the sample period includes years when capital inflows were not entirely voluntary; voluntary flows to Chile resumed only in 1989.

and no effect on long-term flows. Summing up, the results indicate that the URR has a nonlinear, negative, and significant effect on both short-term and total capital flows.

The main shortcomings of the preceding studies is that they do not control for changes in other capital account regulations (namely, liberalization of capital outflows and inflows) and for changes in the URR other than the tax rate (that is, changes in coverage and presence of loopholes).⁴ The recent paper by De Gregorio, Edwards, and Valdés (2000) overcomes some of these limitations by including a new variable aimed at measuring the presence and extent of loopholes (an index measuring the power of the URR). Using a SEM and quarterly data for 1987-96, the authors conclude that the URR provided the central bank with additional room to maneuver (allowed for a higher domestic interest rate) and changed the composition of inflows toward long-term flows. However, like previous studies, they are still unable to find any significant effect of the URR on the real exchange rate (RER).

1.2 System Models

The lack of response of the RER to a change in the URR presents a puzzle, since the higher level for the domestic interest rate—supported by the URR—could be expected to lead to a more depreciated RER through the expenditure channel. The fact that this effect has not been found in the empirical papers based on SEMs is likely due to misspecification problems. This is suggested by the results reported in the two studies that apply VARs: Soto (1997) and De Gregorio, Edwards, and Valdés (2000). Using monthly data for 1991-96 and 1991-98, respectively, these papers report that a temporary shock to the URR depreciates the real exchange rate on a temporary basis.⁵ Furthermore, Soto (1997) finds that increases in the URR lead to a reduction in the volatility of the RER. The three papers using a VAR approach (Soto, 1997; Edwards, 1999; and De Gregorio, Edwards, and Valdés, 2000) also confirm the previous findings regarding the level of domestic interest rates, the composition of inflows, and the absence of any significant effect on total flows.

4. For a critical review of the literature—without rigorous empirical analysis—see Nadal-De Simone and Sorsa (1999).

5. However, using a similar approach, Edwards (1999) finds no effect of the URR on the RER.

Regarding the impact of the URR on the volatility of other macroeconomic prices, Edwards (1999) estimates a GARCH model using weekly data from September 1994 to January 1999, for the volatility of short-term central bank nominal repo rates and the stock market index. His results indicate that the URR has a negative and significant effect only on the volatility of the stock market index.

Finally, Edwards (1999, 2000) analyzes whether capital controls isolated Chilean interest rates from external shocks. Using weekly data for 1994-99, and both SEM and VAR models, he finds that the URR was not able to reduce contagion effects from foreign interest rate shocks to domestic interest rates.

In sum, there is ample evidence showing that the URR has led to higher domestic interest rates—or a larger differential with international interest rates—and a change in the composition of inflows, without affecting the real exchange rate. Yet the effect of the URR on total flows remains controversial, with all studies except Larraín, Labán, and Chumacero (2000) finding no significant effect.

Two broad open questions on the effectiveness of Chile's capital controls warrant a new empirical study. First, what explained the behavior of the Central Bank of Chile in setting and modifying the URR and other controls on capital inflows and outflows during 1989-2000? Second, how robust are the previous findings to the use of better and longer data sets and controlling for better and broader measures of capital controls? We address these issues in section 3, after describing the extent and use of capital controls in Chile in the past decade.

2. CAPITAL CONTROLS IN CHILE DURING THE 1990S

Chile has a long history of controls on capital account transactions, starting in the 1930s and continuing through the mid-1970s. Controls were gradually liberalized in the late 1970s and early 1980s, but were tightened again in the aftermath of the debt crisis of the 1980s.

The resumption of voluntary capital flows to emerging market economies led to a new wave of inflows to Chile starting in 1988. After a growing tide of inflows during 1988-90, the central bank imposed new quantitative restrictions in the form of a URR on

selective inflows in 1991,⁶ and started to liberalize existing administrative controls on outflows. At the same time, however, other quantitative and administrative controls on capital inflows were also lessened. Next we summarize the specific restrictions on outflows and inflows, discussed in more detail by Gallego, Hernández, and Schmidt-Hebbel (1999). We rely heavily on the methodology developed in that paper to quantify the different capital controls in Chile.

2.1 Unremunerated Reserve Requirement

The URR is an obligation to hold an unremunerated fixed-term (mostly one-year) reserve at the central bank, equivalent to a fraction of capital inflows in certain categories. Hence the URR is equivalent to a tax per unit of time that declines with the permanence or maturity of the affected capital inflow. The quantitative nature of this restriction (that is, its tax equivalence) is made more explicit by its alternative form: instead of depositing the unremunerated reserve fraction with the central bank, foreign investors are allowed to pay the central bank an up-front fee. This is determined by the product of the relevant foreign interest rate and the fraction of capital subject to the restriction.

Various features of the URR were altered during its existence. The central bank modified the required rate or fraction of deposit, the coverage of capital inflow categories subject to it, the foreign currency denomination of the reserve deposit or fee payment, the holding period, the restrictions on the rollover of maturing investments, and other administrative requirements related to the URR.

A simple equation that reflects the cost of the URR (urr) is the following:

$$urr = \frac{\tau}{(1-\tau)} \frac{h}{k} i^*, \quad (1)$$

where τ is the fraction of the capital inflow required to be held as a deposit or reserve with the central bank, h is the required holding period, k is the average maturity of the foreign investment for which the URR is calculated (equal to six months in the empirical

6. This lasted through September 1998.

estimations reported below), and i^* is the equivalent foreign interest cost for a k -month operation.⁷

Measures of *urr* similar to that defined in equation (1) have been used in previous empirical studies. They can be termed “naïve” in the sense that they do not reflect the option value of reinvesting or rolling over the capital after maturity (this option existed until 1996) as calculated by Herrera and Valdés (2001).

The resulting time series for *urr* reflects both changes introduced by the central bank (affecting τ , h/k , and the applicable i^*) and changing market conditions (affecting i^*).⁸ Starting at a rate of 20 percent in June 1991, τ was raised to 30 percent in May 1992 and maintained at that level through June 1998, when it was reduced to 10 percent; this was followed by a further reduction to zero in September 1998 (figure 1). Other administrative changes introduced by the central bank altered the maturity (h/k) and the relevant i^* ,⁹ although the latter was also affected by changing market conditions. The *urr* series that takes into account all these factors is depicted in figure 2 and shows a trend increase until late 1997, largely explained by the rising share of up-front fee payments.¹⁰ From June 1991 through September 1998, *urr* averaged 4.24 percent a year, with a standard deviation of 2.14 percent. Its maximum was 7.7 percent in November 1997.

An indirect measure of how binding the URR was for capital inflows to Chile is provided by the total amount collected as deposits. The latter consists of the actual capital stock deposited as required reserves at the central bank, and the capital stock equivalent to the up-front fee payments. At its peak in August 1997, the URR implied a total equivalent to \$2.2 billion in reserve deposits, consisting of \$0.8 billion in actual deposits and \$1.4 billion in fee-equivalent deposits (figure 3). This is a sizable amount, equivalent to 2.9 percent of Chile's 1997 GDP, or 30.0 percent of that year's net capital inflows. During the whole 1991-98 period the total equivalent reserve deposit attained an average of 1.9 percent of GDP.

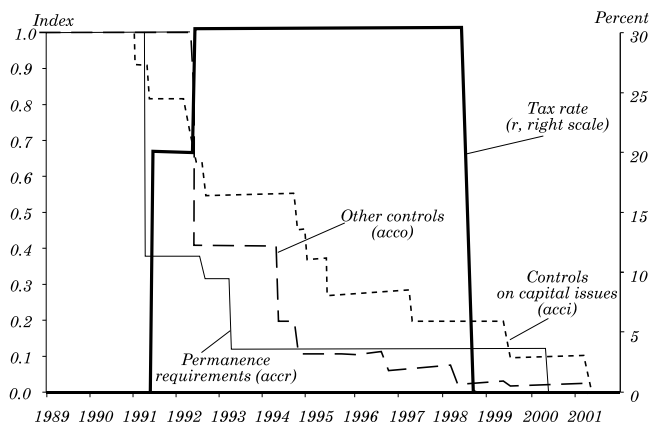
7. For details on the applicable i^* see Gallego, Hernández, and Schmidt-Hebbel (1999).

8. See appendix B for data definitions, sources, and frequency for all variables. The data are available on request.

9. The central bank changed from yen or dollar rates to dollar rates only in November 1994.

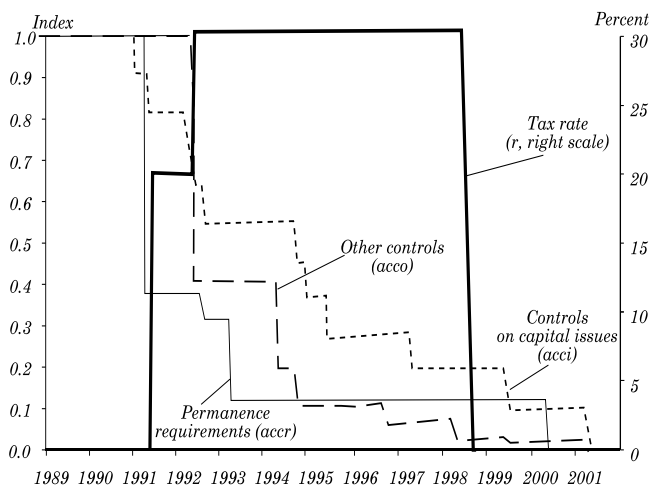
10. The fee option appears to be more expensive than depositing funds with the central bank, because of the spread of 2.5 percent (or 4 percent) applied to it on top of the foreign interest rate i^* .

Figure 1. URR Tax Rate, Index of Foreign Investment Permanence Requirements, Index of Controls on Capital Issues, and Index of Other Administrative Controls on Capital Flows, 1989-2001



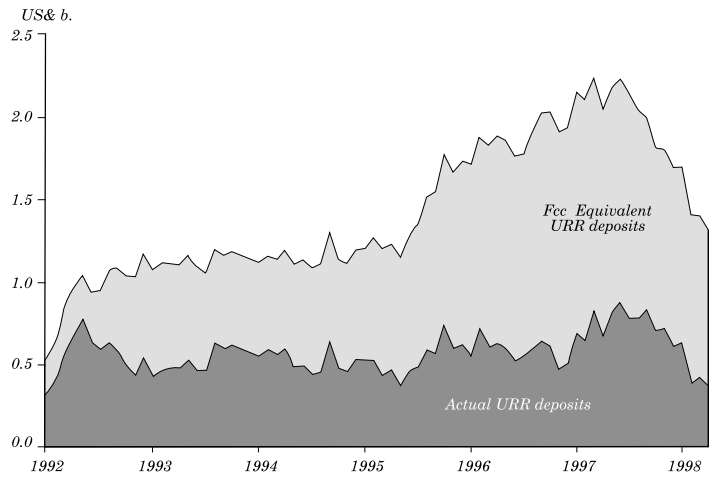
Source: Central Bank of Chile and authors' calculations.

Figure 2. URR Cost, URR Power, and URR Effective Cost, 1991-98 (%)



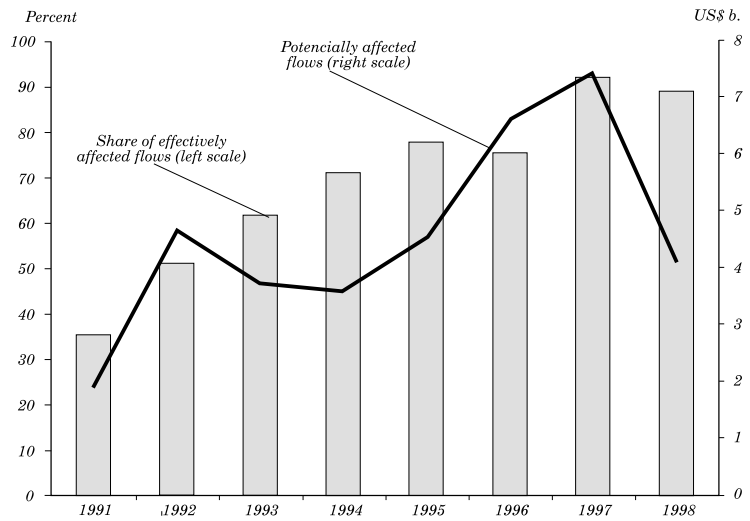
Source: Central Bank of Chile and authors' calculations.

Figure 3. Actual and Fee-Equivalent URR Deposits at the Central Bank, 1992-98



Source: Central Bank of Chile and authors' calculations.

Figure 4. Potentially Affected Flows and Share of Effectively Affected Capital Flows, 1991-98



Source: Central Bank of Chile and authors' calculations.

However, as with any other tax, the URR provided an incentive for tax avoidance and tax evasion.¹¹ Comparing actual and required total reserve deposits provides a measure of the tax effectiveness, or power, of the URR. This is estimated by the ratio between the flows actually taxed by the URR—either by making a deposit or paying the equivalent up-front fee—and the total amount of new flows that were potentially subject to the URR:

$$pow_t = (\text{actual flows paying the URR})_t / (\text{potential taxable flows})_t, \quad (2)$$

where the potential taxable flows are derived after adjusting recorded capital inflows for flow relabeling that occurred through various loopholes.

Figure 4 depicts average annual time series of the potentially affected flows and the share of effectively affected flows. Figure 2 reports the monthly time series for the power index. The latter suggests that the URR gained effectiveness over time, although this happened because of the central bank's continuing effort to close loopholes in URR regulations, in part by increasing its coverage. For instance, in January 1992, six months after its introduction, the URR power index stood at 50 percent, mainly because of extensive relabeling of several forms of capital inflows as dollar-denominated deposits, which were exempted from the URR. When these deposits became subject to the URR in February 1992, the power index increased to 78 percent (although other loopholes were discovered and used by arbitrageurs). A more formal analysis to explain the behavior of the power of the URR is presented in section 3 below.

Combining the simple measure of the cost of the URR, adjusted for changes in its coverage of the capital base (*cov*), and its effectiveness or power allows one to obtain a measure of the effective cost of the reserve requirement (*err*):

$$err = urr * cov * pow. \quad (3)$$

Figure 2 depicts the time pattern of *urr* and *err*. Both show a rising trend until late 1997. The effective cost of the reserve requirement attained a sample average of 3.84 percent and a standard deviation of 2.30 percent during 1991-98.

11. Le Fort and Sanhueza (1997) provide a detailed description of the avoidance of the URR that was observed in the 1990s.

2.2 Other Restrictions on Capital Flows

The central bank largely liberalized administrative restrictions on both capital inflows and outflows during the 1990s and abolished all remaining restrictions in April 2001. This can be seen both as part of the country's overall economic liberalization and as a (temporary) substitution of quantitative restrictions on inflows (the URR) for administrative controls.

Regarding capital inflows, the two main quantitative restrictions—other than the URR—are minimum solvency requirements on domestic issuers of foreign liabilities (bonds and American depository receipts, or ADRs) and size requirements on issues of foreign liabilities by corporations and banks. Both restrictions were partly liberalized during the last decade, as reflected in their liberalization index (*acci*), depicted in figure 1.

Minimum permanence requirements before repatriation of capital and profits may be interpreted as restrictions on both capital inflows and outflows. Technically they affect outflows of capital because they are imposed on capital that has entered at some point in time; that is, they restrict the repatriation of principal and cumulative profits accrued on past investments. However, in an *ex ante* sense they deter additional foreign investment, and hence negatively affect future capital inflows (Labán and Larraín, 1997).

Permanence requirements on foreign investment—both portfolio and direct—were reduced from an average of eight to three years in 1991, and further to two and a half (in 1992) and to one year (in 1993), before being completely eliminated in May 2000 (*accr* in figure 1). This liberalization was implemented in an *ex post* way: existing foreign capital was allowed to leave the country after complying with the new, shorter permanence requirement. For this reason one may expect to observe larger capital outflows at the times when permanence requirements were relaxed—as the central bank intended—and this is why we classify the requirement as a capital outflow restriction. At the same time, however, this outflow liberalization provides an incentive for larger inflows, implying that the total effect on net capital flows is ambiguous in the short term.

Other regulations on capital outflows that were liberalized during the last decade include ceilings on foreign asset holdings by domestic financial institutions and surrender requirements imposed on export proceeds (both were abolished in July 1995).

An aggregate index for these and a host of other secondary administrative controls on outflows is depicted as *acco* in figure 1.

The various indexes in figure 1 show significant and simultaneous progress in the liberalization of both capital inflows and outflows, largely concentrated during 1991-95. This downward trend in the restrictiveness of controls is summarized by the (simple) average of the three indexes, *accf* (not shown).

3. EMPIRICAL RESULTS

This section reports estimation results for two sets of variables. First we specify and estimate equations to explain the adoption by the central bank of quantitative and administrative capital controls. We attempt in their specification to reflect the motivation of the central bank in setting the URR and the average level of administrative controls. Next we specify the effect of capital controls on the relevant macroeconomic and financial variables, following the model spelled out in Gallego, Hernández, and Schmidt-Hebbel (1999).

3.1 Sample Period, Data, and Estimation Strategy

Our sample period covers 1989-2000, thus spanning the period from 1989 to June 1997, when Chile had relatively unhindered access to voluntary foreign capital markets, and from July 1997 through 2000, when voluntary flows to emerging market economies (including Chile) became more scarce. We use monthly data for all regressions, implying a maximum sample of 144 observations. Data definitions and sources are provided in appendix B.

The estimation strategy addresses potential econometric problems derived from spurious correlations, endogeneity of right-hand-side variables, and inefficient estimation due to heteroskedasticity and autocorrelation of residuals. These problems are addressed by conducting appropriate diagnostic tests and using appropriate estimation techniques. Most estimations are performed on first differences of our structural equations. The order of integration of individual variables varies between 0 and 1. A significant number of variables are $I(1)$, justifying estimation in first differences. When appropriate, cointegration tests were conducted, with generally acceptable results. Finally, to account for dynamic behavior, we introduce lagged dependent variables, polynomial distributed lag structures for independent variables, or error correction models.

3.2 Capital Controls

We start by studying the URR, focusing on the determinants of its simple cost measure (*urr*), its power (*pow*), and its effective cost measure (*err*). The behavioral equation for *pow* reflects both the incentives of arbitrageurs to avoid or evade the URR and the effectiveness of the measures developed by the central bank to raise its power. The incentives for avoidance and evasion increase with the URR tax rate and the difference between the domestic and the foreign interest rate, adjusted for devaluation expectations and the country risk premium. The power of the URR is reflected in changes in URR coverage and currency denomination:

$$\begin{aligned}
 pow_t = & \omega_0 + \omega_1 \tau + \omega_2 (r - r^* - \hat{e}^e - \rho) + \omega_3 D922 + \omega_4 D9411 + \omega_5 DYEN \\
 & \quad (-) \quad \quad \quad (-) \quad \quad \quad (+) \quad \quad \quad (+) \quad \quad \quad (+) \\
 & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad (4) \\
 & + \omega_6 D957 + \omega_7 T957 + \omega_8 D9610 + \omega_9 T9610 + \omega_{10} pow_{t-1} , \\
 & \quad (+) \quad \quad \quad (-) \quad \quad \quad (+) \quad \quad \quad (-) \quad \quad \quad (+)
 \end{aligned}$$

where τ is the URR tax rate, r is the domestic interest rate, r^* is the international interest rate, $\hat{e}^e$ is the expectation of real currency depreciation, and ρ is the country risk premium. *D922*, *D9411*, *D957*, and *D9610* are dummy variables for regulatory changes affecting dollar-denominated deposits, the currency denomination of the required deposit with the central bank, the issue of secondary ADRs, and requirements to classify inflows as foreign direct investment, respectively. *T957* and *T9610* are trend variables for the period after dummies *D957* and *D9610* take a value of 1, and *DYEN* is a dummy for 1994, when the interest rate on yen-denominated assets was well below that on dollar-denominated international assets. Expected coefficient signs are presented below the corresponding variables.¹²

The power of the URR rises with changes in URR coverage and other regulations aimed at reducing its avoidance and evasion. This is shown by the positive and significant coefficients reported for the regulatory dummies (table 1). All these changes had permanent effects on the power of the URR.

12. All of the variables except $(r - r^* - \hat{e}^e - \rho)$ are included in first differences.

Table 1. Regression Results for the Power of the URR ^a

<i>Independent variable</i>	<i>Regression coefficient</i>
Constant	0.004 (1.5)
D(τ)	-0.11 (5.8)
$r - r^* - \hat{\epsilon}^e - \rho$	-0.0011 (1.7)
D(<i>D922</i>)	0.27 (10.4)
D(<i>D941</i>)	0.02 (2.8)
D(<i>DYEN</i>)	0.01 (1.3)
D(<i>D957</i>)	0.02 (4.0)
D(<i>T957</i>)	-0.001 (0.2)
D(<i>D9610</i>)	0.01 (3.2)
D(<i>T9610</i>)	-0.00 (0.1)
D(<i>pow</i> ₋₁)	0.23 (2.1)
<i>Summary statistic</i>	
Adjusted R^2	0.78
Durbin's h	0.26

Source: Authors' calculations.

a. Results are based on estimation of equation (4) by the ordinary least-squares method. The dependent variable is the first difference of the power of the URR (*pow*). D(.) is the first-difference operator. The sample period is 1991.7 to 1998.8. Newey-West-consistent t statistics are reported in parentheses.

The results also show that the power of the URR declined with the differential between domestic and foreign interest rates (adjusted by country risk), and the level of the URR tax rate τ (a Laffer-like effect). These results attain statistical significance and economic importance. For instance, for an interest rate differential of 4.5 percent (equal to the sample period average), by the

time τ was lowered to zero in September 1998, the URR would have lost, *ceteris paribus*, about 72 percent of its initial power. This result shows that the URR cannot be used to sustain an interest rate differential on a permanent basis.

We now proceed to specify behavioral equations for the simple cost measure of the URR (*urr*) and its effective cost (*err*). In line with the objectives declared by the central bank when imposing the URR, we posit that the central bank alters the components of *urr* or *err* so that both these variables will increase with the deviation of inflation from its official target level (reflecting a concern with price stability) and with total net capital inflows to Chile and to developing countries (reflecting concern with excessive foreign indebtedness). On the other hand, *urr* and *err* should fall with the share of long-term net capital inflows in total inflows in Chile (reflecting concern with excessive short-term indebtedness) and with the rate of currency depreciation (reflecting concern with excessive competitiveness losses). The central bank also reacts to a decline in the power of the URR. The external interest rate, adjusted for country risk, is positive when included contemporaneously (by definition of *urr*) and negative when included as lags, because of the diminishing effect of this variable on capital inflows to Chile (reflecting concern with excessive foreign indebtedness).

As the specification is almost the same for *urr* as for *err*, we illustrate it for the former here:

$$\begin{aligned}
 urr_t = & \alpha_0 + \alpha_1 \underset{(+)}{PDL(\pi_t - \pi t_t)} + \alpha_2 \underset{(+)}{PDL\left(\frac{e_t kf_t}{y_t}\right)} + \alpha_3 \underset{(-)}{PDL\left(\frac{e_t kfl_t}{y_t}\right)} \\
 & + \alpha_4 \underset{(-)}{PDL\left(\frac{e_t - e_{t-1}}{\bar{e}_{t-1}}\right)} + \alpha_5 \underset{(+)}{\frac{wkf_{t-1}}{wy_{t-1}}} + \alpha_6 \underset{(+)}{(r_t^* + \rho_t)} + \alpha_7 \underset{(-)}{(r_{t-1}^* + \rho_{t-1})} \quad (5) \\
 & + \alpha_8 \underset{(+)}{urr_{t-1}} + \alpha_9 \underset{(-)}{PDL(pow_t)},
 \end{aligned}$$

where $\pi - \pi t$ is the difference between actual and target inflation, e is the real exchange rate, kf is total net capital inflows to Chile, y is real

domestic output of Chile, kfl is long-term net capital inflows to Chile, wkf is total net capital inflows to all developing countries, and wy is world real output. Expected signs on the coefficients are noted below the corresponding variables. Many independent variables are specified here (and in other equations below) as polynomial distributed lags (PDL); their lags and orders are determined empirically. The only difference between equation (5) and the corresponding equation for err is that the latter includes its own lags, instead of urr_{t-1} , and omits the last independent variable, since by definition pow is part of err .

The results in tables 2 and 3 confirm the significance of the right-hand-side variables in equation (5) in explaining the central bank's use of the URR. For both measures of the cost of the URR (urr and err), all variables have the expected signs, and most are statistically significant at conventional levels. The URR was altered in response to changing conditions in world capital markets—it was reduced with the lagged cost of funding ($r^*_{t-1} + \rho_{t-1}$) and raised with the overall availability of funds to developing countries. The central bank raised the URR in response to increased capital inflows but lowered it in response to increased long-term inflows—in other words, it responded strongly to larger short-term inflows. The URR was raised in response to a higher rate of currency appreciation, reflecting a concern with deteriorating foreign competitiveness. It is also interesting to note that urr falls with its own power (table 2); thus the central bank raised the URR in response to a loss in its power or efficiency due to avoidance or evasion of the reserve requirement. Surprisingly, the URR is generally not sensitive to deviations of inflation from target levels; the only (and marginal) exception to this finding is in the first equation in table 3.

As noted above, the central bank started in the early 1990s to lift administrative controls on capital inflows and outflows. Here we use our aggregate index of administrative controls on the capital account ($accf$) to test the central bank's behavior in liberalizing capital flows. We posit that administrative controls are systematically reduced throughout the 1990s, consistent with a trend of abolishing restrictions on capital movements worldwide. Next we consider the interaction of administrative controls with URR policy and effectiveness: administrative controls should increase with the effective cost of the URR if both instruments are applied as complements, and decline if they are considered substitutes.

Table 2. Regression Results for the Cost of the URR^a

Independent variable	Regression coefficient	
	(1)	(2)
$\pi - \pi t$	0.03 (0.5)	0.04 (0.8)
$PDL(\frac{e_t k f_t}{y_t} ; -6, -9, 2)$	2.84 (3.8)	2.87 (3.6)
$PDL(\frac{e_t k f_t}{y_t} ; -3, -14, 1)$	-7.98 (6.1)	-7.33 (5.9)
$PDL(D(\frac{e_t - e_{t-1}}{e_{t-1}}) ; -2, -8, 2)$	-42.26 (3.5)	-53.60 (5.3)
$D(\frac{wfk_{-1}}{wy_{-1}})$	30.00 (1.8)	39.10 (2.0)
$D(r^*) + D(\rho)$	0.73 (5.6)	0.77 (5.9)
$D(r_{-1}^*)$	-0.03 (0.2)	... ...
$D(\rho_{-1})$	-1.15 (1.6)	... ...
$D(r_{-1}^*) + D(\rho_{-1})$	... ...	-0.17 (1.7)
$PDL(D(pow(-1)), 9, 3)$	-3.13 (2.5)	-4.29 (2.8)
$D(urr_{-1})$	0.44 (2.1)	0.46 (2.0)
<i>Summary statistic</i>		
Adjusted R^2	0.51	0.46
Durbin's h	0.10	0.18

Source: Authors' calculations.

a. Results are based on estimation of equation (5) by the ordinary least-squares method. The dependent variable is the first difference of the cost of the URR (urr). $PDL(X; A, B, C)$ is a polynomial distributed lag for variable X , where A and B are the first and last lag, respectively, and C is the order of the polynomial. $D(\cdot)$ is the first-difference operator. The sample period for both equations is 1991.6 to 1998.9. Newey-West-consistent t statistics are reported in parentheses.

Among the components of our aggregate index of administrative controls, those that restrict outflows dominate, while controls on inflows play a secondary role. During the surge in net capital inflows from the late 1980s through the 1990s, the overriding concern of the

Table 3. Regression Results for the Effective Cost of the URR^a

Independent variable	Regression coefficient	
	(1)	(2)
$\pi - \pi t$	0.15 (1.6)	0.07 (1.0)
$\text{PDL}(\frac{e_t k f_t}{y_t} ; -6, -9, 2)$	2.05 (1.8)	2.50 (1.9)
$\text{PDL}(\frac{e_t k f l_t}{y_t} ; -3, -14, 1)$	-4.14 (2.0)	-4.57 (2.0)
$\text{PDL}(\text{D}(\frac{e_t - e_{t-1}}{e_{t-1}}) ; -2, -8, 2)$	-33.39 (2.0)	-45.43 (2.0)
$\text{D}(\frac{w f k_{-1}}{w y_{-1}})$	36.31 (1.7)	33.32 (1.5)
$\text{D}(r^*) + \text{D}(\rho)$	0.63 (5.3)	0.70 (5.8)
$\text{D}(r_{-1}^*)$	-0.02 (0.1)	... ...
$\text{D}(\rho_{-1})$	-1.17 (2.5)	... ...
$\text{D}(r_{-1}^*) + \text{D}(\rho_{-1})$	... ...	-0.23 (1.1)
$\text{D}(\text{err}_{-1})$	0.51 (2.0)	0.43 (2.5)
<i>Summary statistic</i>		
Adjusted R^2	0.39	0.33
Durbin's h	0.48	0.37

Source: Authors' calculations.

a. Results are based on estimation of equation (5) by the ordinary least-squares method. The dependent variable is the first difference of the effective URR (*err*). $\text{PDL}(X; A, B, C)$ is a polynomial distributed lag for variable X , where A and B are the first and last lag, respectively, and C is the order of the polynomial. $\text{D}(\cdot)$ is the first-difference operator. The sample period for both equations is 1991.6 to 1998.9. Newey-West-consistent t statistics are reported in parentheses.

central bank was to stem inflows. Hence the variables that led the central bank to raise the URR could also have led it to reduce administrative controls. Here we posit that a real depreciation contributes to raising controls, whereas a surge in net capital inflows contributes

to reducing them. The corresponding equation for the administrative controls for capital flows is the following:

$$\begin{aligned}
 accf_t = & \beta_0 + \underset{(-)}{\beta_1 trend} + \underset{(?)}{\beta_2 trend^2} + \underset{(?)}{\beta_3 PDL(err_t)} + \underset{(-)}{\beta_4 PDL\left(\frac{e_t kf_t}{y_t}\right)} \\
 & + \underset{(+)}{\beta_5 PDL\left(\frac{e_t - e_{t-1}}{e_{t-1}}\right)} + \underset{(+)}{\beta_6 accf_{t-1}},
 \end{aligned} \tag{6}$$

where *trend* is the time trend variable. A quadratic relationship is considered here, with a negative coefficient expected for the linear term, and with the expectation for the quadratic term ambiguous. For *err* the expected coefficient is positive if the administrative controls on capital flows and the URR were used as complementary policy instruments, and negative if they were substitutes.

The results in table 4 confirm the expected coefficient signs at conventional significance levels for all variables except the real depreciation variable. Capital account liberalization shows a significant downward time trend, but at a decreasing pace. Controlling for the latter trend, administrative controls were lowered with a reduction in the effective cost of the URR, validating the notion that administrative controls on capital flows were used as complements to the URR. Capital account liberalization was also intensified in response to larger net capital inflows. Finally, these results, as well as those for the URR-related variables above and the economic variables below, confirm a gradual response of the dependent variable to changes in the independent variables, reflected in a large positive and significant coefficient for the lagged dependent variable.

3.3 Macroeconomic and Financial Variables

Now we turn to the behavior of the key macroeconomic and financial variables that are potentially affected by capital controls. We briefly spell out the key features of a two-sector, dynamic, open

economy that embeds our model equations.¹³ Domestic interest rates reflect imperfect international arbitrage à la Edwards and Khan (1985), where both risk-adjusted arbitrage and domestic credit market conditions play a role. Net foreign asset accumulation is determined by the current account surplus, itself a function of the determinants of the excess supply of traded goods net of foreign factor receipts (in other words, the excess of saving over investment). Nontraded goods equilibrium relates the equilibrium RER to nontraded supply and demand determinants, which are similar to those included in the current account equation. Our equations add short-term good and asset market rigidities and nominal shocks, as well as capital controls, to the determinants found in standard small open economy models.

Table 4. Regression Results for Administrative Controls on Capital Account^a

<i>Independent variable</i>	<i>Regression coefficient</i>
<i>trend</i>	-0.01 (2.2)
<i>trend</i> ²	4.36e-5 (2.3)
PDL(D(<i>err</i>); -3, -15, 2)	0.06 (2.3)
PDL($\frac{e_t k_f}{y_t}$; -3, -11, 2)	-0.19 (1.7)
PDL($\frac{e_t - e_{t-1}}{e_{t-1}}$; -1, -8, 1)	-0.18 (0.2)
<i>accf</i> ₋₁	0.73 (5.7)
<i>Summary statistic</i>	
Adjusted <i>R</i> ²	0.99
Durbin's <i>h</i>	0.02

Source: Authors' calculations.

a. Results are based on estimation of equation (6) by the ordinary least-squares method. The dependent variable is the measure of administrative controls on the capital account (*accf*). PDL(*X*; A, B, C) is a polynomial distributed lag for variable *X*, where A and B are the first and last lag, respectively, and C is the order of the polynomial. D(.) is the first-difference operator. The sample period is 1989.1 to 1999.6. Newey-West-consistent *t* statistics are reported in parentheses.

13. A more detailed discussion of the model and its dynamic properties is presented in Gallego, Hernández, and Schmidt-Hebbel (1999).

As argued, both external arbitrage and domestic market conditions affect interest rates in the short run. The general specification that nests an equation for the central bank's policy rate and another for the bank deposit rate is the following:

$$\begin{aligned}
 r_t = & \gamma_0 + \gamma_1 r_t^* + \gamma_2 \hat{e}_t^e + \gamma_3 \rho_t + \gamma_4 err_t + \gamma_5 accout_t + \gamma_6 \left(\frac{e_t l_{t-1}}{y_t} \right) \\
 & (+) \quad (+) \quad (+) \quad (+) \quad (-) \quad (?) \\
 & + \gamma_7 tot_t + \gamma_8 \left(\frac{g_t}{y_t} \right) + \gamma_9 \left(\frac{m_{t-1}}{y_t} \right) + \gamma_{10} (\pi_t - \pi_{t-1}) + \gamma_{11} \left(\frac{y_t}{y_t} \right) \quad (7) \\
 & (?) \quad (+) \quad (-) \quad (+) \quad (+) \\
 & + \gamma_{12} \left(\frac{cas_t}{y_t} \right) + \gamma_{13} r_{t-1} \cdot \\
 & (-) \quad (+)
 \end{aligned}$$

The first four regressors represent cost-equivalent components of international arbitrage conditions: the real international interest rate (r^*), the expected real depreciation ($\hat{e}^e$), the country risk premium (ρ), and the effective cost of the URR (err , or, alternatively, the simple cost measure). We also include an index of administrative controls on capital outflows ($accout$, a combined measure of $accr$ and $acco$): restrictive controls on outflows, if binding, reduce interest rates. The ratio of the outstanding stock of net external liabilities (l) to output reflects a combination of the positive country risk effect and the negative effect on domestic credit demand due to lower private net financial wealth. An additional determinant of domestic private credit demand is the terms of trade (tot), also with an ambiguous sign because of opposite substitution and income effects. Macroeconomic policy variables include the ratios of aggregate government spending (g) and real M1 (m) to output. Finally, we include the three main potential arguments of the central bank's monetary policy reaction function: the difference between actual and target inflation, the ratio of actual to trend output, and the ratio of the current account surplus to output.

Two variants of equation (7) are implemented: one for cbr , the central bank policy real rate of interest, and the other for $rdep$,

the commercial banks' average real deposit rate. The central bank rate is expected to have a strong effect on the deposit rate (but not vice versa). Both rates are highly correlated, but the central bank's rate shows less variation.¹⁴ In the spirit of a monetary policy reaction function, we estimate the equation for *cbr* controlling for interest rate arbitrage variables and monetary policy objectives. The *cbr* is specified as depending only on lagged variables or polynomials, as the central bank bases its decisions on information with a lag of one month or more.

The results in table 5 for the central bank's policy rate are supportive of equation (7). Regarding the foreign interest arbitrage components, the foreign rate, adjusted for expected real depreciation, falls just short of significance at the 10 percent level, but its coefficient is close to zero.¹⁵ In contrast, the country risk premium is very large and statistically significant. More important are the results regarding URR policy. No significant effect is found for either of the measures of the financial cost of the URR (*urr*, *err*) alone or in combination with the determinants of the interest arbitrage condition.¹⁶

However, when testing separately for the two main components of the effective cost of URR (*err*), namely, the tax rate (τ) and the power of the URR (*pow*), we find that *pow* matters for setting the policy rate: the role of URR policy in raising domestic interest rates is largely due to its power rather than to the tax rate. During 1991-98, the power of the URR—kept at about 0.7 on average by increasing URR coverage and cracking down on evasion and avoidance—allowed for a rise in the central bank's policy rate of about 110 basis points.

The two traditional determinants of the policy function, the inflation and output gap, are significant in explaining the central bank's policy stance, implying that the central bank raises its policy rate whenever the economy shows signs of overheating. Finally, we tested whether the URR affected the influence of external conditions on the central bank's policy rate. For this purpose we report, in the last column of table 5, a regression with an interactive dummy (with a value of 1 in the period when the URR was operating) that multiplies external conditions (*ext* and ρ). The results show that the URR

14. For monthly observations from 1989-2001 through 2000-12, the contemporaneous correlation between both rates is 0.87. The standard deviation is 0.013 for *cbr* and 0.018 for *rdep*.

15. When r^* and $\hat{e}^e$ are included as separate regressors, the coefficient on $\hat{e}^e$ is significant at the 10 percent level, but its value remains at 0.01.

16. In the latter case the marginal significance level is close to 12 percent.

Table 5. Regression Results for the Real Central Bank Policy Rate of Interest ^a

Independent variable	Regression coefficient							
	Without interactive dummy when URR is operating						With interactive dummy when URR is operating	
	(1)	(2)	(3)	(4)	(5)	(6)	Base	Change with URR
$D(r^*) + D(\hat{e}_t^e)$	0.01 (1.6)	0.01 (1.6)	... ...	... ...	0.01 (1.6)	0.02 (1.9)	0.01 (0.5)	0.01 (0.5)
$D(\rho)$	1.34 (2.5)	1.31 (2.5)	1.32 (2.6)	1.31 (2.6)	1.31 (2.6)	1.16 (3.1)	1.89 (5.0)	-1.89 (4.1)
$D(err)$	0.05 (0.9)	... ...	... ...	... ...	... ...	... ...	... ...	... ...
$D(urr)$	... ...	0.01 (0.1)	... ...	... ...	... ...	... ...	... ...	... ...
$D(r^*) + D(\hat{e}_t^e) + D(err)$	... ...	... ...	0.01 (1.6)	... ...	... ...	... ...	... ...	... ...
$D(r^*) + D(\hat{e}_t^e) + D(urr)$	... ...	... ...	... ...	0.01 (1.6)	... ...	... ...	... ...	... ...
$D(\tau)$	... ...	... ...	... ...	... ...	0.78 (0.9)	... ...	... ...	... ...
$D(pow_{-1})$	... ...	... ...	... ...	... ...	... ...	17 (2.0)	... ...	... ...
$D((\pi - \pi_t)_{-4})$	0.08 (2.5)	0.08 (2.5)	0.08 (2.5)	0.08 (2.5)	0.08 (2.5)	0.05 (1.3)	0.08 (2.6)	
$PDL(-\frac{y}{\hat{y}}; -1, -2, 1)$	2.19 (2.0)	2.29 (2.0)	2.29 (2.2)	2.29 (2.2)	2.23 (2.1)	1.81 (2.1)	1.57 (2.3)	
$D(\frac{cas}{y}_{-1})$	-0.16 (0.3)	-0.14 (0.3)	-0.14 (0.3)	-0.14 (0.3)	-0.17 (0.3)	0.24 (0.4)	-0.44 (1.2)	
$D(cbr_{-1})$	0.23 (3.6)	0.23 (3.4)	0.23 (3.5)	0.22 (3.5)	0.22 (3.5)	0.32 (4.3)	0.21 (4.0)	
<i>Summary statistic</i>								
Adjusted R^2	0.37	0.37	0.37	0.37	0.37	0.48	0.51	
Durbin's h	0.23	0.22	0.21	0.22	0.28	-0.50	0.37	

Source: Authors' calculations.
a. Results are based on estimation of equation (7) by the ordinary least-squares method. The dependent variable is the first difference of the real central bank policy rate (*cbr*). $PDL(X; A, B, C)$ is a polynomial distributed lag for variable X , where A and B are the first and last lag, respectively, and C is the order of the polynomial. $D(.)$ is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses.

contributed to isolate the central bank policy rate from external shocks, in particular from changes in country risk.

For the banking deposit rate (*rdep*) equation we include the central bank policy rate (*cbr*), the foreign interest arbitrage components, and potential credit demand determinants. The results (table 6) show that the central bank policy rate is the main determinant of the bank deposit rate, with a highly significant coefficient that is numerically very close to 1 and statistically not different from 1. Hence it is not surprising that none of the components of the foreign interest arbitrage condition exert an independent influence on *rdep* (the coefficients on the foreign interest rate plus the expected depreciation and on country risk are not significant) beyond their indirect role through the central bank policy rate. The URR—both its simple and effective cost measures—has a small and only marginally significant effect on the real bank deposit rate: the average effect of the URR on the interest rate is 90 basis points, and the variable is significant at only the 10 percent level. The two main determinants of *err* (τ and *pow*) do not attain conventional significance levels when included separately.

We found a large positive effect of the liberalization of capital outflows on the banking deposit rate; this effect is, on average, marginally significant. Among the credit demand determinants, a higher stock of net foreign liabilities and improving terms of trade both reduce the deposit rate. Deposit rates also exhibit a generally significant procyclical behavior. Finally, fiscal and monetary policies have effects with the expected signs but do not attain conventional significance levels.

The equation estimated for the RER¹⁷ combines determinants of equilibrium in the nontraded goods market, temporary effects of asset market pressures (captured by the difference between domestic and foreign interest rates), and nominal exchange rate pressures. The estimated equation is as follows:

$$\begin{aligned} \log e_t = & \delta_0 + \delta_1 rlp_t + \delta_2 \left(\frac{e_t l_{t-1}}{y_t} \right) + \delta_3 \left(\frac{g_t}{y_t} \right) + \delta_4 tot_t + \delta_5 \left(\frac{y_t}{\bar{y}_t} \right) \\ & (-) \quad (+) \quad (-) \quad (?) \quad (-) \quad (8) \\ & + \delta_6 r_t + \delta_7 r_t^* + \delta_8 \hat{e}_{t,t+1}^e + \delta_9 \rho_t + \delta_{10} err_t + \delta_{11} \log E_{t-1}, \\ & (?) \quad (+) \quad (+) \quad (+) \quad (+) \quad (+) \end{aligned}$$

17. An increase in the RER is a depreciation.

Table 6. Regression Results for the Real Deposit Interest Rate^a

Independent variable	Regression coefficient					
	(1)	(2)	(3)	(4)	(5)	(6)
$D(r^*) + D(\hat{e}_t^e)$	0.01 (0.8)	0.01 (0.7)	... ...	... ...	0.01 (0.7)	0.01 (0.7)
$D(\rho)$	0.74 (1.3)	0.67 (1.2)	0.61 (1.1)	0.60 (1.1)	0.61 (1.1)	0.61 (1.1)
$D(err)$	0.19 (1.6)	... ...	... ...	... ...	... ...	... ...
$D(urr)$	... ...	0.26 (1.7)	... ...	... ...	... ...	... ...
$D(r^*) + D(\hat{e}_t^e) + D(err)$	... ...	... ...	0.01 (0.7)	... ...	... ...	... ...
$D(r^*) + D(\hat{e}_t^e) + D(urr)$	... ...	... ...	... ...	0.01 (0.6)	... ...	... ...
$D(\tau)$	... ...	... ...	... ...	... ...	0.88 (0.6)	... ...
$D(pow_{-1})$	... ...	... ...	... ...	... ...	... ...	-0.32 (1.0)
$D(cbr)$	0.91 (3.5)	0.95 (3.7)	0.99 (3.5)	0.99 (3.5)	0.98 (3.6)	0.98 (3.6)
$D(accout)$	-0.78 (1.4)	-0.92 (1.6)	-0.79 (1.5)	-0.80 (1.5)	-0.96 (2.0)	-0.93 (1.8)
$D(\frac{el_{-1}}{y})$	-15.82 (1.8)	-16.14 (1.9)	-16.61 (1.9)	-16.65 (1.9)	-15.67 (1.8)	-16.41 (1.8)
$D(tot_{-3})$	-4.55 (2.1)	-4.53 (2.0)	-4.53 (2.0)	-4.52 (2.0)	-4.34 (2.1)	-4.23 (2.0)
$D(\frac{g}{y})$	8.51 (1.5)	8.45 (1.5)	8.58 (1.6)	8.60 (1.6)	6.51 (1.3)	6.44 (1.3)
$D(\frac{m_{-1}}{y})$	-11.67 (0.9)	-11.36 (0.9)	-8.59 (0.7)	-8.47 (0.7)	-24.19 (1.0)	-23.66 (1.0)
$D(\frac{y}{\hat{y}})$	2.02 (1.9)	2.25 (2.0)	1.78 (1.7)	1.78 (1.7)	0.59 (0.7)	0.57 (0.6)
$D(rdep_{-1})$	-0.32 (1.1)	-0.35 (1.2)	-0.39 (1.3)	-0.39 (1.3)	-0.40 (1.3)	-0.39 (1.3)
<i>Summary statistic</i>						
Adjusted R^2	0.38	0.38	0.37	0.37	0.36	0.36
Durbin's h	0.73	0.64	0.56	0.56	0.56	0.57

Source: Authors' calculations.

a. Results are based on estimation of equation (7) by the ordinary least-squares method. The dependent variable is the first difference of the real deposit interest rate ($rdep$). $D(\cdot)$ is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses.

where $rlpt$ is relative labor productivity growth in the traded goods sector, and E is the nominal exchange rate. The first six regressors reflect short- and long-term influences of changes in nontraded goods. The next four regressors reflect the temporary influence of asset market pressures arising from the three components of foreign interest arbitrage. Note that the domestic real interest rate has two opposite effects on the RER, consistent with the operation of an expenditure channel and a portfolio channel.¹⁸ The final variable reflects the temporary influence of a nominal devaluation.

We estimate an error correction model in two steps (Engle and Granger, 1987). The cointegration vector for the log of the RER consists of the following determinants of equilibrium in the nontraded goods market: the ratio of government spending to GDP, the ratio of net foreign liabilities to GDP, the relative labor productivity of traded goods, and the terms of trade. The coefficients of all but the last variable display the expected signs and are significant (table 7). In the error correction equation we include the lagged residual from the cointegration relationship and add as regressors selective lags of the business cycle, the terms of trade, the fiscal policy stance, the relative labor productivity of the traded sector, temporary effects of asset market pressures (captured by the domestic-foreign interest rate differential), and nominal exchange rate pressures (table 8).¹⁹ The results show that neither the domestic interest rate nor the components of the foreign interest arbitrage condition (except for the expected real depreciation which has a positive and significant, albeit small, effect) affect the RER.²⁰ Only when the cost of the URR is subtracted from the domestic-foreign interest rate differential (*gapext*) does this composite variable have a negative and transitory effect on the RER. Hence, confirming previous research, the cost of the URR has at most a temporary influence on the RER, operating through the difference between the domestic interest rate and the foreign arbitrage rate, adjusted by the cost of the URR.

18. A higher real interest rate reduces aggregate demand (the expenditure channel), lowering demand for both nontraded goods (hence tending to cause the currency to depreciate in real terms) and for traded goods (hence raising the current account surplus). On the other hand, a higher real interest rate increases the wedge between domestic and foreign interest rates (the portfolio channel), thus inducing more capital inflows and tending to cause the currency to appreciate in real terms.

19. We also included a term for the rate of depreciation between periods 5 and 6 as expected at period $t - 1$, to make the actual one-month devaluation horizon consistent with the six-month interest rate parity, in a model that is estimated in first differences.

20. A change in the expected depreciation between periods 5 and 6 of 1 percent causes a spot depreciation of 0.15 percent.

Table 7. Estimation Results of the Cointegration Vector for the Real Exchange Rate ^a

Independent variable	Regression coefficient	
	(1)	(2)
$\frac{g_t}{y_t}$	-1.11 (0.4)	-1.04 (0.3)
$\frac{e_t l_t}{y_t}$	1.08 (0.1)	1.07 (0.2)
$rlpt$	-0.41 (0.1)	-0.45 (0.1)
tot	0.09 (0.1)	... ...
Log likelihood	194.22	193.07

Source: Authors' calculations.
a. The dependent variable is the real exchange rate (*rer*). The sample period is 1989.1 to 2000.12. Estimation is by the Johansen technique. Standard errors are reported in parentheses; constant is not reported.

As in the preceding equation, the specification for net capital inflows reflects both permanent effects of the determinants of goods market equilibrium (that is, of the current account) and temporary influences of asset market pressures (captured by the domestic-foreign interest rate differential). The estimated equation is the following:

$$\frac{e_t \, kf_t}{y_t} = \lambda_o + \lambda_1(r_t - r_t^* - \hat{e}_{t,t+1}^e - \rho \dot{\rho}_t + \lambda_2 err_t + \lambda_3 accr_t + \lambda_4 acci_t$$

(+)

(-)

(+)

(-)

$$+ \lambda_5 \left(\frac{e_t l_{t-1}}{y_t} \right) + \lambda_6 \left(\frac{ls_{t-1}}{l_{t-1}} \right) + \lambda_7 \left(\frac{w kf_t}{w y_t} \right) + \lambda_8 e_t + \lambda_9 tot_t + \lambda_{10} \left(\frac{g_t}{y_t} \right)$$

(-)

(-)

(+)

(-)

(-)

(+)

$$+ \lambda_{11} \left(\frac{y_t}{\bar{y}_t} \right) \, .$$

(+)

(9)

Table 8. Regression Results of Error Correction Model for the Real Exchange Rate^a

Independent variable	Regression coefficient			
	(1)	(2)	(3)	(4)
$U_{\text{coint}}(-1)$	-0.05 (2.6)	-0.05 (2.6)	-0.06 (3.0)	-0.06 (3.0)
$D(\frac{y_{t-1}}{\bar{y}_{t-1}})$	-0.05 (2.6)	-0.05 (2.4)	-0.07 (2.5)	-0.05 (2.6)
$D(\frac{y_{t-2}}{\bar{y}_{t-2}})$	-0.30 (3.1)	-0.30 (3.1)	-0.27 (2.8)	-0.28 (2.8)
$D(\frac{y_{t-3}}{\bar{y}_{t-3}})$	-0.56 (4.7)	-0.56 (4.7)	-0.53 (5.0)	-0.53 (5.0)
$D(\frac{y_{t-4}}{\bar{y}_{t-4}})$	-0.55 (3.9)	-0.55 (3.9)	-0.53 (4.1)	-0.53 (4.1)
$D(\frac{y_{t-6}}{\bar{y}_{t-6}})$	0.15 (1.9)	0.16 (1.9)	0.19 (2.3)	0.19 (2.3)
$D(rlpt_{-8})$	0.01 (0.3)	0.01 (0.4)	0.01 (0.6)	0.01 (0.6)
$D(tot_{-1})$	-0.11 (1.7)	-0.11 (1.7)	-0.11 (1.8)	-0.11 (1.8)
$D(tot_{-3})$	0.02 (0.4)	0.02 (0.4)	0.00 (0.0)	0.00 (0.0)
$D(tot_{-7})$	0.10 (1.7)	0.10 (1.6)	0.10 (1.7)	0.11 (1.7)
$D(tot_{-9})$	0.08 (1.2)	0.08 (1.3)	0.07 (1.2)	0.07 (1.2)
$D(\frac{g_{t-11}}{y_{t-11}})$	0.13 (1.0)	0.13 (1.0)	0.10 (0.8)	0.10 (0.8)
$D(E_{t-1})$	0.18 (2.5)	0.19 (2.5)	0.18 (2.5)	0.18 (2.5)
$D(cbr)$	-0.001 (0.3)	-0.001 (0.3)	...	...
$D(r^*)$	-0.005 (1.0)	-0.003 (1.0)	...	...
$D(\hat{e}_{+6}^e)$	0.002 (2.7)	0.001 (2.7)	...	...
$D(\rho)$	0.003 (0.7)	0.007 (0.7)	...	...
$D(err)$	0.001 (0.3)	...	...	...
$D(urr)$	...	0.001 (0.6)	...	...
$D(gapext) - D(err)$	...	...	-0.001 (2.0)	...
$D(gapext) - D(urr)$	...	...	...	-0.001 (2.1)
Summary statistic				
Adjusted R^2	0.23	0.23	0.23	0.23
DW	1.70	1.70	1.70	1.70

Source: Authors' calculations.

a. Results are based on estimation of equation (8) by the ordinary least-squares method. The dependent variable is the first difference of the real exchange rate (rer). $D(\cdot)$ is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses.

The first regressor reflects the influence of the foreign interest rate differential. The next three regressors reflect the role of capital controls (both *ERR* and administrative controls) on net capital inflows. Next the ratio of the outstanding stock of net external liabilities to output and the ratio of short-term to total net foreign liabilities are included, to take account of a negative country risk effect. In addition, we include a measure of the relative world supply of capital flows to developing countries, *wkf/wy*, to capture international push factors. The final group of regressors reflects the influence of the determinants of the current account deficit on capital inflows. They are identical to the long-term fundamentals of the RER in equation (8), except for the exclusion of the relative labor productivity of the traded sector (*rlpt*) and the inclusion of the RER (*e*). An increase in the RER is expected to reduce the current account deficit and hence net capital inflows.

The overall results in table 9 are mixed. The two measures of the cost of the URR, *urr* and *err*, have the correct sign, but only the latter is statistically significant. This implies that the URR is effective in reducing the flow of foreign capital, but only to the extent that its power is not eroded. Thus, increasing *err* by 100 basis points a year—through some combination of raising its coverage and cracking down on evasion and avoidance, holding *urr* constant—reduces total inflows by about 1 percent of GDP, short-term inflows by 2.2 percent of GDP, and affected inflows by about 2.5 percent of GDP. These results imply a substitution of long-term (unaffected) flows for short-term (affected) flows.

However, the results regarding the other regressors are less satisfactory. Only the determinants of country risk (the ratio of net foreign liabilities to GDP, and the share of short-term debt in total debt), the indexes of administrative controls, and the relative supply of foreign capital to developing countries show the expected signs and attain statistical significance at conventional levels. But all the determinants of the current account and the interest rate differential show the wrong sign (and some have statistically significant coefficients). This leads us to believe that a more serious bias problem may be present in the results reported in table 9.

To check the robustness of these results, we reestimate the previous equation using as a regressor the current account deficit itself instead of its determinants. The results, reported in table 10, show that all coefficients display the expected signs, and except for the index of administrative controls, all attain

Table 9. Regression Results for Capital Inflows^a

Independent variable	Dependent variable					
	<i>D(total flows/GDP)</i>		<i>D(short-term flows/GDP)</i>		<i>D(affected flows/GDP)</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
$D(cbr) - D(r^*) - D(\hat{e}_{t+6}^e) - D(\rho)$	-0.01 (1.8)	-0.01 (2.0)	0.00 (0.6)	0.00 (0.2)	-0.01 (1.7)	0.01 (1.7)
$D(err)$	-0.009 (1.8)	... ...	-0.022 (3.9)	... ...	-0.025 (2.0)	... ...
$D(urr)$	... ...	0.000 (0.2)	... ...	-0.008 (0.5)	... ...	-0.013 (0.7)
$D(accr)$	0.58 (5.9)	0.58 (6.0)	... ...	... ...	0.62 (5.1)	0.61 (4.9)
$D(acci)$	0.07 (0.9)	0.07 (1.0)	... ...	... ...	0.14 (1.5)	0.15 (1.5)
$D(accf)$	... ...	... ...	0.57 (1.1)	0.72 (1.5)	... ...	... ...
$D(\frac{e_t l_{t-1}}{y_t})$	-5.46 (4.5)	-5.37 (4.5)	-3.88 (3.9)	-3.68 (3.6)	-4.84 (4.2)	-4.66 (4.0)
$D(\frac{ls_{t-1}}{l_{t-1}})$	-4.28 (5.1)	-4.32 (5.2)	-6.95 (9.1)	-6.96 (8.9)	-3.89 (3.8)	-3.91 (3.8)
$D(\frac{wfk}{wy})$	1.93 (2.1)	1.96 (2.1)	1.27 (1.5)	1.25 (1.5)	1.92 (1.9)	1.89 (1.9)
$D(e)$	1.62 (1.7)	1.62 (1.8)	0.37 (0.4)	0.63 (0.6)	1.37 (1.2)	1.30 (1.2)
$D(tot)$	0.06 (0.1)	0.08 (0.2)	-0.02 (0.0)	0.01 (0.0)	0.88 (1.5)	0.89 (1.6)
$D(\frac{g}{y})$	-1.08 (1.2)	-1.18 (1.2)	-1.41 (1.6)	-1.47 (1.6)	-0.76 (0.6)	-0.76 (0.6)
$D(\frac{y}{\bar{y}})$	-0.88 (1.3)	-1.01 (1.5)	0.14 (0.2)	-0.03 (0.0)	-0.89 (1.1)	-1.01 (1.3)
<i>Summary statistic</i>						
Adjusted R^2	0.54	0.54	0.53	0.51	0.44	0.42
DW	1.96	1.95	2.00	1.95	2.34	2.30

Source: Authors' calculations.

a. Results are based on estimation of equation (9) by the two-stage least-squares method. The instrumented variables are the real exchange rate and the ratio of actual output to potential output. The instruments are lags of each variable. $D(\cdot)$ is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses; constants are not reported.

statistical significance at conventional levels. Most important, the effective cost of the URR appears to play a marginally significant, negative role in total net capital inflows. Therefore the preceding result, that increasing the *err* by 100 basis points reduces net capital inflows by about 2 to 3 percent of GDP (table 9), is upheld here. This is, again, a temporary effect, as the power of the URR (and hence *err* itself) declines over time for a given interest rate differential. The result regarding the substitution between long-term (unaffected) and short-term (affected) flows is also confirmed.

As a complement to the preceding result, we next test for the effect of capital controls on the composition of outstanding net foreign liabilities, controlling for other return and risk variables that may affect portfolio composition. We specify the following equation for the ratio of short-term to overall net foreign liabilities:

$$\frac{ls_t}{l_t} = \mu_0 + \mu_1 r_t + \mu_2 r_t^* + \mu_3 \hat{e}_t^e + \mu_4 err_t + \mu_5 accr_t + \mu_6 \left(\frac{e_t l_{t-1}}{y_t} \right). \quad (10)$$

(+) (-) (-) (-) (-) (?)

The rationale for the expected signs is similar to that described for equation (9). Only lagged values (PDLs) enter the specification.

The results, presented in table 11, are mixed, as some variables do not exhibit the expected signs or do not reach conventional significance levels. This result notwithstanding, both measures of the cost of the URR unambiguously reduce the share of short-term debt in net foreign liabilities. Also, as expected, lessening the administrative constraints on foreign capital remittances leads to a larger share of short-term foreign liabilities.

3.4 CONCLUSIONS

Having tested in various ways for the macroeconomic and financial effects of Chile's capital controls, we derive the following conclusions. First, capital controls themselves have been highly responsive to the domestic and international macrofinancial environment.

Table 10. Regression Results for Capital Inflows Using the Current Account Surplus as Explanatory Variable^a

Independent variable	Dependent variable					
	<i>D(total flows/GDP)</i>		<i>D(short-term flows/GDP)</i>		<i>D(affected flows/GDP)</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
$D(cbr) - D(r^*) - D(\hat{e}_{t+6}^e) - D(\rho)$	0.00 (0.1)	0.00 (0.2)	0.01 (2.1)	0.01 (1.9)	-0.00 (0.7)	-0.00 (0.7)
$D(err)$	-0.017 (2.7)	... ...	-0.024 (4.6)	... ...	-0.031 (2.6)	... ...
$D(urr)$	... ...	-0.008 (0.6)	... ...	-0.015 (1.2)	... ...	-0.023 (1.2)
$D(acce)$	0.19 (2.9)	0.19 (2.8)	... ...	... ...	0.37 (4.2)	0.37 (4.2)
$D(acci)$	-0.01 (0.2)	-0.01 (0.2)	... ...	... ...	0.10 (1.4)	0.09 (1.3)
$D(acce)$	... ...	... ...	0.22 (0.9)	0.24 (1.1)	... ...	... ...
$D(\frac{e_t l_{t-1}}{y_t})$	-3.55 (4.9)	-3.39 (4.7)	-2.25 (3.7)	-2.02 (3.3)	-3.47 (3.8)	-3.24 (3.6)
$D(\frac{ls_{t-1}}{l_{t-1}})$	-2.84 (5.2)	-2.83 (5.2)	-5.74 (8.6)	-5.70 (8.3)	-3.08 (3.6)	-3.06 (3.6)
$D(\frac{wfk}{wy})$	1.95 (2.8)	1.91 (2.7)	1.46 (2.1)	1.37 (2.1)	1.78 (1.9)	1.67 (1.8)
$D(\frac{cas}{\bar{y}})$	-0.81 (6.4)	-0.82 (6.5)	-0.72 (4.6)	-0.71 (4.6)	-0.57 (4.1)	-0.56 (4.1)
<i>Summary statistic</i>						
Adjusted R^2	0.69	0.68	0.61	0.60	0.50	0.49
DW	2.17	2.13	2.24	2.20	2.52	2.48

Source: Authors' calculations.

a. Results are based on estimation of equation (9) by the two-stage least-squares method. The current account surplus is instrumented using lags of itself, the terms of trade, the ratio of government expenditure to GDP, and lags of the exchange rate and the ratio of actual to potential output. $D(\cdot)$ is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses; constants are not reported.

Table 11. Regression Results for the Portfolio Share of Short-Term Net Foreign Liabilities in Total Net Foreign Liabilities^a

<i>Independent variable</i>	<i>Regression coefficient</i>	
	(1)	(2)
PDL(D(<i>rdep</i>); -1, -5, 2)	0.00 (0.89)	0.00 (1.15)
PDL(D(<i>r*</i>); -1, -5, 2)	0.08 (1.84)	0.01 (1.87)
PDL(D($\hat{e}^e$); -1, -5, 2)	0.00 (1.63)	0.00 (1.69)
PDL(D(<i>err</i>); -1, -5, 2)	-0.01 (2.69)	... ...
PDL(D(<i>urr</i>); -1, -5, 2)	... ...	-0.01 (1.56)
PDL(D $\frac{\hat{e}_t I_{t-1}}{y_t}$; -5, -10, 3)	-0.61 (2.91)	-0.58 (2.67)
PDL(D(<i>accr</i>); -1, -12, 3)	-0.13 (4.10)	-0.14 (4.34)
<i>Summary statistic</i>		
Adjusted R^2	0.15	0.14
DW	1.84	1.83

Source: Authors' calculations.

a. Results are based on estimation of equation (10) by the ordinary least-squares method. PDL (X ; A, B, C) is a polynomial distributed lag for variable X , where A and B are the first and last lag, respectively, and C is the order of the polynomial. D(.) is the first-difference operator. The sample period is 1989.1 to 2000.12. Newey-West-consistent t statistics are reported in parentheses; constants are not reported.

The Central Bank of Chile put the URR in place in order to retain monetary control, stem overall capital inflows (and short-term and financial inflows in particular), and maintain international competitiveness. Our results confirm these policy objectives. Both the simple measure (*urr*) and the effective measure (*err*) of the cost of the URR increase with total capital inflows, the level of short-term flows, and the level of currency appreciation (*err* also responds to the difference between actual and target inflation). In addition, the central bank

responds to the decline in tax power (due to evasion and avoidance) by raising the cost and coverage of the URR through various changes in its administration. Separately, we also obtained results on the intensity of administrative controls on capital outflows: these tend to respond to similar variables as the URR and have been used as a complement to the latter.

Second, in the context of a monetary policy reaction function, complemented by imperfect foreign interest arbitrage, we found that, after controlling for the significant influence of policy objectives, the power of the URR has a significant positive effect on the central bank policy rate. Hence the URR has allowed for a certain isolation of the monetary policy interest rate from external influence. Subsequently we focused on the real bank deposit rate and found the central bank policy rate to be its main determinant. Only small direct effects were found for both *err* and *urr*. Hence *err* has mainly exerted an indirect influence on the bank deposit rate. This stands in contrast to controls on outflows: lowering the latter throughout the 1990s helped in raising the bank deposit rate.

Third, estimation of an error correction model for the RER, which reflects temporary and permanent influences of other equilibrium forces, did not find significant effects of Chile's capital controls on this variable. This may be due to offsetting short- and medium-term effects of larger capital controls on the RER, as suggested by the model sketched in Gallego, Hernández, and Schmidt-Hebbel (1999).

Fourth, a similar model, reflecting the influence of variables that affect investment-saving decisions and temporary effects due to domestic-foreign interest rate differentials, was estimated for net capital inflows. Total net inflows were reduced significantly by the *err* (but not by the alternative *urr*). Moreover, there is some weak evidence that the *err* reduced some categories of capital flows proportionately more, implying substitution between tax-exempt flows, on one hand, and short-term and URR-affected flows, on the other. An alternative portfolio composition equation for the share of short-term assets in total net foreign liabilities shows a significant negative effect of both *urr* and *err*. Hence the URR has unambiguously changed the composition of total net foreign liability flows and stocks away from short-term (affected) flows and toward medium and long-term (unaffected) flows.

4. PROS AND CONS OF THE URR: AN OVERALL ASSESSMENT

We have analyzed the Chilean experience with capital controls during the 1990s, extending the existing literature on the subject in three dimensions. We broadened the concept of the URR to take into account changes in its effectiveness over time. We constructed indicators for other administrative restrictions on capital flows. Finally, we extended the sample period to include those before and after the URR was in place.

From our empirical analysis we distill, in this section, several main findings and assess the overall pros and cons of capital controls. Since our results are based on a single country experience, our final remarks will refer to the potential risks of adopting Chilean-type capital controls in other countries.

4.1 Potential Benefits of the URR

Monetary Independence

Capital controls in general and the URR in particular can contribute to a greater degree of monetary autonomy. Since the controls introduce a wedge between domestic and foreign interest rates, they provide more space for the conduct of an independent monetary policy. Our results show that this benefit was partly achieved in the case of Chile. The interest rate differential supported by the URR (more precisely, by its power) was, on average, relatively small (about 100 basis points) and temporary.

External Competitiveness

The URR should lead in the short run to a more depreciated currency in real terms (and therefore to a more competitive export sector), but its long-term effect may be a real appreciation. Our results support this ambiguity by showing that the introduction of the URR did not significantly affect the RER.

External Indebtedness

The URR is expected to lead to smaller capital inflows, thereby reducing overall foreign indebtedness. Our results validate this view:

the URR led to a fall in capital inflows, although this effect is temporary in nature due to the eventual loss of power of the URR.

Composition of Inflows

The URR is expected to change the composition of capital inflows toward longer maturities, making the recipient country more resilient to shocks. Our results show indirectly that this result was attained in the case of Chile. The introduction of the URR led to a distribution of external liabilities that was skewed toward long-term liabilities.

Overall, through the last two of these channels, the URR may have contributed to a stronger external position of the Chilean economy. This may have reduced the risk of a sudden and large reversal of capital inflows—and of ensuing recession and financial crisis—when external conditions deteriorated in the aftermath of the 1997 Asian crisis.²¹ This benefit should not be overlooked despite the difficulties associated with measuring it. However, when trying to draw the relevant policy lessons, it should be kept in mind that these benefits are temporary in nature and can be realized only if the central bank is very active in maintaining the effectiveness of the URR. The speed with which the URR loses its effectiveness indicates that its benefits start to diminish soon after it is introduced.

4.2 Potential Costs of the URR

Quasi-Fiscal Losses

The URR can lead to quasi-fiscal losses because it loses its effectiveness over time and, for a given interest rate differential sought by the authorities, may induce a rapid accumulation of foreign reserves. The Chilean experience shows that the net cost associated with funding the resulting excess reserves is not negligible (Gallego, Hernández, and Schmidt-Hebbel, 1999).

Misallocation of Resources

Since the URR tends to raise short-term interest rates proportionately more than longer rates, it contributes to an inefficient

21. However, Edwards (1999) shows that the URR was unable to isolate Chile from the very large financial shocks of 1997-99, as it contributed only to lower stock market instability.

allocation of resources. In particular, the URR discriminates against short-term projects and those sectors that are more dependent on bank financing. In addition, there are costs associated with the search for loopholes and with their closure. Although this cost has not been measured for Chile, it is likely that its burden has fallen proportionately more on small and medium-size firms (Edwards, 1999).

Investment and Growth

The increase in domestic interest rates caused by the URR reduces investment and long-term growth. The results presented in Gallego, Hernández, and Schmidt-Hebbel (1999) show that in the absence of the URR—and with a less restricted monetary stance—Chile could have attained somewhat more rapid growth during the 1990s.

4.3 Final Remarks

It is important to keep in mind that the effectiveness of the URR in the case of Chile was due, to a large extent, to the strong enforcement capacity of the Central Bank of Chile, to a long tradition of compliance with the law, and to relatively low levels of corruption. Chilean-type capital controls could be less effective and, in the extreme, could lead to more corruption in countries with a weaker institutional and legal environment.

The URR applied by Chile also has to be understood as a complementary and temporary tool aimed at improving the policy trade-off between the objectives of price stabilization and external competitiveness, in conjunction with exchange rate flexibility limited to a crawling exchange rate band. In other countries, capital controls could be inappropriately adopted to delay implementation of necessary reforms in the financial system or the public sector. This was not the case in Chile, which has a solid, highly capitalized, and well-regulated financial sector, complemented by a strong fiscal stance since the mid-1980s.

Despite the difficulties in assessing its net benefits and costs, Chilean-type capital controls should be understood as part of a policy mix during the country's transition to full financial integration and a truly floating exchange rate regime. The policy mix also comprises strengthening the financial system and improving public finances. In the long run, adequate regulation of banks and corporations, avoidance of government guarantees that lead to excessive foreign

indebtedness, a more developed and sophisticated financial system, and a strong fiscal stance should replace capital controls, in particular within a context of floating exchange rates.

APPENDIX A

Empirical Studies on Chile's Unremunerated Reserve Requirement: Summary of Methodologies and Main Results

<i>Study by</i>	<i>N. Eyzaguirre and K. Schmidt-Hebbel (1997)</i>	<i>Comments</i>
<i>Frequency, period</i>	Monthly, 1991-96	Only comprises the period when the URR was operating
<i>Theoretical model</i>	Yes; portfolio equilibrium (macro) model	
<i>Empirical model</i>	One equation model in all cases; URR enters the equations linearly	Treats URR as an endogenous variable (estimates an equation for this purpose)
<i>Control for sterilization</i>	Does it indirectly by putting the CB set rate as an explanatory variable in the interest rate equation	
<i>scale flow variable</i>	No	
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	No	
<i>country risk rating</i>		
<i>domestic interest rate set by the CB</i>	Yes (see above)	
<i>Dependent variable</i>	Short-term interest rate; flow composition; real exchange rate and URR (also Δ NFA)	
<i>Hypothesis tested</i>	URR on interest rates, flows (composition), and the real exchange rate	
<i>Conclusion</i>	The URR has increased interest rates (though the results are not very robust), and through this channel it has reduced the CAD (though these results are rather weak). Similarly, the URR would have a small and transitory effect on the real exchange rate (though the results are not very robust) The URR has a strong effect on the composition of inflows	The URR responded (Δ^+) to movements in the real exchange rate (appreciation) Same pitfalls as in the previous studies regarding loopholes, re-labeling, and control for other capital controls

APPENDIX A (continued)

<i>Study by</i>	<i>C. Soto (1997)</i>	<i>Comments</i>
<i>Frequency, period</i>	Monthly, 1991-96	Comprises no period before and after the URR
<i>Theoretical model</i>		Uses back of the envelope (simple) formula
<i>Empirical model</i>	Structural VAR	
<i>Variables included</i>	- Domestic interest rate - Capital control index - Real exchange rate - Real exchange rate volatility - Capital flows, level and composition	
<i>Conclusion</i>	URR affects, though in a small amount and on a transitory basis: - the domestic interest rate (increases) - the nominal (and real) exchange rate (depreciates) - and real exchange rate volatility (falls) In the long-term the URR affects flows composition (skewed toward longer term)	Same pitfalls as in previous studies regarding loopholes, re-labeling, and control for other capital controls

APPENDIX A (continued)

<i>Study by</i>	<i>S. Edwards (1998)</i>	<i>Comments</i>
<i>Frequency, period</i>	Monthly, 1988-96	
<i>Theoretical model</i>	No	
<i>Empirical model</i>	Single equation models for the interest rate differential	The existence of URR is incorporated using a dummy variable for the period 1993-98.
<i>Control for sterilization</i>	No	
<i>scale flow variable</i>	No	
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	No	
<i>country risk rating</i>	No	
<i>domestic interest rate set by the CB</i>	No	
<i>Dependent variable</i>	Interest rate differential	
<i>Hypothesis tested</i>	URR changed the dynamic behavior of the interest rate differential	
<i>Conclusion</i>	URR increased the inertia of the interest rate differential, but it did not have any significant effect on the differential itself	Same pitfalls as in previous studies regarding loopholes, re-labeling, and controlling for other capital controls. This is important because the author uses a constant variable for the 1993-98 period, while the available information suggests that the economic importance of capital controls changed significantly during that period.

APPENDIX A (continued)

<i>Study by</i>	<i>B. Laurens and J. Cardoso (1998)</i>	<i>Comments</i>
<i>Frequency, period</i>	Quarterly, 1989-94 and 1985-94	Comprises part of the period when inflows were not voluntary (1985-88) and no period after the URR
<i>Theoretical model</i>	No; partial equilibrium, single equation	URR enters in a non-linear way in the estimation
<i>Empirical model</i>		
<i>Control for sterilization</i>	No	
<i>scale flow variable</i>	No	
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	No	
<i>country risk rating</i>	No	
<i>domestic interest rate set by the CB</i>	Use interest rate differential from abroad	
<i>Dependent variable</i>	Total flows, short-and long-term flows separately	
<i>Hypothesis tested</i>	Whether flows respond to the URR	
<i>Conclusion</i>	No long-term effect on total capital inflows, the exchange rate, or interest rates (though no formal test is provided for the claim on the latter two variables); short-term negative impact on total flows; results are mixed regarding the composition of flows since a drop in short-term flows reverses after a few quarters (but a chart shows a decrease in the share of short-term flows in the total)	The way the model is set casts serious doubts on the validity of the authors' results. The capital control index—right hand side variable—has the dependent variable on it: it is calculated as flows times the tax rate. Same pitfalls as in Valdés and Soto regarding loopholes, re-labeling, and control for other capital controls

APPENDIX A (continued)

<i>Study by</i>	<i>S. Valdés-Prieto and M. Soto (1998 and 2000)</i>	<i>Comments</i>
<i>Frequency, period</i>	Quarterly 1987-96	Comprises part of the period when inflows were not voluntary (1987-88) and no period after the URR
<i>Theoretical model</i>	Yes; partial equilibrium, single equation	Uses back of the envelope (simple) formula; URR enters in a non-linear way in the estimation
<i>Empirical model</i>		
<i>Control for sterilization</i>	Yes	Change in CB's net foreign assets as share of GDP
<i>scale flow variable</i>	C.A balance for LAC countries	As a share of Chile's GDP
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	Yes	
<i>country risk rating</i>	Use S&P rating	Takes value of 1 when investment grade; 0 otherwise
<i>domestic interest rate set by the CB</i>	Yes	Endogenous variable
<i>Dependent variable</i>	Short-term credit flows from Balance of Payments net of URR plus Errors and Omissions	Errors and omissions captures exempt flows
<i>Hypothesis tested</i>	URR on ST flows (and on the Real Exchange Rate in previous paper)	
<i>Conclusion</i>	Effective only for taxed flows. Ineffective for total short-term flows except marginally for high URR rates; i.e., in 1995-96 Previous study finds no systematic effect on Real Exchange Rate	- Does not control for re-labeling - Does not control for loopholes closing (intensity and effectiveness of the URR) - Does not control for changes in other capital controls

APPENDIX A (continued)

<i>Study by</i>	<i>S. Edwards (1999)</i>	<i>Comments</i>
<i>Frequency, period</i>	Monthly, 1991-98; Weekly, 1994-99	
<i>Theoretical model</i>	No	
<i>Empirical model</i>	GARCH models for the nominal short-term interest rate and the stock market price index. Semi-structural VAR	URR enters linearly in all equations and is treated as endogenous in the VAR
<i>Variables included in the VAR</i>	- URR - Change in the real exchange rate - Rate of nominal devaluation - Domestic interest rate - Interest rate on US 3 month certificates (exogenous)	
<i>Hypothesis tested</i>	URR affected domestic interest rate and real exchange rate.	
<i>Conclusion</i>	URR increases the level of domestic interest rate but has no effect on real exchange rate. URR reduces the volatility of the stock market prices but has no effect on the volatility of interest rates	Same pitfall as in previous studies regarding loopholes, re-labeling, and controlling for other capital controls. The GARCH estimation is quite simple and it could be sensible to the imposed structure

APPENDIX A (continued)

<i>Study by</i>	<i>J. De Gregorio, S. Edwards and R. Valdés (2000)</i>	<i>Comments</i>
<i>Frequency, period</i>	Quarterly 1987-96 and Monthly 1991-98	Comprises part of the period when inflows were not voluntary (1987-88) and no period post URR
<i>Theoretical model</i>	Yes, for the derivation of the URR formula	In the empirical part uses a simple back of the envelope calculation; also a <u>power index</u> aimed at capturing the lack (or presence) of loopholes is used
<i>Empirical model</i>	One equation models in all cases plus VARs, linear effect	URR enters linearly in all the equations. Treats URR as an endogenous variable in the VAR
<i>Control for sterilization</i>	No	
<i>scale flow variable</i>	Yes, but resulted being insignificant	
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	No	
<i>country risk rating</i>	Yes (relative to other countries)	
<i>domestic interest rate set by the CB</i>	(used as a dependent variable in the interest rate equation)	Controls for the determi- nants of the CB policy (domestic inflation) instead
<i>Dependent variable</i>	Interest rates; total and short term-flows; real exchange rate	
<i>Hypothesis tested</i>	URR on interest rates, flows (composition), and the real exchange rate	
<i>Conclusion</i>	The URR does permit higher domestic interest rates and skew capital inflows toward long-term flows on a permanent basis; however, the real exchange rate is not affected	In the VAR estimations they find that the real exchange rate depreciates, on a transitory basis, with the increase in the URR; bottom line: there is no conclusive evidence on the effect on the real exchange rate. Innovation: they use a power index which is constructed according to the authors' subjective opinions

APPENDIX A (continued)

<i>Study by</i>	<i>S. Edwards (2000)</i>	<i>Comments</i>
<i>Frequency, period</i>	Weekly, 1994-99	
<i>Theoretical model</i>	No	
<i>Empirical model</i>	Semi-structural VAR	The effect of capital controls in the level of contagion is indirectly tested through a split in the sample
<i>Variables included in the VAR</i>	- Cyclical component of the non Latin American EMBI index - Cyclical component of the Latin American EMBI index - Rate of change in the value of the Mexican and Chilean peso vis-à-vis the US\$ - A measure of the expectations of devaluation in Argentina - Argentine, Mexican, and Chilean 90-day deposit rate in domestic currency - Interest rate on US 30 years bond (exogenous)	
<i>Hypothesis tested</i>	URR affected the level of contagion of domestic interest from external shocks	
<i>Conclusion</i>	URR was not able to isolate Chilean interest rates from the external shocks of late 1997. The benchmark is the level of contagion of Argentina and Mexico.	Same pitfalls as in previous studies regarding loopholes, re-labeling, and controlling for other capital controls.

APPENDIX A (continued)

<i>Study by</i>	<i>F. Larraín, R. Labán, and R. Chumacero (2000)</i>	<i>Comments</i>
<i>Frequency, period</i>	Quarterly, 1986-97	Comprises part of the period when inflows were not voluntary (1987-88) and no period post URR
<i>Theoretical model</i>	Threshold model. Endogenously determined regimes	
<i>Empirical model</i>	Short-term taxed, short-term exempt, and long-term flows separately	URR enters through interest rate differential or directly in the short-term equations
<i>Control for sterilization</i>	No	
<i>scale flow variable</i>	No	
<i>capital outflow liberalization</i>	No	
<i>trade volume (credit)</i>	No	Does it indirectly by putting the investment to GDP ratio
<i>country risk rating</i>	Use the ratio of debt to GDP and the GDP growth rate	
<i>domestic interest rate set by the CB</i>	use interest rate differential from abroad	
<i>Dependent variable</i>	Short-term taxed, short-term exempt, and long-term flows	
<i>Hypothesis tested</i>	Determinants of different types of capital flows to Chile change in different regimes	Uses threshold models to identify switching regimes
<i>Conclusion</i>	The URR has no effect on long-term capital, a negative effect on short term taxed flows (through the gap between internal and adjusted external rates), and a positive (but transitory) effect on exempt short-term flows. The effect of the URR operates in a non-linear way because it depends on the regime	The estimated equations are simple (probably reflecting reduced form equations) and consequently they do not control for a number of relevant variables. Same pitfalls as in previous studies regarding loopholes, re-labeling, and controlling for other capital controls

APPENDIX B

Data Sources and Definitions

<i>Variable and abbreviation</i>	<i>Description</i>	<i>Source</i>
Effective (<i>err</i>) and simple (<i>urr</i>) cost of the unremunerated reserve requirement (URR)	Constructed using equation (3)	Gallego, Hernández, and Schmidt-Hebbel (1999)
Actual (π) and target (π_t) inflation	Monthly inflation targets calculated from linear interpolation of Central Bank of Chile December-to-December targets	Authors' calculations based on Central Bank of Chile data
Real exchange rate (<i>e</i>)		Central Bank of Chile
Policy interest rate (<i>cbr</i>)	CPI-indexed rate on 90-day Central Bank of Chile paper until June 1995; interbank lending rate thereafter	Central Bank of Chile
Deposit interest rate (<i>rdep</i>)	Rate on 91- to 365-day deposits	Central Bank of Chile
Total (<i>kf</i>), long-term (<i>kfl</i>), short-term (<i>kfs</i>), and affected (<i>kfa</i>) capital inflows to Chile		Central Bank of Chile
Aggregate capital flows to emerging market economies (<i>wfk/wy</i>)	Monthly interpolation of the ratio of aggregate capital flows to emerging market economies to world output, using the RATS routine	Authors' calculations based on International Monetary Fund, <i>World Economic Outlook</i> , various issues
URR power index (<i>pow</i>)	Constructed using equation (2)	Gallego, Hernández, and Schmidt-Hebbel (1999)
URR tax rate (τ)		Central Bank of Chile
Administrative controls on capital flows (<i>accf</i>), on capital outflows (<i>accout</i>), on capital remittances (<i>accr</i>), on capital issues (<i>acci</i>), and on other capital account transactions (<i>acco</i>)		Gallego, Hernández, and Schmidt-Hebbel (1999)

APPENDIX B (continued)

<i>Variable and abbreviation</i>	<i>Description</i>	<i>Source</i>
Foreign real interest rate (r^*)	Constructed as the 180-day London Interbank Offered Rate on dollars, adjusted for six-month-ahead projections of the U.S. inflation rate (inflation projected using an ARIMA model for the U.S. consumer price index)	Authors' calculations based on Central Bank of Chile data
Expected currency depreciation ($\hat{e}^e$)	Estimated as projection from rolling regressions for the six-month rate of depreciation	Authors' calculations
Country risk premium (ρ)	Premium on international bonds issued by Chilean corporations	Authors' calculations based on Central Bank of Chile and the JP Morgan Emerging Markets Bond Index (EMBI) data
GDP (y)	Monthly GDP estimated by related series using the monthly aggregate production index (IMACEC)	Authors' calculations based on Central Bank of Chile data
Terms of trade (tot)		Bennett and Valdés (2001)
Current account surplus (cas)		Central Bank of Chile
Government expenditure (g)	Monthly interpolation of public absorption using the RATS routine	Ministry of Finance and authors' calculations
Money stock (M1)		Central Bank of Chile
Relative labor productivity growth in the traded goods sector ($rlpt$)	Constructed using the methodology of Valdés and Délano (1999)	Author's calculations based on Central Bank of Chile and National Bureau of Statistics data
Nominal exchange rate (E)		Central Bank of Chile
Trend output ($\bar{y}$)	Estimated using the Hodrick-Prescott filter	Authors' calculations
Total (l) and short-term (sl) net foreign liabilities.	Calculated from monthly flows applied to the initial stock estimated by Milesi-Ferretti (1998) for December 1988.	Authors' calculations.

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