Exchange Rate Policy in Chile: From the Band to Floating and Beyond

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Abstract

With the exemption of adopting a foreign currency, Chile has experienced virtually all the menu of options of exchange rate policies in the last 40 years. The quest for a reasonable exchange rate policy has been inspired in part by the different goals that, through time, policy makers have attempted to achieve with this policy. After almost of decade of co-existence of inflation targeting and an exchange rate band, in 1999 the Central Bank of Chile gave up the exchange rate band and replaced it with a policy of floating. This paper confronts two main questions: (a) Why was the band abandoned and, by the same token, why it took so long to do it and (b) How has the floating regime worked so far? This last question involves accounting for the possible appearance of "fear of floating" by the macroeconomic authorities, as well as evaluating the regime in three critical issues: exchange rate passthrough to domestic prices, exchange rate volatility and balance sheet effects. In the final section, the paper illustrates the operation of the exchange rate system in the face of regional contagion effects.

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I. Introduction

With the exemption of adopting a foreign currency, Chile has experienced virtually all the menu of options of exchange rate policies in the last 40 years. From hard pegging in the early 60s and 80s, to the current floating, this country has been even precursor of some very "innovative" intermediate regimes that later on were adopted by a number of other nations. The crawling peg adjusted to past inflation scheme of the second half of the 60s, the "active" crawling peg arrangement of 1978 (later popularized in Argentina as the "tablita"), and the crawling band of the late 80s and most of the 90s, have been examples of policy makers "ingenuity"..

The quest for a reasonable exchange rate policy has been inspired in part by the different goals that, through time, policy makers have attempted to achieve with this policy. Goals, in turn, have varied depending on the final objectives with respect to growth and inflation, the "model" of the economy in the policy makers' minds, or both. Many other factors, including conditions in the world economy, the domestic business cycle, imperfections in the workings of internal markets (like widespread price inflexibility), political economy aspects, and even academic fads, have also played a part.

With the adoption of an inflation targeting monetary scheme in the early 1990s, right when capital inflows vigorously resumed, it soon became apparent the conflict between the targets set for inflation and the commitment with respect to the nominal exchange rate contemplated in the exchange rate policy (a crawling band adjusted with respect to past inflation). Although the inflation target always prevailed in case of conflict, in 1999 the Board decided finally to give up the exchange rate band and replace it with a policy of floating.

This paper confronts two questions: (a) Why was the band abandoned and, by the same token, why it took so long to do it and (b) How has the floating regime worked so far? In the final section, the paper illustrates the operation of the exchange rate system in the face of regional contagion effects.

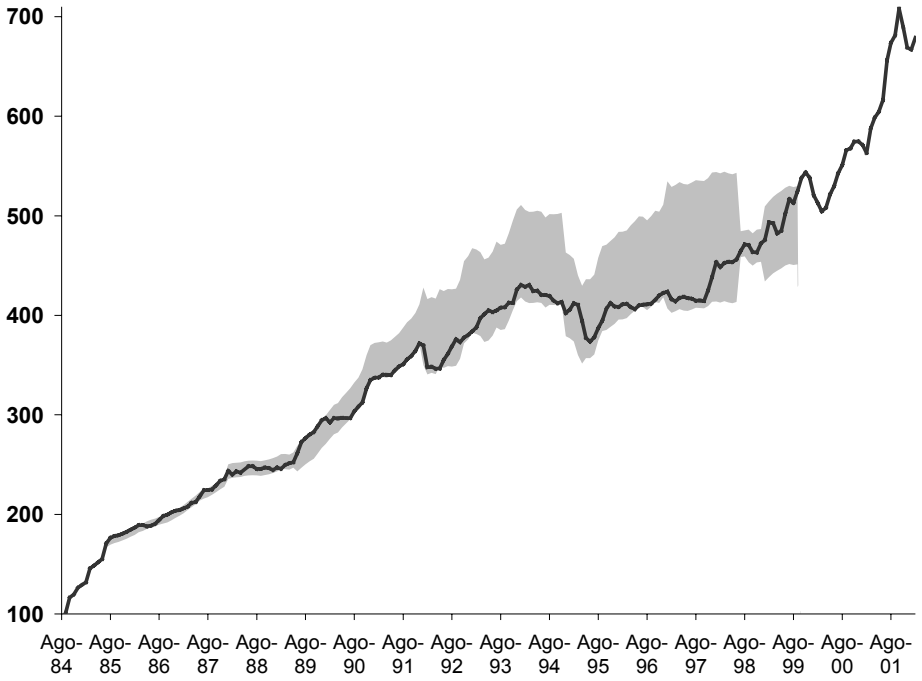
II. Why Was the Exchange Rate Band Abandoned, and Why in September 1999?

II.1 A Preview:

Figure 1 presents the evolution of Chile's nominal exchange rate from 1984 to August 2001, as well as the crawling band that was in place between August 1984 and September 1999. Although the exchange rate band evolved over time since its inception in the late 80s, it had a few central features that remained unchanged until its abandonment (see Appendix 1 for a summary of the band's characteristics in time). The first one is that it was a crawling band whose center or reference value was periodically adjusted to reflect the difference between domestic and foreign inflation in the preceding month. The second general feature is that the band's width was gradually increased with time, except for a temporary reversal in 1998. And the third one is that intra-band interventions by the Central Bank in the foreign exchange market did take place all along, although in rather circumvent ways.

These features reveal in turn important cues as to what the role assigned to the exchange rate policy was in the last fifteen years. The fact that the band's center followed the difference between domestic and external inflation reveals that there was a concern with misalignments of the real exchange rate with respect to a PPP concept, as well as an attempt to manage –at least partially- the real exchange rate. Although the actual mechanism applied to adjust the nominal exchange rate changed through time, the choice of a PPP criterion at least shows that the authorities had no intention to use the exchange rate policy as a blunt price stabilization tool[1]. This was in opposition to the 1979-82 fixed exchange rate, and even with the pre-announced crawling peg of 1978, when exchange rate policy was presented as the nominal anchor of the economy in order to subdue inflation in a short period of time.

Figure 1
Nominal Exchange Rate and Exchange Rate Band
(Chilean Pesos per United States Dollar)
August 1984-February 2002



Source: Central Bank of Chile

As is normally the case, the role assigned to exchange rate policy at a point in time is directly linked to the lack of success of the immediately precedent role. The fixed-rate episode of 1979-82, which occurred at a time of heavy capital inflows intermediated by highly leveraged and badly supervised domestic banks, was associated to a substantial real peso appreciation and an unsustainable current account deficit. More than that, after a sudden reduction in capital inflows, the episode ended up in the biggest recession of the last 50 years (15% drop in GDP in 1982-83), a very high external debt, and an upsurge in inflation.

[1] Of course, there was some leeway given by the definition of the band's parameters and width.

Fair or not, the general public and many economists partly blamed the exchange rate nominal anchor for the disaster. Thus, the reaction was a complete overhaul and switch of macro policies in 1985-90. However, abandoning the peg did not imply freeing the exchange rate, and was rather a shift in management and objectives. The concern was not placed in the exchange rate as the anchor to lower inflation and provide macroeconomic stability, but as an instrument to sustain a depreciated real exchange rate that would boost exports.

There was less concern for reducing inflation, more concern for overcoming the problems posed by the excessive external debt and the scarcity of voluntary foreign financing after the Mexican moratorium of 1982, and more concern for stimulating the economy back to growth again. The formula was to allow the peso depreciate and try to keep it depreciated in real terms, so net exports could go up producing the resources to comply with external debt obligations and bringing dynamism to economic activity. It worked, aid by an austere fiscal policy and a stimulative monetary policy on average. In the end, exports grew at a compounded rate of 10.6% annual, while GDP did so at an average rate of 6.5%, between 1985 and 1990[2]. In spite of an inflation rate that remained above 20% per year, the experience was considered successful, thus establishing, right or wrong, the role of exchange rate policy as a tool to influence the real exchange rate more permanently.

Why was the exchange rate band's width somewhat increased during this period?[3] Why not simply maintain a depreciated peso to boost exports by resorting to a plain crawling peg? Part of the choice was fad - exchange rate bands were the new flavor of the week in the mid 80s, theoretically combining the benefits of monetary flexibility and exchange rate stability/management. The other part reflected the Central Bank's first attempts to establish a more modern monetary policy aiming to reduce inflation. This needed some degrees of freedom in the exchange rate market that a straightforward crawling peg was unable to provide.

Some facts made the commitment to a depreciated peso very difficult in the 1990s. First, after the political change in 1990 that ended seventeen of military government, the new authorities stayed committed to the pro-market policies followed by the previous administration, but in a democratic context, strengthening the long run perspective in the country. As a consequence, capital inflows resumed very strongly. These inflows were also prompted by low interest rates in the US and the rediscovery by foreign investors of a reform-prone Latin America[4]. The other fact was a newly independent Central Bank with a clear mandate to reduce inflation from rates of more than 20% annual to figures more similar to those prevailing in industrial countries. This mandate was materialized in the adoption of annual inflation targets that aimed to gradually reduce inflation over time, and the implementation of a monetary policy subordinated to these inflation targets.

The substantial inflow of capital during most of the decade, whether exogenous or endogenous, or both, put a lot of pressure for a more appreciated peso, in real terms. This was not in principle consistent with a PPP adjusted crawling band that wanted to keep the peso depreciated. On the other hand, the attempt to reduce inflation by resorting to gradually

[2] Notice, however that the average rate of increase in exports in 1990-97, a period of substantial real appreciation, was also 10.6% annual.
[3] The band started with a 0.5% width in 1984 and had a 5% width in 1990.
[4] It is no accident that at that time developing economies were re-baptized as "emerging" economies, perhaps as a symptom of the growing appetite for risk among foreign investors.

declining annual inflation targets could potentially clash with the exchange rate band as well. In a sense, having inflation targets and an exchange rate target simultaneously is an over-determination of nominal variables (two nominal anchors). Moreover, the strong growth exhibited during the 90s was associated to important improvements in factor productivity, particularly in the tradable sector, which was an additional pressure for a more appreciated peso (the Balassa-Samuelson effect[5]). At the same time, demand's vigorous growth exceeded output, forcing on average a strict monetary policy and high domestic interest rates all along. This was an additional factor in the attraction of foreign capital and compounded the pressure for a more appreciated peso, also in real terms.

The reluctance to abandon the exchange rate band in spite of all these conflicts and pressures forced the Central Bank to try different "second-best" options between 1990 and 1997. The band itself suffered a number of amendments during the decade, all aimed to accommodate a more appreciated peso (see Figure 1 and Appendix 1):

(a) Increasing the band's width, which went from 10% in 1990 to 25% in 1997;
(b) Discounting a productivity factor (for the Balassa-Samuelson effect) in addition to foreign inflation in adjusting the band's center;
(c) Changing (increasing) the foreign inflation definition; and
(d) Moving from a dollar reference to a basket of currencies reference (the dollar, the yen and the mark).

All these measures signaled the increasing difficulty of leaning against the trend towards an appreciated peso, and that the nominal exchange rate band increasingly became a second-order objective to the Central Bank, which concentrated its efforts on inflation reduction. Conflicts between the exchange rate band and inflation targets were always solved in favor of the latter[6].

This elastic use of the exchange rate band was accompanied by two other complementary policies that attempted to reduce the peso appreciation. First, the imposition of regulations to capital inflows, the most important one being an unremunerated reserve requirement (URR) of 30% for the first year of stay of foreign loans and money raised in international financial markets[7]. Second, the sterilized accumulation of foreign exchange reserves. Reserves were 18 billion dollars right before the Asian crisis, up from the 3 billions they were in 1990[8].

As it could be expected, this unorthodox policy mix brought costs and benefits. Among the benefits, we could cite the smoothing out of the real peso appreciation that otherwise could have been more intense and drastic, bringing higher real costs in a context of imperfect

[5] Délano and Valdés (1998) estimated the appreciation of the equilibrium real exchange rate associated to this effect in close to 1% per year.
[6] Some authors have argued that exchange rate appreciation, not direct monetary policy, was the instrument used to reduce inflation (Calvo and Mendoza, 1998).
[7] Reduced to 0 in September of 1998 and eliminated in April 2001.
[8] Note that the effect of these measures on inflation were ambigous. On one hand, trying to reduce the peso appreciation coming from heavy capital inflows favored *less* disinflation through the exchange rate – price of imports – price level transmission channel. On other hand, the intended reduction of capital inflows was also meant to contain a source of stimulus to domestic spending, meaning *more rapid* disinflation.

adjustment of prices. The policy mix's costs of the policy were essentially of a microeconomic nature, like a misallocation of financial resources and less access to cheaper foreign financing. Whether or not more autonomy of the monetary policy could be ascribed to this rather unorthodox policy mix is more debatable, however. But, in any event, as inflation was consistently reduced while the economy was kept growing at a speedy pace, the policy mix found more defenders than detractors.[9]

While foreign exchange reserve accumulation and restrictions to capital inflows made somewhat sense in preventing a rapid appreciation of the peso, a frequently amended exchange rate band was an increasingly weak instrument, since the Central Bank's commitment in defending its limits was at least doubtful[10]. However, the dominant view within the government well until 1999 was that even a discredited crawling exchange rate band was instrumental to signal a long term commitment to a certain value of the real exchange rate. And, this line of argument follows, this commitment was key to keep the steam in the exports sector, the "engine of growth" in a small open economy. However, and besides a certain degree of short-run management, time would show what economic sense would have suggested from the start: managing a real variable (as the real exchange rate) by resorting to a nominal instrument is not a sustainable policy. The exchange rate band could not prevent a 50% real peso appreciation between January 1990 and December 1997.

II.2 The 1997-98 World Turbulence and the Reform of Macroeconomic Policies

The Asian crisis and its aftermath (including the Russian moratorium, the LTCM episode, and the fall of the Brazilian currency, the real) had a severe effect on Chile's small open economy. Indeed, terms of trade went down by 14% between 1997 and 1999 while the volume of exports to Asia, which accounts for one third of Chile's total exports, declined by 23% in the same period. Simultaneously, spreads on private corporate debt went from a little bit over 100 basic points (over prime US rates) in 1997 to more than 450 basic points in August 1998, a consequence of financial turbulence abroad and of a current account deficit which approached 8% of GDP. The latter was, in turn, a result of an overheated domestic economy and the trade effects of the Asian crisis.

At first, in early 1998, the main fear of the Central Bank was that the rapid peso depreciation in progress placed a serious threat to the year's inflation target[11]. This concern was

[9] The optimality of the selected policy mix is debatable. Taylor (2001) analyzes the role of a real exchange rate target included in a policy reaction function that also includes inflation and the output gap as arguments. Simulations lead to a result that has also been found in previous studies: the gain (in terms of macroeconomic performance) of including the real exchange in the response function is, at best, small, and most of the times negative. His argumentation for this result is the existence of an indirect effect of exchange rates on interest rates (a combination of rational expectations and inertia). This makes (an implicit) reaction function superior to the explicit inclusion of the RER in the reaction function, because leads to fewer and less erratic fluctuations in the interest rates.

[10] One of the benefits of the exchange rate band vis-a-vis a flexible exchange rate arrangement was, according to Krugman (1988), a reduction in exchange rate volatility. However, this is true only if the band is a credible device.

[11] There were also some fears regarding the balance sheet effects of violent depreciation, due to the uncovered currency mismatch caused by seven years of sustained real appreciation.

based on the high pass-through from the peso depreciation to domestic inflation when the local demand was growing at annual rates of over 12%, estimated then at around 0.6. So, the depreciating pressures were confronted with a combination of open intervention in the foreign exchange market and increases in the monetary policy interest rates. It must be noted that the exchange rate band was 25% wide (12.5% to each side of the center) and that the actual exchange rate was in the lower bound[12] of the band. Thus, the band's upper limit was clearly not binding. By June 1998, the exchange rate was still 3.5% below the center of the band, in spite of a 10.8% depreciation since October of 1997.

In a very controversial move, the Central Bank decided by the end of June 1998 to narrow the band width, from the prevailing 25% to 5.5%, 3.0% above the center and 2.5% below it. It was a risky choice, as the Central Bank committed itself to a target that, if not credible, would result in more intense speculation from agents expecting the band to be broken. On the other hand, the narrowing of the band was, precisely, an attempt to enhance credibility, highlighting the concern of the Central Bank in defending the peso from violent depreciation, which could put at risk the anti-inflationary reputation that had been carefully crafted during a decade.

Thus, the monetary authority reassured its commitment to the year's end inflation target. Although the slope of the daily crawling of the band's center was made somewhat steeper, the main purpose of this decision was to signal the market more clearly the range of exchange rate values the Central Bank considered consistent with its inflation target. About US$ 3.3 billion had been already used to moderate the peso depreciation (close to 18% of total initial reserves) before this move and there was the presumption that too much speculation surrounded the very discretionary intervention policy of the Central Bank within the ample 25% band. So it was hoped that the mere signaling contained in the narrower band would bring less speculation and thus less intervention.

The risk was that a narrow band could be very costly to defend in the face of a new negative shock coming from world financial markets. Unfortunately, such a negative shock did occur: the Russian government declared a moratorium on the service of its debt and the whole world financial market trembled, severely affecting the availability and cost of external financing to emerging economies, Chile included[13]. This time, the Central Bank did not use foreign exchange reserves, but rather defended the peso by allowing interest rates to take the burden[14]. As a result, market interest rates skyrocketed and exhibited high volatility. Under this agitation, on September 16 a new change to the band partially reversed the previous narrowing by increasing its width to 7%. A program of gradual widening in the coming months until reaching 10% by the year's end was also announced. At the same time the band's center parameters were also modified in order to make room for a slightly faster depreciation of the peso. To safeguard this decision, the overnight interest rate was reinstated as the main

[12]We are measuring the exchange rate as number of Ch pesos per US dollar, so a depreciation of the peso means an increase in the exchange rate.

[13] The narrowing of the exchange rate band could be also criticized on credibility accounts. It was questionable at the time the Central Bank's true commitment to an exchange rate device that was before hand on its way out. At the very least, it could have been perceived as a very transitory commitment, as it really was ex-post.

[14] As it was the case earlier in 1998 (January), the usual use of the overnight, interbank interest rate as the policy instrument (or operative target) was temporarily suspended and replaced by a sort of monetary aggregate (liquidity) instrument. This procedure lasted for a couple pf months, until mid-September.

instrument of monetary policy and its value was drastically increased (from 8.5 to 14%)[15]. Beyond the management of instruments, all along the main purpose of the Central Bank was to reduce private sector aggregate spending in order to confront a huge current account deficit that was being built, because this objective was paramount to prevent a balance of payments crisis and a much more severe run on the peso.[16]

The tough monetary policy was then gradually but decisively relaxed in the following twelve months, as evidence indicated that the economy was heading for recession and that the peso depreciation posed no significant inflationary pressures. As the world financial turmoil receded, the hawkish Central Bank's position was apparently successful in calming down the foreign exchange market at home and was definitely successful in containing growth of private spending, keeping inflation close to the target, and averting an uncontrolled current account deficit. The exchange rate band's width, meanwhile, continue steadily increasing. The gradual shift towards exchange rate flexibility was accompanied by several measures that set the general framework for the new regime: implementation of regulations regarding currency mismatches, liberalization of derivatives markets, and liberalization of capital inflows.

Why was the band abandoned? Several reasons can be mentioned. First, after reaching an inflation rate around 3% annual in 1999, a level considered appropriate by the Central Bank as a long term benchmark, the prevailing inflation targeting scheme was modified in order to accommodate that, from then on, the goal was to keep inflation low and stable, rather than reducing it year after year. A longer policy horizon (8 quarters) and increasing transparency were also ingredients in what was called a "new macroeconomic policy", the second phase of the inflation targeting regime[17]. As part of this upgrade in the inflation targeting scheme, a free floating system was seen as much more consistent and immune to conflicts with inflation targets than an exchange rate band. Besides, the pass-through coefficient had proved to be much smaller in the 1998-99 experience that previously thought, so fluctuations in the exchange rate were seen as having a lesser impact on inflation.

A parallel development, consistent with the new environment of higher exchange rate flexibility, was the rapid development of the foreign exchange derivatives and hedging instruments market. The existence of a well-developed financial system, which offers an adequate array of instruments, is required to minimize some possible costs of exchange rate flexibility. However, and as discussed by Fernández (2001), Chile's derivatives market is still underdeveloped for international standards, even when compared with neighbor markets as the ones in Argentina, Brazil, and Mexico. Market access to medium and small firms is still limited. Despite this caveat, the existence of this market is certainly an improvement over the situation prevailing until the mid 1990s. The private sector has become much more ready to undertake exchange rate risks than in the recent past.[18]

[15] This implied in practice that market interest rates at all maturities fell rather than increased, although remained a very high levels.
[16] For more details, see Morandé (2001).
[17] See Morandé (2001) and Central Bank of Chile (2000).
[18] As described earlier, the Central Bank and the Superintendency of Banks also introduced in 1999 a number of modifications that facilitate these operations.

In general, it is fair to say that the new conditions faced by the Chilean economy since 1998 suggested that the prevailing policy mix needed an overhaul. The old policy mix was designed to combine a steady but persistent reduction of inflation at a low cost (meaning the keeping of growth around potential without a huge peso appreciation), in a context of high capital inflows and positive but declining fiscal surpluses. As the mix was successful on its two main parameters (inflation and growth), the microeconomic costs and distortions of unorthodox instruments (like the URR and the exchange rate band), as well as actual or potential conflicts between policy goals, were seen as of secondary importance. The new policy mix, including the floating regime, re-focuses objectives and instruments in a more coherent and transparent way, such that it can fit different and opposing conditions in the international front, like changes in terms of trade and swift variations in foreign investors' mood.

Adopting a floating exchange regime was not only consistent with the inflation targeting framework as it eliminated a second target that could collide with the Central Bank's main objective. It was also in harmony with the intention of relying more on the market, increasing transparency and available information and eliminating restrictions on domestic and external financial operations.

A second reason is more in the political economy realm. The exchange rate is a price that determines many prices, and its behavior will almost invariably upset some pressure group. Thus, any shift in the existing regime could have generated significant opposition from the group that considered itself protected by the *status quo*, unless the new regime appeared harmless to them. The staunchest supporters of the exchange rate band, within and outside the government, based this support on the need to keep a real exchange rate that facilitated the international competitiveness of domestic production and exports. In a sense, the policy of trying to keep a rather depreciated peso (or at least not highly appreciated) substituted for other forms of industrial policies of "picking the winners". This proposition was formulated when the trend was clearly in the appreciating side and the government felt that the Central Bank's interest in reaching the inflation targets and in reducing inflation could have inclined it to pursue policies that prompted a more appreciated peso. Therefore, as the peso actually depreciated in 1998 and 1999 following the external turmoil and the Central Bank changed its commitment from reducing inflation to keep it around the current 3% annual target permanently, the government's fears were reduced and thus the opposition to abandoning the band dismissed.[19]

This line of argument also explains, in part, why it took so long to give up the band. On the other hand, not establishing a free floating before, say in 1998, was a matter of opportunity. At any time during 1998, especially during the episodes of attacks on the peso, abandoning the band could have implied an exchange rate overreaction. This could have had real effects because of the underdeveloped state of hedging mechanisms to cover exchange rate risks [20], and the existence of uncovered currency mismatches in dollar denominated liabilities, stimulated by the long period of peso appreciation.[21]

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[19] Until now, the exchange rate has consistently devalued, in line with the hopes and interests of the supporters of the "depreciated" real exchange rate. Their reaction to possible appreciation in the future is yet to be seen.

[20] There was "fear of floating", in Calvo and Reinhart (2000) words.

[21] This of course, does not mean that a free floating could have been tried *before* 1998, if properly implemented.

Finally, the Asian crisis grossly discredited mixed exchange regimes the world over, among academicians, policy makers, and market participants alike. Thus, abandoning the exchange rate band was also coherent with developments in the rest of the world.

Although free floating was kind of a natural evolution, there were a few voices – more abroad than inside – that asked why not replacing the band with a currency board or why not give up the national currency. A lengthy analysis of the issue is presented in Morandé and Schmidt-Hebbel (2001), who evaluate the costs and benefits of a monetary union between Chile and some prospective currency partners. They include Brazil and Argentina (monetary union with Mercosur), Mexico (monetary union with NAFTA), the United States (NAFTA and dollarization) and Germany (monetary union with the European Union). Their results suggest that, given low correlation in macroeconomic variables, high terms of trade volatility, high diversification in trading partners and relatively inflexible prices, the adoption of a foreign currency is not an adequate choice for Chile for the time bein

III. How has the floating regime worked so far?

As we have previously mentioned, the discussion of exchange rate regimes has been particularly intense in previous years. A series of arguments have been stated against the use of flexible exchange rate regimes. In a very well-known paper[22], Guillermo Calvo and Carmen Reinhart describe the "fear of floating" felt by policy makers in Latin America that inhibit the implementation of clean floating exchange rate regimes in actuality (that is, beyond words). Three reasons could be cited for this fear: (a) the real and financial effects of "excessive" volatility; (b) balance sheet effects of sharp movements in the exchange rate (particularly a depreciation); and (c) a high pass-through from a depreciation of the local currency to inflation. Has Chile experienced fear of floating? How is the current clean floating scheme in Chile rating in the three accounts that would justify this fear? Chile's experience with a free-floating regime is still short lived. However, we already have 2 years of evidence under a free float and "normal" international conditions, plus half a year of more uncertain global conditions (after the 9/11 attacks). This period of time, although not long enough for conclusive results, provides anyway some very suggestive data. Our analysis presents two sub-periods for the free-floating experience: the first one ranges from September 1999 to August 2001, thus excluding the outburst in international volatility in September 2001. The second runs from that date until January of 2002. It is important to notice that during the two years of the first sub-period, Chile's exchange rate was a textbook case of free floating, as the Central Bank never intervened the market. Consequently, the exchange rate provided the macroeconomic flexibility needed to face of adverse shocks, allowing in practice a significant real peso depreciation. This adjustment in the real exchange rate has been justified[23] by the adverse terms of trade shocks experienced after the Asian crisis (in 1999) and during 2001, and the lack of risk appetite on the part of foreign investors since 1998.

The second sub-period includes the effects of the international turmoil brought by the September 11 events. During this time-span, the "purity" of Chile's floating regime experienced some changes. Severe turmoil in a context of widespread uncertainty regarding the situation of Argentina (during June, July and August 2001) and, later, the world-wide panic brought by the

[22] Calvo and Reinhart (2000).
[23] At least in a significant share.

terrorist attacks on the U.S, led to direct intervention by the Central Bank. This intervention, however, differed from previous experiences in its transparency and also in its underlying purposes. The Central Bank explicitly stated back in September 1999, when the new regime was adopted, that it maintained the right to intervene the market under exceptional circumstances. The Central Bank Board understood that the Chilean economy experienced those exceptional circumstances in mid-2001: a scenario that combined the regional turbulence brought by Argentina's uncertain outcome with the global impact of the terrorist strike in New York was anything but normal. Moreover, the intervention was not aimed to a specific exchange rate target value. Intervention was publicly announced, with an explicit assessment of the resources and time length involved in the process[24], as well as of the justification for the decision. The Board stated that intervention would be stopped as of December 31st, 2001, and so it happened. As presented later, this episode of recent intervention, and the way it proceeded, has not changed the main features of Chile's floating experience.

III.1 Fear of Floating

The difference between formal exchange rate regimes and exchange regimes in practice has been highlighted, among others, by Levy-Yeyati and Sturzenegger (2000) and by Calvo and Reinhart (2000). Thus, the announcement of exchange rate flexibility in September 1999 could have been just a formal announcement with no support in practice.

Intervention in the exchange rate market must not only be analyzed by the behavior of foreign reserves. Observing the volatility of the exchange rate and reserves to account for the commitment to exchange rate flexibility is complex, as one should control for at least 2 elements. First, the type and intensity of shocks faced by the exchange rate market. Second, the use of alternative instruments besides direct reserve intervention, such as the interest rate. Following Hernández and Montiel (2001), we assume that shocks consist only on credibility problems and that their variance is constant over time and between countries. Under this scenario, a shock in a flexible exchange rate regime should affect the volatility of the exchange rate and the interest rate, not affecting reserves. If the authority wants to reduce exchange rate volatility, it faces a tradeoff involving the volatility of reserves and interest rates. This lead Calvo and Reinhart (2000) to compare countries according to the volatility of exchange rates, interest rates and reserves. Countries who exhibit relatively more exchange rate volatility and less interest rate and reserves volatility should be considered as having relatively more flexible regimes. Table 1 shows the volatility of reserves, the exchange rate and interest rates through time. An increase in exchange rate volatility is seen, specially after the sample is extended up to January 2002, as well as a consistent reduction in the volatility of reserves and nominal interest rates. This is consistent with moving towards greater exchange rate flexibility, as well as general macroeconomic stabilization. One caveat applies. For the particular case of Chile, looking at nominal interest rates can be misleading, as monetary policy was conducted (until August 2001) through inflation-adjusted interest rates. Thus, nominal rates (defined ex post) captured the whole volatility of monthly variations in inflation, unlike other countries in which real interest

[24] The Central Bank announced the sterilized issuance of US$-denominated debt, for a maximum amount of US$ 2 billion. (= 3% of GDP), as well as direct sterilized intervention, for a maximum amount of US$ 2 billion. Although the Central Bank has publicly announced the intervention days (during the same day, after intevention has been made) no official information is given of the exact intraday timing or the reserves involved in each intervention.

rates carried the burden. Chile's interest rate volatility is probably misrepresented if nominal rates are used. Thus, we also introduce real interest rates in our analysis. We see that real interest rate volatility is extremely low, and (despite the 1998-1999 period) it has decreased in time[25].

Calvo and Reinhart define a benchmark of countries characterized as "pure floaters" and compare their behavior with the one observed in the country under analysis. One of their experiments consists in calculating monthly fluctuations in exchange rates, reserves and interest rates, and analyzing the percentage of changes that lie within a narrow band. The greater the share of exchange rate variations lying inside this band, the less pure is the country's float. Table 2 compares monthly exchange rate, interest rate and reserves variations in Chile in different periods with the benchmark defined by Japan and the US, considered as "pure floaters" by Calvo and Reinhart.

Table 1
Statistical Properties of Exchange Rate Changes, Nominal Interest Rates and Reserves Changes

Mean Absolute Values of Monthly Changes

	Reserves	Exchange Rate	90-Day Nominal Interest Rate	90-Day Real Interest Rate
February 1988- January 2002	2.93%	1.23%	4.85%	0.20%
January 1990- January 2002	2.51%	1.23%	4.65%	0.21%
January 1990-December 1994	3.11%	1.11%	7.53%	0.13%
January 1995-August 1999	2.35%	1.19%	2.70%	0.31%
September 1999 -August 2001	1.23%	1.69%	1.67%	0.14%
September 1999 -January 2002	1.02%	1.98%	1.48%	0.17%

Standard Deviation of Monthly Changes

	Reserves	Exchange Rate	90-Day Nominal Interest Rate	90-Day Real Interest Rate
February 1988- January 2002	2.82%	1.31%	4.66%	0.46%
January 1990- January 2002	2.41%	1.32%	4.45%	0.49%
January 1990-December 1994	3.36%	1.49%	10.02%	0.30%
January 1995-August 1999	3.26%	1.60%	3.58%	0.70%
September 1999 -August 2001	1.52%	2.14%	2.19%	0.25%
September 1999 -January 2002	1.39%	2.28%	1.99%	0.28%

Source: Authors' calculations based on information from the Central Bank of Chile

[25] Due to the change in the monetary policy instrument after August 2001, real interest rate volatility increases when including data up to January 2002. This expected result does not alter the conclusion.

For the case of the exchange rate, +/- 1% and +/- 2.5 % bands are defined. Increased flexibility in the exchange rate is reflected in the consistent decrease of the share of variations lying between the 1% band, from 56% in the first half of the 1990s, 50% in the second and 25% after the adoption of the floating regime. This value is consistent with statistics in the US and Japan. Regarding the 2.5% threshold, the trend is similar, although the figures for the float period are very similar to the ones observed for 1995-1999. This indicates that, although the exchange has become more volatile, the main difference with earlier periods is an increase in relatively small monthly fluctuations (this is, between 1% and 2.5%), without a significant increase in the share of more extreme fluctuations (above 2.5%).

The number of observations lying within the +/- 2.5 % band is higher in Chile than in the US or Japan. However, and as variations below 1% in Chile have been less frequent than in Japan or the US, there is no evidence of the "fear of floating" announced by Calvo and Reinhart. A similar result applies to reserves. Chile's reserves have been more stable after 1999, even more stable than the values observed in Japan and the US for the case of the 2.5% band. The picture is different regarding (nominal) interest rates. According to Calvo and Reinhart, interest volatility could be caused by credibility-shocks (operating through the uncovered interest parity) and by Central bank intervention through interest rates. Nominal interest rates are obviously more volatile in Chile than in the US, although a clear trend towards stabilization (as a result of inflation reduction) is seen. A look at real policy rates shows that their behavior is very similar to the one observed in United States and Japan. Thus, after 1999, Chile's regime is classified as a "pure float". What has happened after September 2001? Although Chile's regime has explicitly ceased to be a "pure float", the main results of the exercise do not vary, and the behavior of the exchange rate, reserves and interest rates remains comparable to the ones observed in "pure floaters".

Table 2
Fear to Float

		Absolute Monthly Fluctuation in Exchange Rate	
		1% threshold	**2.5% threshold**
US/DM		**26.80%**	**58.70%**
US/Japan		**33.80%**	**61.20%**
Chile	February 1988- August 2001	51.53%	86.50%
	January 1990-August 2001	48.68%	78.95%
	January 1990-December 1994	56.67%	93.33%
	January 1995-August 1999	50.00%	69.12%
	September 1999 -August 2001	25.00%	70.83%
	September 1999 - January 2002	24.14%	65.52%

		Absolute Monthly Fluctuation in Reserves	
		1% threshold	**2.5% threshold**
US		**26.8%**	**62.2%**
Japan		**44.8%**	**74.3%**
Chile	February 1988- August 2001	31.3%	60.1%
	January 1990-August 2001	32.2%	59.9%
	January 1990-December 1994	23.3%	58.3%
	January 1995-August 1999	33.8%	50.0%
	September 1999 -August 2001	50.0%	91.7%
	September 1999 -January 2002	58.6%	93.1%

		Monthly Nominal Interest Rate Volatility			
		<25	**<50**	**>400**	**>500**
US		**59.7%**	**80.7%**	**0.3%**	**0.3%**
Japan		**67.9%**	**86.4%**	**0.0%**	**0.0%**
Chile	February 1988- May 2001	3.68%	12.88%	43.56%	36.20%
	January 1990-May 2001	3.95%	13.16%	38.16%	30.92%
	January 1990-December 1994	3.33%	5.00%	70.00%	60.00%
	January 1995-August 1999	4.41%	17.65%	22.06%	14.71%
	September 1999 - August 2001	4.17%	20.83%	4.17%	4.17%
	September 1999 - January 2002	13.79%	34.48%	3.45%	3.45%
		Monthly Real Interest Rate Volatility			
		<25	**<50**	**>400**	**>500**
US		**59.7%**	**80.7%**	**0.3%**	**0.3%**
Japan		**67.9%**	**86.4%**	**0.0%**	**0.0%**
Chile	February 1988- May 2001	76.19%	90.48%	0.00%	0.00%
	January 1990-May 2001	75.17%	88.97%	0.00%	0.00%
	January 1990-December 1994	76.67%	95.00%	0.00%	0.00%
	January 1995-August 1999	71.43%	80.36%	0.00%	0.00%
	September 1999 - August 2001	87.50%	91.67%	0.00%	0.00%
	September 1999 - January 2002	79.31%	93.10%	0.00%	0.00%

Source: Authors' calculations based on information from the Central Bank of Chile

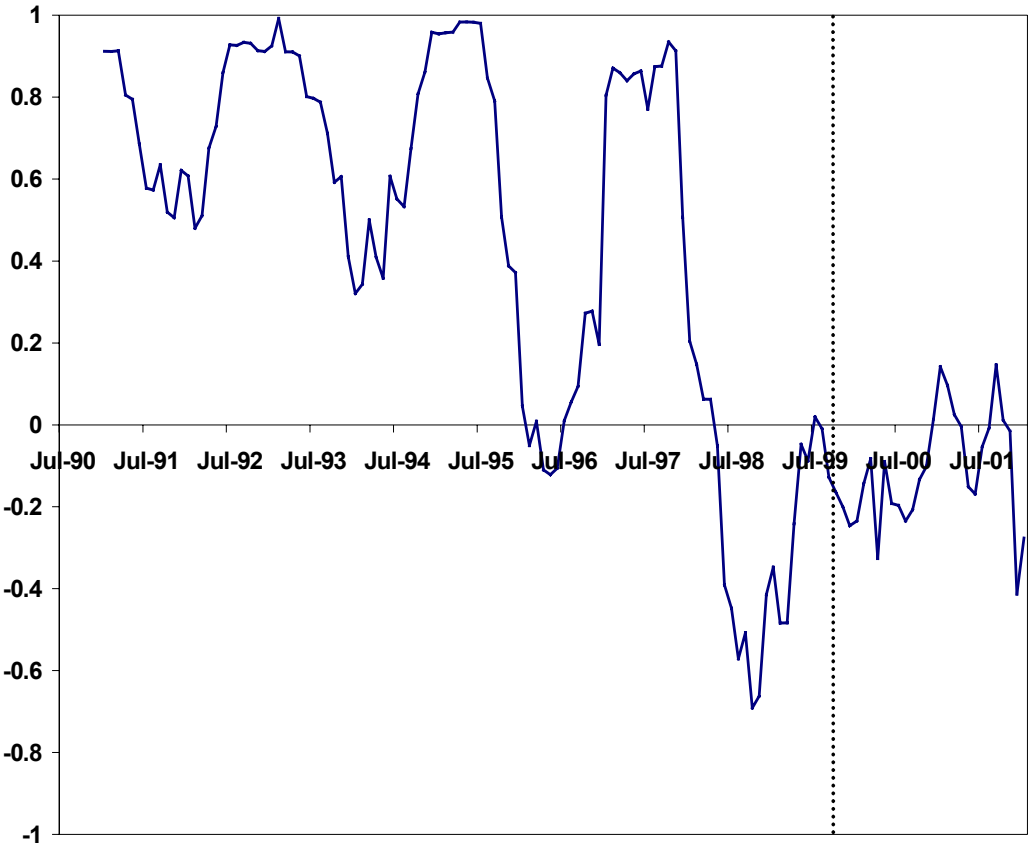
An extension of Calvo and Reinhart's analysis is made by Bofinger and Wollmershaeuser (2001), who directly assess the purpose underlying exchange rate intervention through international reserves. Intervention may be targeted to smooth out short-term fluctuations over an exogenous trend that is freely determined by the market. Alternatively, intervention may be aimed to force the exchange rate to follow a selected trend. To allow for this distinction, the authors define an index of floating, which is calculated as:

$$I_t^{FLOAT} = \frac{S_t^{eff}}{S_t^{abs}},$$

where $S_t^{eff} = \sum_{i=0}^{n}\left(\frac{\text{Re}serves_{t-i} - \text{Re}serves_{t-i-1}}{\text{Re}serves_{t-n-1}}\right)$ is the sum of effective reserves changes as % of initial reserves over a given time window, and $S_t^{abs} = \sum_{i=0}^{n}\left(\frac{\left|\text{Re}serves_{t-i} - \text{Re}serves_{t-i-1}\right|}{\text{Re}serves_{t-n-1}}\right)$ is the sum of absolute changes over the same period. Although this index is flawed as it measures the degree of exchange rate intervention only by looking at the behavior of reserves[26], it allows them to derive a variable bounded between -1 and 1, which controls for the change in the level of reserves over the analyzed period. If the index is zero, the net change in the level of exchange rate reserves is small; this suggests that the country only intervenes to smooth around the exogenous trend. This is is consistent with the IMF's definition of "independent floating". If the value is close to one, the central bank is actively accumulating or losing reserves, which can be interpreted as an attempt to influence the exchange rate's trend. This is the IMF's "managed floating" classification. Figure 2 depicts this indicator for the case of Chile, calculated using 6-month windows.

[26] Thus omitting interest rates.

Figure 2
Floating Regime Index: Chile



Source: Authors' calculations based on definition by Bofinger and Wollmershaeuser (2001).

During most of the decade, the index is close to one, reflecting substantial reserve accumulation and the fact that the Central Bank leaned against the appreciation trend. The index approaches –1 during the 1998-1999 crisis episode, as the Central Bank intervened to prevent violent depreciation. Thus, the Central Bank of Chile's regime was a "managed float" for most of the decade, as reserves were not only used to reduce exchange rate variation (in which case, they should be volatile but exhibit no specific tendency) but rather to stand against the market trend. After September 1999, the index is close to zero, even if data after August 2001 is included. This reflects both the lack of intervention during almost two years, and the fact that intervention after September 2001 has not targeted a specific value for the exchange rate.

The point is confirmed when looking at the correlations between the variation of reserves and the exchange rate movement. The total correlation of the 2 variables between January 1988 and January 2002 is a significant –0.19, indicating that the Central Bank gained reserves when the exchange rate appreciated and lost then when the peso depreciated. Between August 1991 and August 1999, a period of significant capital inflows and where the inflation-targeting regime was adopted, correlation grows to –0.31, indicating a significant increase in intervention by the Central Bank in the exchange rate market. During the "Asian crisis" period (August 1997 to August 1999) correlation grows to –0.62. However, once exchange rate flexibility is adopted in September 1999, figures change dramatically: correlation between international reserves and the

exchange rate is a non-significant 0.01 for the period September 1999-August 2001, and remains non-significant at –0.02 if the sample is extended to January 2002.

One final issue regards our implicit assumption of shocks whose volatility is constant over time. Periods can differ in their aggregate volatility, thus making our comparison of absolute volatilities non-valid to assess the relative behavior of variables. We compute an index of market pressures (as defined by Girton and Roper 1977), which is a weighted average[27] of monthly changes in the three analyzed variables. This indicator, which is not reported for brevity, suggests that market pressures have remained fairly stable throughout the decade, with the exception of specific episodes. This conclusion is maintained with nominal and real interest rates. An analysis of the mean and standard deviation confirms this result, with some evidence of an increase in its stability since the mid 90s. Our assumption of shocks with constant volatility over time appears to be reasonable, and thus our conclusions are valid. The index also highlights the fact that recent events have, unlike the past, only impacted the exchange rate. As reserves and interest rates have remained stable and have not been used to actively impact the exchange rate, aggregate macroeconomic volatility has not risen.

In conclusion, Chile, which during more than a decade followed a policy of managed float with active exchange rate intervention, has not exhibited significant "fear of floating" after September 1999. There was absolutely no intervention for almost two years and interest rates have not reacted to exchange market developments. Although temporary intervention in the exchange rate market after August 2001 prevents from qualifying Chile as an strict pure floater, the characteristics of the regime are statistically similar to those of countries as the United States, that are generally classified as clean floaters. Besides, as explicitly anticipated when implemented, the intervention policy was stopped at the end of 2001.

What explains this behavior? Why has Chile maintained exchange rate flexibility, despite the possible sources of "fear" associated with this regime? We here analyze the behavior, under the regime of exchange rate flexibility, of the three main sources of "fear of floating": (i) the level of passthrough to domestic prices, (ii) excessive exchange rate volatility and (iii) balance sheet effects.

III.2 Pass-through:

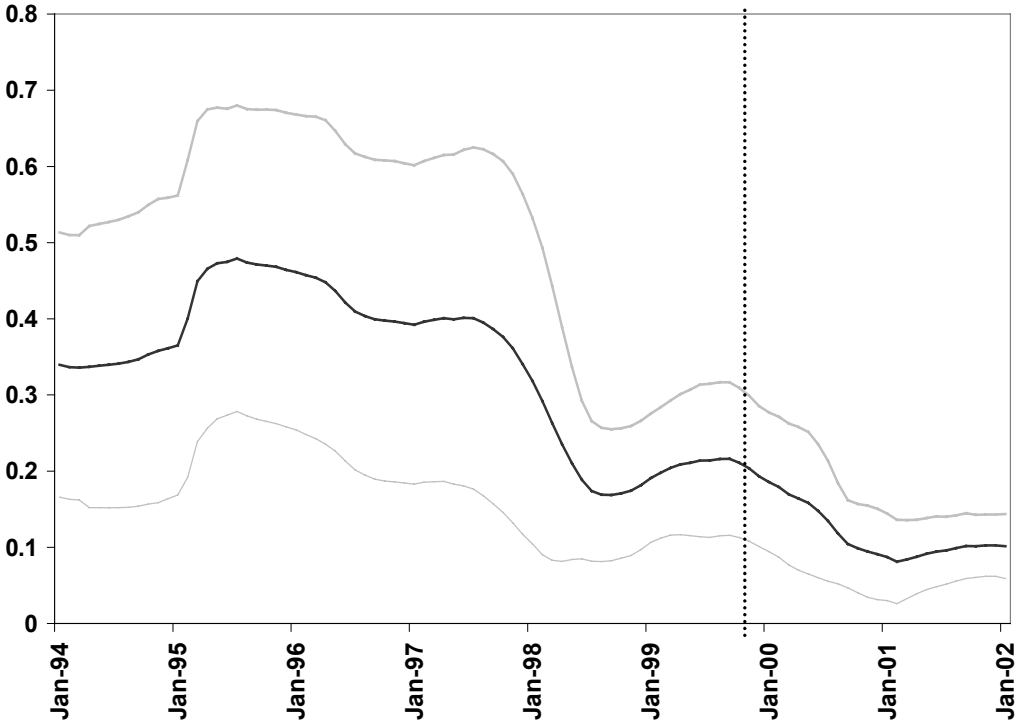
As established before, one of the theoretical benefits of pegging the exchange rate is diminishing inflation. That is akin to say that changes in the exchange rate have a mechanical counterpart in domestic price variations.[28] However, international experience, especially during the 1990s, has showed that the impact of devaluations over inflation has been low. De Gregorio (2001) reports the small effect over inflation of significant nominal devaluations in some European countries in the early 1990s, as well as Australia and New Zealand during the Asian crisis.

[27] The weights are inversely proportional to relative variances, so each of the three components contributes the same amount of volatility.
[28] At least for the price of tradable goods.

Specifically dealing with the case of Chile, Figure 3 presents an estimation of the passthrough from changes in the exchange rate to domestic inflation for an 8 year-rolling sample starting in January 1994. This moving estimator is obtained by a simple linear regression between annual CPI inflation and annual exchange rate depreciation, with 8-year windows, as described by equation 1.

$$(1) \qquad \pi_{t,\,t+12} = \alpha + \beta_1 \hat{e}_{t-1,\,t-1+12} + \beta_2 t \,,$$

Figure 3
Exchange Rate Passthrough to CPI Inflation



Source: Authors' calculations.

What comes clear from this figure is that the passthrough coefficient exhibits a decreasing trend since 1998, reached its lowest level in the sample in December 2000, and has only marginally changed ever since. As a reference, the value of this coefficient was estimated at between 0.4 (when the economy was slowing down) and 0.6 (when the economy was booming) in early 1998, based on a sample starting in 1986.

A more rigorous exercise, which confirms the result of the simple regression, can be done using a formal price equation. We follow McCarthy (2000), who develops a simple model of pricing along a distribution chain in the spirit of Blanchard (1983), Morandé (1986), and Clark (1999). Inflation is thus defined at two stages- wholesale and consumer. In each level, inflation at t can be explained by its expected component (with information available until t –1), domestic supply and demand shocks, exchange rate shocks, shocks at the chain's previous stages and idiosyncratic shocks.

$$\pi_t^{wpi} = E_{t-1}(\pi_t^{wpi}) + \beta_1 \varepsilon_t^s + \beta_2 \varepsilon_t^d + \beta_3 \varepsilon_t^e + \varepsilon_t^{wpi} \quad (2)$$

$$\pi_t^{cpi} = E_{t-1}(\pi_t^{cpi}) + \delta_1 \varepsilon_t^s + \delta_2 \varepsilon_t^d + \delta_3 \varepsilon_t^e + \delta_4 \varepsilon_t^{wpi} + \varepsilon_t^{cpi}, \quad (3)$$

where π_t^{wpi} is wholesale inflation, π_t^{cpi} is consumer inflation and ε_t^s are different types of shocks (s= supply shocks, d= demand shocks, e = nominal exchange rate shocks, wpi = wholesale shocks, cpi= consumer shocks).

The price determination structure of the model is fitted to fall within a recursive VAR framework. To complete the model for estimation, one must identify supply, demand and exchange rate shocks. Supply shocks are here proxied by the behavior of the terms of trade, the VARs most exogenous variable. Demand shocks are obtained from the output gap dynamics, after controlling for the impact of terms of trade. Exchange rate shocks are obtained from an exchange rate equation, after accounting for the effect of demand and supply shocks.[29]

$$\pi_t^{TOT} = E_{t-1}(\pi_t^{TOT}) + \varepsilon_t^s \quad (4)$$

$$y_t^{gap} = E_{t-1}(y_t^{gap}) + \phi_1 \varepsilon_t^s + \varepsilon_t^d \quad (5)$$

$$der_t = E_{t-1}(der_t) + \varphi_1 \varepsilon_t^s + \varphi_2 \varepsilon_t^d + \varepsilon_t^e \quad (6)$$

π_t^{TOT} is terms of trade growth, y_t^{gap} is the output gap and der_t is real exchange depreciation. The model is closed with the inclusion of a policy reaction function, which reflects the effect of inflation and the above-mentioned shocks over policy interest rates[30]. Finally, a money demand equation is included, leaving money as the VARs most endogenous variable.

$$i_t = E_{t-1}(i_t) + \kappa_1 \varepsilon_t^s + \kappa_2 \varepsilon_t^d + \kappa_3 \varepsilon_t^e + \kappa_4 \varepsilon_t^{wpi} + \kappa_5 \varepsilon_t^{cpi} + \varepsilon_t^i \quad (7)$$

$$\Delta m_t = E_{t-1}(\Delta m_t) + \lambda_1 \varepsilon_t^s + \lambda_2 \varepsilon_t^d + \lambda_3 \varepsilon_t^e + \lambda_4 \varepsilon_t^{wpi} + \lambda_5 \varepsilon_t^{cpi} + \lambda_6 \varepsilon_t^i + \varepsilon_t^m \quad (8)$$

i_t is the Central Bank of Chile policy rate and Δm_t is the change in the logarithm of money balances.

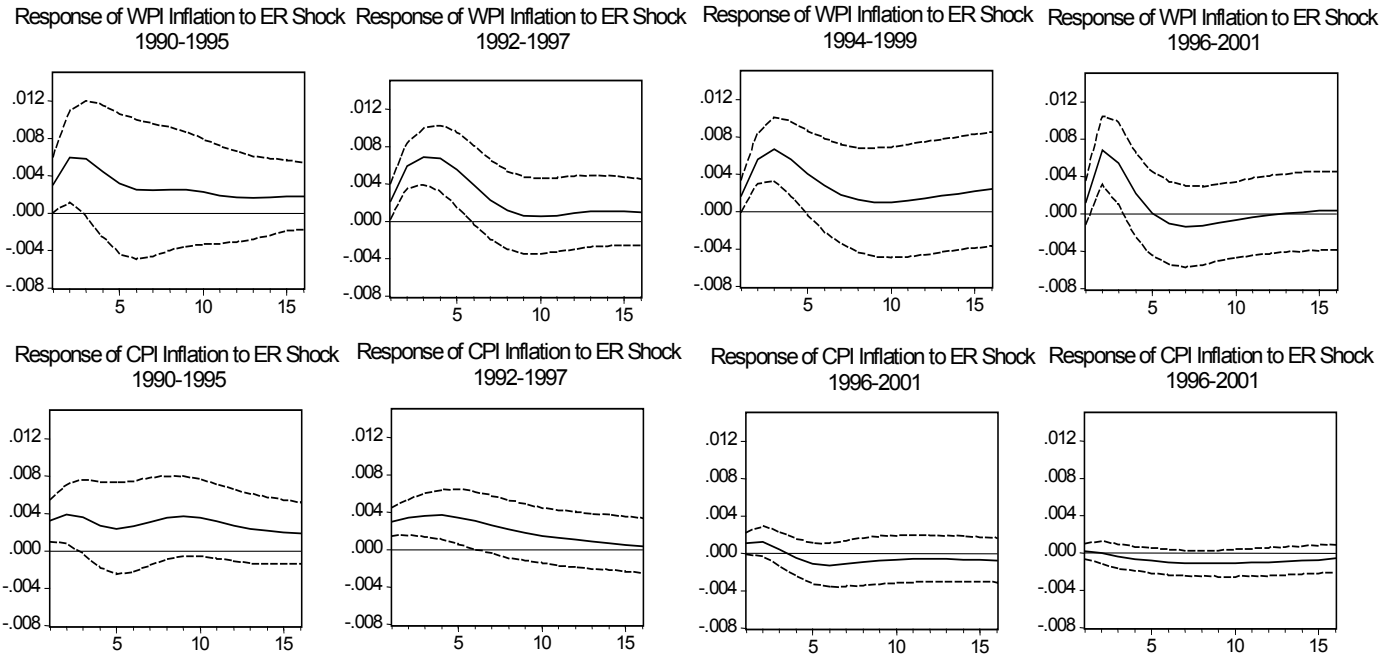
[29] This is consistent with the fact that the empirical relationship between the exchange rate and macroeconomic fundamentals is vague.

[30] This assumption is debatable, both in terms of the determinants of the monetary rate and the lag with which it affects the VARs remaining variables. Results, however, are robust to the ordering of the monetary policy variable inside the VAR.

The model is estimated as a VAR using the Cholesky descomposition, after assuming that conditional expectations can be expressed as linear projections of the variables' lags. This allows to estimate the effect of an exchange rate shock on inflation at both wholesale and consumer levels.

The sample for the VAR system ranges from January 1990 to November 2001. Following the Schwartz information criteria, 2 lags are included. The following variables are included, from most exogenous to most endogenous: variation of the terms of trade obtained from Bennett and Valdés (2001), the output gap, exchange rate 12-month changes, WPI 12-month inflation, CPI 12-month inflation, policy interest rate and the annual growth of M1. All variables, with the exception of the terms of trade, are obtained from the Central Bank of Chile. Impulse response functions of CPI and WPI inflation to an exchange rate shock are estimated over a 16-month horizon. As we are interested in the evolution of the passthrough over time, we make a rolling window estimation of the VAR. The first window ranges from January 1990 to January 1995. Two years of data are added in each estimation. Impulse response functions are calculated for each of the VARs. Results, presented in Figure 4, show that the impact of the exchange rate over both price indexes has varied significantly over time. The effect over CPI has decreased throughout the decade, becoming non-significant in the final windows. Effects over WPI inflation, however, differ, as they become increasingly significant over the decade. This suggests a sustained reduction in margins, a result of increased competition throughout the decade, and certainly mimics the recent experience, in which WPI inflation has largely exceeded CPI inflation.

Figure 4
Exchange Rate Shocks over WPI and CPI Inflation
Rolling Windows



Source: Authors' Calculations
Note: The first row shows the responses of WPI inflation for the windows: 1990-95, 1992-97, 1994-1999 and 1996-2001. The second row depicts the responses of CPI inflation for the same time intervals.

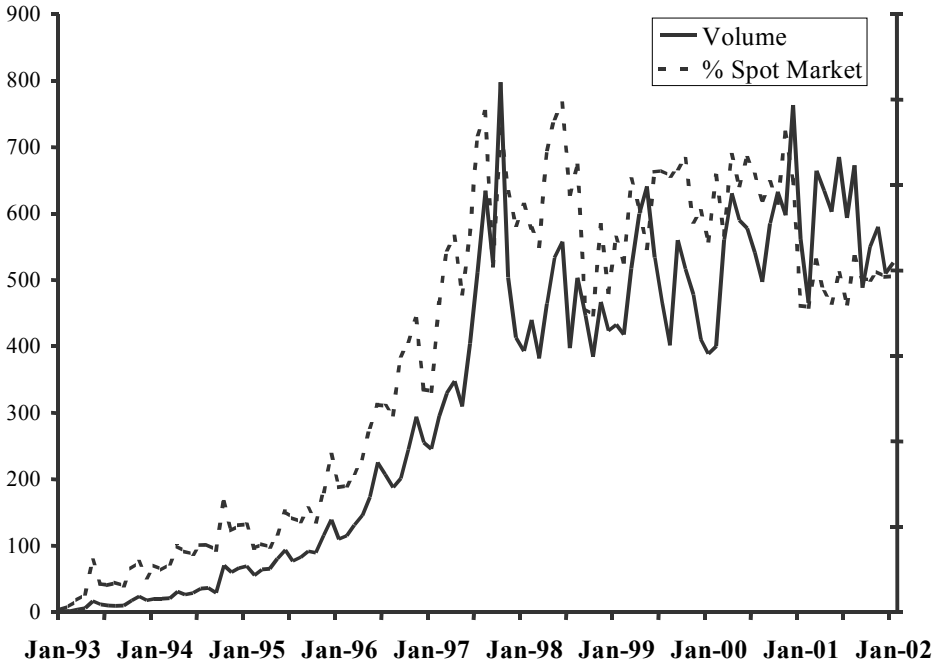
What could be behind this result? Why has the passthrough to CPI inflation declined in time? We could present several hypotheses, some of a permanent nature and some specifically related to the recent shocks.

One hypothesis deals with a shift in people's reaction to changes in the nominal exchange rate in the last two years. Particularly, with the persistence of exchange rate shocks. When the nominal exchange rate was under authority's discretion (the band), the market internalized a significant depreciation (or devaluation) as the failure of authorities to control the currency nominal value because of some changes in fundamentals. So, depreciation was seen as permanent and it was passed to domestic prices of tradable goods and the price level. This effect could be compounded if there are backward looking price indexation mechanisms pervasive enough. This was, in a way, the case of Chile, at least until 1997. In contrast, under a transparent inflation targeting cum floating regime, with solid institutions and sound macro fundamentals, depreciation is not necessarily a permanent phenomenon. The market knows the exchange rate might fluctuate more than in other regimes, so agents react to a depreciation with more caution. In addition, credible targets could be more efficient predictors of inflation than the nominal exchange rate. Although this sort of hypothesis has a lot of merit, it suffers from some drawbacks.

First, the big reduction in the effective passthrough occurred in 1998, in the middle of the Asian crisis and before the adoption of a clean floating regime. Second, the "softness" of the exchange rate commitment and the multiple changes it experienced probably diminished the impact of exchange rate movements that in the context of a more rigid peg would have been taken as more "fundamental-driven". Moreover, the existence of an inflation target also diminished the effect of depreciations, as the market expected that the exchange rate's future movements and effects would be consistent with attaining the target. In that sense, there is no reason to think that there was a "significant" shift in the perception of exchange rate changes by agents. Third, as we will present in the next section, the statistical properties of the exchange rate have changed only slightly since 1999. This reinforces that there is no evidence of a huge "regime-shift" that could justify a different perception by the agents.

Another hypothesis is that the development of financial instruments like futures, forwards, and derivatives in recent years has allowed local producers to hedge the exchange rate risk. Thus, they are not forced to pass a depreciation of the peso to internal prices as long as that depreciation proves to be really transitory. However, it is likely that much of this hedging has to do with balance sheet currency mismatches of medium to large corporations in the non-tradable sector that use to borrow in US dollars. Additionally, transactions in the forward market (as % of spot market transactions) have remained roughly constant between 1998 and 2001 (Figure 5), and the passthrough has decreased throughout the whole period. This is another fact that points to the fact that there has been no perception of a "regime shift" that justifies the adoption of hedging strategies that differ from the ones that were adopted at the time when transactions in the forward market began[31].

Figure 5
Exchange Rate Forward Market



Source: Central Bank of Chile

[31] Fernández (2001) has also highlighted this phenomenon.

A third hypothesis has to do with reduction of margins in the retail activity, so the declining passthrough reflects efficiency gains in trading probably accruing to more competition in retailing. The January 2001 issue of the Monetary Policy Report of the Central Bank contains a box illustrating how, in the case of some imported home appliances there is indeed a reduction in retailing margins that comes as a trend since 1996. In some other cases of home appliances made in Chile, the margin reduction looks more recent and with a less clear trend.

A related hypothesis is that margin reduction is a cyclical phenomenon. During a recession or slowdown, retailers have to postpone the passing of any cost increase (for example, the wholesale peso price of an imported good after a peso depreciation) to the final price because of the risk of heavily losing clients and sales because of soft demand. Domestic demand dropped by around 12% in 1999 and even though has been recovering afterward, still remains at levels slightly below those of 1998. Thus, the real test for this hypothesis is still pending. It is clear that, unlike the previous explanations, this one suggests that the reduction in margins is a temporary phenomenon, as margins can not experience a permanent process of reduction.

From the same cyclical perspective, the characteristics of the exchange rate shocks are likely to be relevant. The peso depreciated not as the result of expansionary domestic policies, but rather due to external recessionary pressures. These pressures have implied a decrease for the dollar prices of both exports and imports. Exchange rate devaluation has come in the context of a slowly growing economy[32], with a low current account deficit –specially when compared to the 1998 levels- and within a stable, credible monetary framework.

A summary of the arguments can be made by realizing that the exchange rate passthrough is a particular case of the transmission of any nominal shock to the economy. The part of the shock that is not reflected on prices (at least in the short run) must affect real variables. In this case, the real exchange rate. Thus, and as discussed in the previous section, the analysis of the behavior of the exchange rate on prices and real variables resembles the analysis of the effects of monetary policy over inflation and output. A model that explains how changes in money translate into changes in prices and output is useful to explain the degree of passthrough. The variables that explain the monetary transmission mechanism, such as the level of inflation or the economy's cyclic position could also explain the economy's degree of passthrough.

Similarly, the value of the passthrough coefficient also depends on the misalignment of the real exchange rate (vis a vis an equilibrium benchmark agreeable with fundamentals) at the time of the depreciation. If the real exchange rate is appreciated (depreciated) relative to its long-term value, the nominal exchange rate operates as the variable that provides the required adjustment in relative prices. It is clear that in late 1997 the peso was overvalued, so the subsequent depreciation was an equilibrium adjustment in relative prices without large

[32] Another issue is if the devaluation itself is recessive. One can at least identify three transmission channels: (i) balance sheet effects through currency mismatches; (ii) income effects through impact over domestic prices and (iii) pressure over intermediation margins. The first channel was extremely relevant for the 1982-83 recession, but does not appear as a significant threat now (see Section IV.4). The latter two channels are specifically related to the discussion above.

implications on the domestic price level. This would reflect in a transitory reduction in the passthrough coefficient. During 2001, the significant peso depreciation was also a reflection of the deterioration of Chile's terms of trade (circa 8%) and growth prospects, which suggested a higher (more depreciated) equilibrium level for the real exchange rate. However, the passthrough remained low in 1999 and 2000, well after the previous overvaluation of the peso was corrected, and prior to the negative impact of the current shock.

As explanations, both temporary and permanent, are multiple, we try to assess them using different methodologies. We take the passthrough coefficient as estimated in equation 1, and run a simple OLS regression between the coefficient and its possible determinants. The monthly sample ranges from January 1994 to January 2002. Two lags of the passthrough coefficient are included to deal with autocorrelation. We begin by including a wide array of variables: inflation volatility and the inflation level (both to measure the degree of macroeconomic stability); real exchange rate misalignment (the dynamics of the exchange rate is influenced by its distance with respect to an equilibrium concept according fundamentals[33]); the output gap (the cyclical position of the economy will affect the speed and intensity with which retailers pass cost pushes into final prices[34]); retail mark-ups (changing degrees of competition at the retail level can affect the passthrough as well[35]); and exchange rate persistence.

After the estimation, markup levels, the level of inflation and exchange rate persistence (in various forms) appear as largely non-significant, and thus are excluded from the equation. The remaining variables, however, are (at least marginally) significant and have positive signs. Results of the estimation are presented in the first column of Table 4.

[33] The "equilibrium" real exchange rate is calculated according a methodology used in Gallego, Hernandez, and Schmidt-Hebbel (2001).
[34] The output gap is defined as the difference between the monthly economic activity index (IMACEC) and its Hodrick-Prescott filtered values.
[35] The evolution of margins is measured by the difference between accumulated CPI and WPI inflation.

Table 3
Passthrough Determinants

	Equation A: All variables	Equation B: Only Inflation Volatility
Constant	-0.0028 (-0.45)	-0.0026 (-1.50)
Inflation Volatility	0.01 (1.80)	0.01 (3.08)
Output Gap	0.069 (2.01)	---
Real Exchange Rate Misalignment	0.011 (1.68)	---
Passthrough Coefficient (-1)	1.90 (13.32)	1.95 (19.0)
Passthrough Coefficient (-2)	-1.16 (-6.48)	-1.22 (-6.41)
Passthrough Coefficient (-3)	0.25 (2.81)	0.26 (2.61)
R^2	0.998	0.998
Serial Correlation LM Test (1 lag) (F-statistic)	3.68	3.22

Source: Authors' calculations

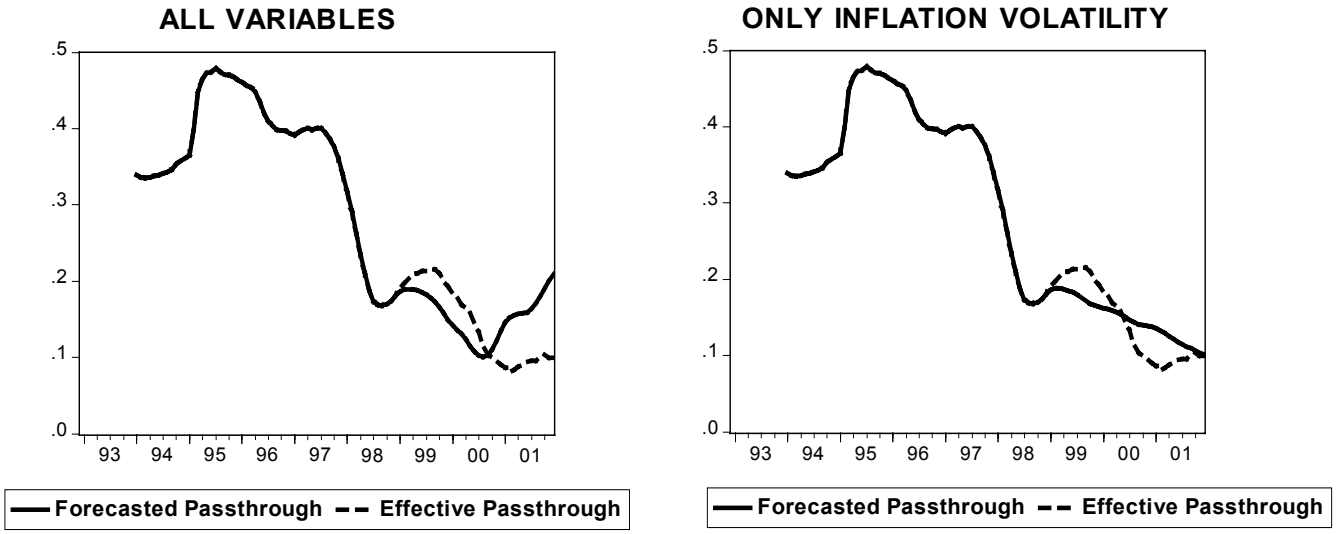
The estimation suggests that the passthrough is positively affected by inflation volatility (a more unstable economy brings more inflationary effects from a depreciation); the degree of exchange rate over-depreciation; and the output gap (the passthrough decreases when the economy experiences a recessive cycle). Although the estimation is stable, an out of sample forecast of the passthrough coefficient (estimating the equation up to December 1998) over-predicts the exchange rate passthrough for 2001 (Figure 6, left panel). This is mainly due to the fact that both the real exchange misalignment and the output gap are estimated as positive for 2001, thus pushing the passthrough coefficient upwards. As the precise measurement of both the output gap and the equilibrium real exchange rate are topics of intense debate beyond the scope of this paper, we estimate the model just including the level of inflation volatility (second column of Table 4), in the spirit of Gagnon and Ihrig (2001). The out of sample forecast of this simpler model is more precise in tracing the evolution of the level of passthrough (Figure 6, right panel), suggesting the relevance of Chile's macroeconomic stability in softening the impact on domestic consumer prices of an exchange rate shock.

The results of this simple estimation suggest that Chile's currently low level of passthrough has some permanent and some temporary determinants. The passthrough coefficient could go up in the future, as the economy grows faster and the effects of the cumulative peso depreciation are felt. Moreover, as WPI inflation in Chile has been significantly higher than CPI inflation during the past months, the passthrough could increase as space for a recovery in margins is generated[36]. The real exchange rate has depreciated circa 20% since

[36] Even if margins do not recover, they can not exhibit a permanent decreasing trend, as they have a lower bound of zero.

1999, and its current level is not far from the values observed in 1986. Almost all the appreciation experienced during the 1990s has now been reversed. Although the significant adverse external shocks experienced since 1998 justify a more depreciated real value for the peso, it is possible that the variable has overshot its long-term value, even after taking into account the appreciation observed since November 2001.

Figure 6
Actual and Projected Passthrough
(Out of sample forecasts: 1999:1-2001:12)



Source: Authors' calculations

However, factors such as a more stable inflation are permanent, and thus should make the passthrough coefficient lower than in the past. Macroeconomic stability (as suggested by traditional aggregate output models such as the neoclassical incomplete information model or neo-Keynesian models) should decrease the impact on prices of nominal shocks over the exchange rate. This is confirmed by the international evidence (see, for example, Goldfjan and Werlang 2000), which shows that the passthrough coefficient has significantly decreased in free-floating countries such as Australia, England and New Zealand[37].

In summary, whatever the reasons, the substantially lower passthrough today allow policy makers to feel more comfortable with a floating regime on this account. Although as domestic demand speeds up in the coming years an increase in the passthrough can be expected, the other factors mentioned above call for low passthrough on a more permanent basis. In

[37] Assuming a permanent reduction in the passthrough coefficient to very low levels could lead to the conflicting implication that nominal shocks have permanent real effects. However, in a context of exchange rate flexibility, the passthrough is low precisely because the nominal shocks are expected to reverse in the near future. This is akin to say that it is unlikely that the passthrough coefficient does not change with the level of cumulated depreciation. High, sustained depreciation over a relatively long period probably indicates that the shock is permanent and not subject to quick reversion, or that macroeconomic policies are inconsistent .

addition, the current policy horizon of the inflation targeting regime (two years) makes more room for experiencing price effects of temporary changes in the exchange rate without requiring a policy reaction.

III. 3 Volatility

The discussion regarding flexible exchange rates and volatility consists of two parts. The first refers to how exchange rate volatility could exceed the level determined by its fundamentals. The second, the impact (if any) of such volatility over the rest of the economy.

In industrialized countries, the demise of the Bretton-Woods agreement brought a significant rise in nominal exchange volatility, which had no counterpart in the behavior of any other macroeconomic variable, with the sole exception of the real exchange rate. This contradicted Friedman (1953), who had stated that underlying volatility could not be eliminated with the adoption of a different exchange rate regime, and could only shift between the exchange rate and monetary aggregates.[38] This is raw evidence for the two different facts that we have mentioned. In one hand, the determinants of the exchange rate seem to lie beyond traditional macroeconomic variables, and thus the variable's volatility could eventually be "excessive". On the other, the exchange rate's erratic behavior does not seem to have any clear effect over the rest of the economy (at least in terms of macroeconomic unstability)[39], making volatility almost irrelevant (this is Rogoff´s "exchange-rate disconnect puzzle"[40]). Ghosh et al (1997) show some effects of regime shifts over output and inflation, for a 30-year sample of 136 countries. Flexible exchange rates usually are associated with less volatility in output and unemployment, although inflation is typically higher.[41]

Do these facts apply to Chile's exchange rate experience? Is there any evidence of "excessive" volatility in the exchange rate market? Has volatility increased since the adoption of the floating regime in 1999? What does the experience of other countries with flexible exchange rates tells us regarding exchange rate volatility and "abnormal" events in the exchange rate market?

III.3.a Macroeconomic volatility in Chile

Figures 7 to 10 present the evolution of monthly exchange rate volatility during the 1990s compared to the volatility of its theoretical determinants[42]. Volatility is here defined as the 12-month standard deviation of monthly percentage changes. These determinants are the Chile-United States differentials in nominal 90-day interest rates, aggregate output and the

[38] For a discussion of these issues and their relation to Robert Mundell's contribution, see McKinnon (2001).
[39] The evidence of a negative impact over investment and trade is far from conclusive.
[40] Which he literally defines as the fact that "while the exchange rate seems to gyrate wildly, it does not appear to feed back in the real economy with nearly the force and speed that one would expect for such an important relative price(..)"
[41] There are two problems with this type of study: the differences between official and effective exchange regimes and the direction of the causality between macroeconomic behavior and the choice of a certain regime.
[42] These determinants can be derived from traditional monetarist models, or from Dornbusch's "overshooting" model.

nominal money supply. A comparison between the volatility of inflation and the exchange rate is also included.

These figures show that the volatility of the exchange rate exhibits no clear trend during the decade (the fit of a 2nd order polynomial trend equation is extremely low), although an increase is observed since the adoption of the floating regime, and specially during 2001. The output differential's volatility also appears to be growing since the mid 90s, as this period accounts for the effect of the Asian crisis and the general slowdown in Chile's GDP growth. However, the remarkable result is that, as a result of inflation reduction during the decade, the volatility of inflation and the interest rate and money differentials has significantly decreased. This is, all nominal macroeconomic variables appear to have become considerably more stable during the decade. This is a trend that is also observed in countries like New Zealand and Australia, where exchange rate volatility appears to be constant despite of general macroeconomic stabilization. The volatility of all remaining variables exhibits no relevant change in their volatility since 1999. The adoption of a flexible exchange regime does not seem to have brought any additional volatility into Chile's economy, at least in nominal terms.

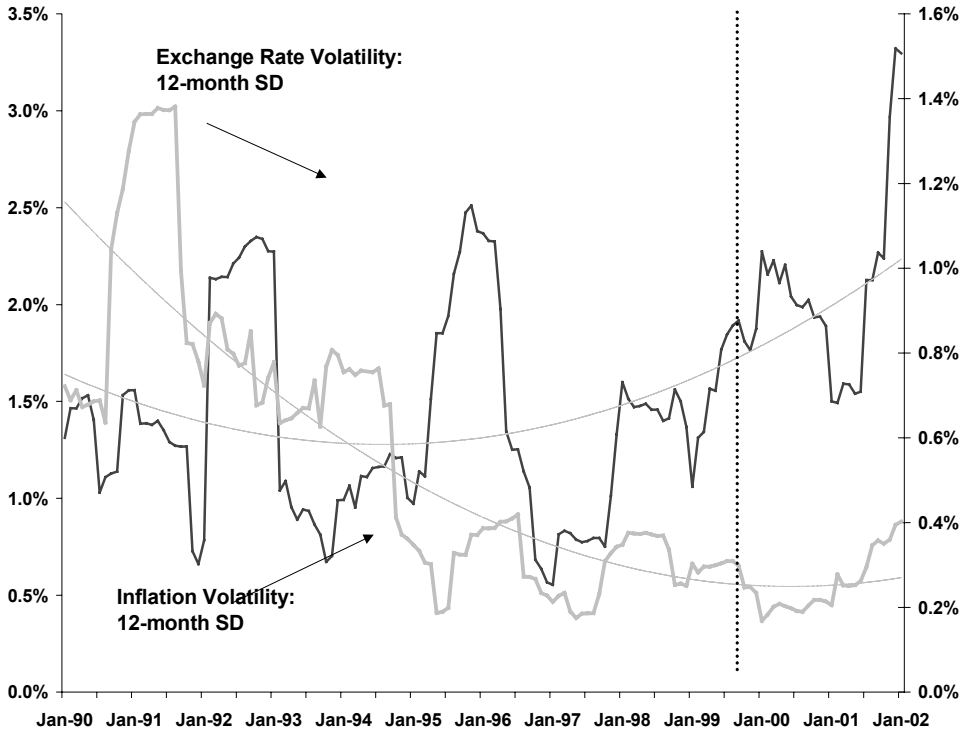
The second conclusion that this simple graphic analysis suggests is that, although the aggregate volatility of the theoretical determinants of the exchange rate has decreased, no significant effect is observed over exchange rate volatility. This is, as Chile's macroeconomic stability has increased, the exchange rate has not followed that trend.[43]

The apparently autonomous behavior of exchange rate volatility does not imply that volatility has increased with the adoption of the flexible exchange rate regime. A first glance at the 12-month standard deviation of monthly changes provides no conclusive evidence of such a phenomenon. However, a more formal and complete analysis is required. Even if monthly volatility has remained unchanged (or has grown only marginally), the exchange rate could have become more volatile at higher frequencies, such as weekly or daily changes.

We cover this issue using different methodologies and definitions of volatility.

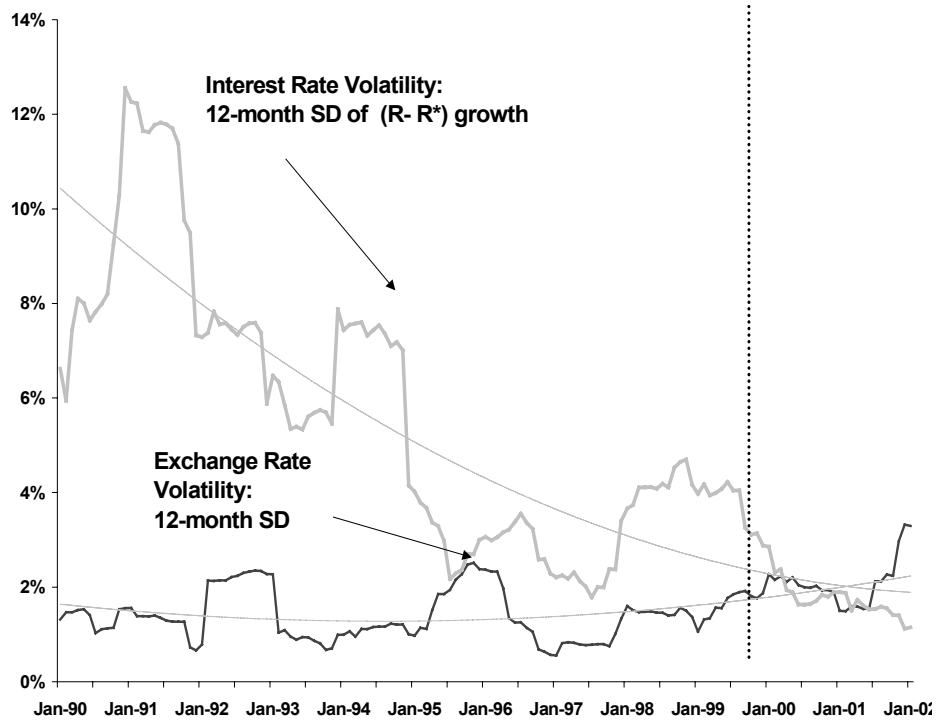
[43] At least two explanations can be proposed: the first is the omission of other relevant variables, such as the exchange rate band, capital controls, etc. which had an effect on the exchange rate and deviated it from its "fundamental" market behavior. This point is certainly relevant for the case of Chile, in which exchange rate stabilization (at least during the first half of the decade) was used with the intention of preventing excessive exchange rate appreciation, thus (indirectly) softening its volatility. The second is to accept this evidence as a confirmation of the findings in industrialized countries; the relative independence of exchange rate volatility from its theoretical determinants.

Figure 7
Inflation and Exchange Rate Volatility (12-month SD)



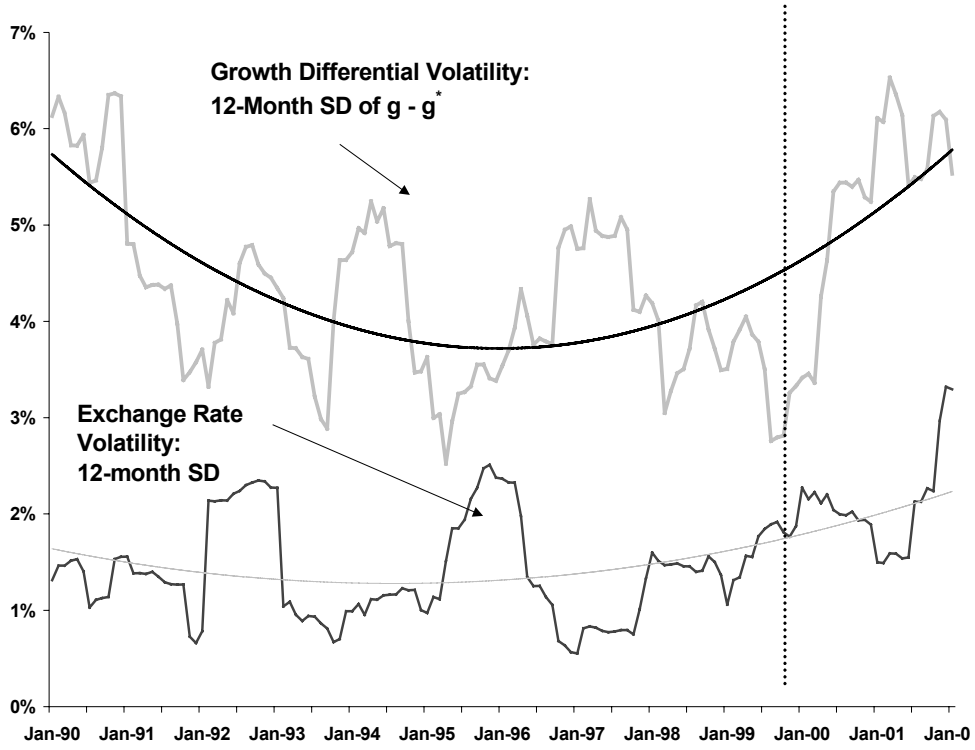
Source: Central Bank of Chile

Figure 8
Interest Rate Differential[a] and Exchange Rate Volatility



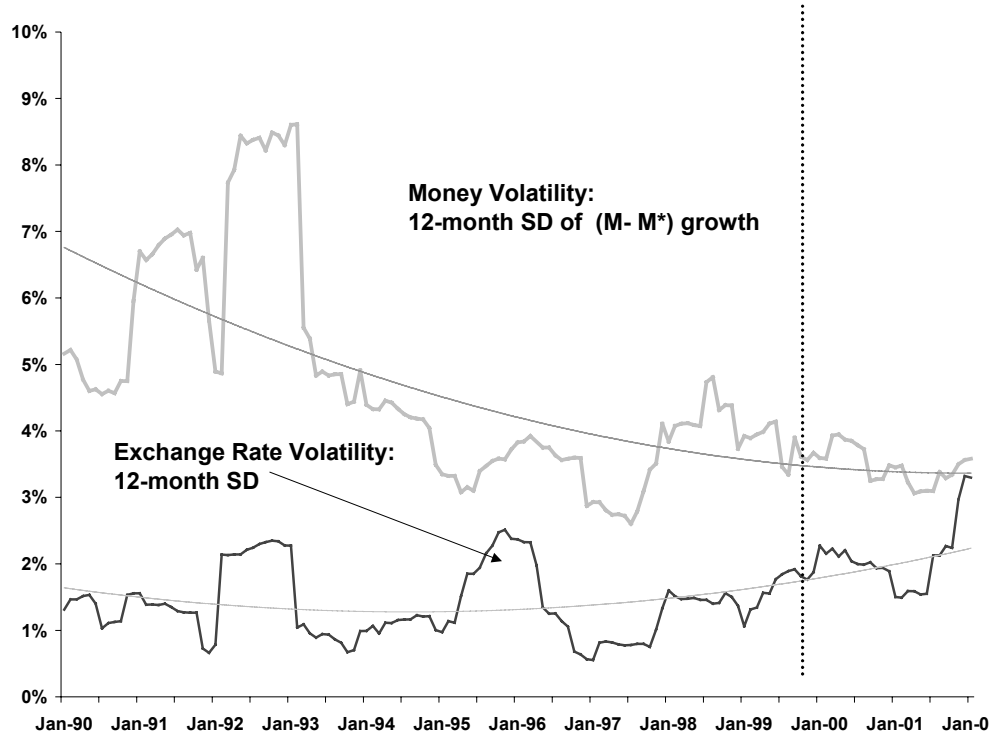
Source: Central Bank of Chile
a: Interest rate differential is the difference between domestic and US 90-day nominal interest rates

Figure 9
Growth Differential[a] and Exchange Rate Volatility



Source: Central Bank of Chile
a: Growth differential is the difference between domestic and US annual GDP growth.

Figure 10
Money Differential[a] and Exchange Rate Volatility



Source: Central Bank of Chile
a: Money differential is the difference between domestic and US 90 nominal money growth.

III.3.b Exchange Rate Volatility in the 1990s

A change in the statistical properties of the exchange rate after the adoption of a flexible regime in 1999 should not be surprising. After all, the exchange rate band in place during the 90s should have had some effect over the exchange rate, either in terms of its level or on its pace of growth. The theoretic conception of the exchange rate band established that it should serve as a stabilization device, as the exchange rate (due to the threat of intervention by the monetary authority whenever the currency came close to the limits) should mainly fluctuate near the center of the band. If the exchange rate band was credible, a r
ise in volatility should come as a natural result of its abandonment and the adoption of absolute flexibility.

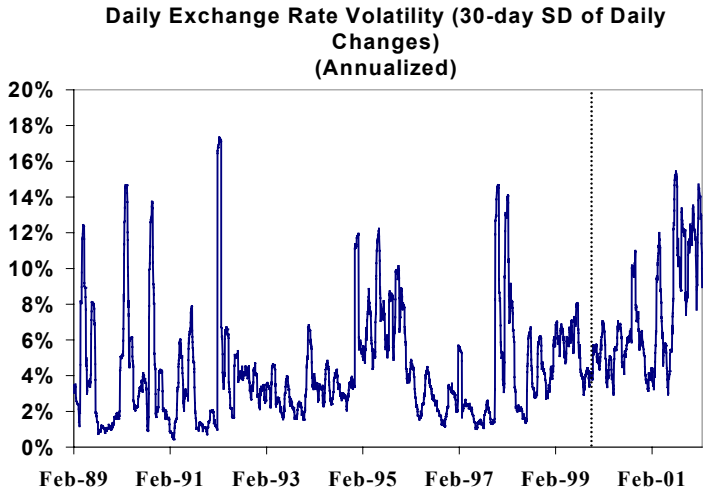
From the graphic examination of monthly exchange rate volatility one can deduce a positive trend since the adoption of the floating exchange rate regime, mainly as a result of the events observed since June 2001.[44] However, a graphic analysis could be misleading, as the statistical properties of the series, although slightly, may have experienced a variation in the last 22 months. Furthermore, the behavior of monthly volatility may differ from the one at shorter frequencies, such as daily or weekly changes.

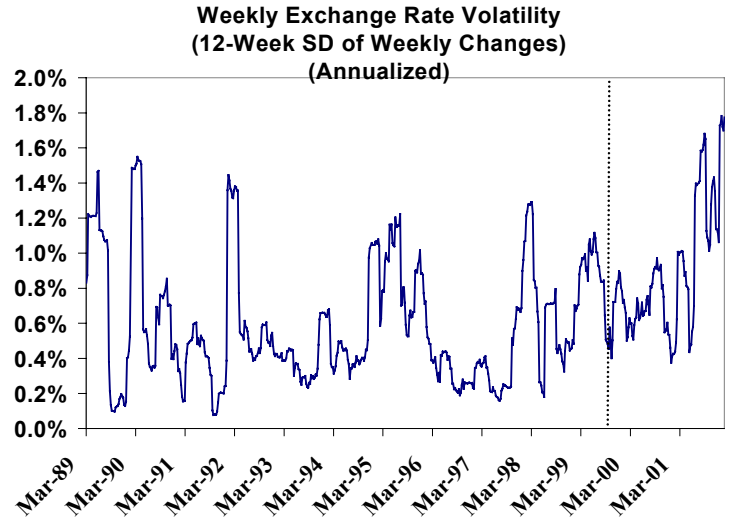
Figure 11 pictures the annualized volatility of daily[45] (30 day-SD), weekly (12 weeks-SD) and monthly (12-month SD) changes in the exchange rates. Unsurprisingly, volatility tends to be higher and more unstable as the frequency of the data augments. Volatility peaks that were reached at the early 90s, during the Tequila crisis and in 1998 were not reached during the first 22 months of the floating experience, and volatility only has increased significantly since June 2001. Notice, however, that a first glimpse at the data indicates that recent volatility has been relatively similar to previous episodes of international financial turmoil, at a time in which the exchange rate band was still in place. In general terms, weekly and daily volatilities do not provide evidence that differs from the derived from monthly data.

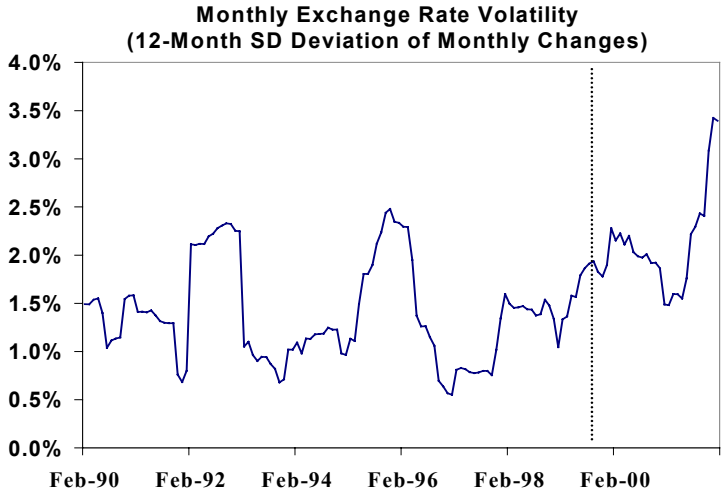
As graphic examination is only a first approach, we examine the statistical properties of Chile's daily, weekly and monthly exchange rate changes in Table 4. The comparison of the January 1995-September 1999, September 1999-August 2001 and September 1999-January 2002 periods shows that the mean and the standard deviation of daily, weekly and monthly returns have increased since the adoption of exchange rate flexibility. Changes in standard deviations (volatility) were only marginal until May 2001, but differences have increased since. Daily volatility had gone from 0.35% in 1995-99 to 0.43% in 1999-2001[46], weekly volatility from 0.66% to 0.88% and monthly volatility from 1.59% to 2.08%. These changes imply a growth in volatility in the 20-30% range, and are statistically significant for daily and weekly data. When the data for the August 2001 to January 2002 period is added, the increases in volatility are significantly larger. Table 4 exhibits F- tests for equality of variances between the 2 periods under study. Other tests, deeming similar results, were also applied to the series, and are not reported for briefness. Equality tests for monthly, weekly and daily data reject the hypothesis that the variance between our three time samples has remained constant[47].

[44] For a discussion of these issues and their relation to Robert Mundell's contribution, see McKinnon (2001).
[45] All daily estimations use 5-day weeks.
[46] For the period including intervention, the figures rise to a 0.49% for daily variations, 1.03% for weekly variations and 2.5% for monthly variations
[47] Until May 2001, the standard deviations of weekly and daily variations were statistically equal pre and post float. The same applied for monthly variations up to July 2001.

Figure 11
Daily, Weekly and Monthly Volatility







Source: Authors' calculations

Table 4
Daily Variations

Period	Minimun	Maximum	Average	Std. Dev.	F- Test of Variance Equality 1995-99 vs. 1999-2001 (p-value)
1989-2001	-4.7%	2.8%	0.03%	0.35%	
1995-1999 (Pre Float)	-2.4%	2.5%	0.02%	0.35%	0.000
1999-2001 (Float)	-1.8%	2.8%	0.05%	0.43%	
1999-2002 (Float+Intervention)	-1.8%	2.8%	0.04%	0.49%	0.0000

Weekly Variations

Period	Minimun	Maximum	Average	Std. Dev.	F- Test of Variance Equality 1995-99 vs. 1999-2001 (p-value)
1989-2001	-4.2%	4.5%	0.15%	0.74%	
1995-1999 (Pre Float)	-3.3%	2.9%	0.08%	0.66%	0.006
1999-2001 (Float)	-1.6%	4.5%	0.24%	0.90%	
1999-2002 (Float+Intervention)	-2.2%	4.5%	0.22%	1.03%	0.0000

Monthly Variations

Period	Minimun	Maximum	Average	Std. Dev.	F- Test of Variance Equality 1995-99 vs. 1999-2001 (p-value)
1989-2001	-6.0%	6.2%	0.7%	1.7%	
1995-1999 (Pre Float)	-4.2%	3.8%	0.5%	1.6%	0.005
1999-2001 (Float)	-3.3%	6.2%	1.1%	2.1%	
1999-2002 (Float+Intervention)	-3.3%	6.2%	1.0%	2.5%	0.0000

However, all these are measures of ex post volatility, and thus do not exactly represent the uncertainty faced by investors and traders when making decisions which, as we have mentioned, is one of the costs mentioned against the adoption of exchange rate flexibility. Thus, ex ante volatility should be also analyzed.

A measure of implicit ex ante volatility can be derived from monthly average of the implicit volatility in options in the non-delivery peso market (NDPM) in New York. Under this measure, during most of the floating period, volatility remains relatively stable and does not exceed the levels observed prior to the band's abandonment. The situation changes in June-

August 2001, when the turmoil brought by the Argentine crisis severely impacts the behavior of the exchange rate. However, this indicator suffers from some serious drawbacks. The data for calculating this indicator starts just in mid 1998 (coinciding with the increase of trading activity in the NDPM), so a comparison with the previous period is troublesome for several reasons. The data set is relatively short, and the "pre float" period basically starts in the middle of the turbulence of the Russian crisis. Moreover, transactions in this market are relatively scarce. Thus, although the options market suggests that volatility has remained relatively stable and has increased more recently, this conclusion must be handled with care.

A better estimator of ex ante volatility can be obtained by using a daily GARCH(2,1)-M[48] model, estimated between January 1992 and January 2002 with robust standard errors. The estimated model can be represented as

$$d\ \log(\ er_t) = \alpha + \beta_1 \sigma_t^2 + \varepsilon_t + \beta_2 \varepsilon_{t-1}$$

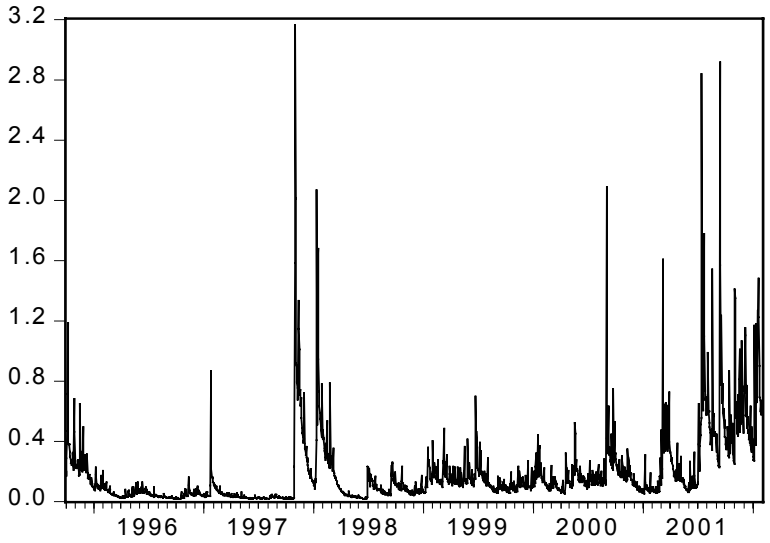
$$\sigma_t^2 = \delta + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \varepsilon_{t-2}^2 + \gamma_3 \sigma_{t-1}^2 + \gamma_4 Mon$$

where $d\log(er_t)$ is the daily variation of the nominal exchange rate(in logarithm) and *Mon* is a dummy variable for Mondays, meant to capture non-weekday trading. The GARCH model models the variance of the dependent variable as a function of past values of the dependent variable, and allows us to derive a series of conditional (expected) variance.

Figure 12 shows the GARCH model variance series. The series suggests that volatility has remained relatively stable throughout the decade, with the exception of some specific episodes, including the recent turbulence. As described in Table 5, the mean of the series between 1995 and September 1999 is 0.145, a figure that rises to 0.165(0.248 if the sample ends in January 2002) after the float is adopted. The hypothesis of equality between means is rejected. This result for ex ante volatility is consistent with ex post volatility: volatility has risen after adoption of the float, and especially in recent months. However, the increase has been relatively mild and the turbulence in the exchange market has been similar to similar episodes experienced in the past.

[48] Autoregressive Conditional Heteroskedasticity (ARCH) models depict and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent, or exogenous variables. GARCH models are a generalization of ARCH models, and were introduced by Bollerslev (1986). In a standard GARCH model, the mean equation is a function of exogenous variables with an error term. The conditional variance, defined as the one-period ahead forecast variance based on past information, is a function of several variables. Among them, the mean, news about volatility from the previous period -measured as the lag of the squared residual from the mean equation (the ARCH term)-, last period's forecast variance (the GARCH term), and exogenous variables.

Figure 12
Daily GARCH Volatility



Source: Authors' calculations.

Table 5
Daily GARCH Volatility Estimation

Period	Mean	Median	F- Test of Mean Equality with 1995-99 (p-value)	Van der Waerden test of Median Equality (1995-99
1995-1999 (Pre Float)	0.145	0.088		
1999-2001 (Float)	0.165	0.129	0.001	0.000
1999-2002 (Float+Intervention)	0.248	0.152	0.000	0.000

Source: Authors' calculations.

Thus, both ex post and ex ante volatility (either derived from financial instruments or from statistical procedures) suggest that the adoption of a floating regime has increased the unstability of the peso, but that this increase has not been large, with the exception of specific episodes of regional turmoil. Moreover, volatility brought by those episodes does not appear as different to the one observed in similar events during the exchange rate band experience, such as the Tequila crisis in 1994-95 and the Brazilian devaluation in early 1999.

Moreover, there is no evidence that, over time, exchange rate volatility has had a negative effect or exchange rate risk premium or in Chile's country risk[49]. Tables 6 and 7 show the correlations between exchange rate volatility and ER and country premium, as well as Granger causality tests between them. Correlations between volatility and exchange rate premium are non-significant and negative, while the flexibility period shows a negative correlation between EMBIs and exchange rate volatility. Causality tests indicate that exchange rate volatility does not Granger cause none of these risk measures.

These simple comparisons show no link between exchange rate volatility and interest rate premiums (the ER and country-risk premiums), one of the major criticisms against exchange rate flexibility. This is consistent with the GARCH and options evidence, which did not show a huge change in ex ante perceptions of exchange rate volatility by the market. As mentioned earlier, forward market transactions (which one would have expected to augment if perceived exchange rate risk increased after 1999) have remained fairly stable, both in level and as a % of spot transactions. There is no evidence of increased speculation, or of a higher perception of risk by agents (if anything, that happened in 1997, when forward transactions reached their peak).[50]

[49] The country risk premium is the spread paid by Chile's sovereign bonds over comparable US instruments. Calculating the exchange rate risk premium is somehow more complicated. The premium is calculated from the uncovered interest rate parity equation. This is, the ERRP is the difference between the nominal interest rate in pesos minus the foreign interest rate in US dollars and the change in the exchange rate (as a proxy of expected depreciation) minus the country risk premium minus local taxes to inflows of capital. For simplicity, we consider the spread between domestic nominal deposit rates in pesos and dollars. This allows us to exclude the country risk premium, as well as the effect of taxes or transaction costs. Effective exchange rate depreciation is used as a proxy of the expected depreciation.

[50] One caveat applies here. Although hedging in firms using the forward market has remained stable, the Central Bank intervention provided hedge, in the form of dollar-denominated bonds (PRDs) with a (maximum) value of US$ 2 billions until December 2001.

Table 6
Monthly Correlations Between ER Volatility and ER Risk Premium/Country Risk Premium

Correlation ER Volatility/ER Risk Premium				
	January 1989-January 2002	**January 1995-September 1999**	**September 1999-August 2001**	**September 1999-January 2002**
Contemporary	-0.0959	-0.3490	-0.0561	-0.0431
1-month volatility lead	-0.0792	-0.3365	0.1091	0.0924
2-month volatility lead	-0.0715	-0.3207	0.1032	0.0823
1-month volatility lag	-0.0671	-0.3268	0.1322	0.0971
2-month volatility lag	-0.0521	-0.2278	-0.0659	0.0162

Correlation ER Volatility/Country Risk Premium				
	January 1997-January 2002	**January 1997-September 1999**	**September 1999-August 2001**	**September 1999-January 2002**
Contemporary	0.3568	0.5229	-0.4978	-0.5341
1-month volatility lead	0.3098	0.4667	-0.6901	-0.5921
2-month volatility lead	0.3572	0.5138	-0.2487	-0.4317
1-month volatility lag	0.2642	0.3920	-0.7517	-0.7825
2-month volatility lag	0.3374	0.4890	-0.0832	-0.1623

Source: Authors' calculation

Table 7
Granger Causality Tests Between ER Volatility and Risk Premia

Pairwise Granger Causality Tests September 1999-August 2001		Pairwise Granger Causality Tests September 1999-August 2001	
	Probability		F-Statistic
Exchange Rate Volatility does not Granger Cause Exchange Rate Risk	0.82038	Exchange Rate Volatility does not Granger Cause Country Risk	0.59227
Exchange Rate Risk does not Granger Cause Exchange Rate Volatility	0.09490	Country Risk does not Granger Cause Exchange Rate Volatility	0.06238

Source: Authors' calculations

III.3.c Volatility in a global context

As Chile's experience with a flexible exchange rate is still short-lived, the moderate increase in volatility observed since 1999 does not guarantee a similar pattern in the future. Moreover, it would be interesting to analyze the level and evolution of Chile's exchange rate volatility compared to the volatility observed in other countries.

Is volatility in Chile "high" for international standards? Is the volatility upsurge observed after June 2001 an "abnormal" event? To assess the question, we analyze the behavior of the daily exchange rate in 13 other countries: Australia, Brazil, Canada, the Czech Republic, Indonesia, Japan, Korea, Mexico, New Zealand, Peru, Poland, Thailand, and Turkey. These countries differ, in time, in the characteristics of their exchange rate regimes and many of them have, as Chile, experienced a shift towards relatively clean floats in recent years.

A first glimpse at Table 8 shows that the behavior of Chile's exchange rate is relatively stable throughout the 1990s, a feature that remains under the floating regime. The standard deviation of the daily variations remains substantially lower than the world average. However, the average variation becomes relatively high since September 1999 (this is, the Chilean peso has lost more value than other currencies since that date). If anything, the problem of Chile's current exchange rate behavior is one of depreciation[51], not of volatility. This is the case even if Chile is compared with countries sharing a common policy mix (inflation targeting cum exchange rate flexibility) as Australia, Brazil or New Zealand. Peso volatility in the floating period is nearly half of the volatility observed in the above mentioned countries. In terms of "abnormal" events, extreme fluctuations in Chile are (in any period) substantially lower than events observed in Australia or New Zealand. It is interesting to notice that, among these 14 countries, only two countries have smaller exchange rate volatility than Chile: Canada and Peru. While the first changed his dirty float for a clean in September 1998 without a clear change in

[51] Depreciation that, as we have mentioned, has not implied a rise in inflation.

volatility, Peru's flexible regime is explicitly a dirty one. It is remarkable to notice the "low" value of Chile exchange rate volatility, a result obtained with no direct intervention for almost two years. Chile's daily exchange rate volatility is comparable to the one observed in other inflation targeting regimes, such as Korea, Mexico and Thailand.

Even recent turbulence in the exchange rate market (with figures circa +/- 15% in one month) did not raise volatility above international standards. Although the daily volatility of 0.74% in September2001-January 2002 is way above Chile's "normal" volatility, it does not differ from the average volatility observed in Australia or New Zealand. A period of "high" volatility according to Chile's historic standards is "normal" when compared to international levels.

The final row of Table 8 shows equality tests for the variance of Chile and the remaining countries between September 1999- August 2001. Chile's daily exchange rate volatility is comparable to the one observed in other inflation targeting regimes, such as Korea, Mexico and Thailand.

Table 9, in turn, illustrates how the experience of Chile after moving to a floating scheme compares to other countries that have done the same recently. The case of Chile is closest to Korea's but not far from Canada's.

In summary, Chile's experience with a free-floating regime has not brought a huge increase in volatility. Moreover, among free floaters Chile is classified among the more stable, in terms of ER volatility and the general behavior of macroeconomic variables. Although ER volatility can rise in the future (as signaled by the events since July 2001), the fact that such events are normal in healthy, stable economies such as Australia or New Zealand diminishes the fear that such rise would be harmful.

Table 8
Statistical Properties of Daily ER Variations in the World

	Australia	Brazil	Canada	**Chile**	Czech Republic	Indonesia	Japan	Korea	Mexico	New Zealand	Peru	Poland	Thailand	Turkey	**AVERAGE**
1990-2002															
Mean	0.012%	0.057%	0.012%	**0.026%**	0.013%	0.081%	0.002%	0.026%	0.037%	0.010%	0.041%	0.041%	0.022%	0.224%	**0.043%**
Maximum	2.92%	10.49%	1.61%	**4.52%**	8.35%	22.14%	4.14%	16.47%	10.72%	3.04%	4.52%	9.85%	19.47%	42.89%	**11.755%**
Minimum	-4.79%	-9.79%	-1.56%	**-4.23%**	-3.22%	-20.62%	-6.71%	-18.41%	-15.44%	-4.61%	-3.26%	-4.49%	-8.22%	-13.01%	**-8.208%**
Std. Dev.	0.603%	0.807%	0.305%	**0.501%**	0.679%	2.009%	0.729%	1.004%	1.012%	0.589%	0.370%	0.646%	0.760%	1.576%	**0.828%**
1995-1999															
Mean	0.012%	0.069%	0.004%	**0.023%**	0.017%	0.147%	0.010%	0.046%	0.058%	0.016%	0.037%	0.044%	0.046%	0.202%	**0.052%**
Maximum	2.45%	10.49%	1.61%	**3.17%**	8.35%	22.14%	3.86%	16.47%	10.72%	2.42%	2.26%	4.70%	19.47%	5.10%	**8.41%**
Minimum	-4.79%	-9.79%	-1.56%	**-1.75%**	-3.22%	-20.62%	-6.71%	-18.41%	-15.44%	-4.61%	-2.11%	-4.49%	-8.22%	-2.74%	**-7.14%**
Std. Dev.	0.614%	0.811%	0.319%	**0.367%**	0.728%	2.823%	0.833%	1.489%	1.198%	0.589%	0.306%	0.578%	1.116%	0.483%	**0.875%**
1999-2001 (Chile Float)															
Mean	0.049%	0.054%	0.009%	**0.048%**	0.032%	0.047%	0.032%	0.014%	-0.003%	0.044%	0.002%	0.0082%	0.022%	0.248%	**0.043%**
Maximum	2.92%	3.04%	0.87%	**2.44%**	2.30%	6.08%	2.15%	1.79%	1.82%	2.46%	1.15%	4.54%	1.53%	42.89%	**5.427%**
Minimum	-3.26%	-4.22%	-1.02%	**-1.33%**	-2.33%	-8.59%	-2.76%	-1.70%	-2.65%	-2.65%	-1.85%	-3.66%	-3.27%	-7.59%	**-3.348%**
Std. Dev.	0.757%	0.696%	0.331%	**0.392%**	0.705%	1.261%	0.662%	0.474%	0.487%	0.831%	0.229%	0.704%	0.452%	2.495%	**0.748%**
1999-2002 (Chile Float + Intervention)															
Mean	0.038%	0.042%	0.014%	**0.041%**	0.017%	0.042%	0.038%	0.013%	-0.001%	0.031%	0.000%	0.003%	0.011%	0.195%	**0.035%**
Maximum	2.92%	3.04%	0.87%	**2.63%**	2.30%	6.08%	2.15%	1.79%	1.82%	3.04%	1.15%	4.54%	1.53%	42.89%	**5.482%**
Minimum	-3.26%	-4.22%	-1.02%	**-2.01%**	-2.38%	-8.59%	-2.76%	-1.70%	-2.65%	-2.65%	-1.85%	-3.66%	-3.27%	-7.59%	**-3.399%**
Std. Dev.	0.754%	0.801%	0.326%	**0.487%**	0.704%	1.250%	0.639%	0.463%	0.470%	0.807%	0.212%	0.677%	0.415%	2.297%	**0.736%**
F-Test of Variance Equality with Chile (p-Value	0.00	0.00	0.0217	0.00	0.00	0.00	0.00	0.409	0.374	0.00	0.00	0.00	0.0811	0.00	

Table 9
Regime Shift in 4 Countries

	England		Canada		Korea		Indonesia		Chile	
	Managed	Free	Managed	Free	Managed	Free	Managed	Free	Managed	Free
Std. Dev.	**3.17%**	**2.86%**	**1.27%**	**1.69%**	**0.71%**	**2.56%**	**0.45%**	**7.9%**	**1.7%**	**2.1%**
Max	**7.02%**	**15.55 %**	**3.17%**	**3.59%**	**2.61%**	**5.72%**	**2.35%**	**13.2%**	**3.8%**	**6.2%**
Min	**-5.29%**	**-5.98%**	**-4.09%**	**-3.43%**	**-1.9%**	**-3.59%**	**-1.02 %**	**-19.6%**	**-4.2%**	**-3.3%**
Variance Equality (P-Value)	**0.5170**		**0.0567**		**0.000**		**0.000**		**0.001**	

III.4 Balance Sheet Effects

The third possible source of "fear of floating" refers to the effects of exchange rate volatility on the firms' balance sheets. Sudden reversals in the exchange rate would be, for firms with currency mismatches, a significant source of financial distress, which could potentially lead to important real costs. Several crises in the past, such as the Asian crisis in 1997-1998 and Chile's own 1982-1983 recession, have been triggered or deepened by the impact of violent exchange rate fluctuations (i.e., devaluations) over the balance sheets of banks and enterprises. Typically, this happens via the explosion of the domestic currency value of dollar denominated debt that exterminates the financial viability of a significant number of firms, which in turn hits the banking system through a huge explosion in nonperforming loans.

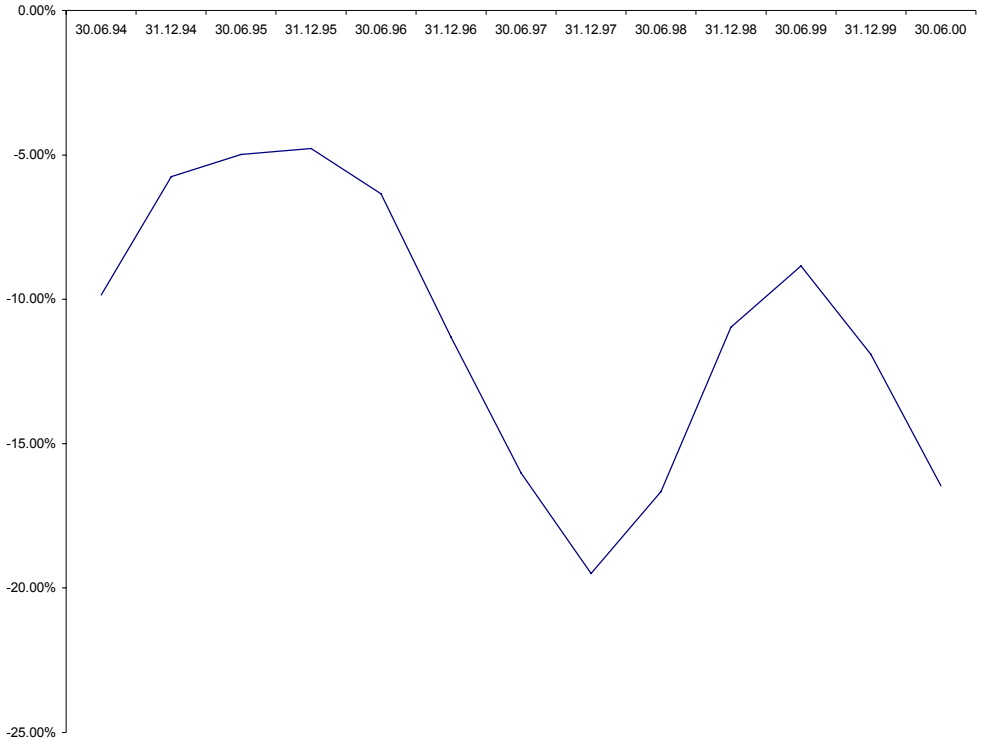
Domínguez and Tesar (2000) evaluate exchange rate exposure in firms from a broad sample of countries, over a 19-year period. Almost 200 Chilean firms are included in their study. Exchange rate exposure is determined through the inclusion of exchange rate variations in a CAPM-equation for the firms' market value. Their results are quite interesting: Chilean firms present the lowest degree of exposure. Less than 14% of Chile's firms appear to be suffering from exchange rate exposure. This value seems relatively low, if one considers that during all the analyzed period some kind of exchange rate control (which provided an implicit insurance that could lead to moral hazard and enhance exposure) was in place. Countries like Japan or the Netherlands present exchange rate exposure in more than 30% of their firms. However, two caveats must be mentioned: (i) as the authors use a CAPM equation, their measure of exchange rate exposure in firms is relative to the market's exposure; Chile's low relative exposure does not imply that the market as a whole is not highly exposed. And (ii) further calculations show that the degree of exposure of these (relatively small number of) firms is relatively high. In a related paper, Domínguez and Tesar (2001, b) discuss the factors that could lead to exchange rate exposure by a firm. Although factors like firm size, industry affiliation, and internationalization could explain whether a firm is naturally exposed to exchange rate risk, they could also explain their access to financial markets that provide hedge. No clear response is obtained from their analysis, finding no definite evidence that firms engaged in international trade have a higher exposition to exchange rate fluctuations. Allayanis *et*

al.(2001) analyze the management of exchange rate exposure and the role of different hedging strategies. They find that operational strategies (such as geographic dispersion) provide worse hedging than the use of financial instruments. This favors the development and deepening of financial markets.

As seen in Figure 13, currency mismatches have increased in Chilean firms since the adoption of the floating regime (from 8% to 16%) and up to mid 2000 (no new information on this ratio is currently available), although they remained lower than the values observed in 1997. These numbers should be taken with care as they represent a relatively small number of large corporations whose stocks are listed in the stock exchange market. Also, some of these corporations are basically exporters, thus they have a natural hedge that does not reflect on their balance sheets.

Even though this could alarm some people, the relatively low degree of volatility presented by the exchange rate since 1999 and an ongoing process of financial deepening and development of more sophisticated financial instruments offers a relatively promising road ahead. Regulation and supervision standards, which have been improved over the years, also suggest that the risk of a financial crisis due to exchange rate fluctuations is scarce.

Figure 13
Foreign Currency Mismatches in Chilean Enterprises
(In relation to capital and reserves)



At a more general level, a quick glance can be given at Chile's financial position, reflected in the net foreign assets since 1990, as a percentage of GDP. Although Chile's position has deteriorated slightly since the mid-1990s, the figure has remained fairly stable throughout the decade, and does not pose a threat over the country's financial stability.

A similar strength can be seen by looking at the Central Bank's net external position, which has grown steadily during the 1990s. The same applies to the private and financial sector position. A somehow more fragile picture is presented by the evolution of real external debt net of foreign reserves, which has grown significantly over the last two years. Despite this, Figure 14 exhibits an interesting feature of Chile's external debt. When analyzing debt by economic sectors, the share of foreign debt in hands of "tradable" sectors[52] has risen when compared to the debt of "non-tradable" sectors, such as services, throughout all the 1990s, with a mild deterioration after 1999. Thus, a significant share of Chile's external debt (circa 40%) is in hands of sectors that have a "natural hedge" against fluctuations in the exchange rate.[53] [54]

Moreover, the concern for balance sheets misses a significant point. The severe effects of balance sheets are associated to currency crises, and currency crises are usually linked to managed or directly pegged float. Under a pegged currency, the impact of a violent devaluation is not only due to the devaluation itself, but also to the fact that pegs provide an implicit insurance for exchange risk exposure, which in turn creates moral hazard. If that moral hazard is combined with insufficient financial regulation or supervision, the incentives for systemic fragility in the face of a nominal devaluation are fully in place. With their own particular details, that general story applies to the cases of Chile in the early 1980s, to the Asian countries in 1998 and, more recently, Argentina. The adoption of a flexible exchange rate regime eliminates that moral hazard.

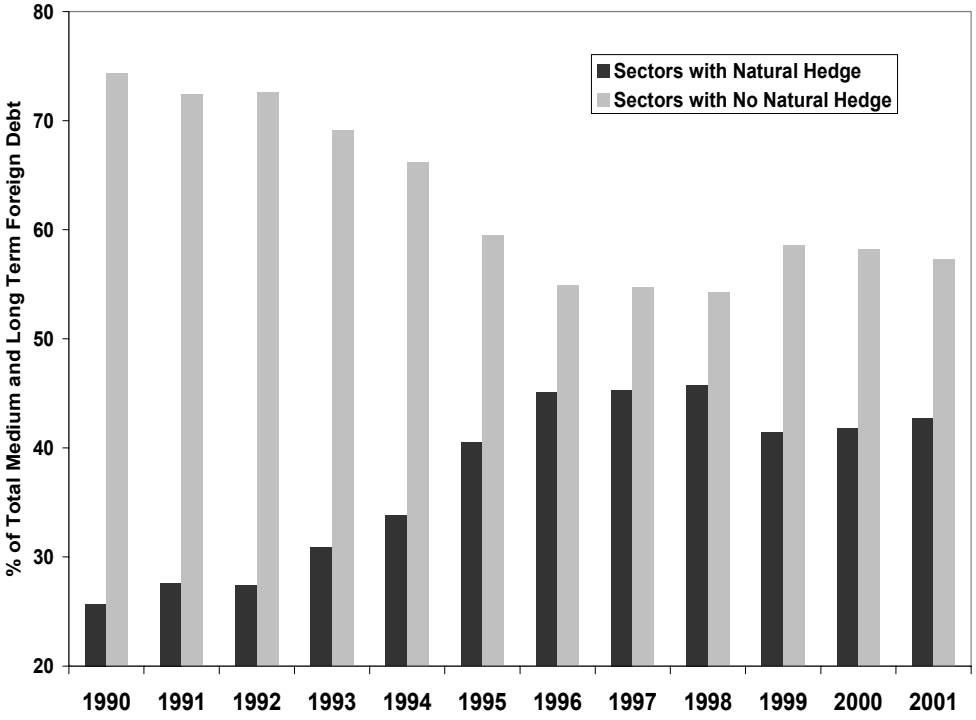
Given the current strength of the Central Bank's financial position and the solid and stable country risk evaluation by international investors, together with sound financial regulation, it is unlikely that fluctuations in the exchange rate would pose a serious threat on the health of the private and financial sectors. However, further developments in financial markets remain crucial, in order to minimize the remaining exposure and to lessen the transaction costs of adopting such hedges.

[52] Mining, manufacturing and agriculture.

[53] Moreover, many public utilities have their fares somewhat indexed to the peso value of the US dollar or the WPI, which follows the exchange rate much more closely than the CPI.

[54] The distinction would be mostly irrelevant in the presence of complete financial markets that provide complete hedging. However, that is not the case in actual financial markets and, as already discussed, is not the case in Chile's still underdeveloped financial market.

Figure 14
Composition of External Debt



IV. The role of the exchange rate as an adjustment mechanism: An illustration

One of the benefits of exchange rate flexibility, as we have already argued, is the way it allows for macroeconomic adjustment, softening the impact of external shocks on other macroeconomic variables. Prior to the international turmoil brought by the World Trade Center attack, the biggest source of uncertainty for the Latin-American economies was the conflicting behavior in Argentina, especially since June 2001. A quick glance at the Chilean press between June and September 2001 shows that the opinions of authorities, journalists, traders and analysts coincide in explaining the significant depreciation and the rise in volatility in the exchange rate by the skyrocketing process experienced by the Argentinean country risk. However, Chile's country risk throughout the period remained almost unchanged. What does an empirical analysis tell us regarding this casual observation?

One way to study this relationship is through a simple, univariate model. A simple GARCH estimation indicates that the level of Argentina's sovereign spread is significant for the variations and the volatility of the exchange rate. The sovereign spreads of Brazil and Mexico do not appear as significant variables. However, a richer analysis, which includes the effects of Argentina's spreads over a wider array of variables is probably more adequate.

In particular, what is the effect of the rise in Argentina's country risk indicators over Chile's country risk, exchange rate and domestic rates? Does the exchange rate absorb the whole impact of the regional turbulence generated in Argentina? Is Chile's response similar to the one observed in Brazil, which also has a floating regime in place?

A similar exercise has been previously done by Edwards (2000). Like him, we estimate a VAR model, which allows us to face the potential endogeneity problem that may appear when estimating a regression for contagion. The VAR system, using daily data, allows explicitly for the inclusion of feedback between the countries financial indicators.. The estimation period ranges from January 1, 1998 to September 7, 2001. We additionally estimate two different subsamples, to analyze if the relationship between the variables has experienced variations in time. The first window ranges from January 1, 1998 to December 31, 1999. The second window goes from January 3, 2000 to September 7, 2001. The ordering of the variables in the VAR system states that domestic financial interest rates and exchange rates do not have a contemporaneous effect over country risk indicators. Although the ordering is arbitrary, our prior is that country risk indicators are more exogenous than interest rates and exchange rate variation. The results are robust to the ordering of interest rates and exchange rates inside the VAR system.

The following endogenous variables were included in the estimation:

1. Argentina's JP Morgan EMBI Index.
2. Brazil's JP Morgan EMBI Index.
3. Chile's JP Morgan EMBI Index.
4. The 90-day rate of change in the Chilean peso/US$ dollar exchange rate.
5. The 90-day rate of change in the Brazilian real/US$ dollar exchange rate.
6. The spread between 90-day peso and US-dollar deposits in Argentina, as a proxy for devaluation expectations.
7. Argentina's 90 day peso-denominated interest rates on domestic deposits.
8. Brazil's 90-day domestic deposit interest rates.
9. Chile's 90-day domestic deposit interest rates.

The Non Latin American EMBI index was also included in the original estimation. This indicator captures the market perception of country risk in Asia and East Asia, and could have been relevant as an indicator of the global shock over all emerging markets. However, it was excluded from the estimation, as it yielded no significant results.

US 90-day deposit rates were included as an exogenous variable. The lag-structure for the weekly and daily VAR systems was estimated using the Schwartz Information Criteria.

Figures 15 reports the impulse response functions of the variables in the system to a one standard deviation shock in Argentina's EMBI index. When estimating using the whole sample, the shock in Argentina's country risk causes an immediate, significant rise in the country risk of both Brazil and Chile, which is still in place after 1 month. However, the magnitude of Chile's response is significantly lower than the impact over Brazil's EMBI. A short-lived nominal devaluation is also experienced in both countries, although (again) the impact over Brazil has a bigger magnitude. Chile's rates exhibit no significant response,

while Brazilian rates experience a mild, short-lived impact. It is interesting to see the way results vary when 2 periods are considered. The 1998-99 sample, in which Chile's exchange rate band was in place for almost all the period, shows that the response of Chile's exchange rate is non-significant. Interest rates, however, do respond, suggesting that contagion of Argentina's situation over Chile's financial variables was channeled through this variable, as well as through the sovereign spread. For the 2000-2001 sample, the response of Chile's sovereign spread, although significant, is significantly shorter and smaller than when the whole period is considered. The exchange rate devaluation exhibits a significant response, although it dies away in 20 days. Interest rates remain unaffected. For the case of Brazil, the three variables respond: interests rate rise together with the sovereign spread, while the exchange rate devaluation also increases. The magnitude of the three responses is higher than in the case of Chile.

In summary, the VAR analysis, as well as the GARCH estimation, suggest that Argentina's sovereign risk spread had a significant effect over the exchange rate, with only a slight impact over the sovereign spread. For the 1998-99 period, the response of the sovereign spread was bigger, and domestic interest rates were also affected. Since the adoption of the floating regime, the response seems to be channeled through the exchange rate market, unlike the case of Brazil, in which the three financial indicators appear to be affected.[55]

[55] Specially after November 2001, Argentina's non-stop flight towards a world record country risk has not been followed by Chile's exchange rate. Moreover, the peso has significantly appreciated over the same period.

Figure 19a
Daily Data Estimation
Response to Argentina's Sovereign Spread
1998-2001

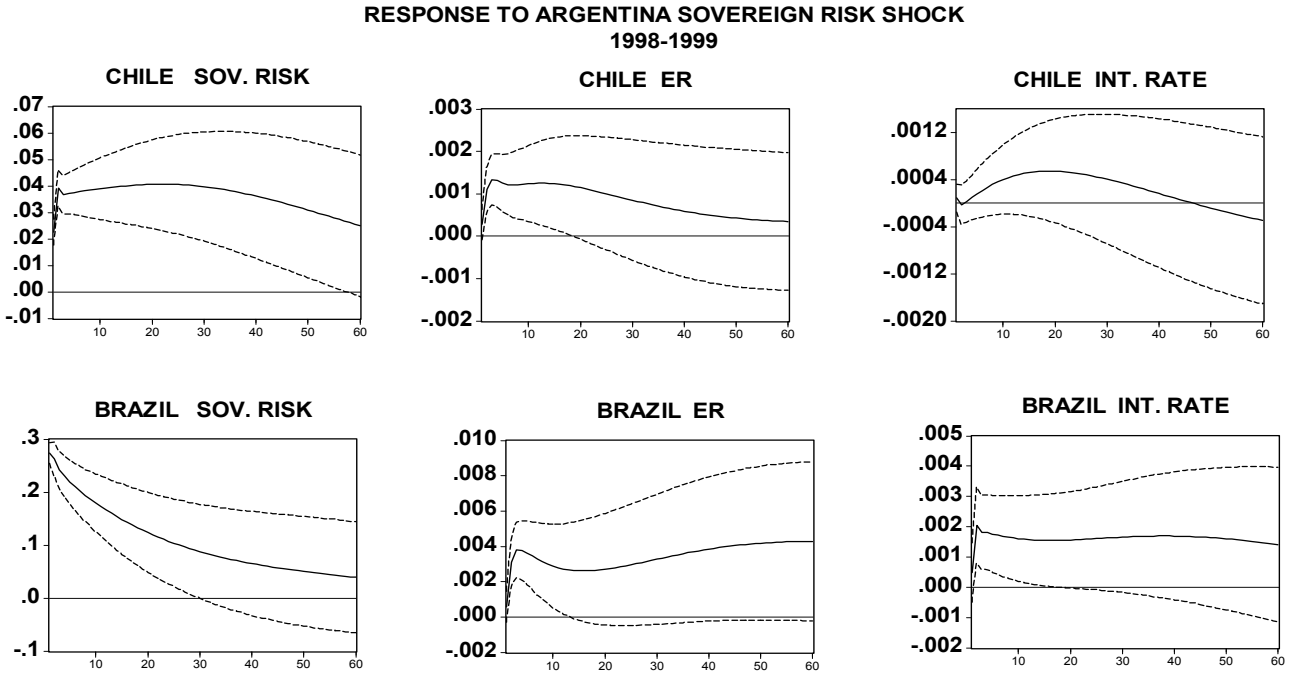


Figure 19b
Daily Data Estimation
Response to Argentina's Sovereign Spread
1998-1999

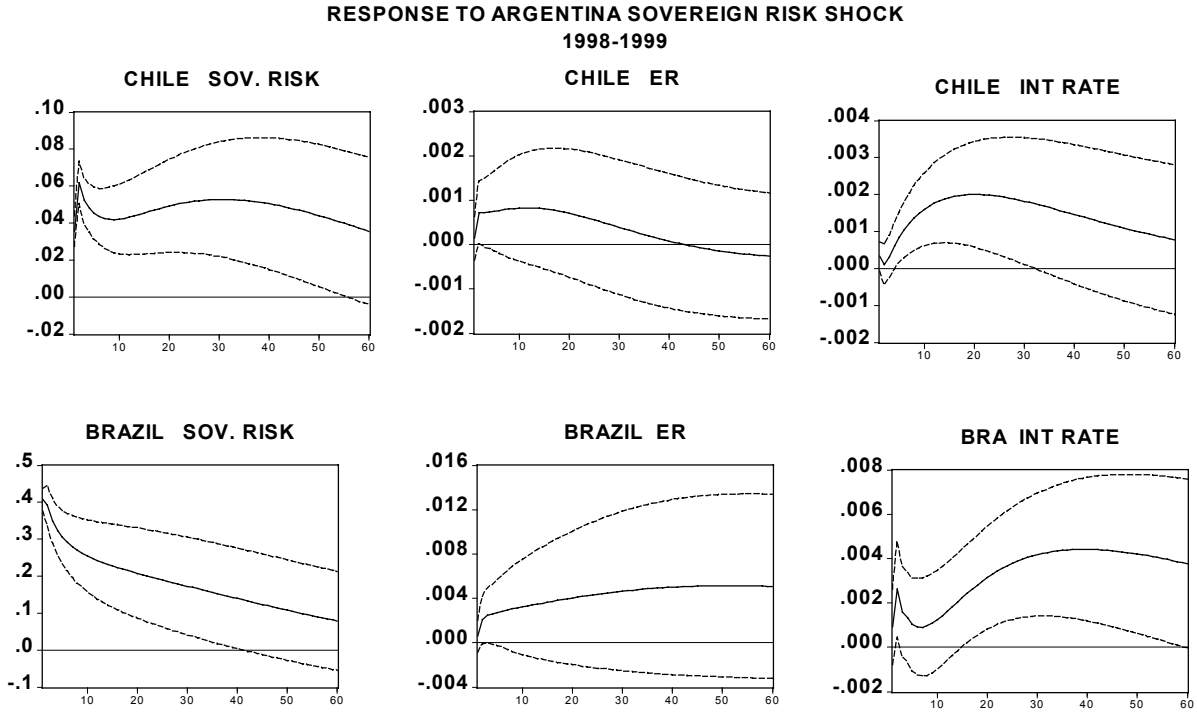
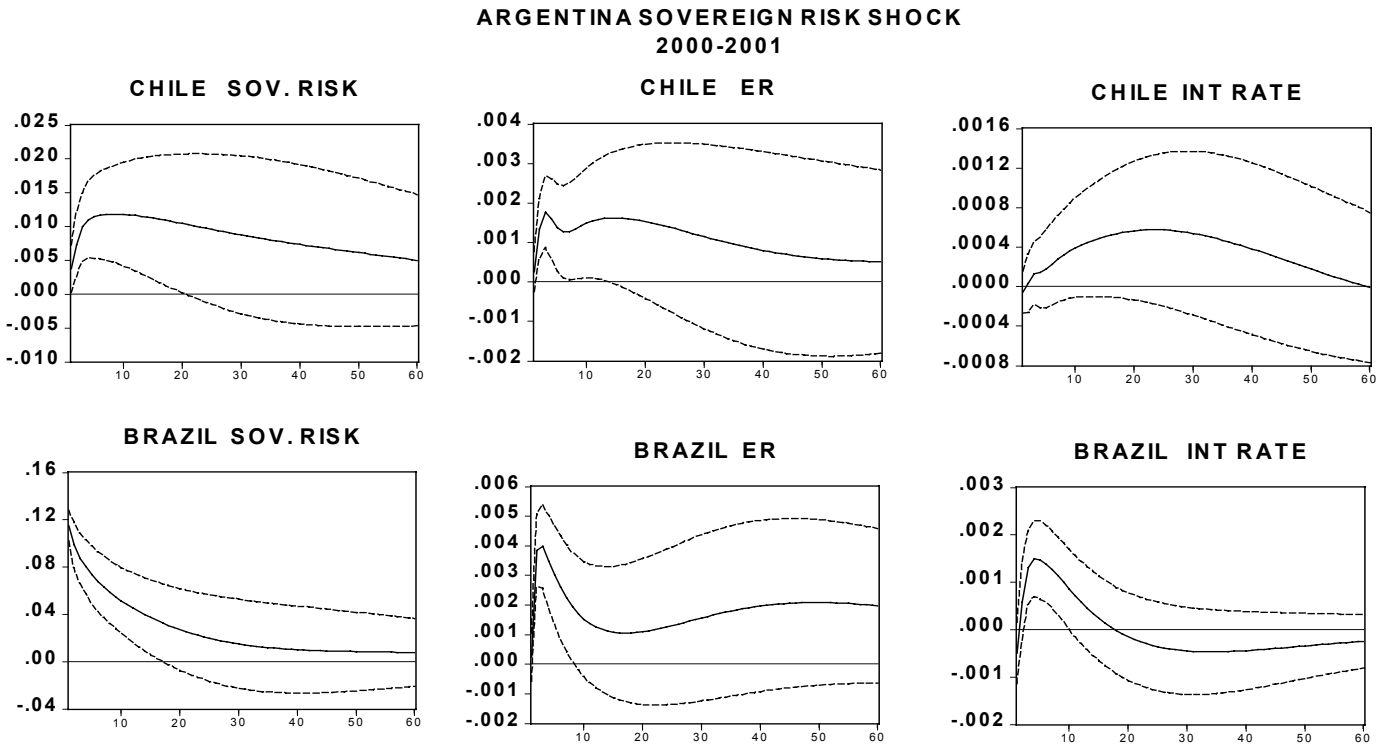


Figure 19c
Daily Data Estimation
Response to Argentina's Sovereign Spread
2000-2001



V. Concluding Remarks

Throughout its history, Chile has experienced a significant number of exchange rate regimes, from hard pegs to total flexibility, and many experiences ended with negative results and a bitter aftertaste. After the collapse of the fixed exchange rate in 1982, an exchange rate band was adopted, and lasted for almost 15 years. The band experienced a significant number of changes through that period, ranging from its width and determinants to its relative importance and the objectives justifying its existence. Despite this general lack of intertemporal consistence, the band proved itself at least as a not embarrassing choice (in a context of almost uninterrupted macroeconomic achievement) and, probably, a (long) transition[56] road to the adoption of exchange rate flexibility in 1999.

Chile's transition to a flexible ER regime, triggered by simultaneous events as the effects of the Asian crisis and the achievement of a long run (steady state) inflation target, was not really a blunt reversal or a sudden change in the direction in which exchange rate policy had been heading. During much of the 90s, the exchange rate band mimicked[57] exchange rate flexibility, as its parameters shifted in order to validate market pressures and its width was significantly large. Exchange rate management *per se*, with the exception of some specific episodes of distress, clearly had a secondary position in the Central Bank's policy priorities.

Thus, the choice of a flexible exchange rate was not only consistent with the changes experienced by the inflation targeting regime under low, steady-state inflation and with eliminating a possible source of conflict, but also with the developments and lessons observed during the 1990s. In that scenario, a movement in the opposite direction (that is, towards higher exchange rate management) would have contradicted the Central Bank's successful monetary scheme, and thus was probably never a valid option. As done elsewhere reveals[58], the adoption of a foreign currency would be a bad policy choice for Chile at the present time. As "softer" versions of dollarization (such as a hard peg or a currency board) share its lack of flexibility without entirely providing its credibility (see, for instance, Argentina's currency board collapse), a floating exchange rate was possibly the best available choice.

Chile's experience with flexible exchange rate has been relatively calm, as core inflation has remained close to the steady-state target and exchange rate volatility has not increased hugely when compared to its pre-flexibility values. Although the peso has depreciated significantly during 2001, a significant amount of that change in value can be justified by the sequence of adverse shocks faced by the Chilean economy during the last year.

[56] Curiously consistent ex post.
[57] Voluntarily or involuntarily.
[58] Morandé and Schmidt-Hebbel (2000).

The low level of passthrough, although subject to many explanations, weakens the case presented by the advocates of exchange rate management in order to avoid significant shifts in domestic prices. Although there is a slight risk of an uprise in inflation, the behavior of prices over a longer horizon will be consistent with the inflation objective, as the monetary framework remains unchanged.

Regarding volatility, the result is somehow striking, as it has been widely reported that exchange rates suffer significant increases (unexplained by fundamental variables) in their volatilities when adopting floating regimes. Until June 2001, volatility in Chile had only marginally increased, and since then it is still below international standards. What can explain this result? Our experience with exchange flexibility is too short as to derive definite conclusions or trace permanent trends, so we can just guess a possible explanation as of today. One of them could lie on the features of Chile's financial system. It is likely that financial markets in Chile (due to a relatively small number of participants, low volume of transactions or non-existence of a broad set of financial instruments) lack significant levels of speculation or heterogeneity, features which are a traditional explanation for exchange volatility in industrialized economies. If further development of Chile's financial system (and greater depth reflected in a higher number of market participants and transactions) will indeed increase volatility remains an open issue. However, financial development would also provide more efficient and complete hedges, thus eliminating one possible negative effect of enhanced volatility.

Although the exchange rate has been under the spotlight in recent months, it is important to keep in mind some important elements. The significant depreciation and increase in volatility observed in 2001 has not affected other macroeconomic variable besides the exchange rate. Unlike similar episodes in the past, the volatility of reserves or interest rates has not risen. The effects of Argentina's crisis has been channeled through the exchange rate market and, despite a possible degree of overreaction, has had no effect over other financial indicators. The lack of commitment of the Central Bank to a specific value of the exchange rate has prevented costly actions that were a source of significant macroeconomic unstability in the past. Moreover, the exchange rate depreciation has permitted soft adjustment to the significant deterioration of the terms of trade experienced during the year. Moreover, Chile's access to international credit has not become more costly, as reflected by the stability of country risk premia. International agents have not seen the rise of exchange rate volatility as a serious threat to macroeconomic stability or to the Central Bank's policy framework.

Part of that confidence probably lies on the reputation and credibility acquired by the country after a historical track of macroeconomic responsibility. The other part probably lies in the fact that the increase in exchange rate volatility, although violent by the country's standard, is just a normal event in the global experience of free floaters.

Why then the Central Bank intervened the ER market? Following the Central Bank's own words, the reaction must be understood as an exceptional event. Under the significant distress and turmoil experienced by the international markets in recent months, it was understood that the associated uncertainty could lead to an overreaction in the exchange rate market. This overreaction could significantly deviate the exchange rate from its long-term value, causing unnecessary costs in terms of inflation and adjustment costs. These costs could generate further speculation against the peso, deepening the effects of the initial depreciation.

However, trying to beat the market by targeting a specific value would only enhance further speculation, and thus intervention can only be understood as an attempt to provide liquidity in moments of extraordinary turmoil and uncertainty. The Central Bank can only credibly try to smooth out the movements generated by the market without trying to change, through intervention, the trend the market itself determines. The fact that intervention has been pre-announced, and defined over a specific time period, shows that the compromise with a floating exchange regime is not at risk.

Maintaining a significant degree of intervention in the future would contradict the foundations of the exchange rate regime adopted in 1999, and thus would be inconsistent with the monetary framework adopted by the Central Bank since the attaining of a steady-state inflation. As the market evolves in the future in terms of higher depth and completeness, the need for direct intervention should be even rarer than what it has been during the last two years.

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Table 1
Summary of Exchange Rate Band Characteristics: 1984-1999

Date	Band Width	Currency Basket Composition			External Inflation for adjustment	Domestic Inflation for adjustment	Real Apreciation (Productivity)
		US$	Yen	Mark			
84.08 - 85.06	± 0.5%	100%	0%	0%	3.60%	Lagged	0%
85.07 - 87.12	± 2.0%	100%	0%	0%	3.60%	Lagged	0%
88.01 - 89.05	± 3.0%	100%	0%	0%	3.60%	Lagged	0%
89.06 - 91.02	± 5.0%	100%	0%	0%	3.60%	Lagged	0%
91.03 - 91.06	± 5.0%	100%	0%	0%	0.00%	Lagged	0%
91.06 - 91.11	± 5.0%	100%	0%	0%	3.60%	Lagged	0%
91.12 - 91.12	± 5.0%	100%	0%	0%	2.40%	Lagged	0%
92.01 - 92.04	± 10.0%	100%	0%	0%	2.40%	Lagged	0%
92.05 - 92.06	± 10.0%	100%	0%	0%	1.20%	Lagged	0%
92.07 - 94.11	± 10.0%	50%	20%	30%	2.40%	Lagged	0%
94.12 - 95.11	± 10.0%	45%	25%	30%	2.40%	Lagged	0%
95.12 - 96.12	± 10.0%	45%	25%	30%	2.40%	Lagged	2%
97.01 - 98.07	± 12.5%	80%	5%	15%	2.40%	Lagged	2%
98.07- 98.09	-3.0% + 2.5%	80%	5%	15%	2.40%	Lagged	0%
98.09 –98.12	± 3.5%*	80%	5%	15%	0%	Target	0%
98.12-99.09	± 8%	80%	5%	15%	0%	Target	0%

Discrete adjustments in band's center		
Date	Change	Sign
1984.09	23.70%	Devaluation
1985.02	9.10%	Devaluation
1985.07	8.50%	Devaluation
1991.04	1.40%	Revaluation
1991.06	2.00%	Revaluation
1992.01	5.00%	Revaluation
1994.12	9.70%	Revaluation
1997.01	4.00%	Revaluation

[viii] Turmoil in the dates surrounding the transition is excluded from the data.
[ix] Marginally significant