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EFFECTS OF FOREIGN EXCHANGE INTERVENTION UNDER PUBLIC INFORMATION: THE CHILEAN CASE

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Resumen

Este trabajo estudia los efectos de las intervenciones cambiarias usando datos diarios e intra diarios para Chile, entre 1998 y 2003. Su mayor contribución es la de reconocer el rol de la transparencia y los anuncios públicos en el éxito de la política de intervención cambiaria, a través de un canal de expectativas que impacta directamente al tipo de cambio. Se distinguen tres instrumentos de política de intervención cambiaria –spot, BCD y anuncios– y son tratados independientemente. Estimaciones de series de tiempo son usadas para capturar el efecto de las intervenciones spot y BCD´s, como también los efectos asociados al canal de anuncio que proponemos como potencialmente relevante. Los resultados obtenidos indican que el efecto de las intervenciones individuales (spot y BCD) son extremadamente pequeños y, en la mayoría de los casos, no significativos estadísticamente. Adicionalmente, la importancia del canal anuncio es confirmada. El impacto de las acciones del Banco Central en el nivel y la tendencia del tipo de cambio parecen ser canalizadas a través de los anuncios hechos por las autoridades monetarias. El mercado ajusta sus expectativas a la información revelada, ajustándose el tipo de cambio de acuerdo a esto. Estos efectos ocurren en un período más prolongado que el sugerido por la literatura tradicional. Finalmente, usando datos intra diarios para el 2001, se confirma la insignificancia de las intervenciones individuales.

Abstract

This paper studies the effects of exchange rate interventions using daily and intraday data for Chile, from 1998 to 2003. Its main contribution is the recognition of the role played by transparency and public announcements in the success of the intervention policy, through the existence of an expectations mechanism which directly impacts the exchange rate. Three foreign exchange policy instruments are distinguished –spot, dollar denominated papers (BCD´s) and announcements- and treated as independent interventions. Time series estimations are used to capture the effect of the traditionally studied spot interventions, as well as the effects associated to the announcement channel that we propose as potentially relevant. Results show that the impact of individual interventions (spot and BCD) are extremely small and, in most cases, non-significant. Also, the importance of the hypothesized announcement mechanism is confirmed. The impact of Central Bank actions on the exchange rate's level and trend seem to be channeled through the public announcements made by the monetary authority. The market adjusts its expectations to the information revealed through them, with the exchange rate responding accordingly. These effects occur on longer time spans than the ones suggested by the traditional literature. The negligible effect of individual interventions is also found, for the year 2001, with the use of intraday data.

I. Introduction

In 1982 Chile experienced the traumatic collapse of the fixed exchange regime in place since 1979. After successive devaluations, the regime finally evolved to the adoption of a band in 1984. Although the band experienced several changes in time, most of them were pointed towards increasing degrees of flexibility. This trend towards flexibility was increased during the 1990s, when the Central Bank of Chile became independent and aimed efforts to the reduction of inflation through the gradual adoption of an inflation-targeting framework. The exchange rate commitment became increasingly secondary vis a vis the inflation objective, the band being ultimately abandoned in September of 1999 with the implementation of a floating regime[1].

While exchange rate interventions were a common (and expected) feature when the band was in place, they are still an issue today, more than 4 years after the adoption of the float. The Central Bank of Chile defined explicit intervention periods both in 2001 and 2002, in response to what were considered exceptional circumstances that put the exchange rate market under significant stress.

In fact, the "two-corner hypothesis" (Eichengreen (1994), Obstfeld and Rogoff (1995)), which suggests that currency regimes worldwide are either shifting towards extremely tight commitments or to floating regimes, has brought new attention to exchange rate intervention. When an explicit currency commitment exists, the central bank has an obvious role to play, naturally using its tools (i.e. reserves, interest rates) to validate such commitment. However, things become fuzzier when analyzing the adequate role to play under flexible exchange rate arrangements.

Even in free-floating countries, where the market in principle determines the parity by itself, interventions are frequent. Clean float is a rarity and almost every regime that is labeled as floating intervenes in the exchange market to some degree.[2]

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[1] For a detailed description of Chile's exchange rate policies in recent years, see Morandé and Tapia (2002).
[2] See, for example, Calvo and Reinhart (2000). Neely (2001) shows the results of a survey to a group of over twenty developed and developing countries, including the G-7. Of this sample, only New Zealand abstained completely from intervening the exchange market between 1990 and 2000.

This paper does not intend to analyze if interventions are efficient in terms of welfare. Given the decision to participate in the exchange market, the goal of this study is to determine if central bank interventions are capable of causing significant effects on the exchange rate's level and/or trend. These effects are analyzed for the Chilean economy, using daily data since 1998 and intraday data for 2001. Following this introduction, section II presents a simple framework of how intervention decisions are made and through which channels they are expected to affect the exchange rate. Section III contains a description of the three intervention episodes under study (January 1998 - September 1999, August - December 2001, and October 2002 - February 2003). Section IV uses time series methodologies to provide an empirical analysis. Section V presents policy implications and conclusions.

II.   Foreign Exchange Intervention Policy

II.1. Sterilized Interventions

The analysis of foreign exchange (FOREX) intervention usually focuses on sterilized interventions. Non sterilized interventions are not interesting, as they are equivalent to monetary policy, thus unambiguously affecting the exchange rate market through arbitrage conditions. The effects of sterilized interventions are of greater interest as they are less obvious, since these interventions do not affect the money base or domestic interest rates, which remain unaltered due to offsetting operations with domestic currency papers implemented to keep monetary policy isolated from exchange rate policy. Thus, in a context of free capital mobility, successful sterilized interventions implies that the central is able to break the "impossible trinity" by independently conducting monetary and exchange rate policies.

II.2. Channels

The theoretical literature has brought up at least three mechanisms through which the exchange rate can experience significant variations after sterilized interventions: portfolio, signaling and information channels. These channels are not mutually exclusive and, in certain conditions, may work simultaneously. A brief explanation of these channels is presented here. Tapia and Tokman (2003) provide a more profound discussion.

In the portfolio channel, under the assumption of imperfect substitution between domestic and foreign assets, changes induced by the forex interventions in the relative supply of domestic and foreign assets force an adjustment in the investors' portfolio, which alters the exchange rate accordingly.

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Thus, the size of the effect depends on the relative amounts of assets involved. As most intervention episodes are characterized by the small amounts involved, many authors have been skeptic on the practical relevance of this channel, and empirical studies have failed to deliver a clear answer (Domínguez and Frankel, 1993; Evans and Lyons, 2001).

The signaling channel states that intervention gives away information on future monetary policy: while a sale of foreign currency anticipates a tighter monetary stance, a purchase anticipates a relaxation in monetary policy. Interpreting the signal, market agents adjust their positions in domestic and foreign currency, whereby affecting the exchange rate (Mussa, 1981).

This channel has important conceptual differences with the portfolio mechanism. First, it does not break the "impossible trinity", as the effect of intervention is conditional on the credibility of the signaled path for future monetary policy. Monetary policy and intervention activities are not exogenous, as a signal that is not validated by policy actions, or that is not credible given the policy framework, will be ineffective or quickly reversed. Moreover, the subsequent reduction in credibility will make the impact of future interventions wane.

Thus, the sterilization of today's intervention must be reversed sometime in the future. In that case, this channel may be seen as a non-sterilized intervention with a time lag. In an inflation-targeting regime, for example, intervention signals must be consistent with the commitment to a credible inflation rate. Thus, the impossible trinity remains unattainable, as the central bank cannot pursue conflicting targets for both the exchange rate and inflation.

A second implication of this mechanism is that only operations performed by authorities with power over the conduct of monetary policy should have an effect. In other words, if the central bank has full and credible autonomy from the government, intervention conducted by the central government should have no impact under this mechanism.

Third, and as this channel operates directly over agents' expectations, interventions must be perceived as such by the general public.

The third channel –the information channel- is a particular case of the former. However, contrary to the first two mechanisms, it assumes the existence of significant exchange rate misalignments. Deviations from

equilibrium are caused by the presence of speculators that, contradicting Friedman's (1953) classic argument, destabilize the foreign exchange market, diverting the rate from its macroeconomic fundamentals.[3]

These agents, whose presence may be endogenous to the market's behavior, are capable of introducing persistent exchange rate deviations from its long-run trend. These misalignments can become a short-run equilibrium in certain circumstances. In this case, the signal provided by intervention must not necessarily validated by actual monetary policy action. If monetary policy is fully credible, the sole threat of adjusting interest rates – given by the intervention signal - may suffice to adjust the market, which interprets that the central bank will change the interest rate if the parity continues along its present trend, which is considered to be deviated from equilibrium.

II.3. Instruments

In general, most studies have focused on spot interventions, as countries usually rely on spot purchases or sales to implement their exchange rate intervention policy. However, the direct currency operations are not the only policy instruments available for central banks. In principle, the above mentioned channels also operate through operations in dollar/domestic currency denominated papers.

However, it is feasible that the authorities are capable of affecting the market not only through actual intervention operations, but also by public announcements regarding them. This is, after all, the mechanism operating in two of the above mentioned channels: interventions have no effect per se, but because of the informational element contained in them. Public announcements, formal or informal, reveal relevant information to the market (on the expected stance of future monetary policy, on expected changes in the relative portfolio of domestic and foreign assets), which should adjust accordingly, before actual events occur. While in the case of Chile, announcements became a formal instrument in the intervention policy framework – as we will see later-, in a more general case one can think of informal instruments in, for example, the importance given by the market to the speeches and announcements made by Alan Greenspan.

The effect of a particular announcement will depend largely on its credibility and feasibility. Credibility should depend on the reputation attained by the authority making the announcement. A credible announcement

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[3] This vision has come mainly as a result of the poor predictive power of theoretical foreign exchange models based on macroeconomic variables (Frankel and Rose, 1995).

should immediately affect expectations, thus reflecting in market prices and adjustment. Agents should dismiss a fully non-credible announcement, on the other side, as irrelevant noise.

Arguably, the effect of the announcement should not only depend on the authority's previous reputation as a reliable agent, but also on the feasibility of implementing the policies that are being claimed. For example, under the assumptions of the portfolio channel, an announcement regarding future interventions will only be deemed credible if the agents believe that the reserves held by the Central Bank are enough to engage in active market participation.

How should announcements operate? As mentioned, the day the authority reveals an insight regarding its future plans (ranging from an informal commentary on the economy's current stance and policy perspectives to a formal policy announcement) expectations are formed regarding the authority's future actions. In the particular case of intervention policies, it could imply an expectation on future monetary policy (in the case of the signaling channel, in which the announcement should have the same effect as actual ER intervention, as they both are relevant for what they imply about future monetary actions) or an expected portfolio adjustment (associated to the expected value of interventions in the portfolio channels). Such expectations should make the market adjust, with prices reacting instantaneously, before any actual events occur. As this effect is based upon expectations, it is likely that additional adjustments in prices are seen in time, as expectations are revised in the light of new developments and the authority's own actions. For example, the authority's lack of action to validate its commitment should damage credibility, reversing the initial effects associated to the announcement.

Thus, the Central Bank has three instruments in the design of its intervention policies (two active instruments of actual intervention and one instrument that precedes them).

II.4. Analytical Framework

To provide a better illustration of the mechanisms and instruments associated to the effect of interventions introduced in the previous sections, this section presents a simple, sketched analytical framework of the relevant variables that are involved. These equations will also illustrate the empirical problems associated to the estimation of intervention effects that are described in the next section.

The first equation describes the behavior of the exchange rate,

$$e_t = f(X_t, S_{t,} B_t, X^e_{t+n}, \sum S^e_{t+n}, \sum B^e_{t+n})$$

where e_t is the exchange rate (either in level or in first differences). The exchange rate is assumed to depend on a set of macroeconomic variables, in present and expected value (X_t and X_{t+n}^e) and, eventually on intervention variables, both in present and expected value (S_t being spot interventions and B_t dollar denominated bonds).

How does the third instrument of intervention previously mentioned operate? Announcements determine the expected level of spot interventions and bond sales. The extent of the impact of a certain announcement on future expectations will depend, as mentioned earlier, on the formality and preciseness of the commitment associated to them and on the central bank's credibility. Moreover, expectations regarding future interventions should not only depend on announcements, but also on expected and actual macroeconomic developments and on the central bank's previous intervention behavior[4].

$$\sum S_{t+n}^e, = f(A_t, X_t^e, X_t, \sum S_{t-n}, A_{t-n})$$
$$\sum B_{t+n}^e = f(A_t, X_t^e, X_t, \sum S_{t-n}, A_{t-n})$$

However, the way the intervention variables affect the exchange rate should depend on the specific channel through which they operate. Under the portfolio channel, the total value of actual and expected sales/purchases of foreign currency directly affects the exchange rate through the actual (expected) change in the agents' portfolio. In the signaling and information, channels, all intervention variables do not affect the exchange rate by themselves, but rather by releasing information on the set of relevant macroeconomic variables. In the case of the signaling channel, revealing information on future monetary policy, one of the variables included in the vector X_{t+n}^e. In the case of the information channel, revealing information regarding the "true" X_t. In fact, the sole announcement– as it encompasses the relevant information associated to the two latter channels – could be the relevant variable.

This is,

$X_{t+n}^e = f(, S_t, B_t, A_t)$ in the case of the signaling channel, and

$X_{t+n} = f(, S_t, B_t, A_t)i$ in the case of the information channel.

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[4] Including his fulfillment of previous announcements.

The previous equations provide a stylized description of the operation of the exchange rate market and its reaction to the intervention instruments. However, these instruments are not exogenous, as the central bank arguably makes intervention decisions conditional on the market's behavior. This endogeneity between intervention decisions and exchange rate movements lies at the core of the empirical problems associated to the estimation of intervention equations.

The three instruments available to the central bank require distinct, while related, decision processes. Spot interventions are clearly conducted on a daily basis, and thus are probably sensitive to the evolution of the exchange rate in the same day in which the operation occurs. That is, precisely, the simultaneity problem between the exchange rate and spot market interventions that has been central to empirical studies regarding the impact of intervention policies. Other variables, such as the evolution of the exchange rate in previous days or macroeconomic variables[5], could also be relevant. Spot intervention decisions probably also present inertia (if, for example, they are conducted under a pre-defined scheme of intervention in successive days) and depend on the capability of the central bank to conduct them (this is, to have sufficient international reserves in the case of dollar sales). The final relevant variables are announcements, either formal or informal. In fact, it may be the case, as Chile during 2001 and 2002, that the existence of spot interventions necessarily requires a previous formal announcement.

Bond operations decisions are very similar but at least in the case of Chile, they are not conditional on daily events, as they are defined on a monthly basis with a publicly announced calendar.

Finally, policy announcements are not conditional on daily events, and reflect the central bank's main concerns regarding the behavior of the exchange rate market, ranging from issues as liquidity or potential "misalignments" to "excessive" volatility.

$$S_t = g(e_t, \sum e_{t-n}, X_t; X_{t+n}^e, \text{Re} \, serves_t, S_{t-1}, A_t)$$

$$B_t = g(\sum e_{t-n}, \sum X_{t-n}, X_{t+n}^e, A_t)$$

$$A_t = g(\sum e_{t+n}, \sum X_{t-n}, X_{t+n}^e)$$

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[5] Particularly, if the Central Bank is concerned about potential exchange rate "misalignments".

II.5. Empirical Evidence and Estimation Problems

There is plenty of empirical evidence on the effects of ER interventions, especially for industrial countries. The earlier studies seemed to reach some consensus on the small effect of sterilized interventions on the exchange rate, with the seminal report by Jurgensen (1983) apparently concluding the debate on the subject. However, the academic interest was reborn in the mid eighties, after the apparent success of coordinated interventions that followed the Plaza and Louvre agreements, which were targeted to reduce volatility. A series of papers (Domínguez and Frankel, 1990 and 1993, among others) found results suggesting that interventions could smooth volatility. Still, the discussion is far from reaching a consensus, with numerous recent studies refuting the conclusions of earlier ones. Sarno and Taylor (2001) and Ramaswamy and Samiei (2000) provide extensive reviews to this still open debate.

The disparity of results can be attributed, in part, to the presence of two empirical problems. The first one is the lack of data, and stems from the reluctance of central banks to publish official intervention information, which makes the task of gathering statistics tedious and deficient. The second one is, as mentioned, the simultaneity bias in the estimation of the effect of the spot interventions in the exchange rate.

Regarding the first problem, public information on interventions is, around the world, very scarce. Central banks normally do not make public announcements of their interventions, let alone disclose the amounts involved. Even when present, disclosures are few and not frequent in comparison to the time span one expects the market to adjust to intervention, often days or even hours. This deficiency has forced researchers to build indirect intervention series, resorting to sources such as media news, surveys, and movements in international reserves. Since these proxies are far from perfect, it is possible that the intervention series built upon them are inadequate to estimate the true effects of exchange rate interventions.

Even when information exists, estimates derived from the impact of exchange rate interventions can be misleading if they do not consider the simultaneous nature of the exchange rate determination process and of intervention decisions, which are typically discretional and taken on a daily or hourly basis[6]. If this simultaneous process is not controlled for, the results obtained can be biased. In particular, the spot intervention coefficient can be biased upwards, and the effect—although significant and negative in the true model—appear non-significant or even positive.

III.   Exchange Rate Interventions in Practice: Chile's experience 1998-2003

III.1 International context

The number of countries leaning towards flexible exchange rate arrangements has grown in recent years (Hochreichter et al, 2002). However, countries with actually clean floating regimes, as mentioned above, are few. Almost all countries that are classified as free floaters by the IMF's classification, including Chile, intervene in the market with some frequency, or explicitly reserve the right to do so. Table 1 provides some examples of intervention practices and motivations in countries with floating regimes. New Zealand is the world's clearest example of a clean floating regime, with no interventions in the last 18 years. Countries that are usually taken as the epitome of free floating as Japan or the United States[7], have intervened the market frequently, although recent trends point towards less frequent, yet bigger interventions (Ito, 2002; Taylor, 2002). Other countries, such as Colombia, operate with predetermined intervention rules linked to the evolution of exchange rate volatility as suggested by Williamson (1998).

What are the motivations behind intervention? Rather than targeting specific values, they seem to be fostered by the attempt to smoothen excessive short run fluctuations, or to resist short-run trends ("leaning against the wind") that could be driving the exchange rate away from its fundamentals. Motives such as optimal portfolio and reserves management are also mentioned.

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[6] In general, exchange rate interventions occur whenever the exchange rate moves in the opposite direction to the effect that is pursued by the central bank's decision. The central bank is more likely to sell foreign currency when the exchange rate is rising—to bring it down—than when it is already falling. This may lead to equate exchange rate increases to the sale of foreign currency, when causality goes in the opposite direction.

[7] For example, Calvo and Reinhart (2000) use their regimes as the benchmark to analyze if developing countries behave as free floaters.

In most countries, the Central Bank is the institution conducting intervention, either autonomously or in accord with the government.

III.2 Chile's intervention experience 1998-2003

As some of the countries included in Table 1, interventions are decided and conducted autonomously by the Central Bank of Chile, which is fully independent from the government. However, the central government has the capacity of intervening, if it decides to strategically manage the resources obtained from its revenues[8], mainly flows derived from copper sales. However, no information exists regarding this form of "intervention", and thus it is excluded from the paper. Moreover, government sales should be ineffective through the signaling channel, as the government has no influence over monetary policy decisions.

Regarding the practice of intervention (Table 2), Chile appears to have incurred less frequently in intervention activities, when compared to other central banks. This is confirmed when looking at the evidence presented by Neely (2001), where the median intervention frequency in the surveyed central banks was 25% of trading days throughout the 1990s. Between August and December 2001, when an explicit intervention regime was announced within the context of the floating scheme, the Central Bank of Chile intervened in the market only in 15% of the trading days.

The intervention episodes analyzed herein occurred in three periods. In all of them, the Central Bank's actions were related to sales of dollar-denominated bonds and/or dollars. Interventions involving dollar purchases, which were very frequent until 1997, are not included as no daily data exists prior to 1998. In the first period, from January 1998 to September 1999[9], the presence of the floating band implied an explicit exchange rate target. Under this regime, the Central Bank of Chile had (and frequently used) the authority to intervene the foreign exchange market at discretion, even if the exchange rate was far from the band's boundaries. In fact,

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[8] Specially, copper sales made through the state company CODELCO.
[9] The last intervention of this period occurred in early 1999, with no further operations until 2001. However, we believe that it is proper to extend the first period to September 1999, since in concept the policy regime—and the possibility of intervention thereunder—remained in place until the band was abandoned.

intramarginal interventions within the band were frequent during the 1990s. This period was also characterized by successive episodes of speculative attacks against the peso, triggered by the international turmoil associated to the Asian crisis and its repercussions.

The second period begins on August 16th, 2001, when the Central Bank announced that from that date on until the end of the year it could intervene the foreign exchange market, that was operating under a free float since September of 1999. Resources available for intervention were announced to be a maximum of US$2 billion in open market operations, and another US$2 billion in dollar-denominated instruments.[10]

The third period is similar in nature to the second one. On October 10th of 2003, the Central Bank announced that, over a period of four months, it could intervene the foreign exchange market for maximum amounts of US$2 billion in open market operations and another US$2 billion in dollar denominated papers. In this case, however, the announcement did not translate into actual interventions in the spot market.

This paper tries to find the effect on the exchange rate of the various foreign exchange intervention policies applied since 1998. To that end, it examines the impact on the exchange rate of spot foreign currency sales by the Central Bank and the placement of dollar-denominated notes at different maturities (BCDs). Distinguishing between both types of instruments responds to the fact that, given their different characteristics, their impact on the currency's value may differ[11].

However, and as discussed earlier, analyzing only the direct effect of individual interventions might be misleading, because—to different extents depending on the type of instrument and the period studied—the Central Bank disclosed some information to the market regarding its future actions. Thus, the market should have adjusted immediately to the new information, before actual interventions took place. This is particularly true for BCDs, where—at the beginning of each reserve requirement period, typically on the eighth of each

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[10] Similarly to the previous case, actual interventions through open market operations occur over a shorter time interval: the last one took place in late October. However, in its August announcement, the Central Bank reserved the right to intervene the market until 31 December 2001. Thus, the "exception regime" within the floating scheme remained in place until that date. Also, interventions with Central Bank notes occured throughout the whole period (in fact, they began a couple of months earlier).

[11] In terms of portfolio, while foreign currency sales indirectly provide liquidity to investors whose needs or relevant horizons are short-term, the notes can provide hedging for agents with longer horizons. In terms of the signal, it is possible that both instruments deliver different information on potential future policy changes, and on the timing of their occurrence.

month—the exact amount of papers to be sold becomes known, together with the specific dates in which the sales will be made.

Spot sales are somewhat different. In 1998, no *ex ant*e information existed on the amounts or timing of such sales. The market only knew that, given the foreign exchange regime, the space for potential interventions was open at any given time, and that the maximum amount of resources that could be used resulted from the stock of international reserves held by the Central Bank. By 2001, information became more accurate. The announcement implied an explicit change in the regime, where the clean float policy applied between 1999 and July of 2001 was publicly suspended for a definite period of time. The announcement set an upper bound for the amount of resources to be used, which is viewed as more precise than the "total value of reserves" that was the implicit limit in 1998-99. Thus, it is reasonable to believe that when the Central Bank announced its intervention policy, the market generated expectations on the actual amount of resources to be injected into the market. As mentioned earlier, successive interventions (combined with the passage of time and new macroeconomic information) would validate (or adjust) original expectations, and the initial effect associated to them.[12] In 2002-03, for example, when the market became aware that the expected spot sales had not taken place, it is possible that market expectations were revised downwards once it internalized that the Central Bank would not use its power to sell foreign currency.

III.2.a Features of the intervention periods

i) 1998-1999

Determining this period's endpoint is easy: the band's abandonment in September 1999, and its replacement for the floating regime currently in place. However, its starting point is conditional on information availability, as no daily data on intervention exists prior to 1998. The available data corresponds to a period where the Chilean economy in general, and the foreign exchange market in particular, suffered the consequences of a series of adverse international events.

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[12] Strictly, not only the Central Bank's official policy announcements deliver relevant information to the market, but also its authorities' speeches and public statements.

With terms of trade falling more than 10% between 1997 and 1998, sovereign spreads going from nearly 100 basis points in 1997 to over 400bp in August of 1998, and a dangerously high and growing current account in the context of a severe contraction of capital inflows, the speculative attacks to the peso in January and June of 1998 were no surprise. Although they never really jeopardized the band (the exchange rate remained far from the upper bound, generally below the middle) it was feared that a sharp devaluation might affect annual inflation and threaten the long-lasting inflation reduction strategy implemented since the early 1990s. Thus, successive interventions to safeguard the peso were complemented with monetary policy actions and several variations in the band definition and width. Toward October, once speculative pressures had diminished, the band was widened, and interventions became rare until the float was adopted a year later.

Spot market interventions in that period occurred between the months of January of 1998 and March of 1999, concentrating primarily on January, June, July and September of 1998. Sales amounted to a combined total of US$4.285 billion,[13] and materialized within 43 days of intervention, or 10% of the trading days in the period. The average monthly amount of foreign currency sold in the market during these episodes was US$109 and US$39 million in 1998 and 1999, respectively. The variance of the amounts involved was high, going from small 5-million worth interventions often times, to large, over 350-million operations twice (in January and June of 1998).

BCD sales concentrated between July 1998 and April 1999, totaling 1.44 billion US dollars. All of them took place over 60 days, 14% of the period's working days.

Regarding the exchange rate, the peso devaluated by 16% against the dollar. The maximum devaluation in one day was 2.5% (January 1998), with a peak appreciation of 1.4% in that same month.

ii) 2001

After abandoning the band in September 1999, the exchange rate was allowed to float freely, consistently with the long-term inflation target. However, the Central Bank reserved its right to participate in the foreign exchange market on exceptional occasions, promising to explain the general public its reasons to do so. Such an occasion came in August 2001, when the severe turmoil in the region caused by the economic situation

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[13] The amount is equivalent to 25% of international reserves existing at December of 1997.

in Argentina, induced a currency depreciation of nearly 20% during the first half of the year. The Central Banks fear of an exchange rate misalignment, and the resulting cost in terms of relative prices and inefficient resource allocation, resulted in the announcement of a limited intervention period.[14]

The Central Bank communicated, on august 16th 2001, that spot market interventions would be restricted to a maximum of US$2 billion, over a time span ending 31 December 2001. Additional BCD sales were also announced (some BDC sales had already been announced in earlier months) for a similar amount.

Concentrated in September and October, spot market interventions totaled US$803 million, less than half the maximum announced, and nearly 5% of the total stock of international reserves. Amounts traded in the 15 interventions (15% of working days) were substantially smaller than in the interventions of the earlier period, with an average of US$54 million, and a peak of US$129 million, less than half the amount observed in 1998.

The sale of BCDs, meanwhile, was distributed more smoothly over the second half of the year, totaling US$3.04 billion, including the BCDs that were part of the regular program. These were more frequent than interventions in the spot market and even than sales of BCDs in 1998, and covered 37% of working days in the period.

During that time, the exchange rate appreciated 3.9% (partly reversing the depreciation observed until August), although it had accumulated a devaluation of nearly 5% during September. The maximum daily devaluation was 2.8% (September), and the maximum appreciation in one day was 1.8%, in October.

iii)   2002-2003

With the Brazilian country risk rate climbing and a complex global scenario, the peso/dollar exchange rate depreciated 7% in one month, showing an ever-increasing trend. On October 10th of 2002 the Central Bank announced a period of interventions very much like that of 2001, to end on February 10th of 2003.

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[14] In the Monetary Policy Report of January 2003, the Central Bank explains that the motive behind its interventions was to prevent the adverse consequences of a possible "overreaction". Recognizing that, *a priori*, it is not feasible to establish precisely if a foreign exchange movement is excessive, the intervention is not intended to defend a specific exchange rate, but "limit the chances of overreaction but without hindering an efficient adjustment via prices."

Contrary to the previous experience, however, the Central Bank did not use the available foreign currency reserves for spot intervention, as no operations of that type were carried out. Thus, the announcement of possible spot interventions did not materialize.

Five hundred million US dollars in BCDs were sold in each of the first two months, October and November. Subsequently, the Central Bank considered that a milder intervention would suffice, and sold 250 million in each of the following months, December and January.

During this period, the exchange rate appreciated by 2.1% (partly reversing the previous depreciation), although by mid December it had appreciated by 8.8%, to later relapse in the following months. The biggest depreciation in one day was 1.3% and a 2.3% appreciation occurred the day after the intervention announcement.

III.2.b A preliminary evaluation of foreign exchange interventions

As aforesaid, the three periods under study differ in the amounts of foreign currency involved. While the average intervention of 1998-99 amounted to nearly 10% of the average transactions in the spot market over the period (with the largest interventions exceeding 30%), spot interventions in 2001 averaged less than 5% of the daily volumes traded in the market, with no spot market interventions in 2002-03. This could suggest that the portfolio channel—if it exists— might have been stronger in 1998-99 than in 2001-2003.

What about the monetary policy signal given by interventions? In 1998-1999 transparency of interventions was limited, because neither the exact date nor the amounts involved were disclosed to the market. In addition, intervention was discretional, and there was no *a priori* limit to the resources that could be used.[15] Information on interventions could only be proxied, on the basis of the biweekly publications on the movements of international reserves, although that figure also included other portfolio adjustments not associated to intervention activities.

In 2001, there was greater transparency. As aforesaid, the Central Bank informed explicitly the total amount of resources available for intervention, the time span over which such interventions might occur, and the rationale for such a policy action. However, reports on specific intervention episodes were only partial. Although

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[15] For the sale of foreign currency, the obvious limit was the stock of international reserves.

at the end of the day the Central Bank informed that it had intervened when it had, it did not disclose the amounts involved in each operation. Such information could only be derived, every two weeks, from statistics on reserve movements, which includes an explicit entry for intervention amounts[16]. In 2002, daily announcements obviously never happened. Tapia and Tokman (2003) present some preliminary evidence – using press information – on market perceptions regarding interventions in the different intervention periods. If the signaling channel is correct, actual intervention activities are not relevant – it is what the market believes is the signal provided by the Central Bank. As expected, their evidence shows that market perceptions were much more precise, regarding actual interventions, in 2001 than in 1998-99, thus suggesting that the signal channel was weaker in 1998-99 than in 2001. Still, and as aforesaid, more or less clarity regarding individual signals may be unimportant in the presence of an intervention announcement, which can carry a large informational content, larger than the marginal contribution of individual interventions.

V.   Time Series Estimates

V.1 Daily data

The main potential pitfall of the traditional empirical exercises to analyze the impact of individual exchange rate interventions in the spot market is the existence of a simultaneous process between exchange rate determination and intervention decisions. The bias caused by the endogeneity of interventions could explain the fact that, in most studies, estimated coefficients of the impact of intervention are statistically equal to zero, or have the "wrong" (positive) sign (Sarno y Taylor (2001)).

Although simultaneity is not an issue in infinitesimal units of time (the intervention responds necessarily to a specific exchange rate variation that occurs before it, and causes an effect that materializes after), it probably exists for the frequency of the available data.

What is the magnitude of the bias involved if this problem is not addressed? A quantification can be obtained by independently estimating equations for interventions and the exchange rate (for further description, see Kearns and Rigobón, 2003). For the case of Chile, the existence of simultaneous equations implies that the

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[16] In other words, intervention was fully public on a bimonthly frequency.

estimated intervention parameter lies within bounds whose width forbids any reasonable inference about the parameter's rue value (the higher bound is more than 100 times the lower bound!).

Thus, it is clear that the potential bias is a relevant problem. The literature has addressed the problem in two ways. The simplest (and a rather rough one) has been to use lagged interventions (see Baillie and Osterberg (1997) and Lewis(1995), for examples). Although this eliminates the possible simultaneity (the past intervention is necessarily exogenous to the contemporaneous exchange rate), it can distort the estimated effect of the intervention. The estimated functional form assumes that the exchange rate responds only to past information, ignoring the contemporaneous effect. If markets are efficient – and interventions are information – only the latter effect should exist. The second approach is resorting to more sophisticated econometric methods, that allow (either simultaneously or in two stages, with instrumental variables) the estimation of the system of equations of interest (Mundaca, 2001; Kearns and Rigobón, 2002).

The econometric strategy pursued in this paper uses a two-stage instrumental variable model to estimate the impact of daily interventions between 1998 and 2003. The results are complemented with the use of intraday data (only available for the 2001 intervention episodes), which allows to estimate OLS equations as the use of lagged interventions to avoid simultaneity is not a crucial distortion in the face of such short time intervals.

IV.1.a Description of the variables used

The sample used for the first estimation covers from January 1998 to February 2003, with daily data defined in 5-day weeks, including holidays. The dependent variable is the daily movement of the logarithm of the interbank market exchange rate at the market's closing time[17].

To measure the Central Bank's participation in the foreign exchange market, a number of variables were built. The most commonly used in the literature is the daily amount of foreign currency sold in the spot market, in millions of dollars. A similar variable was built with the aggregate stock of papers sold on a specific day (the amounts of instruments with different maturities are added together).

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[17] This is not the only possible definition of "exchange rate" that could have been chosen for the whole sample: other variables, such as average exchange rate or opening exchange rate were also good candidates. Although results are not reported for space reasons, the main conclusions shown below are the same for the alternative definitions that were estimated.

However, this paper's main contribution is to recognize the existence of the third instrument through which interventions affect the exchange rate market. We state that intervention announcements made by the monetary authorities, and not necessarily the individual interventions typically studied in the literature, were the main instrument of intervention policy affecting the exchange rate in Chile in 2001 and 2002. To check this possibility, variables reflecting public announcements were included. One dummy for August 16, 2001 and another for October 10, 2002 (signaling the announcement of the beginning of the intervention periods)[18], plus a variable for the monthly announcements of auctions (in millions of US dollars, for the total amount of instruments being tendered), serve that purpose.

Why should these variables be important? After receiving an announcement regarding the two recent intervention periods, the market knew that the Central Bank was prepared to place in the market a certain amount of foreign currency, besides changing—albeit marginally—the characteristics of the floating regime. This anticipation ought to translate in an exchange rate adjustment today, before interventions actually take place.

Does this mean that the only effect should occur at the moment of the announcement? Certainly not. First, the information disclosed by the Central Bank on the intervention amounts was not certain, but a ceiling for the resources that could be used. Even if the announcement was credible, the amount of resources expected by the market could have ranged between slightly more than zero and the announced upper bound. Actual spot and BCD dollar sales remained uncertain and, when occurring, they should have adjusted (in either direction, which cannot be defined in advance) the intervention expectation that the market had generated. For example, if a central bank performs only "small" and infrequent interventions, the market may well revise downward its expected total amount sold, which it had generated when expecting "large" interventions. If such is the case, the effect of specific sale of dollars may not be an appreciation, but rather a depreciation of the exchange rate, when the level of equilibrium derived from expectations is found to be wrong. In the 2002-03 case, actual intervention (zero in the spot market) was below expectations, thus possibly weakening or reversing the initial appreciation it generated.

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[18] The announcement was made on the afternoon of August 16, when the market had already closed. The same happened in 2002.

Second, given the logic of the signaling channel, it may happen that if interventions are not validated by a monetary policy action, and credibility is not absolute on the inflation rate commitment[19], and the initial effect on the exchange rate reverts.

These elements, not considered in previous intervention studies, call for to the incorporation of more variables, aside from the already mentioned variables of intervention and announcement. The dummy variable for the announcement corresponds to a single effect on the exchange rate's level. However, it is feasible that intervention (or the explicit threat of it) generates an effect on the exchange rate's trend. This could reflect the smoothing of the "abnormal" trend that originated the intervention or, in a world where the exchange rate is always in equilibrium, changes in the evaluation the market does of the diverse shocks and actions taken.[20]. This effect will be felt over a longer horizon, and it will not be properly captured by any of the variables defined so far. Thus, a dummy variable is created for the intervention period in 2001 (August - December 2001) and another one for the 2002-03 (October 2002 to February 2003) period. Any value other than zero means that the exchange rate has a particular trend associated to that period.

In order to capture the "updating" of the intervention expectations associated to the participation period, the dummies just defined are multiplied also by a trend ("time"), suggesting that the effect of the intervention period can change (linearly) as it comes to an end.

An analogous dummy is generated for the 1998-99 intervention period. This period had no explicit intervention announcements, and the nature of the prevailing regime provided room for them to happen at any time, with no other upper bound than the total amount of available reserves.

A relevant issue regarding announcements is that, unlike daily intervention decisions, they are not endogenous to daily ER variations. While daily interventions were a series of intraday operations decided by looking at the intraday evolution of the exchange rate, announcements were the result of long, exhaustive discussions between the members of the Central Bank Board and technical staff that were conducted along

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[19] Intervention per se has no effect on that mechanism
[20] In the absence of intervention, the exchange rate's equilibrium may be shifting along with the evolution of its relevant fundamentals. With the threat of intervention, however, this movement might become softer. This, not because the trend in itself has changed, but because the market is aware that a new fundamental variable (intervention, or the threat of it) has entered the picture, and is thus part of the new equilibrium trend.

several days and meetings. Additionally, announcements were made after market transactions had ceased. Thus, even if the announcement was decided by looking at the evolution of the exchange rate in the same day of the decision, its effect was necessarily seen the next day, when the market re-opened. Thus, this time ordering necessarily avoids any risk of simultaneity.

One last variable, built from the Central Bank's intervention data, is the excess demand for BCDs, measured as the difference between the demand for papers on the day of the auction and the available supply. This variable, together with the set of variables defined next, control for market conditions.

What is the set of variables included as controls? The lack of a formal model for the exchange rate process, leads us to take an approximation that incorporates the maximum number of variables that both the theoretical and the empirical literature have suggested as potentially important, and that are available on a daily frequency.

In particular, the set of controls include the following variables: the differential between domestic and US short-term interest rates; the sovereign risk of Argentina, Brazil and emerging economies; copper price; oil price; and the price of the Brazilian currency in dollars. All these variables, except the interest rate differential, are expressed in logarithmic differences. The variables for spreads are introduced to evaluate possible changes in agents' risk perceptions, leading to subsequent portfolio adjustments. The interest rate differential is introduced in order to control for the arbitrage condition given by the interest rates' uncovered parity. The world prices of copper and oil are included as a proxy for the terms of trade, with a potential impact on income.

Finally, dummy variables are included to control for other relevant episodes, such as changes in the monetary policy rate, or in the defined exchange rate band. In 2001, there is also a dummy for September 11, where the attacks in the United States caused a temporary impact on the exchange rate, in a context of anomalous and interrupted functioning of financial markets.

Several robustness tests, involving different specifications were used. Results are qualitatively and quantitatively similar, and are not presented for sake of brevity.

In addition, the Central Bank's spot market intervention decision is modeled as dependent on the accumulated percentage variation of the exchange rate in five days, the stock of international reserves, and past interventions.

IV.1.b Estimation

The procedure starts by identifying a valid instrument to account for the endogeneity of intervention decisions to exchange rate variations. This begins by estimating, with OLS, an intervention reaction function that provides a reasonable description[21] of the individual spot market interventions. The explanatory variables included are the stock of international reserves, the five-day cumulative exchange rate variation, lagged interventions and other macroeconomic controls. Table 3 presents the estimated equation. Interventions are highly inertial. Cumulative exchange rate variations, identified as a potential instrument from an economic perspective, appear to be a statistically significant determinant of daily interventions.

In order to check the validity of the proposed instrument, an LM type test is conducted by computing the residuals of the exchange rate equation that contains the predicted spot interventions (from the reaction function regression) and all the other controls discussed, and regressing it against all the controls of the exchange rate equation, the instrument and the predicted spot interventions. The test does not reject the null hypothesis of ortogonality of the instrument, and thus it is used in the subsequent estimations.

The results for the exchange rate equation, using the instrumented interventions, are presented in Table 4, and commented in the following section.

IV.1.c Results

For clearer presentation, variables are separated in different blocks within the table. Control variables (including macroeconomic variables and monetary policy dummies) are not presented for brevity, although almost all of them had the expected signs. The first block includes, besides a constant, dummies for the three different intervention periods.

The second block shows variables associated to the intervention announcements made in 2001 and 2002. As discussed earlier, announcements should have an instantaneous impact on the exchange rate, even if no actual

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[21] We check for white errors and a good predictive power.

intervention activities are pursued, because they deliver information to the market regarding (uncertain) future Central Bank actions.

Blocks three, four, and five show the estimated coefficients of the interactive intervention variables defined for each of the three intervention periods under analysis; 1998-99, 2001 (8/16/ to 12/31), and 2002-03 (10/10/02 to 2/10/03). Interactive variables allow the impact of intervention to differ among regimes. If the frameworks under which interventions were conducted in different periods had implications for their impact over the exchange rate, estimating a single coefficient may be misleading. A negligible, non-significant overall effect of individual interventions may be an average of significant coefficients of different magnitudes. Differentiated effects of interventions are expected given the different characteristics of the policy actions in each period (frequency, transparency, etc). Moreover, it is possible that, even within the floating regime, the impact of intervention differs among the two episodes, as market expectations or macroeconomic conditions may have varied.

The results indicate that individual spot interventions had a significant, negative effect in 1998, thus appreciating the peso. The size of the coefficient implies that a sale of 500 million dollars would have been required to appreciate the exchange rate by 1%. In 2001, when interventions were conducted after the formal policy announcement, the coefficient is not significantly different from zero. The same story applies to bonds sales: significant and negative in 1998, non-significant in 2001 and 2002.

However, this does not imply that interventions had no effect in 2001 or 2002. The public announcement of an intervention period had a large, significant effect, with a cumulative appreciation of 2.7% and 0.5% in 2001 and 2002, respectively[22]. This suggests that the announcement was deemed credible by the market in both years, with an adjustment in expectations and, subsequently, in the exchange rate. Notice that, taking the scale of the impact of individual interventions found for 1998, the peso appreciation associated to the 2001 announcement is akin to a (expected) sale of 1.500 million dollars. This seems to be a reasonable value for the market's expectations regarding future interventions, as it lies below the 2.000 million dollars ceiling that was

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[22] The existence of significant lags in the response to intervention announcements suggests that the market adjusts slowly.

announced in that date. For 2002, the impact is smaller, suggesting that expectations regarding future interventions were also lower.

Dummy variables measuring a possible change in the exchange rate's trend during the intervention periods, appear as significant for 2001 and 2002. The coefficients suggest that the intervention periods were related to appreciation trends of circa 0.18% and 0.28% daily, respectively.

An additional element is the possible existence of linear time trends in the intervention periods' dummies, capturing changes in the trend effect of intervention periods in time. In fact, a positive, significant coefficient is estimated for the 2002 intervention period, suggesting that the shift towards appreciation observed at the beginning of the period becomes weaker as time advances. This result seems reasonable: as no actual spot interventions took place in 2002, it is likely that agents (who had adjusted the exchange rate expecting some positive value for spot interventions) revised their expectations, reversing the currency's initial appreciation trend.

In summary, our results suggest that the impact of individual interventions is only significant in 1998, where no formal announcements regarding intervention were made. In 2001 and 2002, when the policy framework was altered, a significant effect of relevant economic magnitude is found for the intervention periods of 2001 and 2002, both in terms of level and trend. Both periods were characterized by explicit announcements on the conduction of intervention activities. The diminishing trend effect for the 2002 period suggests that since, unlike 2001, the announcement was not validated with actual spot interventions, credibility was weakened.

A possible critique to the empirical approach taken here is that the definition of dummies is arbitrary. In fact, the 2001 "intervention" dummy is, strictly speaking, contemporary to the intervention period, but not necessarily associated to it, as it could also reflect omitted developments occurring in the same period. This poses two potential problems. First, the fact that what is labeled "intervention" is an unidentified, omitted process that is really driving the exchange rate. Second, that the period chosen for the dummy is not robust in itself, with results changing if the time span is defined differently.

Regarding the first problem, it is difficult to think of which could be the "omitted variable", given the use of a wide group of controls (basically, the whole set of relevant macroeconomic and financial variables available at a daily frequency, plus dummies controlling for policy changes).

Regarding the second critique, a first version of the paper, which only included data for interventions up to 2001, found basically identical results. In fact, the results found when including the 2002 data are consistent with the paper's hypothesis on the transmission mechanism. This reinforces the confidence in the estimated results, and on the interpretation given to them.

IV.2 Intraday data

As a robustness check of the main results presented above, we perform OLS estimations using intraday data from transactions conducted at Santiago's online stock market (*Bolsa Electrónica de Chile*). This strategy has certain drawbacks. First, information of intraday exchange rate variations is only available for the 14 intervention days in 2001. Second, the data is not presented at regular time spans, but at every tick, or transaction time. These transactions obviously differ in number and frequency within and between days. Third, none of the macroeconomic variables used as controls in the previous estimation are available at this frequency.

These limitations lead us to estimate a separate OLS regression for each of the 14 days for which the data is available, including only ER variations and interventions (and lags) as variables. Three time spans are used for the definition of both variables. First, exchange rate variations are defined as the change between private transactions, regardless of the time span between them. Price quotes for intervention operations are excluded, thus measuring the effect of intervention as the change in the exchange rate between the transaction conducted immediately after and immediately before intervention. In this case, interventions are necessarily exogenous to the exchange rate. The second approach defines the exchange rate variation on ten-minute spans, regardless of the number of transactions occurring within[23]. The intervention variable is defined as the accumulated sum of interventions occurring within the time span. Thus, unlike the former case, interventions could be endogenous. However, and as discussed before, no potential instruments are available in this frequency.

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[23] For some cases, defining 10-minutes spans is impossible, as no transactions occurred precisely with that difference. The transactions that lie closer to the selected span are taken in those cases.

The third approach is equal to the former, but using 20-minute windows. For all cases, the variables are defined for transactions occurring between 9 AM and 1 PM, with the latter figure being extended for the days in which late interventions occurred.

Results are presented in Tables 5 and 6. When transactions are analyzed, small, short-lived effects are found in 11 of the 14 days. In the remaining 3 days, net effects are significantly positive, although no potential simultaneity problem exists. When considering 10-minute time spans (almost in all cases, a larger horizon than the one existing between two transactions) the effects of interventions appear to be smaller. They are only significantly negative in 6 of 14 cases, with 2 additional days in which significant positive effects are found. Finally, with 20-minute windows, the effects become even smaller: they are significantly negative in scarcely four days, same number of cases for which a positive impact is found. Although these results should be taken with some reserve due to the lack of controls and the potential endogeneity bias in the two latter estimations, they suggest that the significant impact of individual interventions fades away as time passes, even for time spans that are shorter than half an hour. This seems to be coherent with the non-signficant effects found for daily interventions during 2001 and our hypothesis that the effects were channeled through the policy announcements. Although intraday intervention data for 1998 does not exist, a similar estimation would find – coherent with the daily results – a significant impact of interventions.

V.   Conclusions and Policy Implications

The main contributions of this paper are two. First, it is one of the first studies that analyze the effects of exchange rate interventions, using official daily and intraday data, for a developing economy. That contribution is seldom a merit of the authors, as the lack of previous studies is simply explained by the secrecy regarding official intervention data in most countries. The second, more relevant contribution is the focus given to the role of policy announcement as an instrument through which the effect of interventions might be channeled.

However, the potential use of announcements as an effective intervention instrument critically depends on the credibility associated to them. Empty promises that are not backed up by actual actions (in the case of the portfolio or signaling channels) or that are made by authorities that are not considered reliable (in the case of the information channel) should have no effect or, if the market was misguided this time, weaken the effect of future

announcements. As the empirical methodology is not capable of distinguishing the specific channel through which interventions operate, it is not easy to say if announcements must be followed by actual interventions – or if interventions have some kind of effect by themselves at all. Only under the portfolio channel, the announcement must be necessarily followed by interventions – and, in fact, the Central Bank must have a sufficient number of reserves for the announcement to be credible to begin with. Under the signaling channel, on the contrary, there is no clear need of intervening after making an announcement. As mentioned, interventions here do not have an impact by themselves, but by revealing information on future monetary policy. The announcement arguably plays the same role, thus making actual intervention redundant. Credibility should diminish if monetary policy (not interventions) does not behave as implicitly suggested by the announcement. Of course, actually informing on the willingness to change monetary policy on response to the exchange rate's behavior would be much more straightforward than indirectly recurring to intervention policy announcements.

The results found here indicate that while individual interventions in Chile had a significant effect in 1998, the effect became non-existent in 2001 and 2002, where the impact of the policy regime was channeled through the effect on expectations caused by the (credible) policy announcements made on both periods. Obviously, this result is conditional on the specific characteristics of the Central Bank of Chile, an institution with high levels of credibility and an important stock of international reserves. This suggests that the extension of these results to other countries, or of the policy prescriptions that could be derived from them, is not direct.

One final issue deals with the definition of "effects" of intervention. This paper has analyzed if the Central Bank, of Chile through the use of its intervention instruments, can affect the level of the exchange rate. However, there is no defined benchmark against which the measured effects should be compared, as we do not know the specific effects the Central Bank was seeking in terms of magnitude and time length. In fact, we are not even sure if the Central Bank was solely interested in affecting the level, or that objectives such as reducing volatility or preventing exchange rate misalignments were also present. In fact, and as we are testing an exchange rate model based on macroeconomic fundamentals, the effect of intervention could appears as small (or non-significant) if what they do is, precisely, to prevent the exchange rate from deviating from its fundamentals. Given this, the paper can not give an answer regarding the convenience of intervention operations, and if the eventual costs associated to them are compensated with the benefits they bring.

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Table 1
Characteristics of Intervention Practices in Selected Countries with Floating ER Regimes

Brazil	The float is explicitly dirty, either to support the inflation rate or under "exceptional" circumstances. The CB tries to intervene with "high transparency"
Canada	Until 1998, a mechanical rule for intervention was in place, together with the discretional faculty to intervene at any time. The rule was abandoned in1998, after concluding that interventions were unable to reduce volatility. The discretional faculty remains, but has not been used in recent years.
Colombia	Since 1999, clear rules for intervention were defined, depending both on the presence of violent ER fluctuations and on the existence of high ER volatility.
EMU	Interventions are conducted subject to the "price stability" objective.
Indonesia	Interventions to control the monetary base, reduce depreciation pressures and diminish ER volatility
Japan	The Central Bank intervenes to execute decisions from the Ministry of Finance. A special fund for intervention is available. Interventions are sometimes coordinated with other central banks, or conducted in foreign markets. Interventions are fostered by the presence of "excessive" volatility. Intervention is conducted looking at its effects and the market's response. The CB plans to publish monthly information, but has not done so yet.
Mexico	The Bank of Mexico has an intervention rule consistent in daily auctions of US$200 MM among commercial banks, with a minimum price that equals 1.02 times the exchange rate officially published by the CB of Mexico each day. The CB believes these schemes reduces ER volatility, while still allowing the market to freely determine the ER's equilibrium level. The CB can also sell additional resources, besides those included in the auction.
New Zealand	The ER has floated freely, without intervention, since 1985. However, at least nominally, the CB has the faculty to intervene.
Peru	Intervention is conducted in scenarios with high ER volatility, to attain higher confidence in the ER market.
Poland	No interventions since 2000
Sweden	The CB's board decides intervention to fulfill different objectives: 1. Portfolio balance 2. Economic objectives that do not threaten the inflation target. Clear rules exist to assure transparency, but some space for surprises is left. Intervention periods can not be defined over time spans exceeding the horizon between two policy meetings.
Switzerland	Interventions are conducted only under exceptional circumstances, and must be announced ex ante.
UK	Sporadic interventions have since the adoption of the float in 1992. Decisions are taken jointly by the BoE and the central government; both of them provide funding. Intervention must be coherent with monetary objectives. Monthly information is provided.
USA	The Department of Treasury or the Federal Reserve can take intervention decisions. The Treasury's opinion has primacy. The Federal Reserve Bank of New York conducts interventions. Public information is published only on a quarterly basis. Motives to intervene are various: 1. To support the ER's trend 2. To calm disordered markets 3. To manage foreign reserves 4. To support intervention policies conducted by foreign central banks

Source: Central banks' webpages and reports.

Table 2
Main Features of Actual Spot Interventions in Selected Countries

Country	Starting date	Ending date	Millions of US$ (daily sales)		Shares of market days with intervention
			min	max	(%)
EEUU	July 1983	December 1998	-950	951	5.3
Germany	July 1983	December 1998	-800	833	12.5
Switzerland	March 1986	December 1999	-150	545	3.9
Australia	12/13/1983	7/30/1999	-436	932	42.3
Chile	8/16/2001	12/31/2001	0	129	15.0
	9/1999	31/12/2002	0	129	0.02

Source: Rigobón and Kearns (2002) and authors' calculations.

Table 3
Spot Intervention Reaction Function (January 1998- February 2003)
OLS Estimates (Newey-West Errors)

Variables	Coef.	Std. Error
Constant	-0.58	0.35
5-day cumulated exchange rate variation	**2.38**	1.34
Intervention (-1)	**0.39**	0.07
Band period	**5.95**	1.77
Intervention period 2001	5.19	2.14
Intervention period 2002	**0.61**	0.66
Adj R^2		0.21

Source: Authors' estimates based on Central Bank of Chile information.
Note: Darker coefficients are significant at 90% confidence. The regression also includes macroeconomic variables.

Table 4
Daily Closing Exchange Rate Variation (January 1998- February 2003)
2-stage OLS (Newey West Errors)
Instrument: five-day cumulated exchange rate variation

Variables	Coef.	t-stat
C	**0.0003**	2.16
Trend Effects		
1998-99 Period	-0.0001	-0.32
Int. Period 2001	**-0.0019**	-1.67
Int. Period 2002	**-0.0029**	-2.23
Int. Period 2001*Time	-6.3E-05	-0.40
Int. Period 2002*Time	**5.3E-05**	2.92
Announcement Effects		
Announcement 2001 (-1)	**-0.0154**	-14.20
Announcement 2001 (-2)	**-0.0066**	-6.19
Announcement 2001 (-3)	**-0.0062**	-5.87
Announcement 2002 (-1)	**-0.0155**	-7.47
Announcement 2002 (-2)	**0.0073**	5.57
Announcement 2002 (-4)	**0.0034**	2.50
Intervention Variables 1998-99 (Exchange Rate Band Period)		
Band Period*Intervention	**-2.4E-05**	-2.18
Band Period*BCD	**-4.8E-05**	-2.96
Band period*BCD Announcement	-2.4E-07	-0.04
Intervention Variables 2001 (First Intervention Period)		
Int. Period 2001* Intervention	3.0E-05	0.51
Int. Period 2001* BCD	-1.3E-05	-0.59
Int. Period 2001* BCD Announcement	3.88E-05	1.25
Intervention Variables 2002 (Second Intervention Period)		
Int. Period 2002* BCD	-3.3E-05	-1.43
Int. Period 2002* BCD Announcement	**-1.0E-05**	-1.93
Adj. R-squared Adj. R-squared	0.21	

Source: Authors' estimates based on Central Bank of Chile information.
Note: Darker coefficients are significant at 90% confidence. All regressions control for macroeconomic and policy change variables. All variables, except intervention, BCD, BCD announcement, excess demand BCD, interest rate differential and time, are in logarithmic differences.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
Intervention	-1.4E-04	-2.3E-04	-1.9E-04	-6.5E-05	-1.7E-04	-5.2E-04	-7.9E-05	-8.3E-05	-2.8E-05	-2.1E-05	-2.5E-05	-4.4E-05	2.53E-05	-1.98E-06
	(-2.659)	(-3.611)	(-2.366)	(-1.254)	(-3.227)	(-7.714)	(-2.628)	(-2.594)	(-3.171)	(-1.625)	(-110.5)	(-5.178)	(-1.744)	(-0.287902)
Intervention(-1)				-5.5E-05	1.06E-04	1.52E-04			1.32E-05		2.10E-05		5.66E-05	
				(-2.637)	(3.707)	(5.354)			(3.004)		(20.64)		(3.921)	
Intervention(-2)			4.52E-05						1.59E-05			2.02E-05		
			(2.400)						(2.747)			(2.304)		
Intervention(-3)							4.6E-05							
							(3.920)							
Intervention(-4)							2.6E-05						3.3E-05	1.07E-05
							(2.558)						(6.93)	(2.72)
Intervention(-5)										-5.2E-05		1.99E-05		
										(-2.340)		(2.267)		
Net effect	-1,41E-04	-2,36E-04	-1,53E-04	-5,57E-05	-5,90E-05	-3,63E-04	-7,60E-06	-8,32E-05	8,00E-07	-5,24E-06	-4,50E-06	-4,20E-06	8,94E-05	1,07E-05

Source: Authors' estimates based on Central Bank of Chile information.

Note: Darker coefficients are significant at 95% confidence. Lags were only included when significant.

Table 6
Intraday Exchange Rate, 10 and 20-minutes Variations (Intervention days, 2001)
OLS (Newey West Errors)

	10-minutes intervals													
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**	**Day 13**	**Day 14**
Intervention	**-6,4E-04**	8,75E-06	7,29E-05	-3,17E-05	-6,07E-05	**-5,5E-04**	-1,98E-05	**-1,2E-04**	-1,10E-05	-1,92E-05	**-8,0E-05**	**-5,9E-05**	-1,07E-04	**-4,4E-05**
	(-2,00)	(0,16)	(1,36)	(-0,61)	(-0,60)	(-3,31)	(-1,15)	(-4,12)	(-0,71)	(-0,54)	(-2,90)	(-7,08)	(-1,50)	(-3,57)
Intervention(-1)	**-7,9E-04**	**1,58E-04**				**6,01E-04**	**6,64E-05**							
	(-3,79)	(2,53)				(2,65)	(3,33)							
Net effect	-1,44E-03	1,58E-04	0	0	0	4,80E-05	6,64E-05	-1,26E-04	0	0	-8,07E-05	-5,98E-05	0	-4,40E-05
	20-minutes intervals													
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**	**Day 13**	**Day 14**
Intervention	**-1,4E-03**	**1,79E-04**	-1,80E-04	4,66E-05	2,36E-05	-1,18E-04	**2,47E-05**	**-1,4E-04**	-1,59E-05	-1,14E-05	**-8,5E-05**	**-1,3E-04**	**1,5E-04**	**2,97E-05**
	(-2,54)	(3,40)	(-1,84)	(1,66)	(0,31)	(-0,47)	(3,56)	(-6,33)	(-1,05)	(-0,34)	(-2,01)	(-10,67)	(3,30)	(2,69)
	-1,41E-03	1,79E-04	**0**	**0**	**0**	**0**	**2,47E-05**	**-1,4E-04**	**0**	**0**	**-8,5E-05**	**-1,3E-04**	**1,57E-04**	**2,97E-05**

Source: Authors' estimates based on Central Bank of Chile information.
Note: Darker coefficients are significant at 95% confidence.

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