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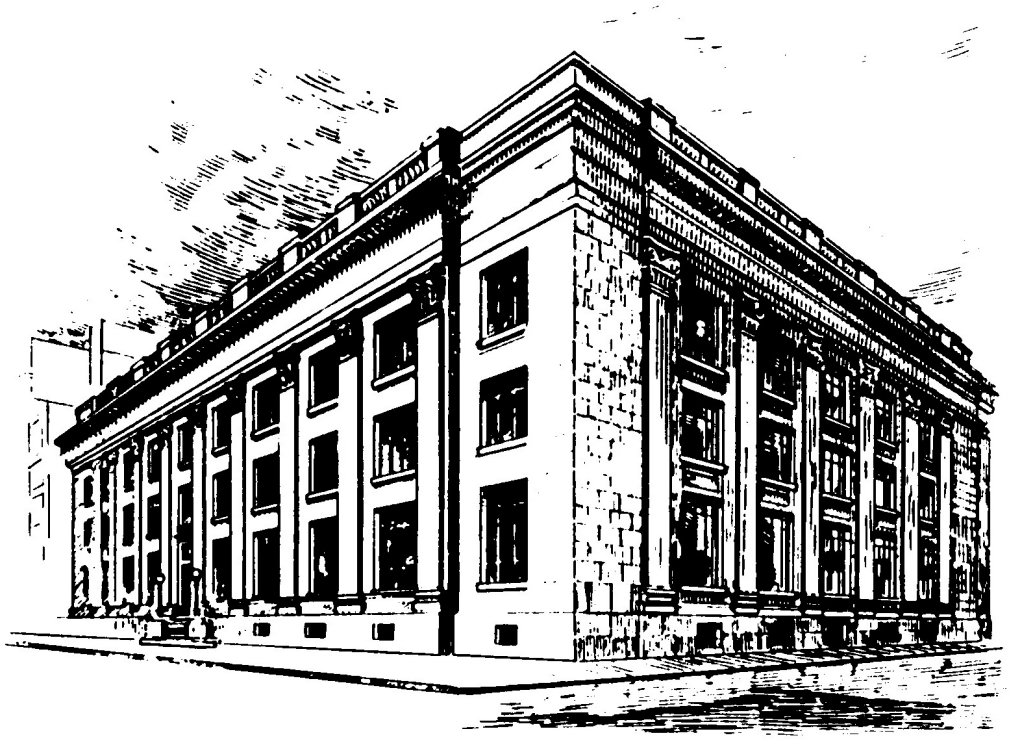

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INTERNATIONAL RESERVE HOARDING IN EMERGING ECONOMIES

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Abstract

This paper analyzes the rationale for hoarding international reserves. Reserves are used as a form of insurance against external financing shocks and also to influence the exchange rate. Here I argue that separating the two objectives is not possible. This is why other types of insurance, although potentially cheaper, are not of widespread use. Meanwhile, the fact that in practice the use of reserves is very low even during crises is proof that they play a rather deterrent role, in the sense that the sole act of having them reduces financial vulnerability. Evidence from the subprime crisis shows that countries with higher levels of reserves suffered less financial stress. I also discuss various ways of measuring the adequate level of reserves, illustrated with evidence for Chile, together with examining variations in reserves and in the exchange rate during the Asian crisis and the subprime crisis.

Our profession has yet to determine the optimal or adequate level of international reserves. Although some "rules of thumb" or some other types of calibrations exist to define the adequate level of international reserves relative to international trade, the external debt or the size of the financial system, justifications rely more on educated guesses based on experience or partial analyses. Important advances have been made, but an explanation and robust conclusions on the optimal level of reserves are still lacking. At the same time, contradictions remain. For example, why hold international reserves when a floating exchange rate regime is adopted. However, even under floating regimes, countries do decide to hold reserves and that means that exchange rate flexibility is not enough per se to accommodate drastic changes in global financial conditions.

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* Presented at the Fifth Annual Conference of Economic Studies, *Mecanismos de blindaje financiero, fondos regionales y otros esquemas sustitutos o complementarios*, organized by the Latin American Reserves Fund (FLAR) and the Andean Development Corporation (CAF), in Cartagena de Indias, Colombia, on August 9th, 2010. This paper was completed a few days after the Board of the Central Bank of Chile decided to accumulate reserves, a fact I will refer to, although the evidence presented here covers basically until the end of 2009. I am grateful for valuable comments and suggestions of Gabriela Contreras, Kevin Cowan, Luis Óscar Herrera and Felipe Labbé.

Countries hoard reserves because they see them as a safety net for periods of financial stress but, in practice, they seldom use them. As I will argue later, reserves play a stabilizing role simply because they are there and not necessarily to be used. In that sense, reserves play a deterrent role, but, when it comes to insurance, there are cheaper ways to hedge against liquidity risk, such as the *Flexible Credit Line* (FCL) of the International Monetary Fund, or policies available in financial markets. However, these options are hardly used, if ever. This begs the question, what is the role of reserves? As we well know, the role is twofold: to affect the exchange rate and provide liquidity insurance. As we will now see, the two cannot be separated.

I will begin this presentation by taking a brief glance at the rationale for reserve accumulation. I will then review the different methodologies that give us an idea of their proper level, elaborating on the case of Chile. I will proceed to analyze the events associated with the global subprime crisis, comparing them with the Asian crisis. I will conclude with some remarks on alternative insurances and their policy implications.

Rationale for reserve accumulation

An interesting discussion on why countries hoard reserves can be found in Aizenman and Lee (2005), who identify two causes. The first is a *precautionary motive*. Countries feel comfortable when they have liquidity in foreign currency, investing their reserves in liquid assets, because they may need them fast in case of an emergency. Even if they have no long-term financing problems, they may encounter liquidity constraints, so they need to have the funds readily available.

Similarly, the accumulation of reserves seeks to minimize the risks of a balance of payments crisis. This is at the origin of the research studies of the early 1980s. Although at the time the term *sudden stop* was not in use, the precautionary motive did surface as a reason to hold reserves should the country suddenly see a halt in external credit inflows. In any case, in general, this has not happened. An interesting point, because in the recent crisis there was no evidence of massive sudden stops, or of any significant depletion of reserves because of it.

Evidence also shows that having reserves reduces risk premiums, because it gives a sign that the country is hedged. This, even when in practice the reserves will not be used and holding them is costly.

The second reason why countries hoard reserves is the so-called *mercantilist motive*. In general, small open economies emphasize the importance of avoiding sharp deviations of their exchange rates. In particular, a strategy to boost export-based growth consists in trying to have a depreciated real exchange rate. Therefore, even under a floating regime, there are times where flexibility is called for and it is necessary to intervene in the foreign exchange market to prevent exchange rate deviations that might hurt growth and stability. Although the effects of sterilized interventions are inconclusive, countries tend to intervene during periods of massive capital inflows.

The accumulation of reserves must be understood as a policy where the two underlying motives are tied together: buying insurance and protecting the exchange rate. This, because normally the periods of reserve accumulation occur when the local currency is relatively appreciated. Whether implicitly or explicitly, the value of the exchange rate and its future outlook are elements used as inputs in the decision to determine international reserves.

The adequate level of international reserves

How to measure the adequate level of reserves? Various methodologies exist, each dealing with the issue from its own particular perspective. One way is to observe series of indicators based on ratios between reserves and certain macroeconomic variables. Another somewhat more sophisticated way is to keep a level of reserves such that it minimizes the cost of holding reserves subject to reducing the probability of a crisis (García and Soto, 2006). Similarly, it is possible to measure the costs of not having access to capital flows in terms of lost welfare (Jeanne and Rancière, 2006). In other words, how costly is it to hold reserves and what is their contribution to welfare?

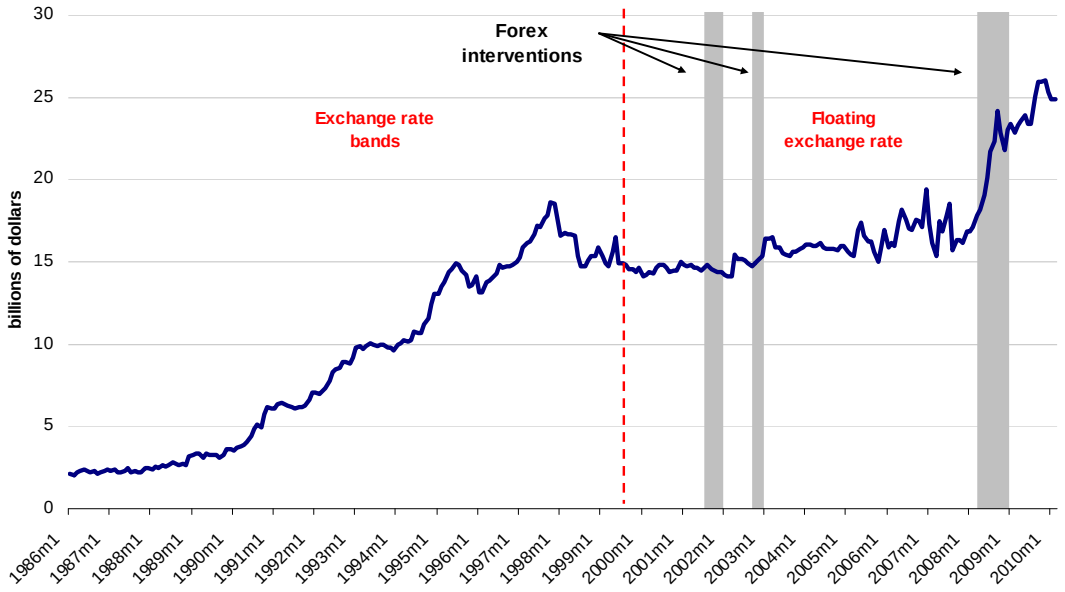
I will now illustrate the ways to measure the adequate level of reserves referring to the Chilean case (figure 1). During the 1990s, our exchange rate was subject to exchange rate bands and, during a significant capital inflow explained by the good standing of our economy and a significant differential between the local and international interest rates there was a substantial accumulation of international reserves. In addition, capital controls were applied to mitigate the capital flows.[1] Later on, with the Asian crisis, the exchange rate, the interest rate differentials and the capital inflows normalized.

Since the onset of the exchange rate float in September 1999, there have been four intervention episodes. In late 2001 and late 2002 the peso/dollar parity depreciated for no fundamental reason. In the former case, the depreciation originated in the Argentinean convertibility crisis. The Chilean economy was facing inflationary problems to which it could have responded prematurely raising the interest rate because it had started to recover. In the latter episode, near the presidential elections in Brazil, there was high volatility in financial markets. These interventions were transitory and succeeded in calming down the foreign exchange market (De Gregorio and Tokman, 2005).

The third intervention occurred in 2008. At the time the peso had appreciated substantially, showing the lowest parity in a decade. This appreciation occurred within a context of financial stress in international markets. Because no reserves had been hoarded for a long time, all the measures of reserves—i.e., with respect to money, months of imports, and as a percentage of GDP—were falling.

[1] See Cowan and De Gregorio (2007) for a review of this experience.

Figure 1: Chile's international reserves, 1986 – 2010



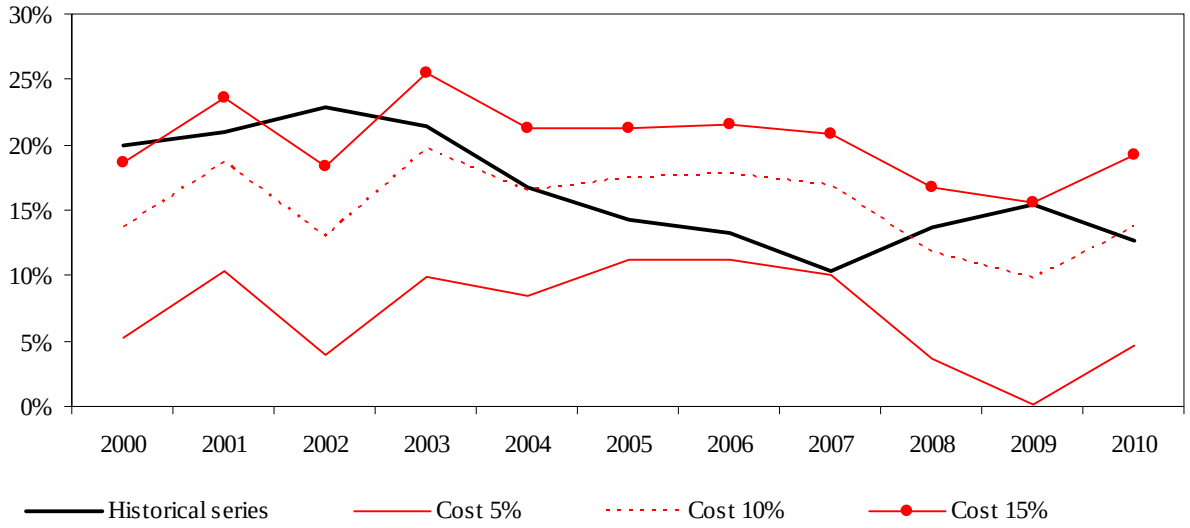
Source: IFS and Central Bank of Chile.

Accordingly, the decision was made to begin a process of reserve accumulation of around 5 points of GDP, which had to be terminated before completion—when roughly 75% of the original objective had been met—due to the severe pressures against the peso brought by the Lehman Brothers collapse.

The latest episode was announced on January 3rd 2011, at a time when reserves as a percentage of GDP had also diminished in line with the exchange rate appreciation and GDP growth. The purpose was to increase the reserves from around 13% of GDP to 17% over the whole year 2011. This is happening in a scenario where the peso has appreciated significantly, and thus the accumulation of reserves should also contribute to smooth the exchange rate adjustment.

There are various estimates of the adequate level of reserves. Figure 2 illustrates an exercise that consists in calculating optimal reserves for different costs, measured in terms of output, of a financial crisis originating in a *sudden stop*, following García and Soto (2006). The solid line shows the actual series of reserves as a percentage of GDP. The other three lines represent the adequate level of reserves for costs of 5%, 10% and 15% of GDP, and of course the adequate level increases as the cost of the crisis increases. In general, during the last decade Chile's level of reserves has been within the range of 5%-20% of the cost of a crisis. In conclusion, the right level of reserves consistent with the probability of a *sudden stop* should be between 10% and 20% of GDP.

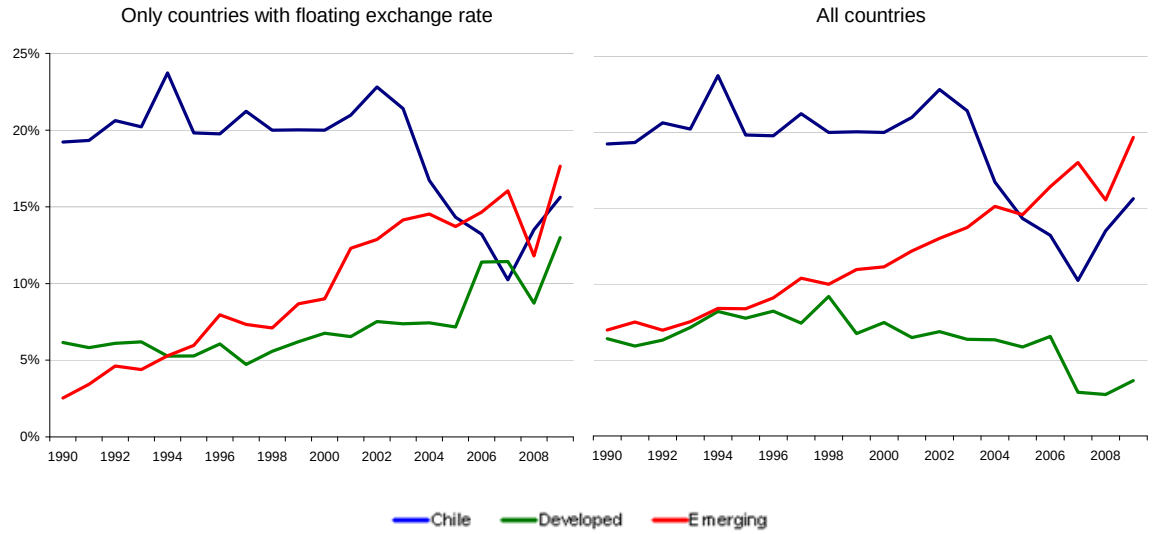
Figure 2: Historical and optimal level of reserves (% GDP)



Source: Contreras et al. (2010).

Figure 3 shows reserves in Chile compared with a wide sample of countries and then with countries with floating exchange rate regimes.

Figure 3: International reserves as a percentage of GDP



Source: Contreras et al. (2010).

In 2008, Chile's reserves diminished as a percentage of GDP, due to an appreciation of the peso and to economic growth. The level of reserves in Chile seems high by developed countries' standards, but compared with all emerging economies the level appears rather low. And compared with other countries with floating exchange rate regimes—which

should be expected to hold similar amounts of reserves—it does come fairly close. Still, with the recent increase in reserves in a large fraction of the emerging world, the average level of reserves-to-GDP in emerging countries with floating exchange rate regimes amounts to 17% as of end-of 2010 (table 1).

Table 1. Level of international reserves, 2010 (% of GDP)
Sample of countries with flexible exchange rate

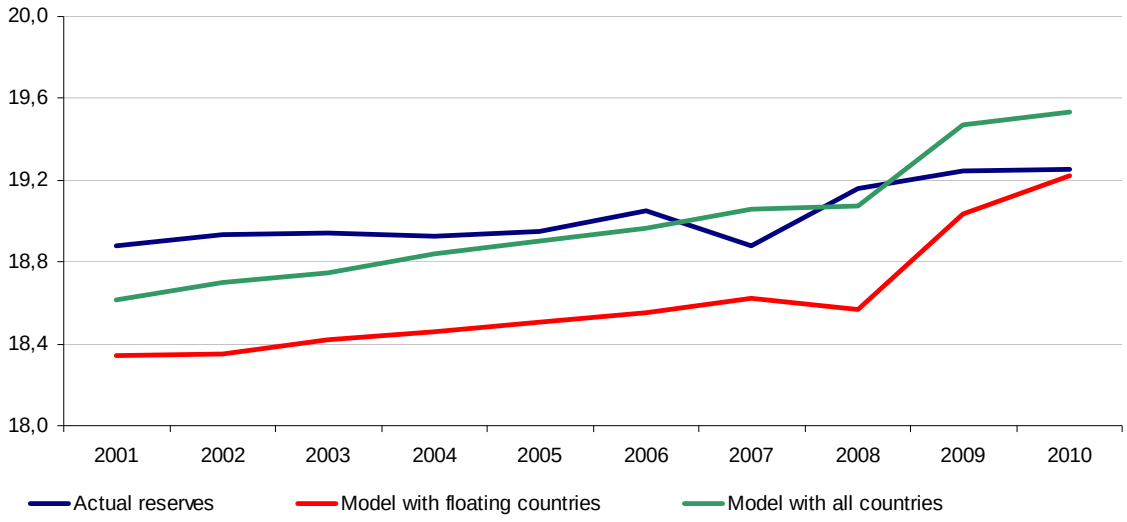
Brazil	13.5
Chile	13.3
Colombia	9.6
Czech Republic	22.3
Hungary	34.8
Israel	34.6
Korea, Rep. of	29.4
Mexico	11.5
Philippines	24.5
Poland	21.7
South Africa	10.9
Turkey	10.9
Average excluding Chile	20.3
Median excluding Chile	21.7
Average excluding Israel and Chile	18.9
Median excluding Israel and Chile	17.6

Source: IMF with GDP forecasts for 2010
Chile: Central Bank of Chile.

Another way of assessing the level of reserves for Chile is to examine the international experience by estimating a panel econometric model conditional on structural variables. The real value of Chile's reserves is illustrated by the blue line in figure 4.

Using economies with floating exchange rate regimes as a benchmark and estimating a panel model for all countries, again the level of reserves in Chile looks fairly adequate by international standards. However, it is important to reiterate that these estimates are done with data up to the end of 2009, and reserves have continued to grow in the recent past because of pressures to appreciate in emerging economies. Estimations performed with more recent data suggest that the levels of reserves that appear most adequate have increased. This is the evidence that warrants the Chilean economy's accumulation of reserves to around 17% of GDP.

Figure 4: Level of real reserves



Source: Contreras et al. (2010).

In any case, the cost of holding reserves is one important element to consider when defining a level of reserves consistent with the central banks' financial solvency, as interest rate differentials impose an important constraint when defining the right amount of reserves to hold.[2]

International reserves during the subprime crisis

The high level of reserves may have played a role in the resilience displayed by emerging economies during the crisis. This may have rendered credible the provision of liquidity in some cases and protected the exchange rate in others. In particular, Brazil and Mexico, which intervened in complicated moments due to difficulties in their corporate sectors, may have seen the credibility of these measures enhanced by their massive reserves. Thus, the level of reserves and the significant depreciation of their currencies may have helped mitigate the effects of the subprime crisis. What is interesting about what we will see in this section is that the countries did not massively deplete their reserves, which may be an indication that if unused, the benefits of the reserves as insurance are limited. However, the evidence seems to confirm that having a high level of reserves, even if unused, can be a strong deterrent to speculation when facing sharp changes in capital flows. The majority of models seeking to determine the adequate level of reserves assume that they are used. The evidence I present here is that their deterrent effect is substantial, whether used or unused.

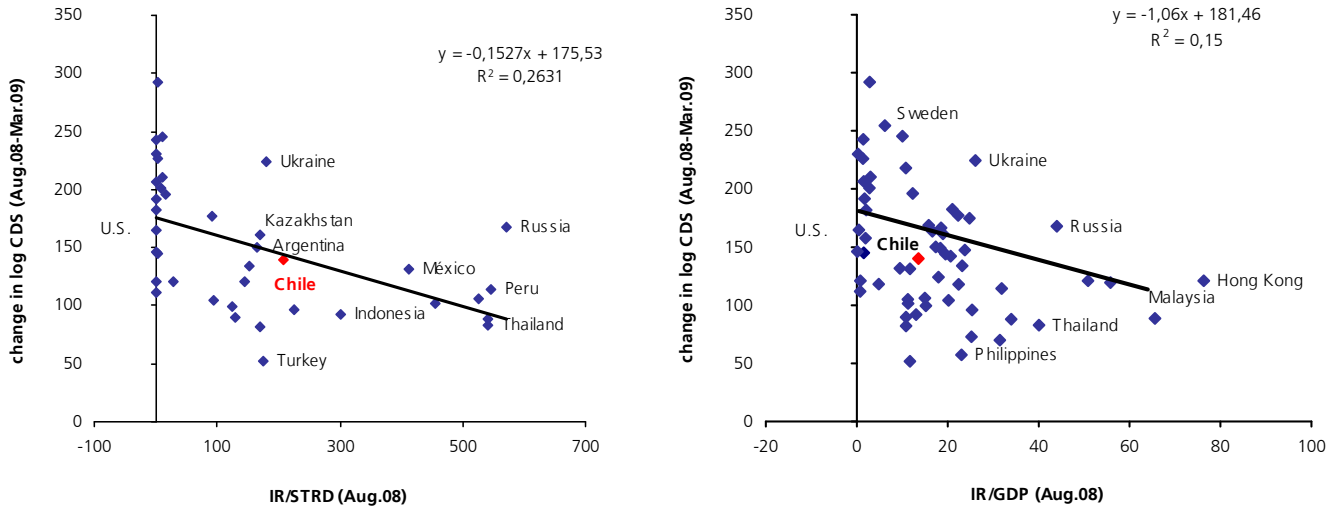
[2] The costs of holding reserves are explicitly modeled in Jeanne y Rancière (2006), although they do not consider the Central Bank's budget constraint.

One risk of using reserves frequently is that incentives and risks of the private sector may be altered. Policy makers intervene and strongly accumulate reserves in periods of capital inflows or when facing pressures to appreciate their currencies. But at the same time, this creates mismatches because the private sector begins to feel that it will be shielded not only against a massive appreciation, but also against a massive depreciation. If an artificially depreciated exchange rate is being defended, private agents may wager against the Central Bank, leading to an appreciation. In turn, this will encourage capital inflows because agents will benefit not only from the interest rate differential but also from overvalued inflowing dollars. The way to prevent these distortions under a floating exchange rate regime is to intervene only on exceptional occasions and in a transparent, mechanical and credible fashion, pointing at no exchange rate target and letting the parity continue to float.

During the crisis, there was an apparent resistance to using up reserves because the depletion was not massive. The reason is that to give signs of strength and increase the degree of resilience of the economy to external crises, policy makers opted for holding a lot of reserves despite the cost, which had a deterrent effect.

Evidence shows that, apparently, those countries that had larger volumes of reserves experienced a smaller increase of their CDS spreads. This may have reduced the impact of the crisis on financing costs (figure 5)[3].

Figure 5: Reserves and credit risk



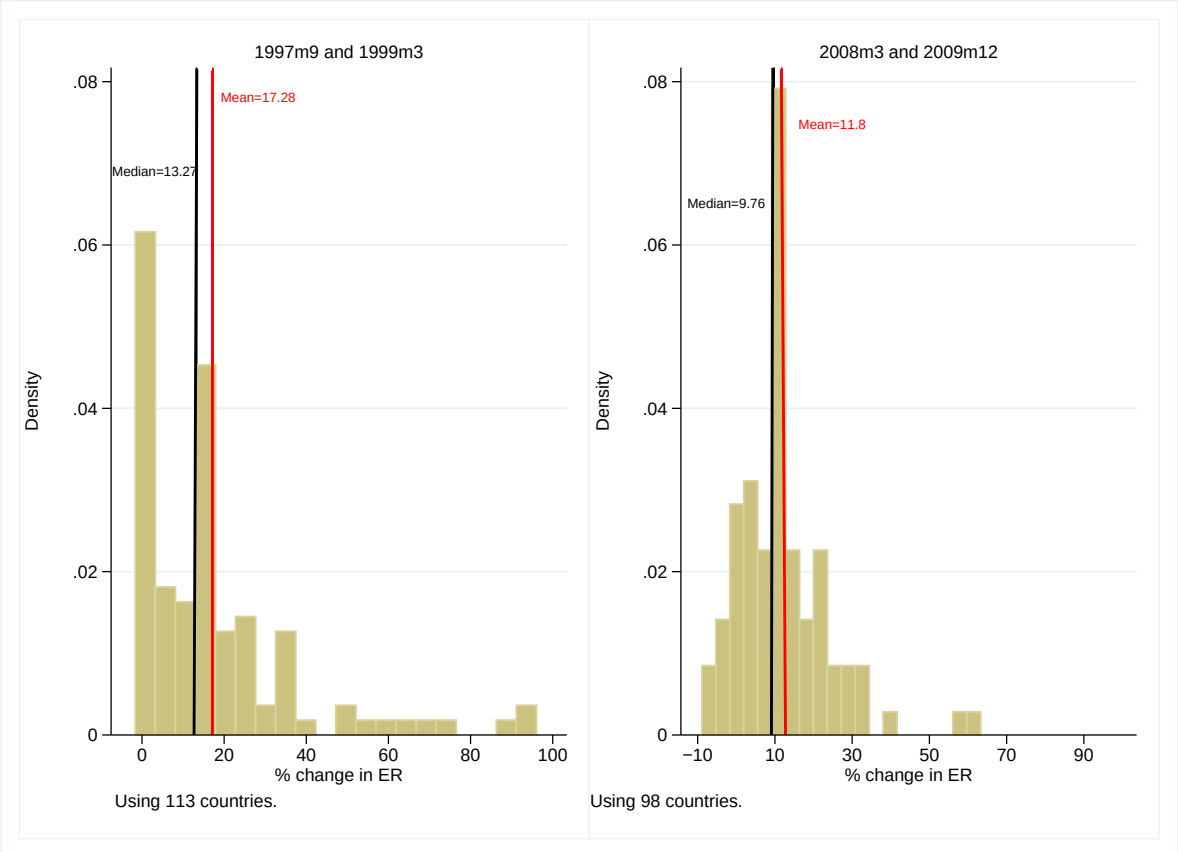
Source: Contreras et al. (2010).

[3] For econometric evidence on the role of international reserves in the determination of changes in EMBIs during the subprime crisis, see Central Bank of Chile (2009), box II.2.

To complement this evidence, it is interesting to compare the evolution of the exchange rate and reserves during the last two crises facing emerging economies: the Asian crisis, which spread throughout the emerging world after severe contagion, and the recent subprime crisis. For the two cases we analyzed the 18 months of greatest intensity of the crisis.[4] The comparison of exchange rate movements (figure 6) shows that in both episodes there were significant depreciations, although during the Asian crisis they tended to be more persistent. Meanwhile, 18 months into the subprime crisis there were already some economies whose exchange rates had begun to appreciate. In fact, if one takes a shorter window for the subprime crisis, it is possible to observe that after nine months the mean depreciation was 22%.

It is worth noting what happened with international reserves (figure 7). In both crises the mean was in the range from 0 to 1 point of GDP, quite a small magnitude. There were even countries that accumulated reserves. Furthermore, during the Asian crisis, which was much more affected by a sudden stop of capital inflows and quick outflows, the change in reserves was not so different from that of the subprime crisis.

Figure 6: Exchange rate depreciation

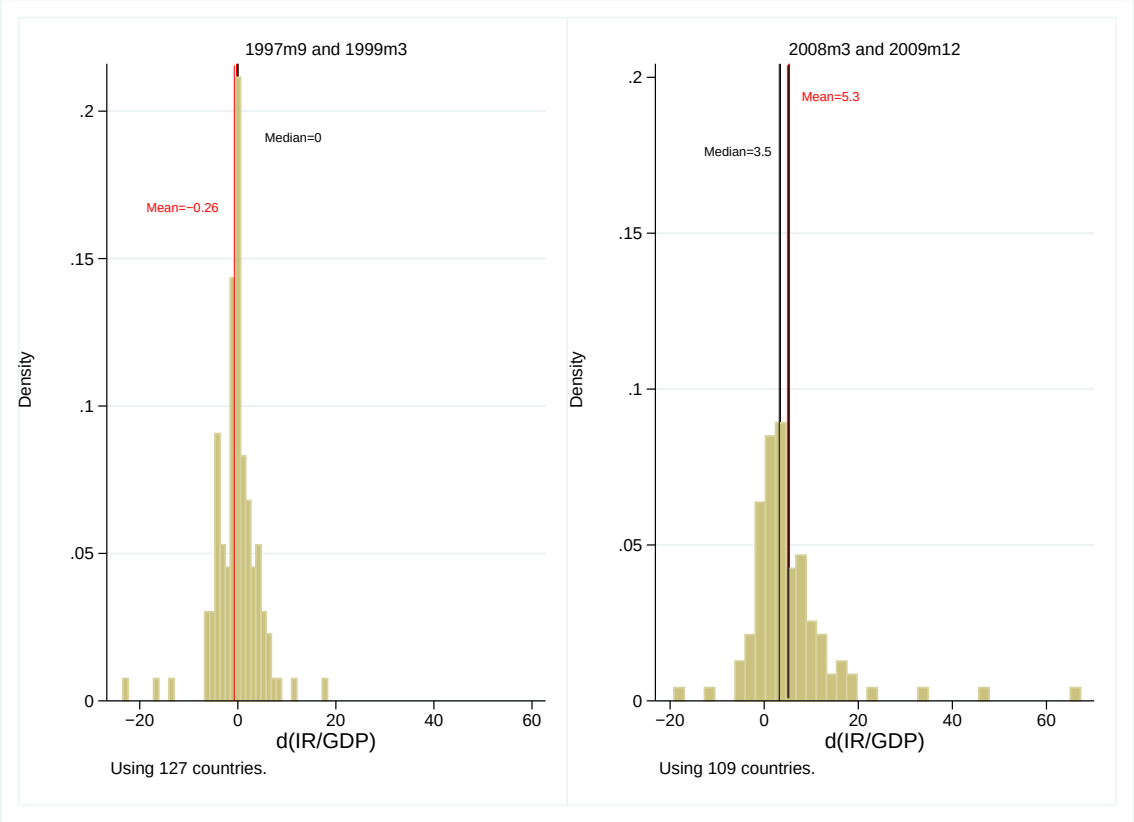


Source: IFS and WEO April 2010.

[4] The histograms are the same if 12 or 24 month windows are used.

The above tends to confirm the fact that reserves are accumulated but seldom used, suggesting that hoarding reserves is a way of averting financial speculation rather than a safety net to be used during times of liquidity shortage. Actually, Frankel and Saravelos (2010) find that the countries that had more reserves when the crisis hit were less affected by it.[5]

Figure 7: Change in IR/GDP



Source: IFS and WEO April 2010.

Insurance and policy implications

These experiences stress the importance of not construing the hoarding of reserves only as an insuring mechanism, because evidence shows that there are over-insured countries. Understanding this over-insurance is necessarily related with interpreting the other component of demand for reserves: to affect the exchange rate.

[5] Earlier works found no significant correlation (e.g., Rose and Spiegel, 2010), although Frankel and Saravelos (2010) claim that their results apply because they cover a longer and most recent period.

Other forms of insurance exist that are less costly than reserves, but with no incidence on the exchange rate. Furthermore, these could generate pressure to appreciate the currency by signaling less vulnerability to external financial turbulence. Commodity exporting countries can use *commodity hedges* instead of hoarding reserves and this could be a better instrument from the financial standpoint. Multilateral contingent credit lines can be used, as is the case of the IMF's Flexible Credit Line. Also bilateral agreements on currency swap lines can be signed which, although common in relatively large economies, are not available for smaller ones.

Although alternative mechanisms are proposed that might help economies to use resources that are less costly than holding reserves, it is not possible to separate a purchase of reserves from an exchange rate intervention and said effect is not taken into account by advocates of cheaper insurances. Actually, more often than not the announcements of reserve hoarding programs in order to increase hedging have coincided with interventions in the foreign exchange markets to mitigate currency appreciations.

This dual effect or reserve accumulation could explain why many countries seem to have invested more than necessary in this self-insurance. In fact, interventions in the forex markets have their origin in fear of having a misaligned exchange rate.

Contingent credit lines are a good idea as insurance, beyond the discussion that may arise on the issues of stigma and moral hazard. A problem arises, however: What would happen if a country decided to take a contingent credit facility instead of hoarding reserves? First, such an economy would be safer, encouraging more capital inflows. Second, it would have no reasons to intervene in the foreign exchange market because it would already be over-insured and would have other ways to obtain external funding in case of a sudden stop of private sources. So this is the difficulty that countries face when looking for cheaper insurance mechanisms: overlooking the fact that at the core of the decision on reserves is the manipulation of the exchange rate.

Finally, it should be noted that there are other ways in which countries can tone down the changing feelings of international investors, and one is via the international asset position of the private sector. The evidence presented in Cowan et al. (2008) indicates that every economy faces capital inflows with high volatility and what makes a big difference between those exposed and not exposed to an external financing shock is the volatility of their capital outflows. The external shock that is the biggest concern is a reduction in demand for local assets by non-residents such as foreign banks. This reduction in demand can be supplemented by liquidating international reserves, but also through the demand of private residents selling their assets abroad to bring home the cash. In Chile, this is the case of pension funds, which have acted as stabilizers in the face of external financial shocks.

Final remarks

I think two aspects related with reserve management are worth discussing. First, reserves act as a substitute for insurance, but one that is rarely used. Most likely they act as a deterrent to financial disruptions. The massive hoarding of reserves among emerging economies in the aftermath of the Asian crisis may help to explain why the subprime crisis had such a small effect—compared with other episodes—on the access of these economies to global financial markets.

From an analytical perspective, one needs models that explicitly include this deterrent channel of international reserves to shed more light on the optimal level of reserves. But from a practical standpoint, this consideration might lead to conclude that the adequate volume of international reserves is bigger than if reserves are seen only as a liquidity safety net. Furthermore, another determinant of the best level of reserves should be the level of other countries, to the extent that foreign investors base their assessments of vulnerabilities on a cross-country comparison.

Secondly, reserve accumulation cannot be dealt with separately from its exchange rate impact. This poses a challenge to central banks, because a floating exchange rate regime must be consistent with holding an adequate level of reserves. Within a regime of floating exchange rate and inflation target as is prevalent in many emerging economies, it would be prudent to think of mechanisms that allow hoarding reserves without interfering with the float. Therefore, to formulate rules for reserve accumulation that adequately incorporate the quasi-fiscal costs of holding reserves is a big challenge ahead of us.

References

Aizenman, J. and J. Lee (2005), "International Reserves: Precuationary vs. Mercantilist Views, Theory and Evidence", IMF Working Paper WP/05/198.

Central Bank of Chile (2009), *Financial Stability Report*, first semester.

Contreras, G., A. Jara, E, Olaberria and D. Saravia (2010), "¿Es adecuado el nivel de reservas internacionales de Chile?", mimeo, Central Bank of Chile, June.

Cowan, K. and J. De Gregorio (2007), "International Borrowing, Capital Controls and the Exchange Rate: Lessons from Chile", in S. Edwards (ed.), *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, NBER and The University of Chicago Press.

Cowan, K., J. De Gregorio, A. Micco and C. Nielsen (2008), "Financial Diversification, Sudden Stops and Sudden Starts," in K. Cowan, S. Edwards, and R.O. Valdés (eds.), *Current Account and External Finance*, Central Bank of Chile.

De Gregorio, J. and A. Tokman (2005), "El Miedo a Flotar y la Política Cambiaria en Chile", *Economía Chilena* 8(3): 29-54.

García, P. and C. Soto (2006), "Large Hoarding of International reserves: Are They Worth It?", in R. Caballero, C. Calderón AND L:F. Céspedes (eds.), *External Vulnerability and Preventive Policies*., Central Bank of Chile.

Frankel, J. and G. Saravelos (2010), Are Leading indicators of Financial Crises Useful in Assessing Country Vulnerability?", NBER Working Paper No. 16047.

Jeanne, O. and R. Rancière (2006), "The Optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications", IMF Working Paper WP/06/229.

International Monetary Fund (2010), *World Economic Outlook*, April.

Rose, A. and J. Spiegel (2010), "The Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure", *Pacific Economic Review*, Blackwell Publishing, vol. 15(3), pages 340-363, 08.