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INFLATION TARGETING IN FINANCIALLY STABLE ECONOMIES: HAS IT BEEN FLEXIBLE ENOUGH?

Mauricio Calani Kevin Cowan Pablo García S.

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Agustinas 1180, Santiago, Chile
Teléfono: (56-2) 3882475; Fax: (56-2) 3882231

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Mauricio Calani
University of Pennsylvania
and
Central Bank of Chile

Kevin Cowan
Central Bank of Chile

Pablo García S.
Central Bank of Chile

Resumen

Los eventos que rodearon la crisis financiera y la recesión de 2008-2009 exigió a los bancos centrales tomar importantes medidas de política. En las economías con un régimen formal de metas de inflación, surge naturalmente la pregunta de si tales regímenes mostraron la suficiente flexibilidad para lidiar con desafíos sin precedentes. Este documento aborda esta interrogante evaluando cómo reaccionaron a la crisis los bancos centrales de nueve economías con metas de inflación cuyos sectores bancarios y financieros no sufrieron problemas sistémicos. En primer lugar documentamos desviaciones sustanciales de las respuestas de política aplicadas de lo que prescriben las funciones de reacción de la política monetaria convencional, a partir del segundo semestre del 2008. Aunque se ofrecen diversas explicaciones para dichas desviaciones, subrayando la gravedad de los problemas, nos resulta más fácil conciliar las conclusiones con una disminución de la persistencia de la política monetaria, en los nueve casos. En segundo lugar, documentamos las medidas de política no monetaria que adoptaron los respectivos bancos centrales, y estimamos su impacto en los mercados monetarios locales (tanto en moneda local como en dólares) y en el tipo de cambio. Aunque, en general, estas medidas ayudaron a normalizar los mercados, no podemos sacar conclusiones definitivas sobre la eficacia de las medidas específicas, dada la dificultad de comparar los distintos paquetes de medidas adoptadas en cada país y la alta heterogeneidad de las respectivas respuestas de cada economía a estas medidas de política no monetaria.

Abstract

The events surrounding the financial crisis and recession of 2008-2009 required significant policy responses by central banks. For formal inflation targeters (IT) a natural question arises about whether IT frameworks were flexible enough to address this unprecedented policy environment. In this paper we tackle this question by assessing the policy responses to the crisis of nine IT central banks that did not face systemic problems in their banking or financial systems. We first document substantial deviations of actual policy responses from prescriptions of conventional monetary policy reaction functions, beginning in the second half of 2008. Although several explanations for the deviations are offered, highlighting the extreme challenges at the time, we can more easily reconcile the findings with a decline in the persistence of monetary policy, again, in all cases. Second, we document the banks' non-monetary-policy measures adopted at the time, and estimate their impact on local money markets (both in local currency and US dollars) and on exchange rates. While these measures helped broadly to normalize markets, firm conclusions on the effectiveness of specific measures are elusive, owing to the difficulty in comparing the different mix of measures adopted across countries and the significant heterogeneity in specific economies' responses to these non-monetary policy measures.

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Introduction

The international financial crisis and Great Recession of 2008-2009 called for a range of significant policy measures by central banks, beyond aggressive interest rate cuts. Measures have ranged from improving international coordination to purchasing local private loan portfolios and direct intervention in both foreign currency forward and spot markets. Moreover, the severity of the situation led to significantly greater international policy coordination. For formal inflation targeting (IT) central banks, a natural question has arisen about whether IT frameworks have been flexible enough to accommodate these diverse policy responses in such a challenging environment, or whether IT restricted their room of maneuver. In this paper we explore the experience of nine IT central banks that did not face systemic financial problems, to assess the dimensions in which policy responded to global financial turmoil. Our sample includes economies from around the globe, namely the experiences of Australia, Brazil, Chile, Colombia, Indonesia, Korea, Mexico, New Zealand and Peru.

The paper presents two pieces of evidence on the policy actions by these central banks. First, we compare actual monetary policy decisions with estimates from conventionally specified Taylor Rules for these economies, using data up to the starting point of the crisis period (the Lehman Brothers collapse). We find large deviations from the rule that cannot be reconciled using plausible expected evolutions of inflation and the output gap. Instead, we find support to an interpretation that accounts for a shift in the weight of past decisions on current decisions, namely, lower persistence. This interpretation points towards considerable policy flexibility within the IT framework. Second, we construct a truly unique daily history of unconventional measures adopted by these nine central banks. These measures include local and foreign currency facilities, swap or liquidity lines with international organizations such as the Federal Reserve or the IMF, and direct exchange rate interventions undertaken in the midst of the financial debacle. We assess the impact of these policy announcements and key money market variables: local currency interest rates, USD onshore interest rates, and nominal exchange rates. We also go on to assess the market impact at the time of implementation. In some cases, the immediate impact of unconventional policies is apparent. However, in other cases, the policy mixes and timing effects are too complex to pinpoint the success of individual measures. Taken as a whole though, these non-monetary policy measures were successful in calming market tensions. The heterogeneity of policy choices reveals the evolving concerns of the central banks during the crisis.

1. Assessing Monetary Policy Responses During the Crisis

Taylor (1993) suggested that simple linear reaction functions can describe reasonably well monetary policy actions, by relating the policy rate with the output gap and inflation deviations from the target. Over time, refinements to this basic framework have been proposed. For instance, Judd and Rudebusch (1998) suggested this basic description could be improved by controlling for persistence or inertia. Persistent interest rate patterns can arise from several sources, such as: forward-looking expectations, uncertainty about data, and uncertainty about monetary policy transmission (Sack and Wieland, 2000). Moreover, Woodford (2003) and others have argued that predictable and gradual monetary policy actions are consistent with optimal monetary policy making in the framework of dynamic stochastic general equilibrium models with price stickiness.

In this context, inflation targeting (IT), narrowly interpreted as following Taylor-type rules, mean that large changes in interest rates, such as those observed in our sample of central banks,

arise from, among other reasons, major changes in the underlying arguments, or from severely reducing its persistence. We find evidence supporting the latter explanation, showing that interest rates that rigorously followed a standard Taylor Rule would, by and large, have surpassed actual monetary policy actions during the severe liquidity crisis following the Lehman Brothers bankruptcy into year 2009, but that shifting the persistence parameter in the rule allows for a more precise tracking of actual policy.

1.1 Has Monetary Policy Deviated from Previous Patterns?

Let us represent monetary policy decisions with the following Taylor Rule:

$$r_t = \gamma + \rho r_{t-1} + (1-\rho)\left[\gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_x(x_{t-1} - x^*)\right], \quad (1)$$

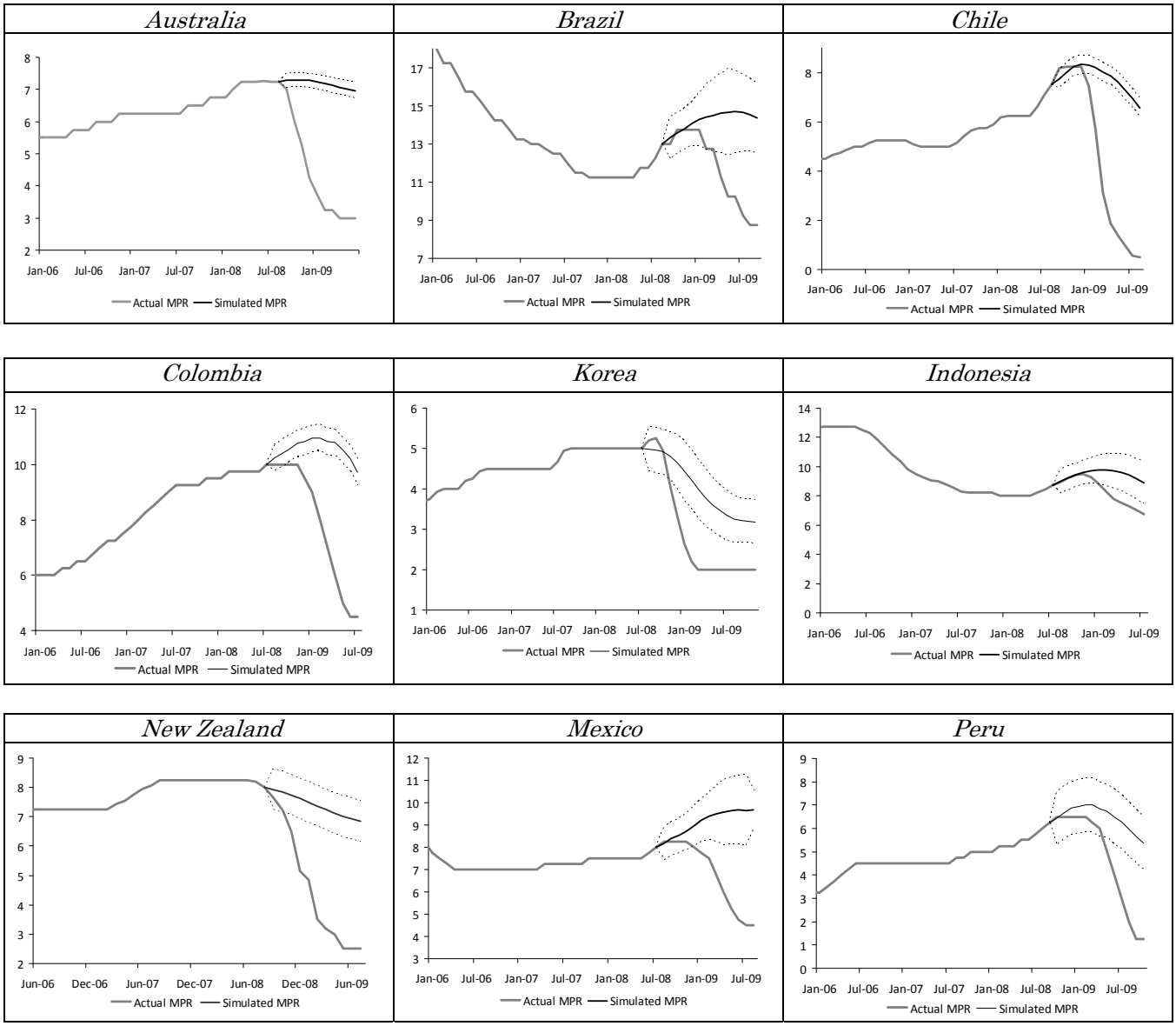
where r_t is the monetary policy rate at time t, π_t is the 12-month inflation rate and x_t is the 12-month growth rate of the industrial production index.[1] In this specification, π_t^* stands for the inflation target, and x_t^* acts as proxy for the natural output growth rate. With this framework, we proceed to estimate equation (1) for each of our selected economies up to the moment when aggressive monetary policy easing began, typically in the fourth quarter of 2008. Then we dynamically forecast the path for policy rates, given the actual evolution of inflation and industrial production growth, and we compare the resulting policy path with actual policy. Any large and statistically significant deviation of actual monetary policy away from the estimated path after the global financial crisis hit would suggest a break in the way monetary policy reacts to deviations of target variables.

Figure 1 shows the significant deviations from prescribed rule-based policy actions for the nine economies. The gray lines show actual monetary policy response (MPR) by central banks, while black lines show the conditional point forecasts (solid line) and its 95% confidence intervals (dashed lines). It is clear that, all in all, monetary policy response has been significantly different from the predictions arising from simple Taylor rules such as (1), estimated for normal times. This result holds qualitatively and – more importantly – quantitatively, if we choose to vary the sample period used for parameter estimation. Note that Australia, New Zealand, Chile and Colombia post the largest differences between simulated and actual MPRs.

Figure 2 summarizes the resulting gaps between the actual path followed by effective MPRs and the ones simulated using the evolution of inflation and the output (growth) gap. A number of observations are in order. First, these gaps are quite large, ranging from 200 to 700bp. Second, the timing of the gaps indicates that Australia, New Zealand and Korea started to deviate from policy rule prescriptions earlier than Latin American economies (and Indonesia). We confirm this observation estimating a Markov Switching Model, which allows for two states in equation (1) (explained in detail in the rest of this section), thereby providing an estimated regime shift.

[1] The specification uses the annual growth rate of industrial production instead of an output-level gap, due to the lack of long historical monthly time series that could be used to confidently estimate the level of these output gaps. This specification follows Walsh's view (2003) that optimal monetary policy can be thought of as reacting to changes in the output gap instead of its levels. For this last variable, and unlike the widely used HP filter (or any other filter for that matter), we choose not to use past, current and future values of growth to infer trend growth; x_t^* but we use the last 24-month simple mean of annual industrial production growth, which has performed satisfactorily in this same context (Moura and de Carvalho, 2009).

Figure 1
Effective and simulated monetary policy responses in selected economies



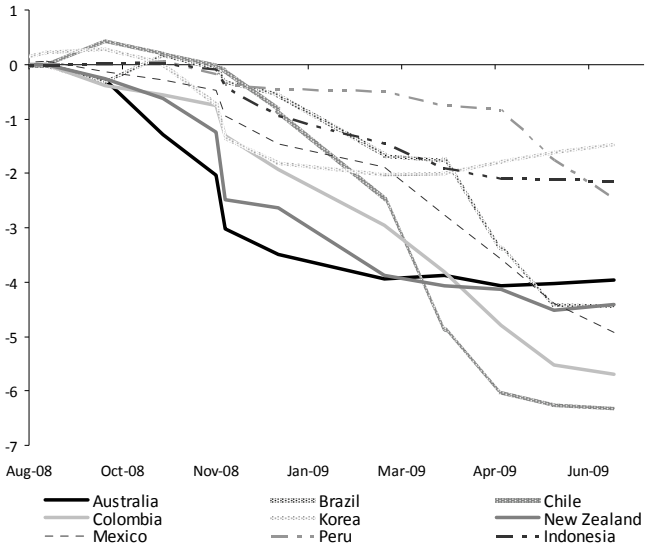
Results of this robustness exercise are presented in appendix 1.[2]

2. We estimate the two-state version of equation (1) $r_t = \gamma + \rho_{S_t} r_{t-1} + (1-\rho_{S_t})\left[\gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_x(x_{t-1} - x^*)\right]$, where $\rho_{S_t} = \rho_0 1(S_t = 0) + \rho_1 1(S_t = 1)$ and ρ_0 stands for high persistence and ρ_1 stands for low persistence. Figure A1 presents the path of actual MP interest rates in dashed lines (left axis) and the probability of being in a high persistence state, $\Pr[S_t=0]$ in solid lines (right axis). We understand earlier reaction to the financial shock as earlier swift changes in the probability of being in the high-persistence state to being in the low-persistent state. Our initial observation is then

Nevertheless, by the second quarter of 2009 the gaps in Latin American economies had widened significantly more than in the other cases. Thirdly, the shape of the policy deviation indicates a gradual start and a gradual end to the aggressive easing of policy in Latin American economies, whereas in Australia, New Zealand and Korea the earlier deviation appeared much more sudden[3].

The different policy paths between the latter group and Latin America (plus Indonesia), could be accounted for by the state of the policy cycle at the time. The earlier start for the former group appears consistent with relatively tight policies in place as indicated by flat or falling prescribed policy rates from the conventional Taylor rule at the start of the period under question. In contrast, most of the other economies had rising prescribed rates at the time of the Lehman bankruptcy. More over, the shape of the deviations for Latin American economies also reflected the more gradual start and also a gradual end of the easing cycle than in Asia and the Pacific, likely associated with the earlier recovery in Asia-Pacific economies.

Figure 2.
Gap between actual and simulated monetary policy rates.



Alternatively, more anxiety about exchange rate fluctuations in Latin American monetary policy making could account for a more gradual initial reaction, which turned aggressive as developing conditions indicated that monetary policy was not worsening turbulence in the foreign exchange market. In contrast, in Australia, New Zealand and Korea, where policymakers were probably less concerned about exchange rate fluctuations, the easing of policy could be, and indeed was, swifter.

Differences in the monetary policy transmission mechanism could also explain the magnitude of the maximum deviation from simulated policy paths. We note that the significance of floating interest rate mortgages in Australia makes for a more potent transmission mechanism, while in

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confirmed, as Australia, Korea and New Zealand are the very first countries to be in state $S_t=1$, followed by Chile, Colombia, Mexico and Peru, and much later by Indonesia.

3. This observation is also confirmed in Figure A1. Australia, Korea and to a lesser extent New Zealand and Chile exhibit a reversal in their highly persistent state, $S_t=0$, after a brief time spent in the low-persistence state $S_t=1$

Latin America, with less developed mortgage markets, monetary policy would have needed more aggressiveness to achieve similar macroeconomic impact.

1.2 Activism or Dovishness?

Several interpretations could explain the fact that monetary policy has been more aggressive than the standard prescription of a simple policy rule estimated for normal times. In particular, in light of the perception that optimal policy should be predictable, a first take on these results is that monetary policy in these IT countries has deviated significantly from standard monetary policy recommendations and that, therefore, the monetary policy framework itself has deviated from a "pure" IT regime. We argue against this view, on several counts.

First, a specification such as (1) is a simple rendering of reality, abstracting many aspects of optimal monetary policy. Although it has been widely shown that simple monetary policy rules lead to economic outcomes in terms of inflation and output volatility, which do not differ substantially from optimal policy rules[4], this doesn't necessarily hold true in the event of large shocks. Faced with large shocks, the linearity assumptions that permit the equivalence between simple policy rules and more complex optimal rules break down. It may therefore be the case that under the special circumstances experienced from the last quarter of 2008 onward, the optimal policy response should deviate from a simple policy rule such as (1). This deviation would be consistent with the traditional view on optimal policy and Svensson's (2009) view that financial factors play a major role in terms of affecting the transmission mechanism and thus, faced with a financial shock, monetary policy needs to react more forcefully.

Second, the assumption that current monetary policy actions do not affect current macroeconomic outcomes, – valid in normal times –, might not hold under financial distress. Indeed, standard reaction functions such as (1) identify the policy reaction by assuming that the arguments on the right-hand side of the equation are not themselves determined by current monetary policy decisions. In normal times, price stickiness and policy lags make this true. However, under financial stress, planning horizons shorten and confidence about the future becomes a paramount determinant of current spending and pricing decisions. This confidence, in turn, becomes largely dependent on policy actions and signaling.

Thus, we can think that the economic counterfactual would have been a smooth and gradually adjusting monetary policy, combined with a much more protracted and severe economic downturn. In a structural sense, the gap between simulated and actual monetary policy paths could actually represent the magnitude of the confidence shock to output and prices, which is currently driving the cycle. Policy then, has to adjust quickly to prevent this large deflationary shock from affecting in economic activity and prices.

A proper interpretation and quantification of the latter channel would require a structural, model-based approach that could help simulate the performance of an economy hit by a large shock, under the assumption of optimal policy versus simple rule-based policy. This goes beyond the scope of this study, but other contributors to this volume touch on this issue. Moreover, it is supported by recent views on optimal monetary policy design amidst financial turbulences or stress, such as those presented in Curdia and Woodford (2009), Taylor (2008a) and Taylor (2008b). In the context of our reduced form analysis, we posit two extreme assumptions about what drives the shift in the monetary policy response in these economies. The first one is that monetary policy has become more *activist,*[5] in the sense of reducing the weight of past decisions on current decisions. Hence, this activism can be interpreted as reducing the persistence of the policy rule. The second

4. See Clarida, Gali and Gertler (2001) as well as Schmitt-Grohé and Uribe (2006).
5. We are reluctant to using the term "hawkish", as the literature has related this term to strong inflation aversion alone.

assumption is that monetary policy became more *dovish*, tending to increase the weight of the output gap on the reaction function.

Returning to our baseline policy rule in (1), the stylized fact found in the previous section is that observed monetary policy, ro_t can be seen as the prescription from the rule plus a shock ε_t:

$$ro_t = r_t + \varepsilon_t = \gamma + \rho r_{t-1} + (1-\rho)\left[\gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_x(x_{t-1} - x^*)\right] + \varepsilon_t \ .$$

The activist interpretation identifies shock ε_t as a shift (reduction) in the persistence parameterρ, while the dovish interpretation implies a shift (increase) in the weight of the output gap γ_x. To obtain a sense of whether our simulations support one or the other, we followed the simple expedient of minimizing the squared deviations of actual policy from a simulated path with either a changing persistence or a changing weight on the output gap. For each country this provides us with a new set of estimates for persistence and sensitivity to the output gap, consistent with a policy path that attempts to closely fit actual events. The result of these exercises for all nine economies is presented in Figure 3.

Table 1 presents four columns summarizing this exercise. The first two present the value of the minimized quadratic loss function that penalizes deviations from actual policy by changing either persistence (column 1), or the output gap parameter (column 2). The third column shows the ratio between these last two numbers, and reveals that by changing the persistence parameter in (1), we can approximate actual policy more closely than if we adjust the output parameter for Australia, Chile, Colombia, Indonesia, Korea. For Peru and New Zealand, the two loss functions are extremely similar and only for Mexico and Brazil does adjusting the output weight parameter outperform adjusting the persistence parameter. More importantly, columns 5 and 6 show the ratio of the simulated and estimated persistence parameter and output weight parameter, respectively. It is evident that required changes in ρ mean that this parameter needs only to be reduced around 6% to 24% to approximate actual data. On the other hand, the required change of γ_x is at least an order of magnitude greater to approximate actual monetary policy actions. This degree of *dovishness* is simply too extreme to be plausible.

Figure 3
Activist (persistence) and Dovish (output gap) simulated paths for monetary policy

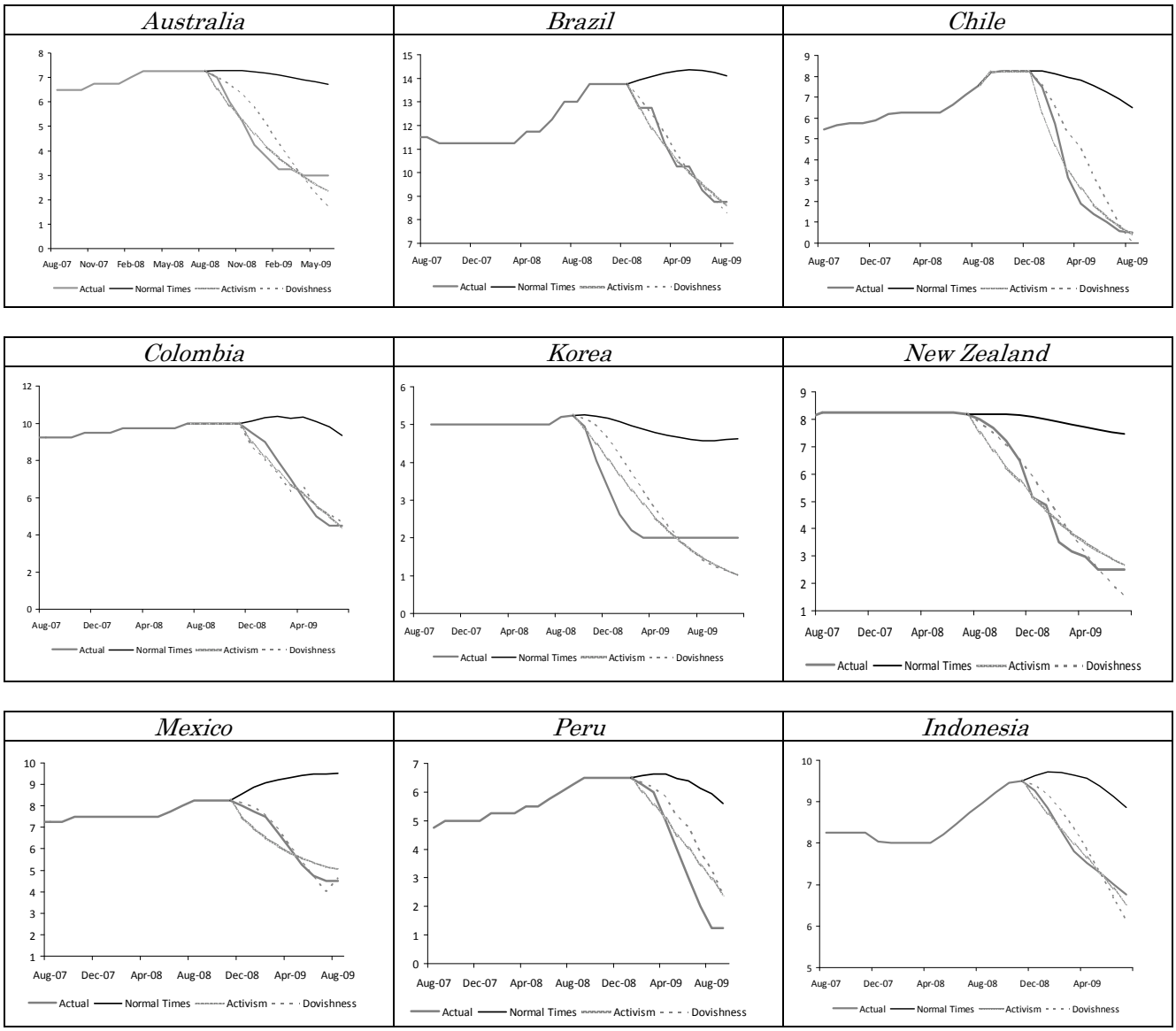


Table 1.
Activism vs. Dovishness in Monetary Policy

Country	Loss Function			Required changes	
	Activism (1)	Dovishness (2)	(1) / (2) (3)	Simul. ρ / Est. ρ (4)	Simul. β_2 / Est. β_2 (5)
Australia	1.42	9.26	0.15	0.89	12.00
Brazil	1.15	1.00	1.16	0.90	58.00
Chile	3.84	16.95	0.23	0.74	6.81
Colombia	2.12	3.50	0.61	0.87	6.36
Indonesia	0.16	1.25	0.13	0.93	25.50
Korea	6.59	11.99	0.55	0.93	3.64
Mexico	3.42	0.41	8.34	0.86	15.36
New Zealand	4.24	3.20	1.33	0.91	5.37
Peru	46.23	43.58	1.06	0.93	2.70

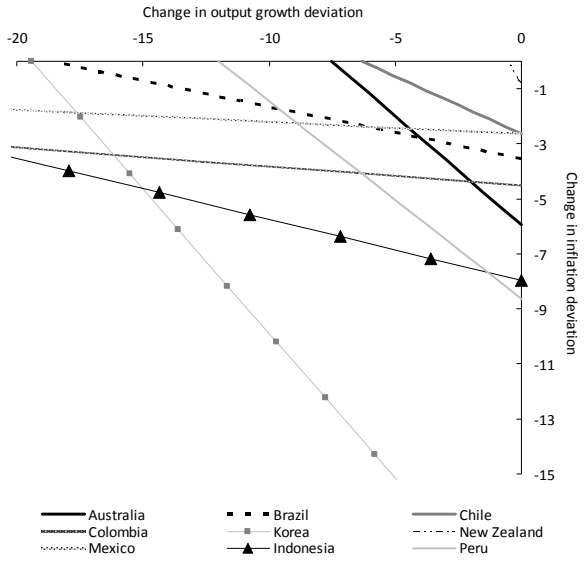
In a second exercise we take our estimations of equation (1) and compute the values for the change in inflation deviations and/or output growth deviations consistent with both, actual monetary policy action and the estimation of equation (1) for normal times. Specifically we take the long run representation of equation (1) and subtract its lag to obtain the following equation

$$\Delta r_t = \frac{\alpha}{1-\rho}\Delta(\pi_t - \pi^*) - + \frac{\beta}{1-\rho}\Delta(y_t - y^*). \qquad (2)$$

From (2) we compute the necessary change of inflation deviation, $\Delta(\pi_t - \pi^*)^{simulated}$, consistent with the decrease of MPR and actual realization of $\Delta(y_t - y^*)$. This inflation deviation is compared to actual $\Delta(\pi_t - \pi^*)^{data}$ and its difference is the intercept with the vertical axis in Figure 5. We do the same to compute the difference between simulated and actual output growth deviation consistent with actual change in inflation deviation and monetary policy rate, which is graphed as the intercept with the horizontal axis in Figure 4. The linearity of equation (2) allows us to extrapolate those combinations of exceeding deflationary and contractionary shocks that are necessary for central banks to lower MPR as they did, using normal-time Taylor-type reaction rules.

Figure 4 directly suggests that either inflation and/or output growth should have been radically lower for them on their own to account for the central banks' observed reaction, as they aggressively lowered interest rates. All in all, these arguments support our claim that flexibility, i.e. temporarily abandoning the persistence of the past, was the most likely and important characteristic of IT implementation in the period of financial stress.

Figure 4.
Required differences in output (growth) gap and inflation deviations, consistent with actual monetary policy actions



2. Assessing Non-monetary Policy Responses

As discussed above, the central banks included in this study, all engaged in a number of non-monetary policy actions. Before addressing the more general issue of whether these measures were consistent with a framework based on inflation targeting (IT), we tackle the more concrete aspect of whether these measures had (or didn't have) any measurable and statistically significant correlation with key financial variables.

To narrow the scope of this issue, we focus on the more direct concerns of central banks: money market liquidity and the exchange rate. As mentioned in the introduction, the selection of financially-stable IT economies allows us to avoid the thorny issue of the optimality of central banks' assessing credit risk during financial crises, the required coordination with the treasury, and the impact of credit-easing or quantitative-easing policies on a broad set of asset prices, such as house prices, long-term interest rates and equities.

2.1 Empirical Approach

We compile the daily history of unorthodox non-monetary policy measures undertaken by nine central banks and assess their (partial) correlation with three variables: short-term (one-month) local currency money market interest rates; short-term (one-month) USD local interest rates; and the bilateral exchange rate vis-à-vis the USD. Ishi et al. (2009) follow a similar line of research, to explain the reasons behind implementation of certain measures and their effectiveness. In principle, the outbreak of financial turmoil affected all three markets, as the tightening of USD liquidity worldwide was reflected in onshore USD markets, the transmission of financial shocks, high global volatility, and uncertainty regarding authorities' capacity to respond in a timely and

effective manner This, in turn, should have led in varying degrees to higher local currency, money market spreads. Finally, the sudden stop of capital inflows, or more generally, the prevalence of home-bias effects, stressed the external financing available to several economies. Flight to quality (with the USD role as a reserve currency) only reinforced this phenomenon, depreciating bilateral exchange rates against the dollar, worldwide.

Policy responses varied enormously, but can be classified in three groups, corresponding to the three variables discussed above. Some measures aimed to ease USD liquidity, e.g. forex swaps between central banks and between central banks and local financial or non-financial corporations; some aimed to ease local money market tensions, such as deposit guarantees, extensions of the tenors of standard REPO operations and/or the broadening of eligible collateral. Finally, we can think of the third set of measures as aiming to directly affect exchange rate parities, namely direct forex reserve sales or purchases.

Most measures targeting a particular market indirectly affected other markets. This can be clarified with a number of examples. Take, for instance, the extension of term lending in local currency. This should, of course, directly impact local money market interest rates, but not necessarily local USD money market interest rates. If the magnitude of the impact on local money market interest rates is large enough, then the exchange rate should also react through the uncovered, interest rate, parity condition. On the other hand, an intervention in the foreign exchange market should affect the bilateral dollar exchange rate, while having an ambiguous effect on local currency, money markets, depending on the degree and characteristics of the sterilization of the spot sale. Moreover, the forex intervention should have opposite effects on local USD money market rates, depending on whether the intervention is performed in the spot or the forward markets.

Thus, given the diversity of non-monetary policy measures undertaken by our selected IT central banks, in principle one should allow for specific measures potentially affecting different dimensions. The specifications selected for the empirical exercise follow this eclectic approach. In each case, we allow for the selected, extraordinary policy variables (represented by dummies) to influence all three variables. We control for standard global financial variables, which in some cases are specific to the selected variable, and in other cases are common across variables[6]. Each non-monetary policy measure specific to an economy is identified with a dummy variable. As per the discussion above, we do not exclude the possibility that these non-monetary policy measures could have had an effect on all three variables. Moreover, we allow for an initial announcement effect and a more lasting, implementation effect from these measures.

We are also aware of the endogeneity issues involved in this specification: the timing of implementation is indeed endogenous to the tensions in the different financial markets and thus our endogenous variables. We proceed, however, based on three factors. First, we believe that the estimated correlations are informative for policy discussion. Second, the bias, if any, in the estimated coefficients is against finding significant results. Third, the endogeneity problem is to some extent ameliorated by the fact that global developments and not specific local events were at the root of local financial turbulences.

2.1.1 Functional Forms

Nominal exchange rate

Equation (3) is the specification for the bilateral nominal exchange rate against the US dollar. It relates the (log of) exchange rate to (i) variables to capture international financial market stress,

6. For instance, the commodity price index is used as a control for the nominal exchange rate specification, but is not considered in the local interest rate specification. Controls which are common to all three specifications include a constant dummy that captures the stress that started after Lehman Brothers collapsed, the VIX and the Libor-OIS spread.

the (log of) VIX index, the Libor-OIS spread, and a dummy for the period after the bankruptcy of Lehman Brothers, (*ii*) the (log of) the effective nominal multilateral USD exchange rate, and (*iii*) the (log of) commodity price index provided by the CRB.

$$e_t = \alpha_o + \alpha_{vix} \ln(VIX) + \alpha_{USD} \ln(USD) + \alpha_{CRB} \ln(CRB) + \alpha_{l-bro} D^{l-bro} + \alpha_{lOIS} \left(r^* - OIS^*\right) + \sum_i \left(\alpha_d^i D^i + \alpha_{d-a}^i \Delta D^i\right) + \vartheta_t. \quad (3)$$

We include specific non-monetary policy variables through dummies which are equal to one during their implementation, and also their change to capture the initial effect of their announcement. We consider only the initial change, and not the pre-announced lapsing of the measures, in those cases where this was part of the initial announcement.

Local currency money market

Equation (4) presents the specification for the local, money market, interest rate. It relates the short-term (30-day) local currency deposit (or Libor) rate, *i,* to the current overnight interbank rate, *r* (most often the policy rate), the expected interbank rate 20 working days ahead (where available measured by an interest rate swap), the local USD money market rate *i**, and the same variables used in (3) to capture international financial stress. As in (3), we include the full set of dummies for exceptional measures and their respective announcements.

$$i_t = \beta_0 + \beta_r r_t + \beta_{re} r_{t+20} + \beta_{i*} i_t^* + \beta_{vix} \ln(VIX) + \beta_{l-bro} D^{l-bro} + \beta_{l-OIS} \left(r^* - OIS^*\right) + \sum_i \left(\beta_d^i D^i + \beta_{da}^i \Delta D^i\right) + \varepsilon_t. \quad (4)$$

Local USD money market

Several countries in our sample saw large deviations of dollar interest rates in domestic markets, with respect to those in key, offshore, financial markets after October 2008. For economies fully integrated into global financial markets, one would not expect this to happen, as domestic USD interest rates should exactly match risk-adjusted USD rates in international financial markets. Note, however, that in most countries in our sample, financial integration is imperfect due to both regulatory restrictions and underdevelopment of some key financial markets. Moreover, during the recent financial crisis, many of the agents that are able to arbitrage differences between international and local USD rates in normal times were unwilling or unable to do so. The severity of the turmoil increased concerns about counterparty risk and made funding liquidity risk paramount, probably hindering these trades. Following the latter idea, Hui et al. (2009) document large deviations from corresponding dollar Libor rates, and argue precisely that funding liquidity risk (Libor OIS spreads) can explain such deviations.

Equation (5), then, models the local USD rate by relating the short-term (30-day) local USD rate *i** to the current, local, money market rate *i*, the 30-day USD Libor *r**, the *financial stress* variables and the policy dummies.

$$i_t^* = \delta_0 + \delta_i i_t + \delta_r r_t^* + \delta_{vix} \ln(VIX) + \delta_{l-bro} D^{l-bro} + \delta_{l-OIS} \left(r^* - OIS^*\right) + \sum_i \left(\delta_d^i D^i + \delta_{da}^i \Delta D^i\right) + \nu_t. \quad (5)$$

Equations (3)-(5) are not extracted from any optimizing behavior solution, but offer the great advantage of providing a framework flexible enough to assess the wide variety of measures undertaken by our selection of central banks. Moreover, simple extensions of these equations allow us to, for instance, test whether these policy measures also affected interest rate sensitivity of interest rates and the exchange rate to global factors, such as the VIX, the multilateral, dollar exchange rate and commodity prices.

In what follows we present the results of estimating equations (3)-(5) for a number of economies that follow IT frameworks: Australia, Brazil, Chile, Colombia, Korea, Indonesia, Mexico, New Zealand and Peru. In each case, we provide a brief description of the rationale for the policy measures undertaken in 2008 and 2009, a list of these measures, and how we label these last with dummies. We then estimate and comment on the results of these estimations.

2.1.2 The Data

Before proceeding to the details of estimations, it is worth discussing the specifics of the selected data set. All data is daily, and the estimation was performed for the January 2007 to August 2009 period. The nominal exchange rate and the macro-financial controls selected, such as VIX, the one-month USD Libor, the Libor-OIS spread, the multilateral nominal value of the USD, commodity prices, were easily obtained from the usual sources. For local money market interest rates and local onshore USD interest rates, however, there are no easily available, standard datasets. Money market infrastructures and practices differ widely between economies, and variable selection must therefore be very careful. Regarding local currency money market interest rates, we proceeded to select "a Libor-type" interest rate, that is, a term (one-month) interbank interest rate. In some cases, such as Australia and New Zealand, the one-month Libor in local currency is readily available, whereas for other economies it is not. For instance, for Chile we used the prime, one-month deposit rate, which in practice is very similar to a money market rate, although more than banks participate in its pricing. Appendix 2 presents the details of the selected, local, money market rates for each economy, along with their Bloomberg tickers.

Short-term, onshore, USD, local, interest rate data collection is a challenge, as it is unavailable for most economies. We proceeded, therefore, to construct a proxy for local dollar liquidity interest rates using forward prices and the covered interest rate parity condition – under the assumption of arbitrage and no transaction costs –expressed as follows:

$$F = S \times \frac{(1+i)}{(1+i^*)}, \tag{6}$$

where F is the forward exchange rate at a given tenor, S is the spot nominal exchange rate, i and i^* are the local currency and USD interest rates for the same tenor. Thus, by knowing the spot and forward exchange rates and the local currency interest rates it is possible to infer the implicit USD interest rate; the onshore USD interest rate:

$$i^* = (1+i) \times \frac{S}{F} - 1. \tag{7}$$

In practice, bid-ask spreads and different tenor standards for the measurement of interest rates differ. On the one hand, bid-ask spreads can be as high as 10% in some economies, while the

standard tenors can be calendar days (360 or 365 days) or working days (252 for instance). Hence, the implicit onshore USD rate we calculate follows this expression:

$$i_b^{on} = \left(\frac{S_a}{F_a} * \left(1 + i_b * T\right) - 1 \right) * \frac{1}{T}.$$

where S_a and F_a are the spot and forward exchange rates, i_b is the local currency deposit interest rates and T is a time factor adjusted for the tenor standard. With this procedure we constructed onshore USD interest rates at 1, 3 y 12 months, from January 2007 to the end of October 2009. All data is from Bloomberg. Specific details are presented in appendix 3.

It is noteworthy to highlight the situation in a number of Asian economies, which alter the financial crisis in the late nineties took a number of measures that led to the segmentation of onshore and offshore Forex markets. In those cases, we considered the onshore forwards for our calculations.

2.2 Results

2.2.1 Chile

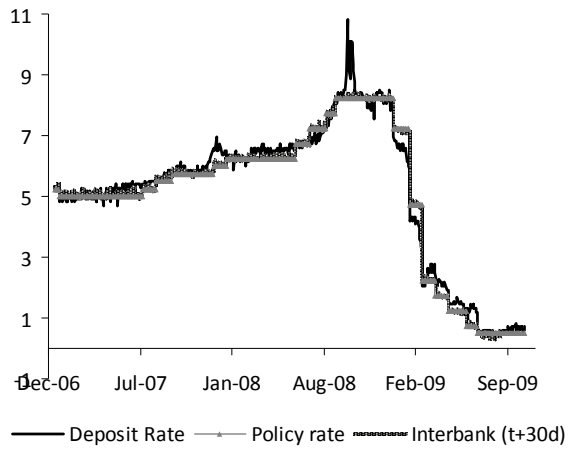
The sequencing of measures is presented in Table 2a. Prior to the collapse of Lehman Brothers the Central Bank of Chile had put in place a reserve accumulation program. This program was cut short on September 29th of 2008, as acute dollar liquidity shortages became apparent globally. What followed was a number of liquidity provision measures in both dollars and local currency. Foreign currency *swaps* were implemented, in the form of sales of foreign exchange in the spot market with a simultaneous REPO of foreign exchange. In terms of domestic currency, term Repos in local currency (at a floating interest rate) were implemented, and the set of collaterals broadened to include time deposits. All these measures were in place by October 2008. Moreover, to enhance the monetary policy stimulus in the context of a binding zero-lower bound, in July 2009, a term (six-month) lending facility at the fixed policy rate was implemented.

Table 2a: Extraordinary actions in Chile

Start	End	Extraordinary Action
14-Apr-08	12-Dec-08	CB decision to increase USD reserves by US$8000M
		US$50M every day / competitive auctions + sterilization
29-Sept-08		Interruption to IR accumulation process (70% of goal achieved)
30-Sept-08		Currency swap auctions
10-Oct-08		Extension of liquidity providing operations
		Extension (from 1) to 6 months – currency swaps
		REPO facilities
		REPO facilities (7 days) in CLP with bank deposits as collateral
10-Oct-08	8-Apr-09	Banks' reserve requirement denomination constraint is relaxed (for USD liabilities)
03-Dec-08		Extension of liquidity providing operations: currency swaps up to 180d
10-Dec-08	31-Dec-09	Extension of liquidity providing operations
		Currency swaps up to 180d
		REPO operations to 28d (using CB bonds) and 7d (using bank deposits)
15-Dec-08	31-Dec-09	REPO operations to 28d (using bank deposits as collateral)
01-Jan.-09	31-Dec-09	28-day liquidity facility broadening collateral assets (Govt. Bonds and Bank Deposits)
10-Jul-09		As of 15-Jul-09 FLAP (90 and 180d): Term Liquidity Facility
30-Dec-08	26-Jan.-10	Liquidity credit line in CLP for banking enterprises with collateral
		New credit line for banks

We identify one policy dummy with the accumulation of reserves in 2008 prior to the crisis, two dummies represent first, the implementation of foreign currency swaps in late September, and second, by the middle of October, as these forex swaps broadened to include time deposits as collateral for money market operations. A fourth dummy represents term lending at a fixed rate, implemented in July 2009. Table 2b presents the results of these estimations. We also include dummies for the announcement of each program.

Figure 5. Key Money Market Variables in Chile



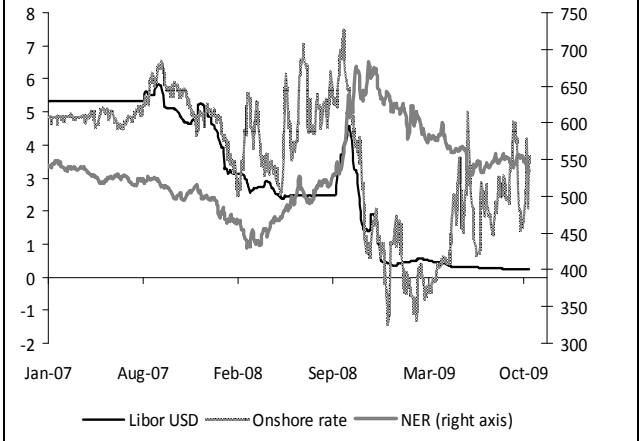


Table 2b: Estimation results for Chile

Deposit Rate			***Onshore rate***			***NER***		
Interbank rate	0.663		Deposit rate	-0.083		Log USD Mult	-1.059	
	[37.13]***			[2.50]**			[13.06]***	
Expected rate (t+20)	0.245		Libor USD	0.629		Log (CRB)	-0.357	
	[12.46]***			[11.22]***			[8.88]***	
Log (VIX)	-0.122		Log (VIX)	0.222		Log (VIX)	0.004	
	[2.10]**			[1.00]			[0.58]	
Libor USD	-0.057							
	[3.55]***							
Onshore Rate	0.016							
	[1.45]							
Non-MP actions			*Non-MP actions*			*Non-MP actions*		
Reserve Accumulation +	-0.248	0.334	Reserve Accumulation +	1.034	-1.134	Reserve Accumulation +	0.056	-0.063
	[5.17]***	[1.46]		[5.82]***	[1.25]		[12.74]***	[2.00]**
Currency Swap Options	0.721	-0.237	Currency Swap Options	0.015	-0.128	Currency Swap Options	0.011	-0.046
	[5.28]***	[0.71]		[0.03]	[0.10]		[0.68]	[1.00]
Curr Swap Op Ext & REPC	-1.187	1.372	Curr Swap Op Ext & REPC	-2.594	1.126	Curr Swap Op Ext & REPC	-0.005	0
	[11.49]***	[5.78]***		[6.86]***	[1.20]		[0.36]	[0.01]
Term Liquidity Facility	-0.285	-0.144	Term Liquidity Facility	1.491	0.726	Term Liquidity Facility	0.028	-0.036
	[3.41]***	[0.60]		[5.90]***	[0.78]		[3.08]***	[1.10]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.17		Lehman Bro	0.725		Lehman Bro	-0.014	
	[1.95]*			[2.14]**			[1.32]	
Libor OIS	0.313		Libor OIS	0.52		Libor OIS	0.046	
	[7.21]***			[3.10]***			[11.37]***	
Constant	1.049		Constant	1.465		Constant	13.201	
	[5.19]***			[1.88]*			[62.90]***	
Observations		613			649			680
R-squared		0.99			0.8			0.9

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan. 2007 - Oct 2009, daily data

The specifications yield the expected results regarding the controls for each case. The effective nominal USD exchange rate and the commodities index have a large and significant effect on the bilateral peso/USD exchange rate; the VIX does not impact nominal exchange rate and dollar liquidity conditions, once the Libor-OIS spread is included, while the USD Libor also affects local dollar liquidity conditions.

On policy measures, the 2008 reserve accumulation program significantly influenced the nominal exchange rate, while increasing the local USD rates and local money market rates in the baseline specifications. The more aggressive forex swap program had an important effect, in the correct direction, on local money market conditions, reducing peso and dollar rates. Local USD interest rates fell by close to 250bp while local currency deposit rates fell by close to 100bp. Finally, the term lending facility implemented in July 2009 significantly influenced interest rates. Peso rates fell by 30bp, while onshore rates rose.

2.2.2 Brazil

The October 2008 financial crisis led to a sizeable increase in capital outflows, and reduced Brazilian companies' access foreign lines of credit. This prompted authorities to apply significant measures to bolster domestic liquidity and facilitate access to USD liquidity. By the end of September, the Central Bank had already phased out its reverse forex swaps operations (which amounted to the purchase of a forward USD position and therefore increased the USD position in the balance sheet of the Central Bank) and also stopped buying USD on the spot market. By early October, the Central Bank started to unwind its forward USD position, as a first reaction to the financial crisis. Moreover, to further bolster the foreign liquidity buffer, on October 21st the Central Bank received authorization to undertake currency swap agreements with foreign central banks, paving the way for a USD 30 billion swap arrangement with the US Federal Reserve in late October. This was extended for six months into late June 2010, and has not been tapped. In terms of forex intervention, most measures have been implemented through these forex swaps, and only partially through spot sales.

Table 3a

Start	End	Extraordinary Action
21-Dec-07	29-Septt-08	BCB carries out reverse FX swap auctions
6-Oct-09	28-Apr-09	BCB offers traditional FX swap on a daily basis
8-Oct-08		Direct USD spot purchase
21-Oct-08		CB authorized to swap currency with foreign CBs
30-Oct-08	30-Oct-09	Agreement for up to USD 30 billion with the NY Fed
5-May-09		BCB carries out reverse FX swap auctions
30-June-09	1-Feb-10	Ceiling on FX swaps with the Fed raised to USD 30 bn

In terms of local financing, the Central Bank took measures both to facilitate exporting firms' access to credit lines and to ease other, local, currency liquidity strains. The former involved implementing credit lines for exporters. In domestic liquidity, by reducing the large reserve requirements on deposits, the banking system significantly boosted local liquidity, to 100 billion reales in the last quarter of 2008, that is, 2/3 of base money[7]. To contain financial stress in the most exposed segments of the banking system, incentives were provided to encourage larger institutions to reduce their reserve requirements by acquiring smaller institutions' credit portfolios. Table 3a reveals the sequence of these different policy measures.

7. OECD (2010)

To assess the impact of these measures we identify six policy dummies: Reverse forex swap operations, traditional forex swap operations, spot intervention in the forex market, the announcement of the USD/BRL swap between the Central Bank and the Federal Reserve, the implementation of credit lines to exporters, and the reduction in the compulsory reserve requirement. These policy dummies take the value of 1 while the measures are in place. Dummies are also included on announcement.

Figure 6. Key Money Market Variables in Brazil

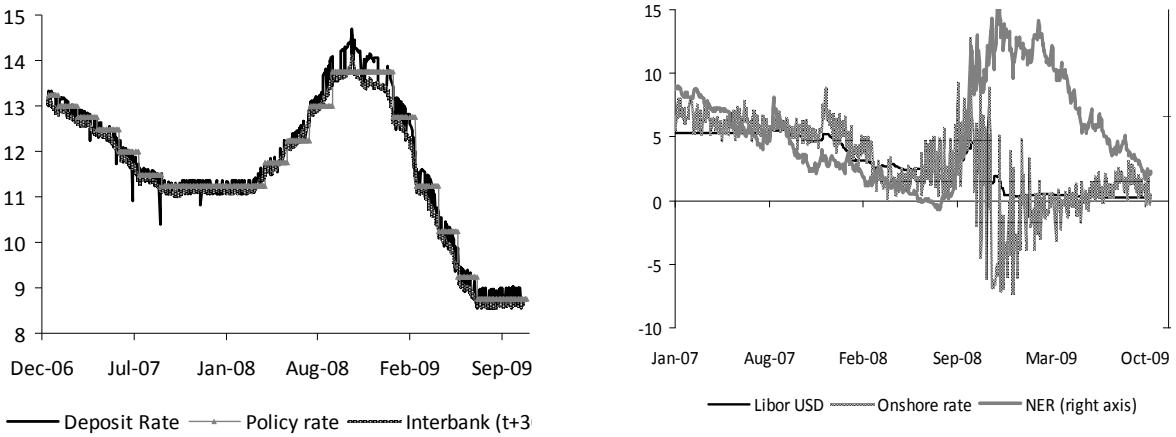


Table 3b shows the results of the estimation. With regards to the effects on the exchange rate, the reverse swap operations (e.g. increasing the long USD position prior to the crisis and after May 2010) seems to have kept the nominal exchange rate weaker, but the traditional swaps do not seem to have stemmed depreciation in any statistically significant way. The swap agreement with the Fed does appear to have been significant, from either a statistical or an economic point of view, affecting the nominal exchange rate (appreciation was almost 6%). The measures designed to bolster domestic liquidity and access to credit both point to depreciating the currency.

In terms of domestic liquidity, the measures seem less relevant, although policy measures seem to have eased foreign liquidity. USD interest rates reacted most significantly to the swap agreement with the Fed (a reduction of more than 300 bp), while spot sales also had an impact. This is consistent with the findings of Stone and others (2009), who find that both the announcement and the implementation of foreign exchange easing reduced the local cost of dollar borrowing. Neither forex swaps nor credit lines to exporters significantly affected this variable.

Table 3b: Estimation results for Brazil

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	-0.058		Deposit rate	-0.106		Log USD Mult	-1.104	
	[1.19]			[1.08]			[15.13]***	
Expected rate (t+20)	1.12		Libor USD	1.208		Log (CRB)	-0.586	
	[23.06]***			[16.88]***			[16.42]***	
Log (VIX)	0.013		Log (VIX)	-0.044		Log (VIX)	0.012	
	[0.25]			[0.10]			[2.15]**	
Libor USD	0.031							
	[2.88]***							
Onshore Rate	-0.005							
	[1.12]							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Reverse Swaps	-0.056	-0.266	Reverse Swaps	-0.543	0.174	Reverse Swaps	0.022	-0.001
	[0.99]	[1.27]		[1.13]	[0.10]		[3.23]***	[0.04]
Traditional Swaps	0.037	0.085	Traditional Swaps	-0.303	0.447	Traditional Swaps	-0.006	0.044
	[0.54]	[0.56]		[0.56]	[0.34]		[0.80]	[2.34]**
Spot Intervention	-0.061	-0.571	Spot Intervention	-1.065	8.365	Spot Intervention	0.006	0.103
	[1.11]	[2.68]***		[2.40]**	[4.64]***		[0.96]	[3.93]***
Possibility of FX Swaps/FED	0.026	0.052	Possibility of FX Swaps/FED	-3.08	-4.447	Possibility of FX Swaps/FED	-0.059	-0.025
	[0.30]	[0.25]		[4.30]***	[2.48]**		[5.64]***	[0.95]
Credit Line - Exp	-0.076	0	Credit Line - Exp	-0.443	0	Credit Line - Exp	0.033	0
	[0.95]	[.]		[0.72]	[.]		[3.76]***	[.]
Comp Res Req	0.408	0.08	Comp Res Req	0.641	-0.396	Comp Res Req	0.029	-0.004
	[3.64]***	[0.37]		[0.68]	[0.21]		[1.98]**	[0.14]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro		-0.197	Lehman Bro	1.817		Lehman Bro	0.016	
		[2.69]***		[3.03]***			[1.77]*	
Libor OIS		0.02	Libor OIS	-0.661		Libor OIS	0.001	
		[0.53]		[2.12]**			[0.16]	
Constant		-0.66	Constant	2.316		Constant	9.125	
		[2.67]***		[1.17]			[46.44]***	
Observations		653		680			680	
R-squared		0.98		0.74			0.96	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan 2007 - Oct 2009, daily data

2.2.3 Colombia

The impact of the October 2008 financial crisis on the Colombian foreign exchange and short-term money markets was mild, compared to other countries in our sample. The inter-bank overnight interest rates remained close to the policy rate. Indeed the spread between short-term deposit interest rates and the actual or expected policy rate (as measured by the OIS market) did not increase in late 2008. Similarly, the implied dollar rates in forward contracts rose in late 2008 to almost 100 bp above LIBOR. It is therefore not surprising that the *Banco de la República* (BDR, Colombian Central Bank), did not implement liquidity provision programs in USD, in response to rising spreads on Colombian USD-denominated bonds and simply eliminated capital controls. In terms of domestic liquidity provisions, in October the BDR reduced reserve requirements on local currency deposits, announced 14- and 30-day REPO operations and an outright purchase of government bonds. In June, the BDR had implemented a reserve accumulation program, purchasing USD 20 million per day in competitive auctions. After conditions in international financial markets changed in October, the program was suspended. Finally, in April, Colombian authorities secured a contingent credit line facility from the IMF.

Table 4a

Start	End	Extraordinary Action
20-Jun-08		Modification of International Reserve Accumulation Program USD 20M/day - competitive auction
9-Oct-08		Elimination of URR & cancellation of International Reserve Accumulation
24-Oct-08		Reduction of cash position requirements (pesos) REPO Operations of 14 to 30-days (pesos) Purchase of treasury bonds: p$500MM
20-Apr-09		Contingent Credit Line petition to the IMF (USD 10400 M)
28-Aug-09		Special Drawing Right (IMF) availability for USD 890 M

Table 4b: Estimation results for Colombia

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	0.877		Deposit rate	0.984		Log USD Mult	-1.147	
	[39.18]***			[16.83]***			[13.83]***	
Expected rate (t+20)	0.085		Libor USD	1.142		Log (CRB)	-0.405	
	[3.53]***			[25.40]***			[10.12]***	
Log (VIX)	0.051		Log (VIX)	-2.811		Log (VIX)	0.033	
	[1.13]			[11.33]***			[4.96]***	
Libor USD	0.078							
	[6.75]***							
Onshore Rate	-0.039							
	[6.27]***							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Intens Res Acum Pr	0.186	-0.146	Intens Res Acum Pr	1.46	-1.102	Intens Res Acum Pr	-0.003	-0.067
	[7.13]***	[1.03]		[8.33]***	[1.08]		[0.65]	[2.05]**
Repo+ResReq	-0.086	0.042	Repo+ResReq	2.821	-0.197	Repo+ResReq	-0.097	0.024
	[1.86]*	[0.29]		[9.42]***	[0.19]		[9.91]***	[0.71]
Contingent CrLine IMF		0.114	Contingent CrLine IMF		0.034	Contingent CrLine IMF		0.034
		[0.81]			[0.03]			[1.06]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	-0.077		Lehman Bro	2.486		Lehman Bro	0.032	
	[1.59]			[7.63]***			[3.39]***	
Libor OIS	0.009		Libor OIS	-1.107		Libor OIS	0.014	
	[0.38]			[7.16]***			[3.60]***	
Constant	-0.067		Constant	-2.204		Constant	15.206	
	[0.59]			[3.03]***			[77.98]***	
Observations	576			626			680	
R-squared	0.99			0.72			0.9	

Source: Authors' computation

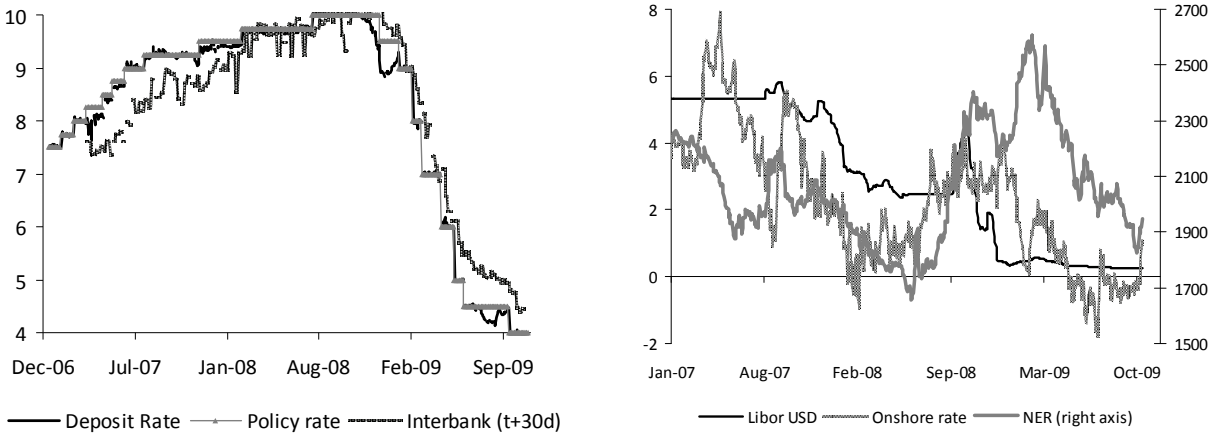
Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan 2007 - Oct 2009, daily data

To assess the impact of these measures, we identify three policy dummies: (*i*) the reserve accumulation program, (*ii*) the changes in reserve requirements and REPO operations, and (*iii*) the contingent credit line announcement. The non-significant coefficients on foreign volatility measures (log VIX) or liquidity premium in US interbank rates in the estimation for Colombian interbank rates is consistent with international financial conditions having little impact on domestic money markets. In terms of policies, the domestic liquidity measures correlate with lower interbank rates, as expected. The positive estimated coefficient on the reserve accumulation program dummy, however, is surprising.

Figure 7. Key Money Market Variables in Colombia



In terms of onshore dollar rates, as expected, these move in line with Libor in our sample, rising significantly after the financial crisis deepened (Lehman Brothers collapse dummy). However, unlike onshore rates in Chile and other countries, we actually find a negative correlation between these rates and the VIX and Libor-OIS spread. In terms of policies: domestic dollar rates were higher in the reserve accumulation period.

Results for the exchange rate are closer to our priors. In this period the dollar/peso exchange rate moved due to changes in the dollar value against other countries, depreciating after the financial crisis deepened in October, as well as in those periods in which the VIX was rising. We find that the announcement – and not the implementation itself – of the reserve accumulation process appreciated the NER, as well as the domestic liquidity provision measures, as arbitrage conditions would predict.

2.2.4 Mexico

The October financial crisis significantly affected peso/dollar markets in Mexico. In Mexico, falling global demand for emerging market assets interacted with rising demand from the corporate sector for dollar-denominated assets, as companies rushed to cover unhedged dollar positions that had built up over the period of exchange rate stability (see Kamil et al. 2009). The result was a significant reduction in turnover in peso/dollar markets and remarkable peso depreciation. Companies' higher demand for USD assets also explains why, during the last quarter of 2008, the implicit, onshore dollar rate in Mexico fell. Increased demand to buy dollars in future markets pushed up forward rates via-à-vis spot rates, depressing the implicit dollar rate. This led the Bank of Mexico to start selling international reserves through several extraordinary auctions in October and a daily auction program that began in early October and continued through June 2009. This program initially set the minimum price at 2% above the previous day's exchange rate, to reduce volatility. This minimum price was eliminated in March.

Lack of a swap market for overnight interbank rates makes it difficult to precisely determine whether Mexico experienced rising tensions in peso money markets in this period. The available data suggests this was not the case. Indeed, 28-day interbank rates actually fell in October, driven by investors reducing their positions in long-term government paper, and switching to short-term debt instruments. In this context, the extraordinary liquidity facilities implemented by Banco de Mexico in October (and extended in December) can be seen as a "preventive measure" (Banco de Mexico 2008) to help local institutions manage liquidity.

Table 5a

Start	End	Extraordinary Action
8-Oct-08	23-Oct-08	Extraordinary USD auction: 11000M
9-Oct-08	1-Oct-09	Daily Auctions. Initially for USD 400M (with minimum price). March onwards: no minimum price and reduced amounts
27-Oct-08	31-Dec-08	Mod (-) to the auction program of public bonds for 2008Q Replacement with short-term debt CETES and later, repurchase of bonds.
27-Oct-08	4-Nov-08	Mod (-) to the auction program of "Bonos de Proteccion al Ahorro" by IPAB Around USD140M for 2008Q4 Later announcement of repurchase of "Bonos de Proteccion al Ahorro", USD 10714M
8-Oct-08		
1-Dec-08		Broadening of admissible collateral for liquidity provision for OM operations
18-Dec-08		
14-Nov-08	28-Nov-08	Interest rate swap lines - domestic - up to P$ 50000M (around USD 3500M)
29-Oct-08	1-Feb-10	Swap lines with foreign CB (extended in May and June)
21-Apr-09		Auction of swap line funds: USD 4000M
1-Apr-09	1-Apr-10	IMF (contingent) flexible credit line of USD 47000M

Banco de Mexico also introduced an interest rate swap facility in mid-November. This facility aimed to reduce bank exposure to high volatility in Mexican government bond prices. In addition to this swap, and in an attempt to reduce long-term interest rates on public debt, the Mexican authorities reduced their issuance of long-term bonds during the last quarter of 2008.

Figure 8. Key Money Market Variables in Mexico

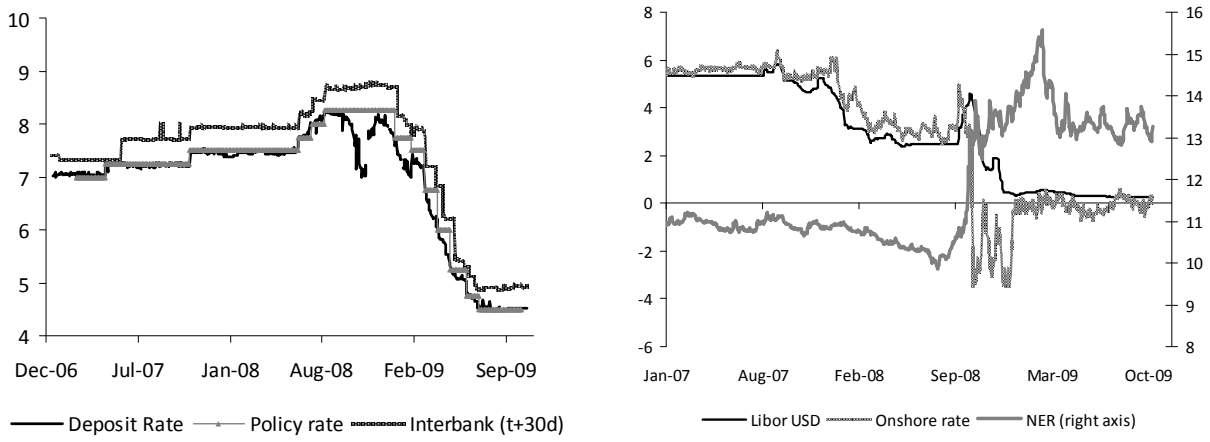


Table 5b reports estimates of the partial correlation of these policy measures with domestic rates, onshore rates and the nominal exchange rate. For the interbank rate (the mexibor), the policy rate has the expected sign and magnitude. Interestingly, the coefficient on the VIX is negative and significant (however small), unlike other countries that saw short-term rates go up relative to the policy rate after Lehman. The estimated coefficients indicate a negative correlation between domestic liquidity measures and the interbank rate, and a negative correlation between the interbank rate and interest rate swaps. The fact that so many programs where announced on October 8th makes it difficult to interpret the positive coefficient on the announcement dummy.

The onshore rate co-moves with the Libor, as expected. However, the correlation with the VIX and Libor OIS spreads is negative, due to the unwinding of corporate derivative positions in the last quarter of 2008. Both, the announcement and implementation of the Fed swap line reduced the onshore dollar rate, as expected.

The Mexican peso depreciated after the Lehman Brothers bankruptcy, and further depreciated in those periods of highest volatility (VIX). We did not find the expected impact of dollar sales (both programmed and extraordinary), probably due to endogeneity in the timing of these measures.

Table 5b: Estimation results for Mexico

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	0.877		Deposit rate	-0.64		Log USD Mult	-0.421	
	[45.47]***			[7.36]***			[6.93]***	
Log (VIX)	-0.075		Libor USD	0.648		Log (CRB)	-0.142	
	[2.07]**			[23.22]***			[4.64]***	
Libor USD	-0.029		Log (VIX)	0.588		Log (VIX)	0.067	
	[3.63]***			[3.98]***			[13.27]***	
Onshore Rate	-0.009							
	[1.10]							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Direct USD Sales	0.166		Direct USD Sales	-0.081		Direct USD Sales	0.023	
	[2.74]***			[0.29]			[2.47]**	
Broadening of Adm. Coll.	-0.494	0.303	Broadening of Adm. Coll.	-4.262	4.281	Broadening of Adm. Coll.	0.115	-0.031
	[8.79]***	[2.00]**		[19.50]***	[6.17]***		[14.34]***	[1.34]
FED swap line	-0.086	0.037	FED swap line	-1.005	-1.048	FED swap line	-0.001	-0.01
	[1.79]*	[0.50]		[4.85]***	[3.07]***		[0.29]	[0.91]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.063		Lehman Bro	1.078		Lehman Bro	0.029	
	[1.44]			[5.41]***			[3.98]***	
Libor OIS	-0.031		Libor OIS	-0.976		Libor OIS	-0.038	
	[1.19]			[8.55]***			[10.51]***	
Constant	1.298		Constant	5.405		Constant	4.988	
	[7.51]***			[6.91]***			[32.65]***	
Observations	628			662			680	
R-squared	0.98			0.94			0.96	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan. 2007 - Oct 2009, daily data

2.2.5 Australia

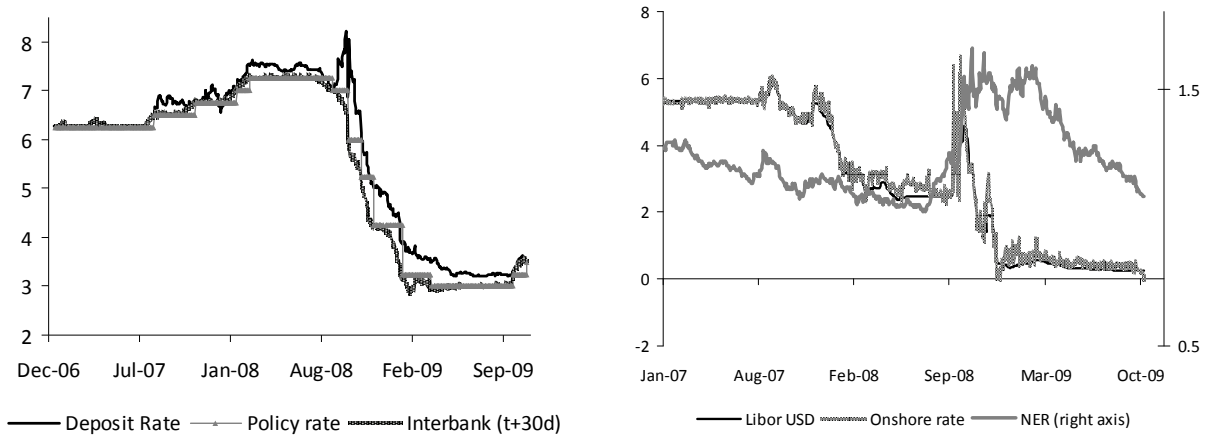
The financial crisis also affected money markets in Australia. Markets for bank funding became particularly stressed and the RBA applied several measures to alleviate the situation and satisfy the increased demand for cash balances. The tenor of REPO operations was extended, and the frequency of 6- and 12-month Repos was increased to daily in early October. Moreover, to confront the increase in counterparty risk, the range of acceptable collaterals expanded to include RMBS and ABCP of related parties, in contrast with constraints normally in place on the eligibility of collateral for REPO operations.[8] Also, restrictions on the ability to substitute collateral within an existing REPO were removed. The average term of REPO operations increased significantly in October thanks to these measures. Regarding the provision of USD liquidity, the main measure was a bilateral swap arrangement with the Federal Reserve.

8. Debelle (2008).

Table 6a

Start	End	Extraordinary Action
24-Sept-08		Bilateral Swap with Federal Reserve for USD 10 billion
29-Sept-08		Increase of bilateral swap with the Fed to USD 30 billion
8-Oct-08		Frequency of 6- to 12-month Repos increased to daily Acceptance of related parties' RMBS and ABCP as eligible collateral Restrictions on substituting collateral within an existing repo removed REPO Operation of 14 to 30 days Term Deposit Facility with one- and two-week maturities introduced to absorb liquidity
12-Oct-08		State guarantee introduced for an unlimited amount for deposits until October 2011 and for debt securities maturing in up to five years.

Figure 9. Key Money Market Variables in Australia



What were the effects of these measures according to our empirical specification? We identify two dummy variables, corresponding to the bilateral swap agreement with the Fed on one hand, and the broadening of eligible collateral and term extension for REPO operations plus the state guarantees for deposits and other liabilities, on the other. Due to the short time between the latter measures it is not possible to separately identify the impacts on our selected financial variables. Table 6b presents the results.

Table 6b: Estimation results for Australia

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	0.137		Deposit rate	-0.096		Log USD Mult	-1.51	
	[4.96]***			[2.63]***			[30.63]***	
Expected rate (t+20)	0.884		Libor USD	0.934		Log (CRB)	-0.267	
	[27.67]***			[88.66]***			[11.41]***	
Log (VIX)	0.007		Log (VIX)	0.092		Log (VIX)	0.044	
	[0.34]			[1.60]			[11.13]***	
Libor USD	0.04							
	[2.79]***							
Onshore Rate	-0.025							
	[1.69]*							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
RBA-TD and FED swap line	0.066	-0.179	RBA-TD and FED swap line	-0.656	0.503	RBA-TD and FED swap line	-0.044	0.018
	[1.12]	[1.65]*		[4.30]***	[1.72]*		[4.44]***	[0.90]
REPO and Collateral	0.014	-0.143	REPO and Collateral	-0.989	1.44	REPO and Collateral	0.004	0.043
	[0.28]	[1.34]		[8.02]***	[5.11]***		[0.56]	[2.18]**
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.286		Lehman Bro	1.045		Lehman Bro	0.016	
	[6.51]***			[9.59]***			[2.11]**	
Libor OIS	0.365		Libor OIS	0.151		Libor OIS	0.038	
	[17.04]***			[2.32]**			[16.64]***	
Constant	-0.284		Constant	0.697		Constant	8.546	
	[2.25]**			[2.27]**			[74.08]***	
Observations	644			679			680	
R-squared	0.99			0.98			0.97	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan 2007 - Oct 2009, daily data

The bilateral swap with the Fed and the extensions of REPO operations plus the implementations of deposit and other guarantees caused significant currency appreciation and reduced the onshore rate significantly (from 60 to 100 basis points) and persistently over the period. Interestingly, for local liquidity conditions things were slightly different. The effects were most marked after the announcement, but did not seem to persist, even when we control, of course, for other variables. The effects also seem to have been more muted, around 15 to 20 basis points.

2.2.6 New Zealand

In contrast to other economies, the financial and banking system in New Zealand was undergoing a downward credit cycle prior to the October 2008 financial turmoil. Hence, already by June, some precautionary measures had been adopted to expand collateral and assist domestic liquidity. When the crisis hit New Zealand, some finance companies were already under pressure.[9] These measures were further complemented in early October as funding became harder to obtain and thus RMBS were also allowed as eligible collateral. By November, further liquidity facilities were implemented through term lending and by December more securities were accepted for domestic liquidity operations, including highly rated corporate bonds.

9. See Bollard and Ng (2009) and Nield (2008)

Table 7a

Start	End	Extraordinary Action
3-Jun-08		Broadening of Collateral: Extension of the range of securities eligible for acceptance in the RBNZ domestic liquidity operations: NZ-registered NZ dollar AAA rated securities, including residential mortgage-backed securities, and AA rated NZ Government sector debt – including Government agencies, SOEs and Local Authorities. The discount margin applied in the Bank's Overnight Reverse REPO Facility will be 50 basis points for all eligible securities. Extension of Overnight Reverse REPO Facility: 1 to 30 days
9-Oct-08		Broaden securities program to RMBS (Residential Mortgage Backed Securities)
29-Oct-08	30-Apr-09	FRBNZ and Fed announce USD Facility up to USD 15 billion
12-Nov-08	26-Oct-09	Term Auction Facility offer up to NZD 2 billion to 3, 6 and 12 month maturity
12-Nov-08	26-Oct-09	RBZ bill tenders to withdraw liquidity injected via TAF
17-Dec-08		Extension of the range of securities acceptable in the RBNZ's domestic liquidity operations to include: Sec guaranteed by the government Highly rated NZ corporate securities NZD Assed Backed securities
30-Jun-09		Prudential Liquidity Policy
22-Oct-09		Prudential Liquidity Policy deadline implementation is relaxed

Table 7b presents the effects of these policy interventions. All three sets of measures (and their announcements) coincided with significantly lower domestic interest rates. Effects of the policy dummies on the onshore rates were mixed. The announcements of all measures coincided with currency appreciations, whereas the measures themselves coincided with a depreciated currency.

Figure 10. Key Money Market Variables in New Zealand

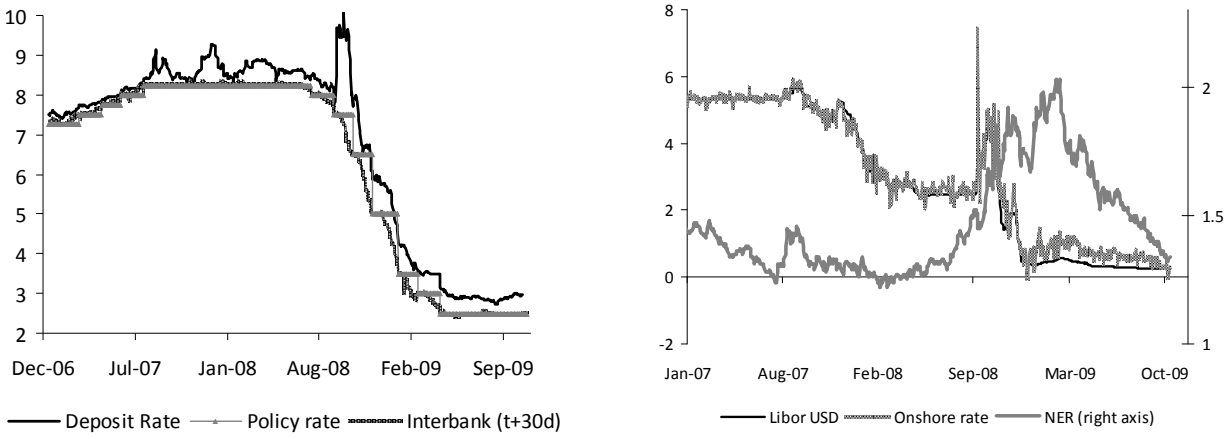


Table 7b: Estimation results for New Zealand

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	0.26		Deposit rate	-0.079		Log USD Mult	-1.312	
	[6.82]***			[3.74]***			[18.02]***	
Expected rate (t+20)	0.802		Libor USD	0.978		Log (CRB)	-0.077	
	[18.93]***			[70.38]***			[2.04]**	
Log (VIX)	-0.207		Log (VIX)	0.17		Log (VIX)	0.02	
	[5.13]***			[2.64]***			[3.32]***	
Libor USD	0.136							
	[5.55]***							
Onshore Rate	-0.13							
	[5.49]***							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Broadening eligible coll.	-0.059	-0.064	Broadening eligible coll.	0.075	-0.012	Broadening eligible coll.	0.077	-0.046
	[2.03]**	[0.36]		[1.59]	[0.04]		[19.85]***	[1.74]*
Swap lines FED	-0.196	-0.616	Swap lines FED	0.17	-0.391	Swap lines FED	0.035	-0.073
	[6.95]***	[3.42]***		[3.82]***	[1.33]		[6.37]***	[2.72]***
TAF and Ext. of Acc. Coll.	-0.113	-0.346	TAF and Ext. of Acc. Coll.	-0.582	0.985	TAF and Ext. of Acc. Coll.	0.072	-0.042
	[1.71]*	[1.93]*		[5.84]***	[3.40]***		[9.16]***	[1.59]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.884		Lehman Bro	0.246		Lehman Bro	-0.041	
	[14.02]***			[2.76]***			[5.13]***	
Libor OIS	0.499		Libor OIS	-0.142		Libor OIS	0.033	
	[16.70]***			[2.76]***			[7.90]***	
Constant	0.171		Constant	0.33		Constant	6.703	
	[1.14]			[1.40]			[37.54]***	
Observations	677			679			680	
R-squared	0.99			0.98			0.96	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan 2007 - Oct 2009, daily data

2.2.7 Korea[10]

The Central Bank of Korea initially responded to rising international financial volatility by supplying liquidity to banks and securities companies through long-term REPO operations, starting in October 2008. To further ease tensions in funding markets, in November and December 2008 the Bank included bank debentures and certain government agency bonds among the securities eligible for use as collaterals in open market operations, which originally included only Treasury bonds, government-guaranteed bonds and monetary stabilization bonds. In November, the Central Bank supported the creation of a bond market stabilization fund, while in December counterparties for REPO operations were expanded to include securities companies in addition to banks.

To facilitate lending, the aggregate credit ceiling was raised in November to boost banks' incentives for lending to SMEs. The aggregate credit ceiling was further increased on March 23, 2009. Moreover, in December 2008, to help banks expand their credit supply capacity by raising their BIS capital adequacy ratios, the Central Bank paid them a one-off remuneration on their required reserve deposits.

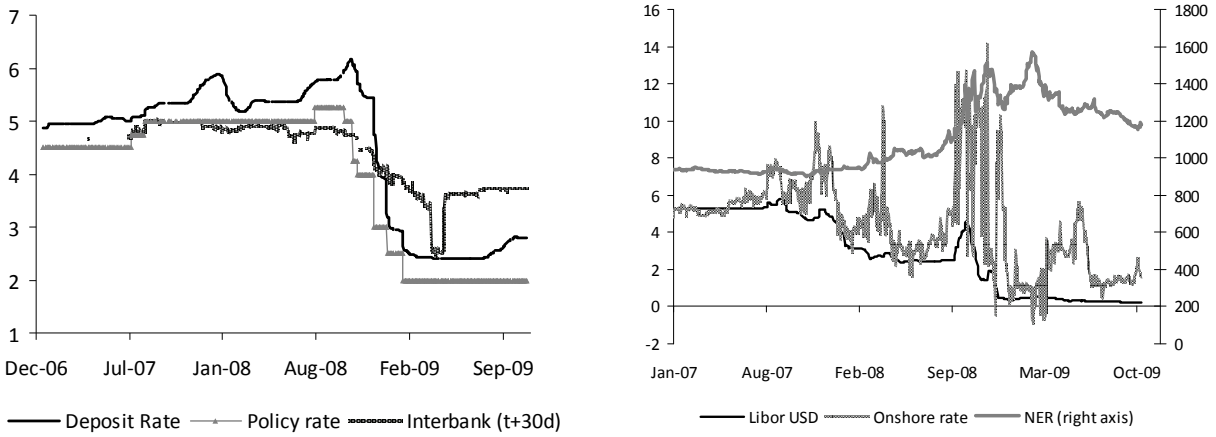
10. Based on Bank of Korea (2009)

Table 8a

Start	End	Extraordinary Action
1-Oct-08		Specific support to businesses
1-Dec-08		Specific support to businesses
30-Apr-08		Specific support to businesses
17-Oct-08		FX Swap Auctions
27-Oct-08		Extension of accepted collateral
		Bonds issued by banks
29-Oct-08	30-Oct-09	Swap Facility with the Fed
12-Dec-08	1-Apr-09	Expansion of BoJ swap line
11-Dec-08		12 more eligible firms for repo operations
3-Dec-08		Interest began to be paid on bank deposits in the CB
9-Dec-08		Extension of accepted collateral
		Public Corporation Bonds
9-Jan.-09		91 day Repos introduced

As in other economies, in the wake of the Lehman Brothers collapse, foreign exchange market tensions grew. This is evident from the shift in the level and volatility of the onshore dollar rate in Korea in the fourth quarter of 2008, which peaked at over 600 bp over LIBOR. The Central Bank undertook a number of measures to alleviate further financial market unrest and to prevent the turmoil from evolving into a full-blown currency crisis. On October 30, 2008, the Central Bank entered into a 30-billion US dollar swap arrangement with the Federal Reserve. On December 12, in addition, the Bank not only entered into a swap arrangement with the People's Bank of China, but also expanded the ceiling of an existing currency arrangement with the Bank of Japan.

Figure 11. Key Money Market Variables in Korea



Furthermore, the Bank of Korea acted directly to ease corporate access to foreign credit through a number of measures. It directly provided US dollars in foreign currency liquidity to financial institutions experiencing difficulties in overseas fund-raising by way of a competitive swap facility between October 21 and December 16 2008 On November 17, 2008, it introduced measures to heighten the attraction to foreign exchange banks of providing trade finance to SMEs. Meanwhile, for firms which had taken out of foreign currency loans or purchased financial derivative products and

were facing a widening debt service burden and losses on derivative products, the Bank of Korea allowed domestic banks to extend the maturities of their foreign currency loans made for use as working capital and also permitted export firms to take out foreign currency loans for settlement of currency option contracts such as KIKOs. Table 8a presents these measures

Table 8b: Estimation results for Korea

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	-0.498		Deposit rate	1.947		Log USD Mult	-1.403	
	[10.16]***			[13.38]***			[16.80]***	
Expected rate (t+20)	1.581		Libor USD	0.069		Log (CRB)	0.395	
	[38.49]***			[0.42]			[8.74]***	
Log (VIX)	-0.045		Log (VIX)	1.243		Log (VIX)	-0.01	
	[2.28]**			[3.64]***			[1.37]	
Libor USD	0.038							
	[4.13]***							
Onshore Rate	0.003							
	[1.24]							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Support to Businesses	0.086		Support to Businesses	-2.772		Support to Businesses	0.104	-0.063
	[3.39]***			[6.01]***			[21.95]***	[2.06]**
KRW-USD FX swaps	0.148	-0.1	KRW-USD FX swaps	-3.319	3.702	KRW-USD FX swaps	0.072	-0.036
	[3.38]***	[1.18]		[4.40]***	[2.24]**		[4.55]***	[1.07]
Coll relaxation and CB dep ir	0.403	0.064	Coll relaxation and CB dep ir	4.114	-8.603	Coll relaxation and CB dep ir	0.06	-0.018
	[7.76]***	[0.79]		[4.84]***	[5.45]***		[3.71]***	[0.58]
Swap Fac FED and BoJ	-0.044	0.084	Swap Fac FED and BoJ	-2.636	1.308	Swap Fac FED and BoJ	0.052	-0.07
	[3.00]***	[1.09]		[9.97]***	[0.85]		[8.25]***	[2.23]**
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	-0.179		Lehman Bro	3.726		Lehman Bro	0.082	
	[6.00]***			[7.18]***			[8.27]***	
Libor OIS	0.115		Libor OIS	0.025		Libor OIS	0.047	
	[7.84]***			[0.09]			[10.04]***	
Constant	-0.452		Constant	-7.955		Constant	10.896	
	[5.63]***			[6.34]***			[45.74]***	
Observations	559			649			680	
R-squared	0.99			0.65			0.97	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets
(2) significance: 10% (*), 5% (**) and 1% (*)
(3) Period of analysis: Jan. 2007 - Oct 2009, daily data

For our purposes, we identify as policy dummies the direct provision of liquidity to businesses, the USD-Kwon swap operations by the Central Bank, collateral extensions and the remuneration of reserves and the swap arrangement with the Federal Reserve. Table 8b presents the results of the estimation. Two results are the most noteworthy. First, the variable that most reacted to these policy measures was the onshore USD interest rate. The liquidity support to businesses, KRW-USD swaps and the swap arrangement with the Fed reduced this interest rate substantially, by 270 bp, 330 and 260 bp respectively. Similarly to other cases, the nominal exchange rate did not seem to react in a significant way to any of these policy measures, in the sense of experiencing an appreciation.

2.2.9 Indonesia

A significant concern in the wake of the global financial crisis in Indonesia was the magnitude of external debt maturing over 2009 as well as the settlement of structured products between a number of banks.[11] Hence, as elsewhere, the implementation of measures to ease short-term funding pressures was key to dealing with the crisis. Most of the measures implemented by the Central Bank

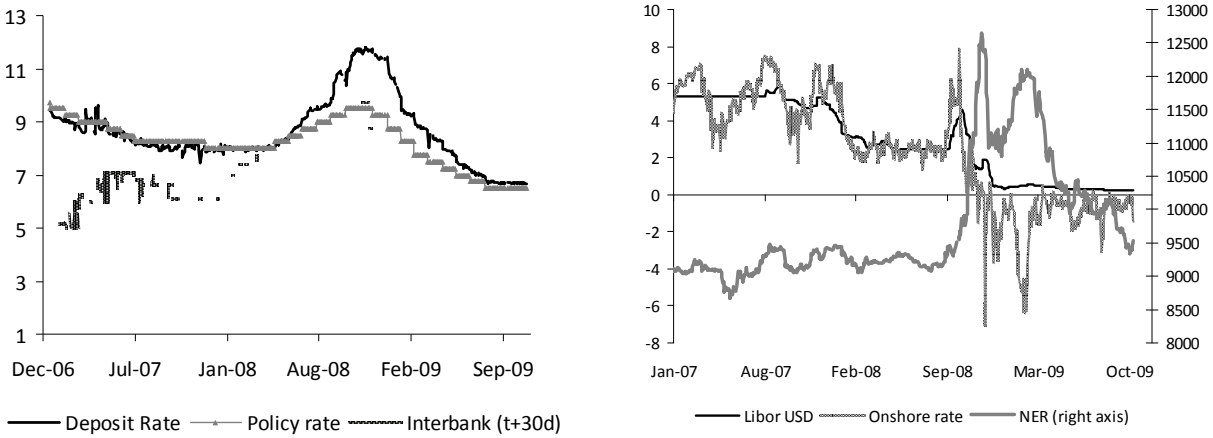
11. See Mulya (2009).

related to the provision of liquidity in foreign currency. By mid-October, the tenor of USD-local currency swaps was extended to one month, reserve requirements on USD deposits were cut, and limits on foreign borrowing by local banks were abolished. Additionally, in February 2009, as global financial turmoil continued, Indonesia secured a number of facilities to provide additional foreign liquidity in the form of standby loans from the World Bank, bilateral swap agreements with Japan and China, and an expanded pool of reserves through the Chiang Mai initiative. In terms of local money markets, also by mid-October, the maximum guarantee for deposit of selected institutions was expanded and longer tenor REPO operations were introduced. In December, the corridor for the overnight rate was narrowed. Table 9a summarizes the timeline of implemented measures.

Table 9a

Start	End	Extraordinary Action
9-Oct-08		Introduction of two week REPO operation
4-Dec-08		Corridor for overnight interest rates narrowed from 200 bp to 100 bp
14-Oct-08		FX Market measures
		FX swaps maturity extension from seven days to one month
		Reserve requirements on FC deposits lowered from 3% to 1%
		Limit on foreign currency borrowing (by banks) is abolished
2-Feb-09		Credit lines with foreign institutions
		Arrangement of US$5.5 bn standby loans from WB, ADB, Australia and Japan
		Expansion bilateral C-Swap arrangement with Japan (US$2 to US$6 billion)
		(23/03/2009) bilateral swap line with China

Figure 12. Key Money Market Variables in Indonesia



For our purposes, we identify three policy dummies. First, the introduction of local money market and USD facilities in mid-October; second the narrowing of the interbank rate corridor;, and third, the number of credit lines with foreign institutions. Results are presented in Table 9b. These suggest that several of these measures were indeed effective in easing money market tensions, both in local currency and USD. Although the initial implementation of measures in October did not

significantly reduce the spread between interbank and policy rates, it did reduce implied onshore USD interest rates by close to 300 bp. The access to a broader set of foreign resources by the first quarter of 2009 significantly affected both local money market interest rates and implied onshore USD rates. Interestingly, none of these measures seems to have significantly affected the exchange rate.

Table 9b: Estimation results for Indonesia

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	1.344		Deposit rate	-0.553		Log USD Mult	0.102	
	[69.64]***			[7.38]***			[1.20]	
Expected rate (t+20)			Libor USD	1.01		Log (CRB)	-0.372	
				[21.93]***			[9.00]***	
Log (VIX)	0.417		Log (VIX)	0.141		Log (VIX)	0.112	
	[9.53]***			[0.58]			[19.19]***	
Libor USD	-0.115							
	[10.41]***							
Onshore Rate	-0.014							
	[2.01]**							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Repo/Swap/Res Req Lim	0.131	-0.969	Repo/Swap/Res Req Lim	-3.726	0.475	Repo/Swap/Res Req Lim	0.047	-0.094
	[1.93]*	[4.86]***		[10.19]***	[0.41]		[4.94]***	[3.20]***
Corridor of OIR narrowing	0.013	0.412	Corridor of OIR narrowing	-0.203	-0.985	Corridor of OIR narrowing	-0.005	0.031
	[0.24]	[2.09]**		[0.64]	[0.86]		[0.58]	[1.06]
Credit lines w/ foreign banks	-0.645	-0.028	Credit lines w/ foreign banks	-1.776	1.614	Credit lines w/ foreign banks	0.03	0.023
	[12.59]***	[0.15]		[5.62]***	[1.42]		[4.92]***	[0.80]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.849		Lehman Bro	3.69		Lehman Bro	-0.04	
	[12.65]***			[9.62]***			[4.60]***	
Libor OIS	0.01		Libor OIS	-0.302		Libor OIS	-0.01	
	[0.33]			[1.74]*			[2.26]**	
Constant			Constant	4.402		Constant	10.574	
				[4.04]***			[56.80]***	
Observations				641			670	
R-squared				0.86			0.91	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets
(2) significance: 10% (*), 5% (**) and 1% (*)
(3) Period of analysis: Jan 2007 - Oct 2009, daily data

2.2.10. Peru

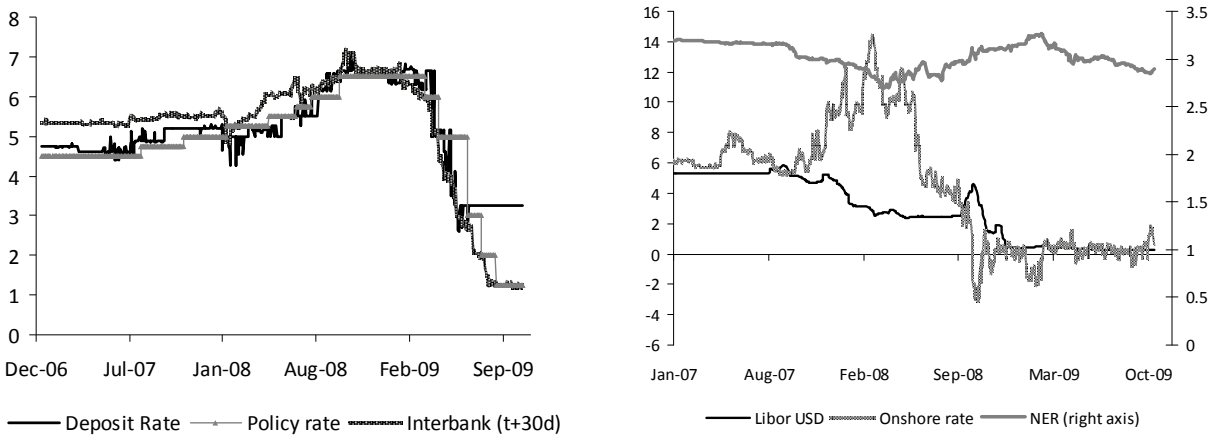
Peruvian authorities did not hesitate to aggressively provide domestic and foreign currency liquidity starting September 2008. Table 10a summarizes the most relevant actions adopted by the Central Bank of Peru (CBP, *Banco de la Reserva de Peru*). On domestic liquidity provision, the CBP reduced reserve requirements for banking institutions gradually but significantly, starting on September 26, 2008 and deepening this incentive into the first quarter of 2009, in six different press releases. On the foreign exchange market, as Peru is a highly dollarized economy, intervention needed to be aggressive. The CBP intervened in the USD market selling almost USD7 billion from September 2008 to May 2009, with public announcements by authorities that these interventions were to reduce exchange rate market volatility. From the right panel of Figure 13 it is evident that depreciation of the Nuevo Sol was mild compared to both its own history and other Latin American economies.

Table 10a

Start	End	Extraordinary Action
26-Sept-08		Suspension of reserve requirement for 2- to 7-year obligations (< twice banks equity) if >7 years : 49% of marginal reserve requirement
1-Sept-08	30-Sept-08	Selling auction of US$2,008 million to avoid ER volatility
10-Oct-08		Establishment of REPO operations to provide USD liquidity Accept treasury and BCRP bonds with repurchase agreement Maximum amount previously communicated + allocation to highest interest rate bids
20-Oct-08		9% unique reserve requirement (nat'l currency) for general liabilities (dep)
21-Oct-08		Reduction (49 to 35) of marginal reserve requirement
24-Oct-08		New option of currency swaps (soles and US$)
1-Oct-08	31-Oct-08	Selling auction of US$ 2588 million to avoid ER volatility
28-Nov-08		Modifications to Reserve Requirements Vindication reserve requirements to 33% of liabilities Reduction (120 to 30) reserve requirements for deposits of non-residents Reduction (120 to 30) reserve requirements for deposits of non-residents w/ inv purposes Top mean reserve req (35) to short-term foreign loans
1-Nov-08	11/31/2008	Selling auction of USD 810 million to avoid ER volatility
30-Dec-08		7.5% unique reserve requirement (nat'l currency) for general liabilities (dep) Reduction (35 to 30) of marginal reserve requirement
1-Dec-08	31-Dec-08	Selling auction of US$ 289 million to avoid ER volatility
30-Jan.-09		6.5% unique reserve requirement (nat'l currency) for general liabilities (dep)
1-Jan.-09	31-Jan.-09	Selling auction of US$ 676 million to avoid ER volatility
1-Feb-09	28-Feb-09	Selling auction of US$ 473 million to avoid ER volatility
20-Mar-09		6.0% unique reserve requirement (nat'l currency) for general liabilities (dep)
15-Apr-09		CB offers to buy with repurchase agreement loan portfolios from commercial banks (requirement represented in "*títulos de valores*")
1-May-09	30-May-09	Selling auction of US$ 77 million to avoid ER volatility
24-Jul-09		First currency swap (soles vs. USD) CB sells soles
14-Aug-09		Currency Swap (CB sells soles)

The CBP also implemented REPO operations and currency swaps to further ease liquidity in foreign currency. Moreover on April 15, 2009 the CBP, in a highly unusual policy, offered to buy – with a repurchase agreement – loan portfolios from commercial banks, thereby moving private sector risk onto the Central Bank balance sheet.

Figure 12. Key Money Market Variables in Peru



Thus, we identify five dummies for the Peruvian case: (i) Liquidity provision through reserve requirement reductions, (ii) direct sales in the forex spot market, (iii) REPO operations in foreign currency, (iv) loan portfolio purchase from commercial banks, and (v) currency swap implementation. Domestic interest rates, as expected, correlated negatively with reserve requirement reductions and the loan portfolio purchase offer, and positively with the VIX index and the policy rate. On the other hand, direct sales of USD seem to are positively associeated to higher domestic rates, just as forex swaps. REPO operations and currency swaps aimed to enhance foreign currency liquidity tam forex interest rates, as expected. Although direct USD sales by the Central Bank do not seem to affect the bilateral exchange rate with the USD, the counterfactual scenario would have been one of extensive depreciation of local currency, as in other economies. Direct interventions specifically aimed to avoid such events. No other policy variable seems to have had a large economic impact on the bilateral exchange rate.

Table 10b: Estimation results for Peru

Deposit Rate			*Onshore rate*			*NER*		
Interbank rate	0.719		Deposit rate	-1.837		Log USD Mult	-0.988	
	[16.91]***			[8.77]***			[22.67]***	
Expected rate (t+20)	-0.146		Libor USD	-0.753		Log (CRB)	-0.065	
	[4.23]***			[10.56]***			[2.91]***	
Log (VIX)	0.305		Log (VIX)	1.59		Log (VIX)	0.011	
	[5.75]***			[4.23]***			[2.90]***	
Libor USD	-0.082							
	[7.69]***							
Onshore Rate	-0.027							
	[5.02]***							
Non-MP actions (Imp/Ann)			*Non-MP actions (Imp/Ann)*			*Non-MP actions (Imp/Ann)*		
Res Req Liquidity	-0.449	0.263	Res Req Liquidity	-1.72	0.631	Res Req Liquidity	-0.001	0.011
	[3.61]***	[1.02]		[1.96]**	[0.34]		[0.12]	[0.59]
Direct Sales of USD	0.417	0.38	Direct Sales of USD	-0.262	0.152	Direct Sales of USD	-0.007	-0.002
	[8.07]***	[2.14]**		[0.69]	[0.12]		[2.02]**	[0.16]
REPO USD Liq	-0.05	-0.317	REPO USD Liq	-3.277	-0.956	REPO USD Liq	-0.055	0.034
	[0.51]	[1.25]		[4.70]***	[0.52]		[7.94]***	[1.94]*
Buying offer of loan port	-0.51	1.801	Buying offer of loan port	-3.6	4.796	Buying offer of loan port	-0.01	-0.008
	[5.73]***	[7.20]***		[6.83]***	[2.58]**		[2.37]**	[0.49]
Currency Swap	0.488	-0.038	Currency Swap	-0.97	0.326	Currency Swap	0.015	0.008
	[5.42]***	[0.15]		[1.67]*	[0.18]		[2.59]***	[0.43]
Financial Stress			*Financial Stress*			*Financial Stress*		
Lehman Bro	0.16		Lehman Bro	-4.118		Lehman Bro	-0.002	
	[1.61]			[6.00]***			[0.35]	
Libor OIS	0.086		Libor OIS	0.628		Libor OIS	-0.011	
	[2.19]**			[2.45]**			[4.48]***	
Constant	1.466		Constant	14.801		Constant	6.014	
	[5.45]***			[9.30]***			[52.50]***	
Observations	680			680			680	
R-squared	0.93			0.81			0.86	

Source: Authors' computation

Notes: (1) Absolute values of t statistics in brackets

(2) significance: 10% (*), 5% (**) and 1% (*)

(3) Period of analysis: Jan 2007 - Oct 2009, daily data

2.3 Empirical Results – Summary

Table 11
p-values for joint test on non-monetary policy actions efficacy

		Deposit rate	*Onshore rate*	*Exchange rate*
Chile	Imp	0.00	0.00	0.00
	Ann	0.00	0.31	0.24
Brazil	Imp	0.72	0.00	0.00
	Ann	0.06	0.00	0.00
Australia	Imp	0.47	0.00	0.00
	Ann	0.11	0.00	0.06
Korea	Imp	0.00	0.00	0.00
	Ann	0.36	0.00	0.03
Indonesia	Imp	0.00	0.00	0.00
	Ann	0.00	0.40	0.01
Peru	Imp	0.00	0.00	0.00
	Ann	0.00	0.00	0.46
New Zealand	Imp	0.00	0.00	0.00
	Ann	0.00	0.00	0.01
Mexico	Imp	0.00	0.00	0.00
	Ann	0.11	0.00	0.28
Colombia	Imp	0.00	0.00	0.00
	Ann	0.61	0.75	0.12

The previous sub-section highlights the diverse experiences in domestic local currency and dollar markets. In most cases domestic local currency markets experienced some degree of "stress" in the second half of 2008, with the average spread between 28-day interbank rates and the expected policy rate rising significantly compared to previous levels and becoming considerably more volatile (table 12a). Notable exceptions to this were Colombia and Mexico. In Mexico, "flight" from long-term public debt pushed down short-term rates. In Colombia, although there was no evident pressure in money markets, the Central Bank expanded its mechanisms for domestic liquidity provision, which in turn pushed down short-term interbank rates.

In those countries which experienced rising rates, central banks expanded their offer and the scope of liquidity facilities, seeking to align short-term bank funding rates with policy rates to ensure effective the monetary policy transmission. Despite the fact that the interbank-swap spread came down in most countries in 2009, the simple regressions presented in the previous section suggest that the statistical effectiveness of these measures was mixed. Table 11 shows a summary of p-values of a joint significance test on the policy dummies (for implementation and announcement alike). In 10 out 54 country-policy measure pairs, statistical significance was different from zero at 15% confidence. However, for 37 out of 54 country-policy measure pairs the p-value was lower than or equal to 1%. This is broadly consistent with the small but growing empirical literature on the effectiveness of unconventional measures for advanced economies. This literature tends to find that domestic liquidity provision programs tend to reduce libor-ois spreads (see Aït-Sahalia and others 2009; Artuç and Demiralp, forthcoming; McAndrews, Sarkar, and Wang, 2008; Deutsche Bank, 2009; and Christensen et al., 2009)

Note however, that with few exceptions central banks responded to rising market rates by reducing exceptionally high spreads between 28-day and overnight policy rates, but did not abandon the pre-crisis schemes of primarily targeting short-term rates. Indeed, in most cases the liquidity tools traditionally used to target overnight rates were simply enhanced to extend the maturity and eligible collateral of the central bank operations.

Table 12a

	Swap spread in local currency (bp.)						Spread Volatility (st dev)			
	Jan07-May07	June07-Aug08	Sept08-Dec08	Ave 2009	Max 2008	Last Avg.	Jan07-May07	Jun07-Aug08	Sept08-Dec08	Avg 2009
AUS	2	18	58	30	205	38	19	22	40	33
BR	-8	-4	27	-9	110	-15	16	23	60	46
CL	4	17	22	0	255	22	15	7	21	21
CO	-10	-5	-12	-6	5	-3	25	44	26	73
IND	-19	0	180	67	250	19	2	11	26	8
KO	18	22	61	27	108	40	4	6	37	21
MX	3	-3	-39	-19	28	1	6	20	75	17
MZ	25	36	93	42	260	47	8	24	19	84
PE	-65	-49	-8	81	26	201				

Source: authors' calculations based on data from Bloomberg and Central Bank (see appendix 1).

For Mexico and Indonesia, we report spreads between the 28 day interbank rate and the overnight policy rate, because data on interest rates swaps is not available.

Several central banks in our sample also participated in some form of public debt policy. In the case of Chile, for example, the CBCh shifted the maturity of debt issuance to minimize the impact on the yield curve of higher public sector issuance. Implicit in these policies is a belief that particularly at a time of financial distress, the supply of debt could have significant (if probably transitory) effects on rates. The available information indicates that again, in most cases, the objective of these measures was to avoid temporary deviations of rates from "fundamentals" that would impact the transmission mechanism rather than complement traditional monetary policy by pushing down long-term rates.

The impact of the crisis on onshore dollar rates is more heterogeneous. Whether rates rose or fell relative to LIBOR depends on both, how financial stress affected external financing costs and on events in domestic forward markets. In several cases (Brazil and Mexico), agents rushed to unwind short dollar positions, pushing down domestic dollar rates. In others, the risk adjusted rate rose in line with rising global uncertainty or illiquidity and pushed up onshore rates (table 12b). In most cases, however, volatility increased over levels observed in the first semester of 2007.

Here policies aimed to either complement the private supply of dollar credit directly, via swaps or other mechanisms, or to offset the lack of dollar liquidity on the exchange rate. Many of the measures that provided dollar loans seem to have been relatively successful in reducing domestic dollar rates. The effects of direct (one off or programmed) sales of USD, as discussed in the previous section, were mixed. For instance, direct USD sales in the spot market in Peru appreciated local currency while in Mexico this same operation was associated with national currency depreciation, possibly due to an intervention that was less aggressive than required. Swap lines with foreign central banks (for those countries that implemented them), on the other hand, do seem to have been widely effective, taming the depreciation of local currencies both during implementation and at the time they were announced.

Table 12b

	Swap spread in USD currency (bp.)					Spread Volatility (STDV)			
	Jan07-May07	Jun07-Aug08	Sept08-Dec08	Ave 2009	Max 2008	Jan07-May07	Jun07-Aug08	Sept08-Dec08	Ave 2009
AUS	0	14	26	15	318	79	111	444	174
BR	101	28	-116	-26	845	11	118	141	149
CL	-46	81	112	102	458	140	117	128	112
CO	-33	-161	62	11	347	119	91	214	134
IND	-22	10	-105	-153	373	21	111	338	129
KO	-13	125	513	157	1270	8	32	237	45
MX	24	51	-249	-49	177	10	19	68	22
MZ	2	2	24	32	426	66	321	234	71
PE	93	381	-171	-24	1154	0	0	0	0

Source: authors' calculations based on data from Bloomberg and Central Bank (see appendix 2).

In general, the period after the Lehman Brothers collapse saw a significant increase in onshore USD interest rates. This effect occurred over and above the sensitivity to other risk and volatility measures, such as Libor OIS spreads and the VIX, and the actual movement of USD Libor itself. Local interest rates also reacted to global financial turmoil, although the degree of heterogeneity between economies seems to be larger in this case. The local exchange rate followed the gyrations of the dollar worldwide and commodity prices.

3. CONCLUSIONS

Events surrounding the financial crisis and the Great Recession of 2008-2009 have required significant policy measures by central banks. Has the inflation targeting framework been flexible enough to accommodate these responses? Or has IT restricted their room of maneuver? In this paper we tackle this question by assessing the policy responses to the crisis of a selection of nine central banks that follow inflation targeting (IT) frameworks and that remained financially stable, in the sense of not facing systemic problems in their banking or financial systems. We find that from the second half of 2008 on, monetary policy responses deviated substantially in all cases from the prescriptions of standard and simple reaction functions, a finding that we have reconciled with a drop in the persistence of monetary policy, in all cases. We show that neither inflation nor output deviations (actual or expected), were plausibly large enough to account for such severe and swift deviations from past policy actions. We have also constructed a time-line history for the nine economies on non-monetary-policy measures and estimate their impact on local money markets, both in local currency and USD, and the exchange rate. We find that although there is a significant heterogeneity in the specific characteristics of non-monetary-policy measures and their eventual effectiveness, they were broadly successful in limiting and reducing money market and foreign exchange rate market tensions. The heterogeneity of these types of measures across different IT central banks, along with the general preservation of price stability in the selected economies, suggests that IT frameworks have been flexible enough to accommodate unconventional central bank policies.

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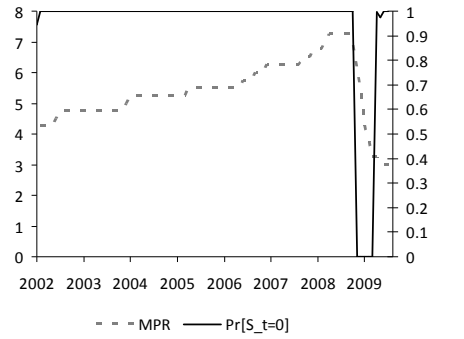
Appendix 1
Two-State Markov Switching Estimation of Taylor Rules: High vs. Low Persistence

Australia



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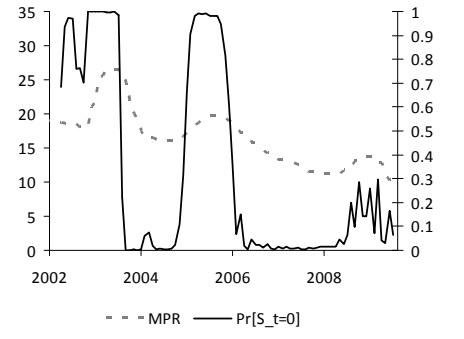
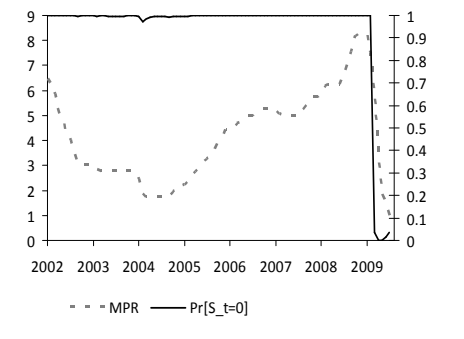
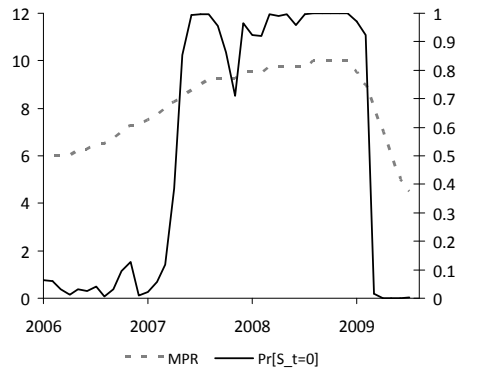


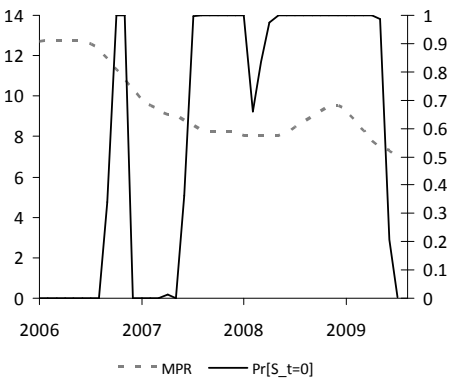
Chile



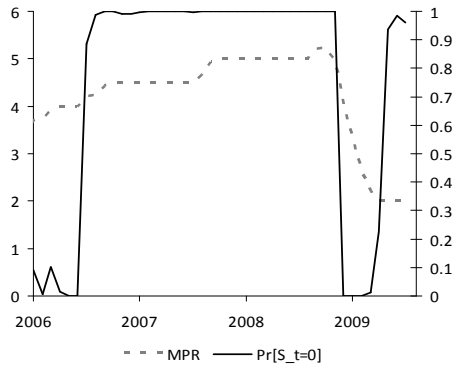
Colombia



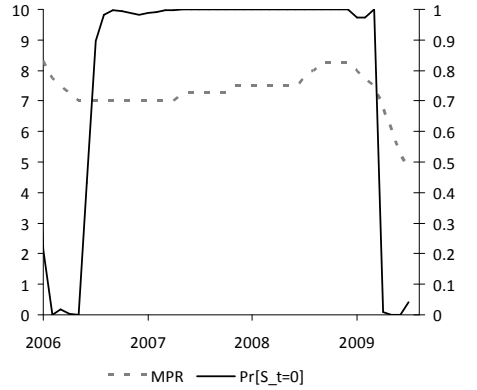
Indonesia



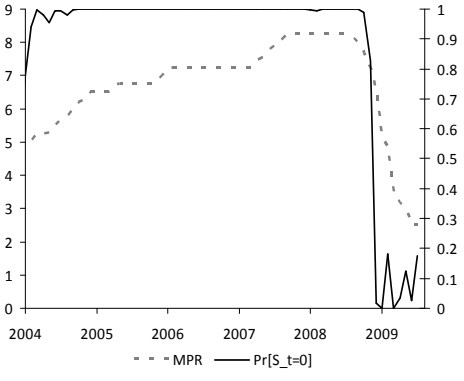
Korea



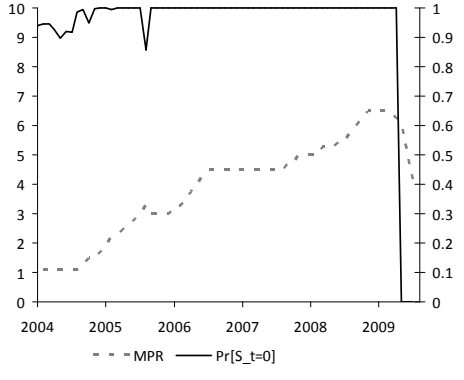
Mexico



New Zealand



Peru



Appendix 2

Table A1: Variable definitions

Chile		
Deposit rate		30/90 day banking system average deposit rate
Swap rate		*Swap Promedio Camara*
Monetary policy rate		Overnight interbank rate
Australia		
Interbank rate	AU0001M	Libor AUD 1M. British Bankers Association Fixing for Australia Dollar.
Monetary policy rate	RBATCTR	Australia RBA Cash Rate
Swap rate	ADSOA Curncy	AUD Swap OIS 1MO
Brazil		
Swap rate	BCSWAPD Curncy	RL Swap Pre-DO 1MO. Pre is the fixed rate and DI is the floating rate. Di is the Brazilian Interbank Deposit Average rate
Interbank rate	BCCDIO Curncy	Brazilian Interbank lending rate with no government bonds as collateral
Deposit rate	BCCDBAE Index	Brazilian retail certificate of deposit quoted as an effective annualized rate. 30d rate
Monetary policy rate	BZSTSETA Index	Brazilian SELIC Target rate
New Zealand		
Interbank rate	NZ001M Index	London Interbank Offered Rate - BBA fixing for NZ dollar.
Monetary policy rate	NZOCRS Index	New Zealand official cash rate
Swap rate	NDSOA Curncy	NZ swap OIS 1Mo
Colombia		
Interbank rate		90-day interbank rate
Swap rate	CLSWA Curncy	COP Swap 1MO
Deposit rate	CLDRA Curncy	COP Deposit 1MO
Monetary policy rate	CORRRMIN Index	Colombia minimum repo rate
Mexico		
Monetary policy rate	MXONBR Index	Official overnight rate
Interbank rate	MPTBA Curncy	Mexibor
Korea		
Deposit rate	KWCDC Curncy	KRW CD 3MO Curncy
Interbank rate	KRBO1M Index	SK KFB KORIBOR KRW 1MO Index
Monetary policy rate	KOCRD Index	Official overnight rate
Peru		
Deposit rate	PSDRA Curncy	Peruvian deposit 1MO
Interbank rate	PEOPRBI Index	Peru Reference Interest rate. LIMABOR rate in local currency
Monetary policy rate	PRRRONUS Index	Official overnight rate
Indonesia		
Interbank rate	JIIN1M Index	Jakarta Interbank 1MO
Monetary policy rate	IDBIRATE Index	Official overnight rate
Swap rate	IHSWOOA Curncy	IDR Swap Onshore 1MO
Deposit rate	IDRE1MO Index	IDR Deposit rate av. 1MO of 131 banks

	Bloomberg Ticker	Description
Australia		
Nominal Exchange Rate	AUD Curncy	Spot Exchange Rate - Price of 1 AUD in USD. The Australian dollar is the official currency of the Commonwealth of Australia. The conventional market quotation is the number of US dollars per Australian dollar. It is an independent free-floating currency.
Forward Contract	AUD1M Curncy**	1 Month Forward Points.
	AUD3M Curncy**	3 Month Forward Points.
	AUD12M Curncy**	12 Month Forward Points.
Interest Rate	ADBB1M Index	Bank Bill 1 Month. Day Count: ACT/365.
	ADBB3M Index	Bank Bill 3 Month. Day Count: ACT/365.
	ADSWAP1Q Index	Interest Rate Swap Quarterly 1 Year. Quote: Quarterly 1 to 3 year use Quarterly Settlement vs. 3 month Bank Bill. Day Count: ACT/365.
Brazil		
Nominal Exchange Rate	BRL Curncy	Spot Exchange Rate - Price of 1 USD in BRL. The Brazilian real is the official currency of the Federative Republic of Brazil. The conventional market quotation is the number of reales per US dollar. It is an independent free-floating currency.
Forward Contract	BCN1M Curncy***	1 Month NDF Points.
	BCN3M Curncy***	3 Month NDF Points.
	BCN12M Curncy***	12 Month NDF Points.
Interest Rate	OD1 Comdty	Generic 1st 'OD' Future. One-Day Interbank Deposit Futures Contract. Underlying asset: the interest rate of Interbank Deposits, defined as the capitalized daily avg. of 1 day rates based on the period from the transaction date to the last trade day. Price quotations expressed as a percentage rate per annum compounded daily based on a 252-day year. Day Count: DU/252.
	OD2 Comdty	Generic 2st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD3 Comdty	Generic 3st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD4 Comdty	Generic 4st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD7 Comdty	Generic 7st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD8 Comdty	Generic 8st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD9 Comdty	Generic 9st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD10 Comdty	Generic 10st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD11 Comdty	Generic 11st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD12 Comdty	Generic 12st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD13 Comdty	Generic 13st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD14 Comdty	Generic 14st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.
	OD15 Comdty	Generic 15st 'OD' Future. One-Day Interbank Deposit Futures Contract. Day Count: DU/252.

Chile		
Nominal Exchange Rate	CLP Curncy	Spot Exchange Rate - Price of 1 USD in CLP. The Chilean peso is the official currency of the Republic of Chile. The conventional market quotation is the number of pesos per US dollar. It is an independent free-floating currency.
Forward Contract	CHN1M Curncy***	1 Month NDF Points.
	CHN3M Curncy***	3 Month NDF Points.
	CHN12M Curncy***	12 Month NDF Points.
Interest Rate	CLTN30DS Curncy	Nominal Avg. Interbank Rate 30 days. Nominal Average Interbank Rate informed by Asociacion Nacional de Bancos, observed amongst the local financial institutions. Nominal rates are ACC/30-days and without considering inflation.
	CHSWPC Index	Interest Rate Swap Peso vs. Camara 3 Month. Quote: Semi-Annual settlement & Compounding vs. Camara. Day Count: ACT/360.
	CHSWP1 Index	Interest Rate Swap Peso vs. Camara 1 Year. Quote: Semi-Annual settlement & Compounding vs. Camara. Day Count: ACT/360.
Colombia		
Nominal Exchange Rate	COP Curncy	Spot Exchange Rate - Price of 1 USD in COP. The Colombian peso is the official currency of the Republic of Colombia. The conventional market quotation is the number of pesos per US dollar. It is a free-floating currency.
Forward Contract	CLN1M Curncy***	1 Month NDF Points.
	CLN3M Curncy***	3 Month NDF Points.
	CLN12M Curncy***	12 Month NDF Points.
Interest Rate	DTF RATE Index	DTF 90-day interest rate. This index is released on a weekly basis. It is a weighted average of all financial institutions' deposit rates, calculated by the Central Bank. This is an annual effective rate.
	COMM1YR Index	Time deposits of banks yield curve 1 year. Rates are also known as TBS (Tasa Basica de la Superintendencia Bancaria). Refers to a 360 days period.
Indonesia		
Nominal Exchange Rate	IDR Curncy	Spot Exchange Rate - Price of 1 USD in IDR. The Indonesian rupiah is the official currency of the Republic of Indonesia. The conventional market quotation is the number of rupiah per US dollar. It is an independent free-floating currency.
Forward Contract	IHO1M Curncy*	1 Month Onshore Forward Points.
	IHO3M Curncy*	3 Month Onshore Forward Points.
	IHO12M Curncy*	12 Month Onshore Forward Points.
Interest Rate	IHDRA Index	Deposit 3 Month. Day Count: ACT/360.
	IHDRC Index	Deposit 1 Month. Day Count: ACT/360.
	IDRE12MO Index	Indonesia Deposit Rate Avg. 12 Month. Day Count: ACT/360.
Mexico		
Nominal Exchange Rate	MXN Curncy	Spot Exchange Rate - Price of 1 USD in MXN. The Mexican peso is the official currency of Mexico. The conventional market quotation is the number of pesos per US dollar. It is an independent free-floating currency.
Forward Contract	MXN1M Curncy**	1-Month Forward Points.
	MXN3M Curncy**	3-Month Forward Points.
	MXN12M Curncy**	12-Month Forward Points.
Interest Rate	MXIBTIIE Index	Benchmark Interbank Deposit Rates TIIE 28 Day. The TIIE is an interbank interest rate which is decided by the supply and demand of funds. Calculated by bids provided by Mexican banks, when supply and

		demand reach equilibrium, this is the rate which is set.
	MPSWC Index	Mexican peso-denominated interest-rate swaps (TIIE) 3 Month. Daycount: 28/360
	MPSW1A Index	Mexican peso-denominated interest-rate swaps (TIIE) 13 Months. Daycount: 28/360
New Zealand		
Nominal Exchange Rate	NZD Curncy	Spot Exchange Rate - Price of 1 NZD in USD. The New Zealand dollar is the official currency of New Zealand. The conventional market quotation is the number of US dollars per New Zealand dollar. It is an independent free-floating currency.
Forward Contract	NZD1M Curncy**	1 Month Forward Points.
	NZD3M Curncy**	3 Month Forward Points.
	NZD12M Curncy**	12 Month Forward Points.
Interest Rate	NDBB1M Index	Bank Bill 1 Month. Day Count: ACT/365.
	NDBB3M Index	Bank Bill 3 Month. Day Count: ACT/365.
	NDBB12M Index	Bank Bill 12 Month. Day Count: ACT/365.
Peru		
Nominal Exchange Rate	PEN Curncy	Spot Exchange Rate - Price of 1 USD in PEN. The Peruvian new sol is the official currency of The Republic of Peru. The conventional market quotation is the number of new soles per US dollar. It is an independent free-floating currency.
Forward Contract	PSN1M Curncy***	1 Month NDF Points.
	PSN3M Curncy***	3 Month NDF Points.
	PSN12M Curncy***	12 Month NDF Points.
Interest Rate	PRBOPRBI Index	Asbanc 1 Month Nominal Rate. Reference LIMABOR interest rates in local currency (PES), is the interbank rate to which any bank is available to buy or sell. Day Count: ACT/360.
	PRBOPRB3 Index	Asbanc 3 Month Nominal Rate. Reference LIMABOR interest rates in local currency (PES), is the interbank rate to which any bank is available to buy or sell. Day Count: ACT/360.
	PRBOPRB1 Index	Asbanc 1 Year Nominal Rate. Reference LIMABOR interest rates in local currency (PES), is the interbank rate to which any bank is available to buy or sell. Day Count: ACT/360.
Korea		
Nominal Exchange Rate	KRW Curncy	Spot Exchange Rate - Price of 1 USD in KRW. The South Korean won is the official currency of The Republic of Korea (South Korea). The conventional market quotation is the number of won per US dollar. It is a free-floating currency.
Forward Contract	KWO1M Curncy*	1 Month Onshore Forward Points.
	KWO3M Curncy*	3 Month Onshore Forward Points.
	KWO12M Curncy*	12 Month Onshore Forward Points.
Interest Rate	KRBO1M Index	KORIBOR (Korea Inter-Bank Offered Rate) 1 Month. Is the average of lending interest rates in the interbank market.
	KWCDC Index	Certificate of Deposit (CD) 3 Month. Is a debt instrument issued by a bank that will pay principal and interest when it reaches maturity. Settlement for KRW CD's is T+0.
	KWSWO1 Index	Interest Rate Swap Onshore 1 Year. Quote: Quarterly fixed rate vs. 91 Day KRW CD. Day Count: ACT/365

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