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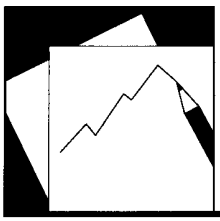

IMF Working Paper

To Cut or Not to Cut? That is the (Central Bank's) Question

In Search of the Neutral Interest Rate in Latin America

Nicolas E. Magud and Evridiki Tsounta

INTERNATIONAL MONETARY FUND

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To Cut or Not to Cut? That is the (Central Bank's) Question In Search of the Neutral Interest Rate in Latin America[1]

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Abstract

This paper estimates neutral real interest rate (NRIR) ranges for 10 Latin American countries that either have full-fledged inflation targeting regimes in place or have recently adopted them, using an array of methodologies commonly used in the literature. We find that NRIRs have declined in the last decade, with more economically and financially developed economies exhibiting lower NRIR levels. Based on the estimated NRIRs, we assess that the current monetary stance (measured by the *interest rate gap)* is appropriately neutral in most of the considered economies, in line with closing output gaps. We also observe that the interest rate gap can be a good predictor of future inflation dynamics and economic growth. In addition, looking at the recent experiences in Brazil and Peru, we suggest that macro-prudential policies could affect the monetary stance even in the absence of direct interest rate changes, through affecting the NRIR.

JEL Classification Numbers: E43, E52, E58, E61

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I. INTRODUCTION

An increasing number of Latin American countries have been recently strengthening their monetary policy frameworks, using the policy interest rate as the main tool to calibrate the stance of monetary policy. In doing so, central bankers face the difficult task of determining how the current interest rate compares to the *neutral* real interest rate (NRIR)—that depicts stable inflation within a closed output gap (over the medium-term—the horizon relevant for monetary policy decisions). [2,3] The NRIR is not an observable variable, so there is no unique way to estimate it; and it can change over time. As noted by Blinder (1998), the NRIR is "*difficult to estimate and impossible to know with precision.*" This task has become particularly complex in the current conjecture in the context of the structural changes in domestic capital markets and improved macroeconomic fundamentals in the region, as well as sharply lower global interest rates. Notwithstanding these limitations, having some consistent estimated *range* of the NRIR could be useful for policymakers' objectives, including their communications with the public.

Against this background, in this paper:

1. We estimate the NRIR using a set of methodologies commonly used in the literature for a group of ten Latin American countries. These countries have either a full-fledged inflation targeting (IT) framework (Chile, Brazil, Colombia, Mexico (all in place since 1999), Peru (since 2002) and Uruguay (since 2007)); or have recently adopted one (Dominican Republic (in 2012), Guatemala, which has yet to adopt a formal inflation target but has price stability as a stated objective and uses the monetary policy rate as the main policy instrument, and Costa Rica and Paraguay, that are committed to or in the process of transitioning to an IT regime, respectively).

2. We use the estimated NRIR to compute the interest rate gap—the difference between the actual policy rate and the neutral rate (both in real terms)—to assess the monetary stance over the past few years, and its impact on inflation and output. [4] We also compare the monetary stance to the output gap, to inspect the inter-linkages between monetary policy and economic activity.

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[2] The concept of the neutral interest rate was originally suggested by Wicksell (1898), who defined the *natural* real interest as the rate that equates saving and investment (thus, being non-inflationary, or neutral), which in the absence of frictions would equal the marginal product of capital in the long-run. The short-run (or "operationally") neutral real interest rate (depicting stable inflation with a closed output gap) could differ from the long-run natural interest rate, as frictions and other market conditions might not necessarily hold in the short-run.

[3] See Archibald and Hunter (2001) and Bernhardsen and Gerdrup (2007).

[4] Unless otherwise stated, real values are deflated by one-year-ahead inflation expectations.

3. Finally, given the increased use of macro-prudential policies (MaPPs) in some countries, we assess the extent to which these policies affect NRIR levels or the stance of monetary policy. Specifically, we explore whether central banks, especially in financially open economies, could use MaPPs to change their monetary stance without modifying the policy rate, an important tool for countries that face (capital inflow-driven) appreciating pressures. We focus on the experience of Brazil and Peru—the two economies that have been more actively using MaPPs in the region.

Our results can be summarized as follows:

- We present *a range* of values for the policy NRIR for each of the ten countries considered. Despite the differences in methodologies, each country's NRIR point estimates are usually clustered within a 200 basis points band—in particular for the more developed Latin American economies. As expected, we find lower levels of the NRIR in more economically and financially developed economies; Brazil is an exception that we discuss in some detail below.

- We document a downward trend in the NRIR for all the countries in our sample during recent years. Stronger domestic economic fundamentals (lower exchange rate risk and inflation risk premiums, as well as fiscal consolidation) and easing global financial conditions are possible explanations for this trend. In all cases, we observe that near-record low global interest rates following the 2008 global financial crisis affected NRIRs.

- Using data up to May 2012, we find that for most countries, the monetary stance is currently appropriate—close to neutral, in line with closing output gaps. More recent data (at end-August) point to monetary easing in Brazil and Mexico (given their negative output gaps).

- Notwithstanding data limitations that may hinder the accuracy of the NRIR estimates, we also find that Costa Rica, Dominican Republic, Guatemala, and Paraguay, still have a somewhat accommodative monetary policy despite closing output gaps. However, the estimated interest rate gaps might not accurately reflect the current monetary stance in these countries given weaker monetary transmission mechanisms; a monetary framework that is still under development; and segmented short-term funding markets which could result in that the policy rate might not accurately reflect financing conditions in all markets.

- We observe that the interest rate gap and the output gap are strongly and positively correlated. Although we do not claim causality, we infer that this correlation could possibly indicate that central banks do respond counter-cyclically to business cycles fluctuations. Furthermore, we conjecture that monetary policy is effective in fine-tuning the business cycle as periods of relaxing monetary policy (decreasing interest rate gaps) are followed by shrinking (negative) output gaps (and vice versa).

- The estimated interest rate gap (both in sign and magnitude) is correlated with future GDP growth rates for most countries, notwithstanding other variables (in line with Neiss and Nelson, 2003). Periods of accommodative monetary policy (negative interest rate gap) are followed (typically within 9 months) by strong economic expansions. As expected, the *magnitude* of the interest rate gap is correlated with future economic growth—for example, periods where a *negative* interest rate gap approaches zero (i.e., monetary policy remains accommodative but at a diminishing rate) are followed by a slowdown in economic growth.

- When comparing interest rate gaps with deviations of inflation from target (the inflation gap), as in Woodford (2003), we observe that central banks typically undertake restrictive monetary policies if the rate of inflation exceeds the target (and vice-versa). Uruguay and Mexico are exceptions, as due to particularly persistent inflation rates they have experienced above target inflation rates for the whole sample period.

- Based on preliminary evidence, it appears that both Brazil and Peru successfully tightened their monetary stance (i.e., raised the interest rate gap) via MaPPs, without altering their policy rate in several occasions recently (2006, 2008, and 2010). We conjecture that the increase in the interest rate gap was achieved by reducing the NRIR, possibly through contracting the output gap (quantifying and rigorously analyzing these effects is left for future research). Implicitly, it appears that the NRIR is affected by the workings of the credit channel. Specifically, these economies had in recent years experienced a surge in their (carry-trade driven) capital inflows, resulting in increasing domestic currency deposits and thus credit growth. MaPPs seem to have lowered the NRIR by mitigating the expansionary effect of the credit channel on GDP by containing the demand for loanable funds.

- Against this background, we conjecture that in overheating situations, MaPPs could be complementary to conventional monetary policy. In that case, the slowdown in economic activity due to higher interest rates would be partly/fully offset by the expansionary effects of the credit channel triggered by (the carry spread-driven) higher capital inflows. Thus, MaPPs could mitigate some of the effects on the credit channel. For external shocks, such as a positive term of trade shock that attracts capital flows, MaPPs could even act as a substitute to conventional interest rate policy, as they would directly tighten the credit channel, without further increasing capital inflows.

This paper is, to the best of our knowledge, the first study that looks at NRIR developments and the stance of monetary policy in Latin America from a cross-country perspective. Existing papers usually focus on only one country (concentrating mostly on Brazil, Chile, and Colombia), and typically use a limited number of methodologies at a time.

The rest of the paper is organized as follows. In Section II we briefly review the existing literature and document the main pros and cons of the methodologies that have been used, while in Section III we describe the set of approaches that we use to estimate the NRIR. Section IV delves into the data set briefly. In Section V we present the results, as well as the monetary stance estimations that they imply. Section VI focuses on the role of MaPPs in the design of monetary policy, while Section VII provides some concluding remarks.

II. SOME EXISTING LITERATURE

Extensively reviewing the literature on NRIR is beyond the scope of this paper (see Bernhardsen and Gerdrup (2007) for an overview). Most of the studies estimate the NRIR in advanced economies and usually concentrate on one country.[5] There are only a few studies that estimate the NRIR for emerging economies, with studies for Latin America largely focusing on Chile, Colombia and Brazil.[6]

A number of different methods have been used for assessing the NRIR (see Giammarioli and Valla (2004) for further details). Some of them are static (defining the NRIR as a parameterized steady state point estimate) while others are dynamic (estimating the temporal path of the NRIR). Static methods usually rely on the consumption-based CAPM framework, in which the risk-free interest rate is used as a proxy for the steady state NRIR or on the uncovered interest parity condition. These methodologies are simple to use and rely on economic theory. However, the CAPM-based approach is appropriate for closed economies and ignores the role of money, prices, inflation, and the supply side of the economy (Giammarioli and Valla, 2004), while the uncovered interest parity condition is hard to estimate for countries with thinner and less liquid financial markets (such as Costa Rica, Dominican Republic, Guatemala, Paraguay, and to some extent Uruguay, in our sample).

Dynamic models usually entail a maximum likelihood estimation in conjunction with a filtering technique. In the simplest dynamic analyses, the NRIR can be derived by applying simple statistical/filtering techniques—such as HP filters, linear de-trending, and moving averages—to real interest rates. While these techniques are straight-forward to compute, they lack structural interpretation, ignore structural breaks and regime shifts, and are without economic foundation. Thus, they may not be as useful as other methods in a policy context. In addition, the estimates are very sensitive to the sample period selected (in particular, the end-of sample bias) and can be quite distorted if output or inflation is not stable over time.

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[5] See for instance, Laubach and Williams (2003) for the United States; Bernhardsen and Gerdrup (2007) for Norway; ECB (2004) for the euro area; Bjorksten and Karagedikli (2003) for New Zealand; Lam and Tkacz (2004) for Canada; and Adolfson et al. (2011) for Sweden.

[6] See for example, Ogunc and Batmaz (2011) for Turkey; Calderon and Gallego (2002) and Fuentes and Gredig (2007) for Chile; Minella et al. (2002), Portugal and Barcellos (2009), Duarte (2010), and Perrelli (2012) for Brazil; Pereda (2010), Humala and Rodriguez (2009), and Castillo et at. (2006) for Peru; and Gonzalez et al. (2010, 2012), and Torres (2007) for Colombia.

A more rigorous analysis entails estimating a dynamic stochastic general equilibrium model (DSGE), often based on New-Keynesian theory.[7] In these models, the NRIR is interpreted as the real interest rate in a model with flexible nominal wages and prices. These models are particularly suitable for the analysis of the NRIR, as they allow for a full specification of economic shocks. Given their microeconomic foundations, they enable welfare analysis to assess the optimality of policies (see Giammarioli and Valla, 2004). Despite being theoretically appealing, this methodology usually produces volatile estimates and results are sensitive to the choice of the model and the estimation/calibration of the parameters.

Difficulties with the latter structural models prompted the development of small-scale macroeconomic models which are estimated using a Kalman-filter. These approaches are simpler to use than DSGE models and do not rely on *a priori* theoretical models or structural equations (Giammarioli and Valla, 2004). Laubach and Williams (2003) were the first to take such an approach. Using a Kalman filter, they construct a reduced-form model consisting mainly of an IS curve and a backward looking Phillips curve, which requires the real interest rate to equal the NRIR when the output gap is zero and inflation is stable at its target.[8] Other approaches that utilize Kalman filter techniques include estimating variations of the Taylor rule (with and without inflation expectations), recently used by Basdevant et al. (2004). These filters are also used in state-space models that assume a common stochastic trend between short- and long-term nominal interest rates (see Basdevant et al., 2004, and Fuentes and Gredig, 2007).

In sum, there is no single best method for estimating the neutral real interest rate. Thus, we present a broad array of alternative methods to provide a range of possible magnitudes for the NRIR. In the next section, we briefly describe each of the models used in our analysis.

III. Econometric Analysis

A. Static Methodologies

Consumption-Smoothing Models

In this framework with no market frictions, a standard*, closed-economy*, optimizing representative agent solves a consumption-saving problem. The NRIR is computed by fitting the Euler equation for reasonable parameter values. We do this for two versions of the model: with and without habit persistence following Cochrane (2001) and Campbell and Cochrane

[7] See Woodford (2003), Bernhardsen and Gerdrup (2007), Neiss and Nelson (2003), Giammarioli and Valla (2003), Gali (2002), and Amato (2005).

[8] See Basdevant et al. (2004) for a discussion of the Kalman filter methodology.

(1999), respectively, later also used by Fuentes and Gredig (2007). The Euler equation is given by:

$$\frac{1}{r_t} = E_t\left\{\frac{\beta u'(c_{t+1})}{u'(c_t)}\right\} = E_t\left\{\frac{\beta u'(y_{t+1})}{u'(y_t)}\right\}$$

where $r_t$denotes the real interest rate, β the intertemporal discount factor, and $u(.)$ stands for the utility function; E(·) is the expectation operator, c is consumption, and y is per capital potential GDP; the rightmost expression incorporates the resource constraint, $c_t = y_t, \forall\, t$. Assuming a CRRA utility function, after some manipulation the Euler equation can be rewritten as:

$$\ln(r_t) = -\ln(\beta) + \gamma E_t \Delta \ln(y_{t+1}) - (\gamma^2/2)\, Var_t[\Delta \ln(y_{t+1})]$$

where γ is the coefficient of relative risk aversion, Δ is the difference operator and Var(.) is the variance operator.

Using a measure of the country's medium term potential per capita GDP growth rate and its volatility, we compute the NRIR for a set of plausible free parameters, γ and β, as in Cochrane (2001).

Following Campbell and Cochrane, we add habit persistence to the utility specification for a better fit. We assume the following variation to the utility function:

$$u(c_t) = \frac{(c_t - x_t) - 1}{1 - \gamma}$$

where $x_t$characterizes the level of habit persistence and, to simplify the analysis, will be assumed to be exogenous. The Euler equation could be rewritten as:

$$\frac{1}{r_t} = E_t\left\{\frac{\beta M_{t+1} c_{t+1}}{M_t c_t}\right\}$$

in which, M_t stands for the surplus consumption ratio ($M_t = (c_t - x_t)/c_t$). Following Fuentes and Gredig (2007), we assume that $x_t \sim \mu \sum_{j=0}^{\infty} \varphi c_{t-j}$, φ being the weight of past consumption in the degree of habit persistence. Denoting the growth rate of potential output by *g*, the NRIR can be obtained by solving the following equation:

$$\ln(r_t) = -\ln(\beta) + \gamma\, g - (1/2)\gamma(1 - \varphi)$$

where parameter φ is calibrated for each country using the risk aversion and the discount factor parameters for a given level of potential GDP.

Uncovered Interest Parity (UIP) Condition

Assuming no-arbitrage conditions in a model with free capital movements, the NRIR can be estimated using the uncovered interest parity condition.

$$i_t = i_t^* + \hat{E} + \rho$$

where i_t (i_t^*) stands for the nominal domestic (international) interest rate, $\hat{E}$ for the expected nominal rate of depreciation of the domestic currency, and ρ for the country risk premium. In turn, the expected nominal rate of depreciation is given by the rate of depreciation of the real exchange rate, $\widehat{RER}$, and the domestic-international inflation differential, namely

$$\hat{E} = \widehat{RER} + (\pi - \pi^*)$$

where π (π^*) denotes the domestic (international) inflation rate. We assume that the international nominal interest and inflation rates are 4 and 2 percent, respectively, (as typically used for the United States). The country-specific risk premium is based on J.P Morgan's EMBI spreads, while the expected depreciation rates are based on the medium-term Consensus Forecasts (see Appendix II for details). Given the uncertainty regarding the expected depreciation value, we choose to report a range of values (plus or minus one percentage point the mean estimate).

B. Dynamic Methodologies

HP Filters

As a first pass to dynamic estimations of the neutral interest rate we run a standard Hodrick-Prescott (HP) filter to the interest rate series. In all dynamic estimations, we focus on the short-term (typically approximated by the 3-month Treasury bill) rate, deflated by the 12-month-ahead inflation expectations. To minimize the common HP-filter bias (of putting more weight on the most recent observations of the data series), we add about 18 months of projections.[9] These additional projections are used throughout the dynamic estimations, including with the use of Kalman filters (below), to minimize the end-of-sample bias.

Implicit Common Stochastic Trend

Conditional on the degree of sophistication of a country's financial market, the yield curve could provide information about a country's monetary stance and the NRIR. For instance, a steepening yield curve may be signaling that the real interest rate is below its neutral level. As such, the spread between the short- and long-term interest rates (term spread) could be

[9] See Appendix II on details on the ARIMA procedure used to simulate these projections.

used to estimate the NRIR (the spread also reflects the degree to which inflation expectations are anchored).

In this vein, following Basdevant et al. (2004), we assume there is a common stochastic trend between short-term and long-term nominal interest rates.[10] To this end, we propose a four-equation dynamic system:

$$\begin{cases} r_t = r_t^* + \pi_{t+1}^e + \varepsilon_t^1 \\ R_t = r_t^* + \alpha_t + \pi_{t+1}^e + \varepsilon_t^2 \\ r_t^* = r_{t-1}^* + \vartheta_t^1 \\ \alpha_t = \mu_0 + \mu_1 \alpha_{t-1} + \vartheta_t^2 \end{cases}$$

where (i) the nominal short-term rate of return (90-day Treasury bill), r_t, is equal to the sum of the (12-month-ahead) inflation expectations, π_{t+1}^e, the NRIR, r_t^*, plus a stochastic disturbance term; (ii) the long-term rate of return, R_t (typically on a 10-year bond or the best available proxy) is equal to the sum of the short term interest rate (substituted for by the first equation in this system), a term premium α_t—as is usual in the literature—and a stochastic term (both disturbances are assumed to be mean zero i.i.d. processes with constant variance), (iii) a transition equation for the (state variable) NRIR, which is assumed to follow a random walk, and (iv) a transition equation for the other state variable, the term-premium, which is assumed to be an AR(1) process with drift. The disturbances for the state equations are also assumed to be mean-zero constant variance processes. The model is estimated using a Kalman filter.

Dynamic Taylor Rule

In this model, we utilize the Taylor rule—typically used in IT frameworks—in which the monetary policy rate responds to deviation of (i) inflation from the central bank's target and, (ii) real GDP from its potential level. When both deviations are equal to zero, the interest rate should be set at the neutral rate, so the constant in the Taylor equation can be interpreted as the nominal neutral rate. Specifically, using the Kalman filter we estimate the following system of equations:

$$\begin{cases} r_t = r_t^* + \beta(\pi_t - \pi_t^*) + \theta \tilde{y}_t + \varepsilon_t^1 \\ r_t^* = r_{t-1}^* + g_{t-1} \\ g_t = g_{t-1} + \vartheta_t^1 \end{cases}$$

where r_t is the nominal short-run (90-day paper) interest rate, r_t^* the neutral nominal interest rate, π_t stands for the rate of inflation, π_t^* is the inflation target of the central bank, $\tilde{y}_t$ is the output gap (measured as the percentage deviation of real GDP from its potential level in each

[10] We interpret an observed simultaneous shift in both the long- and the short-term interest rates (after cyclical fluctuations have been taken into account) as a shift in the NRIR.

period). All stochastic disturbances are assumed to be zero mean variables with constant variances. The transition process for the (state) NRIR is given by a random walk process as described above, with *g,* defined as the growth rate of the state variable r_t^*.

Expected-Inflation Augmented Taylor Rule

For robustness, we also estimate the Taylor rule augmented for inflation expectations. Namely, the system is similar to the one described above (same notation as in the Dynamic Taylor rule), with two important differences: (i) the neutral interest rate r_t^*, is now in real terms, and (ii) an equation for the long-term nominal interest rate, R_t, with one-year ahead inflation expectations, π_{t+1}^e, is now introduced:

$$\begin{cases} r_t = r_t^* + \pi_{t+1}^e + \beta(\pi_t - \pi_t^*) + \theta\tilde{y}_t + \varepsilon_t^1 \\ R_t = r_t^* + \alpha + \pi_{t+1}^e + \varepsilon_t^2 \\ r_t^* = r_{t-1}^* + g_{t-1} \\ g_t = g_{t-1} + \vartheta_t^1 \end{cases}$$

In this specification, the nominal long-term interest rate, R_t, is equal to the short-term nominal interest rate ($r_t = r_t^* + \pi_{t+1}^e$) plus a premium α (no arbitrage condition). The unobserved neutral real interest rate is modeled as a non-inflation-augmented version of previous model. All stochastic disturbances are again assumed to be mean-zero variables with constant variance.

General Equilibrium Model (S-I Macro Model)

Following Laubach and Williams (2003) we estimate a semi-structural macroeconomic model—a saving-investment equilibrium model—in the spirit of Wicksell's (1898) definition of the NRIR. This model focuses on aggregate demand-supply equilibrium, and as such we deem it, in general, as a better specification to estimate the NRIR for more developed and integrated economies, with good time series data on interest rates.

Specifically, there is an IS equation which relates the output gap to the NRIR and a Phillips curve that relates the inflation rate to the output gap:

$$\begin{cases} (y_t - y_t^*) = \sum_{s=1}^{S} \alpha_s^y (y_{t-s} - y_{t-s}^*) + \sum_{v=1}^{V} \alpha_v^r (r_{t-v} - r_{t-v}^*) + x_{1,t}'\alpha + \varepsilon_t^{\mathrm{y}} \\ \widehat{\pi_t} = \sum_{p=1}^{P} \beta_p^{\pi} \widehat{\pi_{t-p}} + \sum_{q=1}^{Q} \beta_q^y \left(y_{t-q} - y_{t-q}^*\right) + x_{2,t}'\beta + \varepsilon_t^{\pi} \\ y_t = y_t^* + \varepsilon_t^{\mathrm{c}} \\ y_t^* = y_{t-1}^* + g_{t-1} \\ g_t = g_{t-1} + \varepsilon_t^{\mathrm{g}} \\ r_t^* = r_{t-1}^* + \varepsilon_t^r \end{cases}$$

The first equation depicts the IS curve, where log-deviations of real GDP from potential (the output gap), $y_t - y_t^*$, are expressed as a function of its lags given the slow reaction of real GDP, lagged deviations of the actual real monetary policy rate from the NRIR, as given by $r_t - r_t^*$ (in both cases we use one lag), and a vector with control variables for the output gap, $x_{1,t}$ (cyclical deviations of the real exchange rate estimated using an HP-filter; see Kara et al. (2007) for details). The disturbance term, ε_t^y, is a zero-mean white noise process with variance σ_y^2.

In turn, the Phillips curve (the second equation) assumes that inflation deviations from the central bank's target, $\widehat{\pi_t}$, are explained by their own lags (using one lag) to capture some degree of inflation persistence, lags in the output gap (also one lag), and a vector of inflation controls $x_{2,t}$ (cyclical deviations of the real exchange rate and oil/commodity prices, where trends are computed using an HP-filter). The stochastic term, ε_t^{π}, is assumed to be a zero-mean white noise process, with variance equal to σ_{π}^2. Other controls (public debt-to-GDP ratio, share of public consumption to GDP, and credit to GDP ratio) were tried with no substantial additional explanatory power.

We estimate the two unobservable variables—the NRIR and potential GDP—using a Kalman filter. For simplicity, we assume that the NRIR follows a random walk, and the residual term has zero mean and variance σ_r^2. We also assume that potential GDP grows at a rate *g,* which follows a random walk with zero mean and variance σ_g^2. We add an auxiliary variable to model the fact that real GDP is essentially given by stochastic deviations from its potential level. The stochastic disturbance in this equation is a mean zero i.i.d process with variance σ_c^2.

For completeness, we need to impose some restrictions for the smoothness of the trend components in the maximum likelihood estimation of the Kalman filter. Following Fuentes and Gerdig (2007), we assume the following restrictions: $\sigma_c^2/\sigma_g^2 = \lambda_1$ and $\sigma_y^2/\sigma_r^2 = \lambda_2$. The estimations are carried out using λ's equal to 14400 as is customary for monthly data.

IV. DATA DESCRIPTION[11]

Our static UIP estimations are carried out using medium-term inflation and interest rate projections from the April 2012's *World Economic Outlook*. The individual country risk premium is proxied by J.P. Morgan's Emerging Bond Index (EMBI), while estimates of expected exchange rate depreciation/appreciation are taken from May's 2012 *Foreign Exchange Consensus Forecasts*.[12] Our static consumption-based estimations utilize medium-

[11] Please refer to Appendix II for details, including on data interpolation and projections.

[12] For Brazil and Colombia we also use central banks' market expectations survey for robustness check.

term projections of per-capita GDP potential growth rate from April 2012's *World Economic Outlook.*

The dynamic estimations use seasonally adjusted (monthly) economic and financial data for the period January 2000 to end-2013 (data permitting); quarterly/annual data were interpolated when monthly data were not available.[13] To correct for the end-of-sample bias that filtering methods suffer from, the sample period was extended for the period post May 2012 using projected data. Given that interest rate observations were spotty for some countries with less developed financial systems, we choose to use the 12-month moving average for interest rates (typically 90-day Treasury bill for short-term and 10-year Treasury bond for long-term). Interest rates were available from Haver Analytics and national sources. For period/country observations lacking policy rates, we use an alternative interest rate that is a good proxy—such as an interbank interest rate—or interpolate the series using changes in an interest rate that exhibits a close co-movement with the policy rate for the overlapping period (see Appendix II for details).

Inflation targets are based on the official central bank's inflation targets since 2000—in the event the IT framework was adopted afterwards, the average of the actual annual inflation rate in the sample is taken as the target for that year. One-year-ahead inflation expectations are based on one-year-ahead WEO forecasts (results are essentially the same if expected inflation implied by indexed bonds are used when available).

Estimates of the output gap are taken from April 2012's *World Economic Outlook* or based on IMF internal country desks' estimations. The latter are oftentimes calculated using de-trended GDP series, calculated either with statistical filters or via the production function approach.

An important caveat about the less financially integrated Latin American economies in the sample (namely Costa Rica, Dominican Republic, Guatemala, Paraguay, and to some extent Uruguay) is in order. For these countries, financial markets are thinner, and thus data on interest rates (particularly long-term rates) are scarce. In those cases, data were interpolated or an instrument with shorter maturity that is more highly traded was used instead. Given these limitations, for most of these countries, all dynamic estimates should be interpreted with caution; indeed, in the next section, we only report the methodologies that give reasonable results based on reliable data.

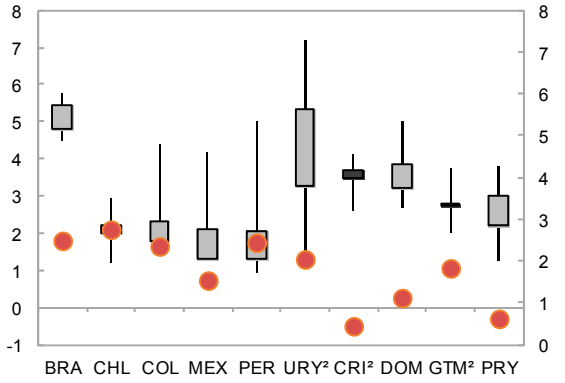
[13] Inflation target and expectations, as well as interest rates were not seasonally adjusted.

V. RESULTS

Despite differences in methodologies, and notwithstanding data limitations, we find that the point estimates are rather clustered for each country (typically within 200 basis points) and consistent with those reported in country-specific studies.[14]

We observe that the dynamic estimates are somewhat lower than the static estimates in the case of less financially open economies—possibly reflecting the limitations in financial data when undertaking the dynamic estimates as thinner financial markets and less developed yield curves are observed. Due to these limitations, these economies also exhibit a larger range of estimates (though we chose to only report the results that we deem reasonable).

NRIR: Summary Results from Different Methodologies[1]
(Percent)



Source: Authors' calculations.
[1] Red dots denote end-August 2012 real policy rate (deflated by expected inflation). Rectangle represents values between the 70th and 30th percentile.
[2] For Costa Rica, Guatemala, and Uruguay a sub-sample of methodologies is used due to data limitations.

The Neutral Interest Rate: Summary Results From Various Methodologies, May 2012[1]
(Percent)

	Uncovered Interest Parity	Consumption-based CAPM	HP Filter	Implicit Common Stochastic Trend	Dynamic Taylor Rule	Expected-Inflation Augmented Taylor Rule	General Equilibrium Model	**Average**
Brazil	4.5	4.5	4.8	5.4	5.7	5.5	5.5	**5.1**
Chile	1.3	2.9	2.0	2.1	2.3	2.2	1.2	**2.0**
Colombia	2.5	4.4	1.9	1.8	1.6	1.7	2.1	**2.3**
Mexico	2.0	4.2	1.7	1.3	1.3	1.3	2.9	**2.1**
Peru	2.3	5.0	1.3	1.5	1.8	1.0	1.3	**2.0**
Uruguay	3.6	3.3	1.3	2.1	5.3	-	7.2	**3.8**
Costa Rica	2.6	4.1	-	-	-	-	3.7	**3.5**
Dominican Republic	3.2	4.2	1.7	2.7	3.8	3.1	3.9	**3.2**
Guatemala	2.3	3.2	-	-	-	2.0	3.7	**2.8**
Paraguay	2.0	3.8	1.0	1.3	2.2	2.2	3.2	**2.2**

Source: Authors' calculations.
[1] For Costa Rica, Guatemala, and Uruguay, a sub-sample of methodologies is used due to data limitations.

The NRIR is usually lower (i) in the more economically and financially developed economies, and (ii) in countries with a longer IT history; although other country-specific

[14] Calderon and Gallego (2002) and Fuentes and Gredig (2007) for Chile; Minella et al. (2002), Portugal and Barcellos (2009), Duarte (2010), Perreli (2012), and Bloomberg (2012) for Brazil; IMF (2012c) for Paraguay; Gonzalez et al. (2012) for Colombia; and IMF (2011b) for Dominican Republic.

factors are also at play. These cross-country differences may reflect stronger fundamentals and higher levels of capital account openness and financial development (for more details see Archibald and Hunter, 2001). A notable exception is Brazil, where the NRIR is among the highest in the region (see Box 1 for the Brazilian interest rate puzzle). Data limitations for countries with thinner financial markets should also be taken into consideration. In addition, for highly dollarized countries and those with large fiscal dominance, weaker monetary transmission mechanisms, segmented short-term funding markets, and large banking sector concentration, the estimated neutral interest rate might not fully capture the actual domestic financing conditions. (see Medina Cas et al., 2011a,b) Complementing NRIRs with some financial/monetary condition index would thus add information about domestic financial conditions.

Box 1. Why is Brazil's Neutral Real Interest Rate so High?

While the Brazilian neutral real interest rate (NRIR) has declined considerably over time, it still remains high by international standards. Various hypotheses have been formulated for this high neutral real interest rate level:

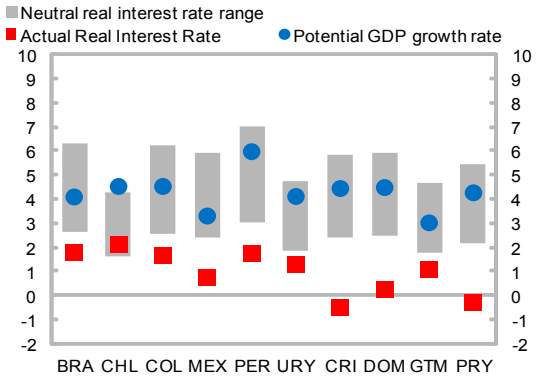
- ***Fiscal considerations.*** Brazilian public debt, at around 65 percent of GDP in gross terms, is high by regional standards. Moreover, there is a strong endogeneity between the level of the policy rate—the SELIC—and the level of public debt, given that about half of the domestic public debt is indexed to the SELIC. This restricts the degrees of freedom for monetary policy and feeds back into a higher than otherwise SELIC, and thus NRIR (World Bank, 2006). Similarly, Rogoff (2005) argues that Brazil incurs a significant default risk premium due to its inflationary history; an argument reinforced empirically by World Bank (2006).
- ***Low domestic savings.*** Brazil's low domestic savings, and thus investment, is also cited as a reason for a higher NRIR (Fraga, 2005; Miranda and Muinhos; 2003; Hausmann, 2008; and Segura, 2012). However, Segura (2012) finds that low domestic savings cannot adequately explain the cross-country discrepancy.
- ***Institutional factors.*** Weak creditor rights and contractual enforcement have been cited as possible explanations for a higher NRIR (Arida et al., 2004; Rogoff, 2005). Lack of full central bank independence is also used to explain the high NRIR, though Nahon and Meuer (2009) find no changes in central bank's credibility due to recent changes in its Board of Directors.
- ***Widespread financial indexation.*** There is strong inertia due to the indexation of financial contracts to the overnight interest rate (World Bank, 2006). While this indexation has maintained financial intermediation in Reais, it has created a system of unusually short duration financial contracts. The legacy of indexation to the overnight interest rate has created institutional and psychological inertia, and a path-dependency that has been difficult to dislodge. It has also made inflation less responsive to interest rate changes.
- ***Other Brazil-specific factors.*** Subsidized lending has resulted in credit market segmentation, pushing up market-determined interest rates. Other factors that might keep the nominal neutral interest rate high include an inflation target that is higher than in other emerging market economies and the minimum remuneration requirements in saving accounts (see Segura (2012) and Central Bank of Brazil (2012) for details).

Next, results for each approach are described in more detail. Static methodologies are usually more appropriate for economies with thinner and less liquid financial markets, while dynamic estimates work better in the most economically/financially advanced economies. [15]

A. Static Estimations

Table 1 presents the estimates for the NRIR using the consumption CAPM model for different subjective discount factors and risk aversion coefficients. We only report the results using the habit formation utility function since the NRIR estimates without habit are implausibly large, as is usual in the literature (see Cochrane (2001); Campbell et al. (1997) for more details).[16] We observe that in most cases—for LA6 countries—the actual real policy interest rate is within or close to the estimated range of values for the NRIR indicating, in general, a close to neutral monetary stance at end-August 2012.[17] However, this model's results are typically on the high side since it assumes that the economies are closed.

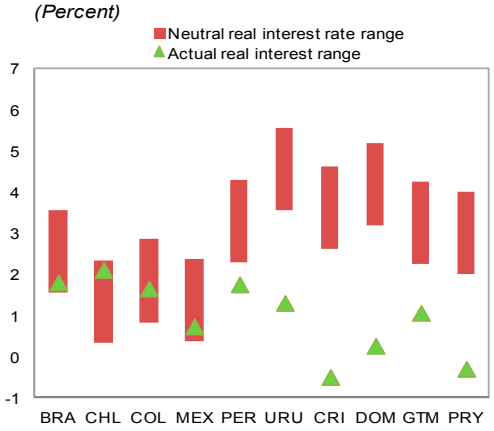
Selected Latin American Countries: Actual and Neutral Real Interest Rate[1]
(Percent)



Sources: Authors' estimates.
[1] Based on a consumption-based model with habit persistence in consumption (Campbell and Cochrane, 1999).

Table 2 reports estimates for the NRIR using the uncovered interest parity equation for different assumptions on the expected depreciation of the currency. (To estimate a range of values, the latter is assumed to fluctuate within 1 percentage point from the *Consensus* expected exchange rate movements.)[18] We observe that the estimates using this methodology are, in general, lower than the ones using the consumption CAPM analysis, as is typical in the literature, due to open economy considerations, and particularly financial deepness and integration issues.

Selected Latin American Countries: Actual and Neutral Real Interest Rate[1]
(Percent)



Source: Authors' estimates.
1/ Based on the interest rate parity equation, for different expected exchange rate changes.

[15] For example, the consumption-based CAPM model is mostly biased toward higher estimations for the financially open economies. In part, this captures the lack of (economic and financial) openness of the model—despite the introduction of habit persistence.

[16] The results without habit persistence are available from the authors upon request.

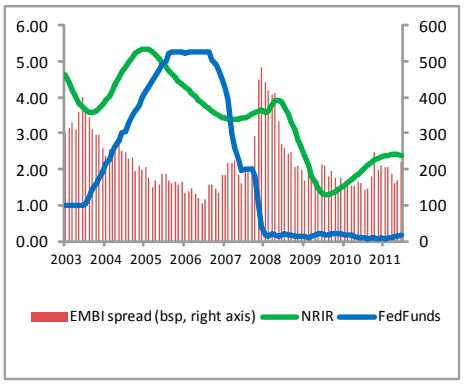
[17] LA6 refers to Brazil, Chile, Colombia, Mexico, Peru, and Uruguay in our analysis.

[18] Data do not differ markedly if central bank surveys are used instead.

B. Dynamic Estimations

In all the dynamic specifications, we document a downward trend in the NRIR for all countries in our sample, in line with the experience in other country studies (albeit with some recent pick-up in some countries; Figures 1–5).[19] This downward trend possibly reflects the region's stronger economic fundamentals in recent years (also reflected in lower sovereign spreads) due to enhanced fiscal consolidation and monetary credibility, lower exchange rate risk and inflation premiums, as well as the easing in global financial conditions; (explaining the drivers behind the downward NRIR trend is beyond the scope of this paper).[20,21] In almost all specifications, we observe a strong decrease in the policy rate following the global financial crisis (also reflected in a sharp decrease in the NRIR). Under the circumstances, it is likely that the trajectory of NRIR might partially reverse as global financial conditions normalize.

Neutral Real Interest Rate,[1] EMBI Spreads,[1] and Fed Funds Rate
(Percent)



[1] Average of Brazil, Chile, Colombia, Mexico ,and Peru
Source: IMF staff calcullation, St. Louise Fed, and Bloomberg.

C. Effectiveness of Monetary Policy, Measured by the Interest Rate Gap

To evaluate the appropriateness of the current monetary stance, we calculate the interest rate gap—defined as the difference between the actual policy rate and the neutral real interest rate.22 For several of the countries in the sample the monetary stance is currently appropriately neutral, in line with closing output gaps. Mexico's monetary policy remains accommodative, in line with its still negative (although shrinking) output gap, while Brazil's stance has recently turned accommodative in response to a growth slowdown. Most of our results also suggest that Uruguay's policy rate is below its neutral level.

Notwithstanding data limitations that may hinder the accuracy of the NRIR estimates, we also find that Costa Rica, Dominican Republic, Guatemala, and Paraguay, still have a

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[19] See Marques and Manrique (2004) for Germany and the United States, Andres et al. (2009) for the United States and the Euro area, Basdevant et al (2004) for New Zealand, and Djoudad et al. (2004) for Canada.

[20] Better fundamentals usually translate into lower and better anchored inflation expectations, while more developed and open financial markets ease consumption smoothing. Additionally, fundamentals are typically associated with relatively more developed countries, which should have a lower marginal product of capital (hence NRIR), as per the standard conditional convergence growth theory (Barro and Sala-i-Martin, 2003).

[21] Archibald and Hunter (2001) elaborate on how these variables increase the NRIR of a country.

[22] Throughout, we use the General Equilibrium model, unless data limitations reduce its reliability.

somewhat accommodative monetary policy despite closing output gaps.[23] However, the estimated interest rate gaps might not accurately reflect the current monetary stance in these countries given weaker monetary transmission mechanisms (reflected through a small response of market interest rates to a change in the monetary policy rate, e.g., due to excess liquidity); a monetary framework that is still under development; and segmented short-term funding markets which could result in policy rates that do not accurately reflect financing conditions in all markets.

In addition, *country specific factors* could raise the effective market interest rate for the private sector, resulting in tighter financial conditions than those captured by the policy rate. Among these factors, we include a high public sector demand for credit (e.g., due to high fiscal expenditure needs), insufficient exchange rate flexibility, excessive bank concentration, high financial dollarization, and low financial intermediation. These factors have been shown to reduce the effectiveness of the policy rate by hindering the proper functioning of the transmission channel of monetary policy (see Medina Cas and others, 2011a,b). Indeed, muted inflationary pressures and tightening financial conditions have been observed in some of these countries despite our estimated accommodative monetary stance, pointing to the importance of complementing NRIRs with, e.g., financial condition indices to better assess the stance monetary policy.

In addition, we observe a correlation between the interest rate gap and the output gap (Figure 6). Although we do not claim to show causality, we infer that this correlation could possibly indicate that central banks do respond counter-cyclically to business cycles fluctuations. Furthermore, we observe that monetary policy is effective in fine-tuning the business cycle as periods of relaxing policy (declining interest rate gaps) are followed by shrinking (negative) output gaps (and vice-versa). Our analysis also suggests that most countries in the region entered the crisis from a position of strength—with positive output gaps and large monetary space.

Indeed, (similar to Neiss and Nelson, 2003), we find that the interest rate gap (both in *sign* and *magnitude*) highly commoves with GDP growth for most countries, notwithstanding other variables that affect GDP growth. Periods of accommodating monetary policy (negative interest rate gap) are followed (typically within 9 months) with strong economic expansions (Figure 7). Interestingly, we observe that the *magnitude* of the interest rate gap is also correlated with future economic growth—as the interest rate approaches its neutral level, the impact on GDP growth dissipates.

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[23] IMF (2011a, 2011b) recommends monetary policy tightening for Costa Rica and Dominican Republic and no further monetary easing for Guatemala (IMF, 2012b) and Paraguay (IMF, 2012c) given closing output gaps and high inflation expectations.

Interestingly, and ignoring other factors at play, our analysis seems to suggest that the strong monetary policy stimulus withdrawal in Brazil in 2010–11(SELIC rose by 3¾ percentage points between March 2010 and June 2011) could be correlated with the recent slowdown in Brazilian economic activity (GDP growth was at 2.7 percent in 2011, with GDP essentially flat in the second half of 2011).[24] Moving forward, based on our model, we would expect (ceteris paribus) stronger economic growth as the interest rate gap is now again in negative territory (following SELIC cuts of 4½ percentage points since mid-2011).[25]

Figure 8 compares our estimate of the interest rate gap with the inflation deviations from target (the inflation gap). Though not claiming causality, we observe that central banks typically undertake restrictive monetary policies if the rate of inflation exceeds the target (and vice-versa, in line with Woodford, 2003). Uruguay and Mexico are the only exceptions—they have experienced above target inflation rates for the whole sample period—due to particularly persistent inflation rates. As in Neiss and Nelson (2003), we find that the interest rate gap is correlated with future inflation—periods with positive interest rate gap are followed by subdued inflation (typically inflation rate below the target rate).

The output gap estimates implied by our NRIR model regressions point out similar expansion and recession periods for all countries in the sample (Figure 9). In particular,

- In most cases, the current estimated level of the output gap is in line with WEO estimates—hovering around zero; only in Colombia the model estimates a higher degree of overheating than envisioned by the WEO estimates.

- For the cases of Brazil, Chile, and Paraguay, the model estimates of the *path* of the output gap closely resembles the WEO numbers.

- Our estimated figures indicate that the countries considered have been exposed to several shocks during the sample period, and in all cases the model captures the economic downturn during the Great Recession. The model, however, predicts faster recoveries from recessions than envisioned by the IMF desk economists (e.g., Chile, Mexico, Dominican Republic, and Paraguay) possibly due to the frictionless economic environment assumed by our model.

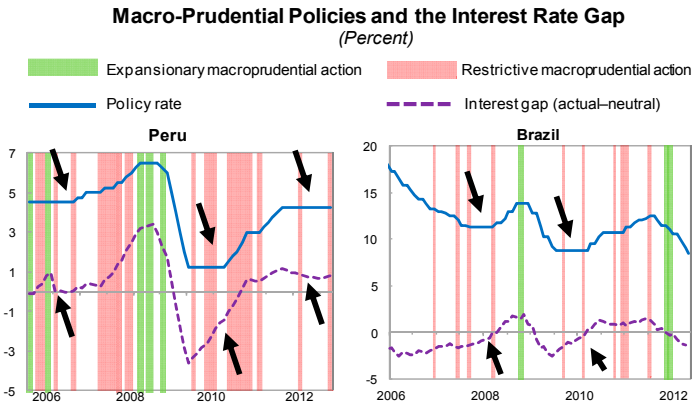
- As before, in economies with better data, model estimates of the output gap depict similar figures to those computed by IMF desk's estimates.

[24] IMF (2012a) points out that (i) a deterioration in global sentiment, (ii) a fall-off in intra-regional trade with Argentina, and (iii) tighter credit conditions in certain market segments could also be important factors behind the recent Brazilian slowdown.

[25] IMF (2012a) also notes that current monetary conditions are accommodative and envisions a pickup in economic growth—though somewhat slower in this cycle, reflecting the effect of rising non-performing loans on the transmission of monetary policy to lending rates and credit supply.

VI. Macro-Prudential Policies: An Effective Complement/Substitute to Interest Rate Policy?

So far our analysis was centered on interest rate policy, i.e., conventional monetary policy. The remaining section provides some preliminary analysis of the impact of macroprudential (or less conventional monetary measures) on the neutral interest rate and thus the monetary stance. These measures (such as changing reserve requirements, imposing limits on currency mismatches or loan-to-value ratios, imposing specific asset risk weights, etc.) had gained importance in recent years, especially in Brazil and Peru, with some measures enacted even prior to the 2008 crisis to control overheating pressures (Tables A.1–A.2 in Appendix I provide a detailed description of the MaPPs enacted in Brazil and Peru since 2006). [26]



Sources: Authors' caltulations; and IMF (2011).

Building on the information in Tables A.1–A.2, we date the tightening and easing in MaPPs in Brazil and Peru in recent years. Green bars are used to denote easing in MaPPs, while red ones show tightening. Both countries rely mostly on restrictive rather than expansionary MaPPs, with Peru being the most active at implementing such measures.

Using the estimated interest rate gap and the incidences of macro-prudential intervention, we explore the effectiveness of MaPPs to affect the monetary stance in Brazil and Peru. Our preliminary (graphical) inspection suggests that both Brazil and Peru successfully tightened their monetary stances (i.e., raised interest rate gaps) via MaPPs, without altering their policy rate in several recent occasions (2006, 2008, and 2010) by lowering the NRIR.

We conjecture that the credit channel affects the output gap and thus the NRIR. [27] Specifically, the increase in the interest rate gap must have been achieved by reducing the

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[26] In its recent statement, the central bank of Uruguay noted that it sometimes prefers to tighten (or complement) monetary policy through reserve requirements as opposed to using the benchmark policy rate, as currency-dependent reserve requirements might be more effective in a dollarized economy.

[27] Paul Tucker (Deputy Governor of Financial Stability, Bank of England), stated in early 2012 that "…We […] need macro-prudential regimes to ensure that […] (risk appetite behavior) mechanisms do not lead to stability-

(continued)

estimated *neutral* policy rate (NRIR), possibly through contracting the output gap (quantifying these specific effects is left for future research). These economies had in recent years experienced a surge in their (carry-trade driven) capital inflows, which increased domestic-currency deposits and thus credit growth. MaPPs seemed to have been employed to mitigate the expansionary effect of the credit channel, possibly resulting in lower demand for loanable funds and thus lower NRIR.

However, more research needs to be undertaken in understating the mechanics of MaPPs, including quantifying their impact on credit, the output gap, and thus NRIR, and investigating whether their effect is temporary or permanent (see Tovar and others, 2012 for a discussion of the duration of the effects of MaPPs). Box 2 suggests that the credit channel might be relevant in LA6, though a deeper analysis is needed to verify it.

Are MaPPs a complement or a substitute for conventional monetary policy? For financially integrated IT countries, the answer seems to depend, in part, on the source of the shock—domestic or external (for a related discussion on MaPPs please also see Unsal, 2011). Despite the limited available data and experience with MaPPs that hinder a rigorous analysis, we provide some preliminary thoughts on the trade-off and/or complementarity of conventional monetary policy and MaPPs.

On the one hand, we conjecture that if a domestic shock results in overheating, MaPPs could be complementary to conventional monetary policy. Increasing interest rates directly raises the cost of funding, thus cooling down the economy. However, some of this slowdown in economic activity would be offset by additional (carry-trade driven) capital flows that would tend to create a credit-driven expansion. Complementing conventional monetary tightening with MaPPs (for example, by raising loan-to-income ratio) would help contain credit growth more directly, thus lowering some of the overheating pressures arising from the credit channel.[28]

On the other hand, if the economy faces an external shock, such as a positive term of trade shock that attracts capital flows, then MaPPs could be a superior option to conventional interest rate policy. They would tighten the credit channel directly, without further increasing capital inflows.

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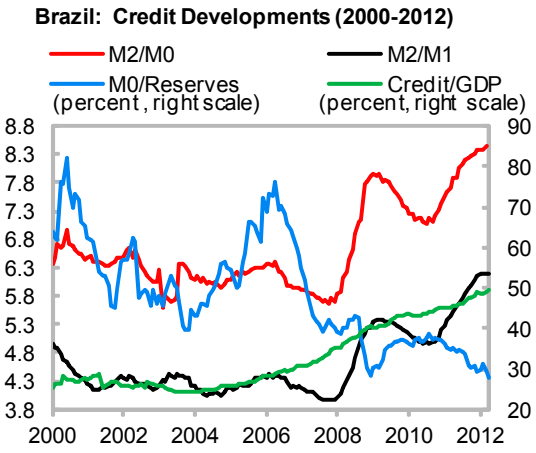
threatening indebtedness or otherwise endanger the resilience of the financial system. We need […] to be ready to contain private sector liquidity creation […]."

[28] Magud, Reinhart, and Vesperoni (2011, 2012) show that during excessive capital inflows, the share of foreign currency credit increases—especially in more rigid exchange rate regimes—as lenders transfer the currency risk to borrowers, holding only the credit risk. In these circumstances, foreign-exchange oriented MaPPs (such as higher reserves requirements or loan-to-income ratios for foreign exchange lending) could also lower the degree of currency mismatches by forcing the banking sector to internalize the currency risk. As it was recently used in Brazil and Peru, this is achieved by equalizing the rates of return of credit in different currencies.

Evidence on these issues is still to be presented. But a deeper discussion of the role of MaPPs as complement or substitute to standard interest rate polices deserves better attention. This is of particular importance in more financially developed and integrated economies with modern (IT) monetary regimes, where most of the economies of the region are converging.

Box 2. How Strong is the Credit Channel in Latin America?

LA6 economies had in recent years experienced a surge in their (carry-trade driven) capital inflows, increasing domestic currency deposits and thus credit growth. For example, Brazilian private credit increased from 26 percent of GDP in 2000 to about 50 percent in early 2012 (boosted by a higher credit multiplier—M2-to-M0 ratio) despite a marked sterilization effort (reflected in the declining M0 to net international reserves ratio).[1,2] MaPPs seemed to have been employed to mitigate the expansionary effect of the credit channel, also resulting in a lower NRIR. This would suggest that the credit channel could be important in affecting the output gap through changes in the demand for loanable funds.



Sources: Haver Analytics; and Authors' calculations.

A first pass to the data might suggest the importance of the credit channel's offsetting effects to traditional interest rate policy. The table below shows factors affecting the credit-to-GDP ratio for the LA6 countries using an OLS regression for each country—notwithstanding important endogeneity issues (which we leave for a future proper econometric assessment). After controlling for the money multiplier (M2/M0), the degree of sterilization (M0/NIR), the real effective exchange rate (REER), and the capital and financial account balance (as a percentage of GDP), we find that the coefficient of the monetary policy rate in determining the credit to GDP ratio is oftentimes positive; though only statistically significant for Peru and Uruguay. Only for Mexico the coefficient is negative and statistically significant, as is common knowledge for closed economies. Therefore, our preliminary evidence would suggest that in the majority of the countries considered, interest rate hikes either do not affect credit to the private sector or, in some cases even increase it. The evidence, of course, deserves a deeper analysis—it would be worth to explore if this finding, controlling for endogeneity, remains and if it is contingent on open economy considerations (such as more flexible exchange rate regimes).

Determinants of Credit/GDP in LA6

	Brazil	Chile	Colombia	Mexico	Peru	Uruguay
Monetary policy rate	0.07	-0.23	-0.01	-0.26 ***	0.22 *	0.32 ***
Sterilization	-13.06 ***	0.05 ***	0.01	1.29 ***	-15.18 ***	1.06 ***
Money multiplier	3.90 ***	0.01	0.82	-1.27 ***	-0.81 ***	14.40 ***
REER	0.29 ***	0.11 **	0.21 ***	-0.06 *	0.58 ***	-0.28 ***
Financial account/GDP	-6.11 **	-9.39 ***	-5.80 *	-2.84	-1.95 **	-20.77 ***
Constant	1.16	45.95 ***	-11.48	27.15 ***	-23.38 ***	7.75
Adjusted R2	0.92	0.34	0.54	0.60	0.67	0.90
Prob(F-statistic)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Source: authors' calculations.
*,**, and *** indicate the 10 percent, 5 percent, and 1 percent level of statistical significance

[1]Total private sector credit is based on data from Financial System Credit Operations.

[2]Higher credit is also observed in the rising M2-to-M1 ratio, as more long-term deposits facilitate greater credit growth by the banking system. See also Citibank (2011).

The analysis on MaPP seems to be symmetric, except for its fiscal cost. If capital inflows are sterilized (purchasing reserves with domestic paper) the quasi-fiscal cost increases. Capital outflows, however, do not increase the quasi-fiscal deficit, as they entail selling reserves while purchasing domestic assets by issuing domestic currency.

VII. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper we present various estimates of the NRIR for a group of ten Latin American countries based on several methodologies commonly used in the literature. Most methodologies give similar results for each country with most estimates clustered within two percentage points. In line with the experience in other countries, we observe a downward trend in the NRIR, with more developed economies and veterans in IT frameworks typically enjoying a lower NRIR.

Using the estimated NRIR, we construct estimates of the interest rate gap to evaluate the stance of monetary policy and the prospects for future inflation and GDP growth. We find that the current monetary stance: (i) is appropriately neutral in most of the countries in the sample, in line with closing output gaps; (ii) remains stimulative in Brazil and Mexico given their negative output gaps; and (iii) notwithstanding data limitations and weak monetary transmission mechanisms that might hinder NRIR from accurately capturing domestic financing conditions, we also find that Costa Rica, Dominican Republic, Guatemala, and Paraguay, still have a somewhat accommodative monetary policy despite closing output gaps; and (iv) is correlated with future economic growth and inflation.

We also find that MaPPs could affect the interest rate gap through the NRIR, even when the policy rate remains unchanged. Looking at the cases of Brazil and Peru, our preliminary evidence suggests that MaPPs are a useful tool for the central bank to tame domestic demand pressures through the credit channel. Conventional monetary policy can be complemented by MaPPs when an economy faces domestic shocks; MaPPs could even substitute for interest rate policy in case of external shocks. In turn, as MaPPs affect the interest rate gap, it makes monetary policy *cum* MaPPs a stronger mechanism to smooth business cycles. However, more research needs to be undertaken in understating the mechanics of MaPPs, including quantifying their impact on credit, the output gap, and thus NRIR, and investigating whether their effect is temporary or permanent.

The NRIR is one of the many unknowns with which monetary policy makers must contend. Since no methodology estimates “the” correct NRIR, central banks would continue to operate on the basis of well-informed, but inherently subjective judgment about unobserved variables such as the output gap and the NRIR. At the end of the day, one of the main decisions of central banks is to cut or not cut. This paper aims at helping in answering that question.

Table 1. NRIR using consumption CAPM (with habit persistence)
(Percent)

	Gamma				Gamma		
	1.0	1.5	2.0		1.0	1.5	2.0
	Brazil				Chile		
0.97	4.69	5.52	6.34	0.97	3.65	3.95	4.25
0.98	4.18	5.00	5.83	0.98	3.13	3.43	3.73
0.98	3.67	4.49	5.32	0.98	2.62	2.92	3.22
0.99	3.16	3.98	4.81	0.99	2.11	2.41	2.71
0.99	2.65	3.48	4.30	0.99	1.61	1.91	2.21
	Colombia				Mexico		
0.97	4.63	5.41	6.20	0.97	4.48	5.20	5.91
0.98	4.11	4.90	5.69	0.98	3.97	4.68	5.40
0.98	3.60	4.39	5.18	0.98	3.45	4.17	4.89
0.99	3.09	3.88	4.67	0.99	2.95	3.66	4.38
0.99	2.58	3.37	4.16	0.99	2.44	3.16	3.87
	Peru				Uruguay		
Beta 0.97	5.04	6.04	7.04	Beta 0.97	3.88	4.29	4.71
0.98	4.53	5.53	6.53	0.98	3.36	3.78	4.20
0.98	4.02	5.02	6.02	0.98	2.85	3.27	3.68
0.99	3.51	4.51	5.51	0.99	2.34	2.76	3.18
0.99	3.00	4.00	5.00	0.99	1.84	2.25	2.67
	Costa Rica				Dominican Republic		
0.97	4.45	5.14	5.84	0.97	4.49	5.21	5.93
0.98	3.93	4.63	5.33	0.98	3.97	4.69	5.41
0.98	3.42	4.12	4.82	0.98	3.46	4.18	4.90
0.99	2.91	3.61	4.31	0.99	2.95	3.67	4.39
0.99	2.40	3.10	3.80	0.99	2.45	3.17	3.89
	Guatemala				Paraguay		
0.97	3.86	4.26	4.67	0.97	4.23	4.82	5.41
0.98	3.34	3.75	4.16	0.98	3.72	4.31	4.90
0.98	2.83	3.24	3.64	0.98	3.20	3.80	4.39
0.99	2.32	2.73	3.14	0.99	2.69	3.29	3.88
0.99	1.82	2.22	2.63	0.99	2.19	2.78	3.37

Source: Authors' calculations.

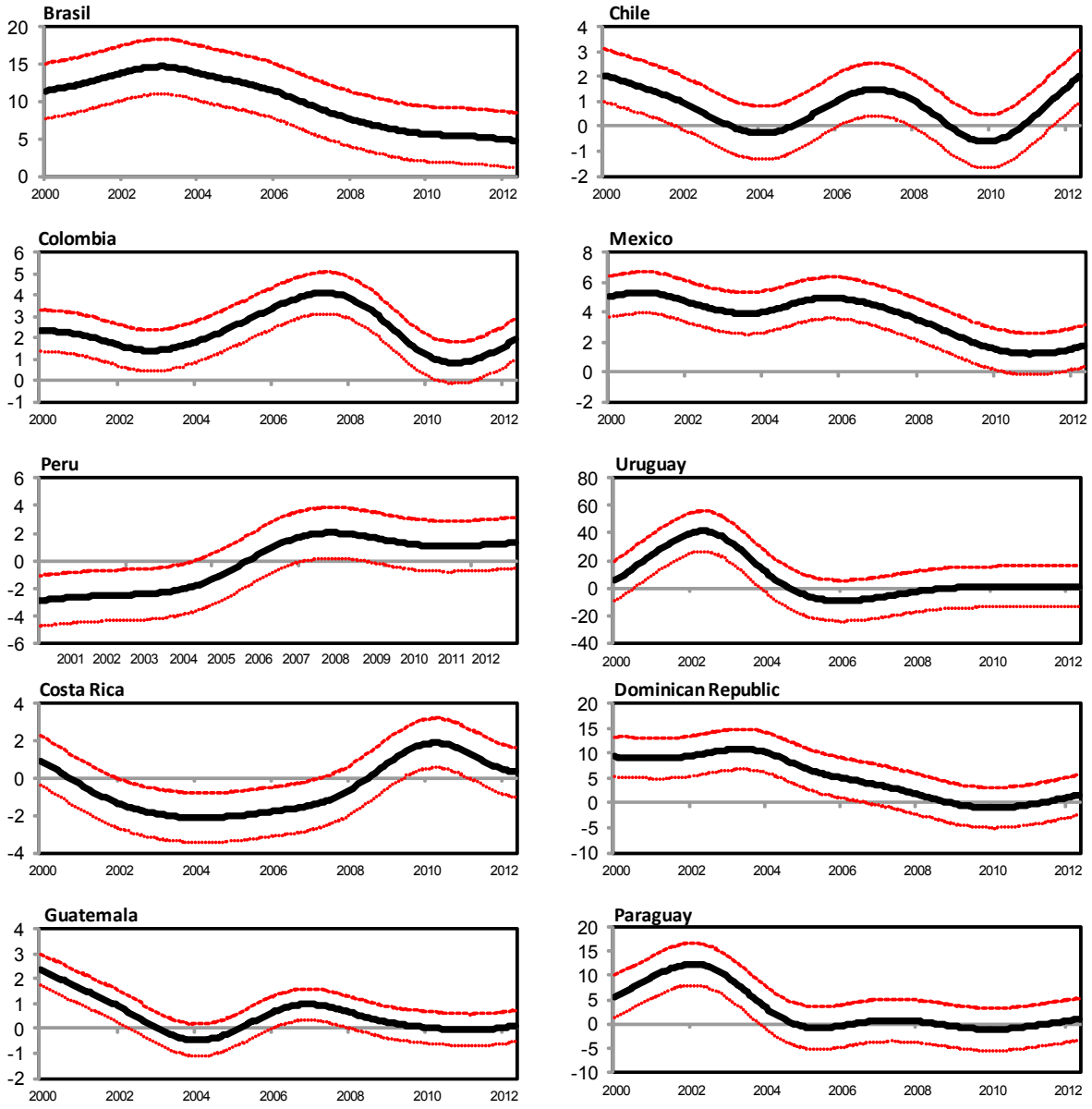
Table 2. The Neutral Interest Rate using Interest Rate Parity Condition

(Percent)

	Expected Real Depreciation Rate	Risk Premium	Neutral Nominal Interest Rate	Neutral Real Interest Rate
Brazil	[-0.5,-1.5]	2.0	[8.0-10.0]	[3.5-5.5]
Chile	[-1.6,0.3]	1.5	[3.3, 5.3]	[0.3, 2.3]
Colombia	[-1.2,0.8]	1.7	[5.5,7.5]	[2.5,4.5]
Mexico	[-1.7,0.3]	1.7	[5.0,7.0]	[2.0,4.0]
Peru	[-1.7,0.3]	2.0	[4.3,6.3]	[2.3-4.3]
Uruguay	[-0.5,0.5]	2.1	[8.6,10.6]	[3.6,5.6]
Costa Rica	[-0.3,1.7]	1.9	[7.6,9.6]	[2.6,4.6]
Dominican Republic	[-0.6,1.4]	3.8	[8.7,10.7]	[3.2,5.2]
Guatemala	[-2.9,-0.9]	3.2	[7.3,9.3]	[2.3,4.3]
Paraguay	[-1.5,0.5]	3.5	[7.0,9.0]	[2.0,4.0]

Source: Authors' estimates based on cited references.

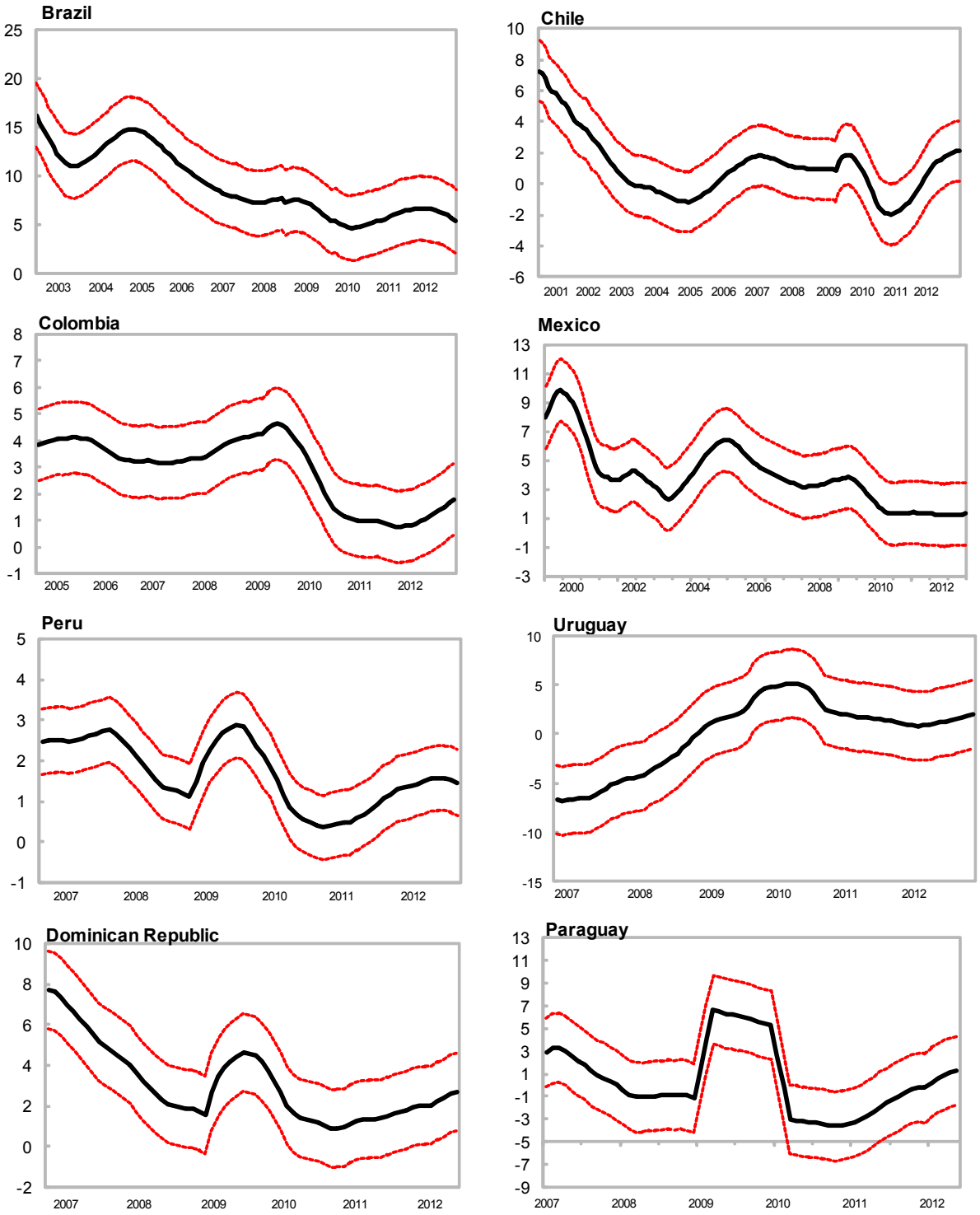
Figure 1. NRIR using HP Filter
(Percent)



[1]± 1 Standard deviation is shown by red dotted lines.
Source: Authors' calculations.

Figure 2. NRIR: Implicit Common Stochastic Trend[1]

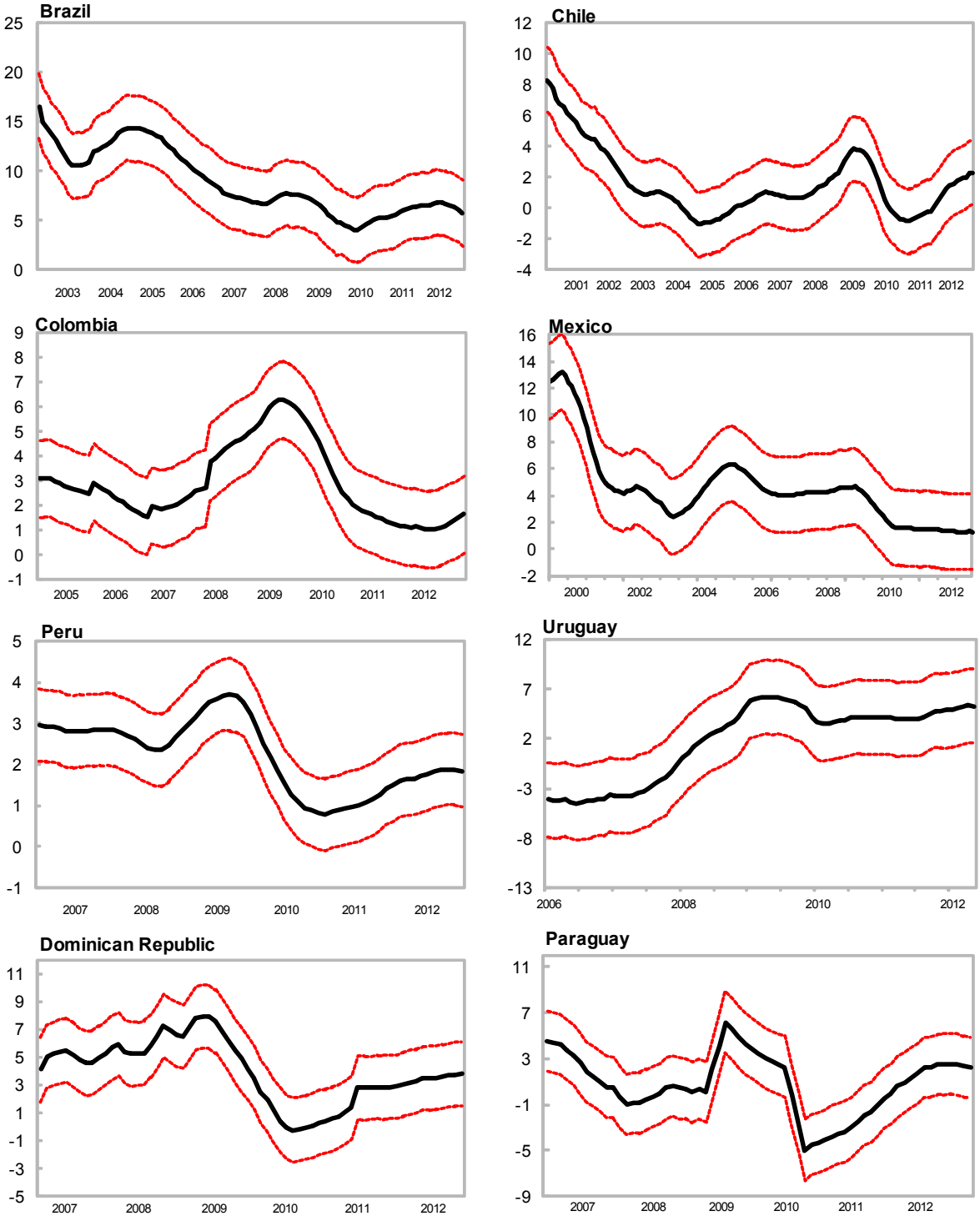
(Percent)



[1]± 1 Standard deviation is shown by red dotted lines.
Source: Authors' calculations.

Figure 3. NRIR: Dynamic Taylor Rule[1]

(Percent)

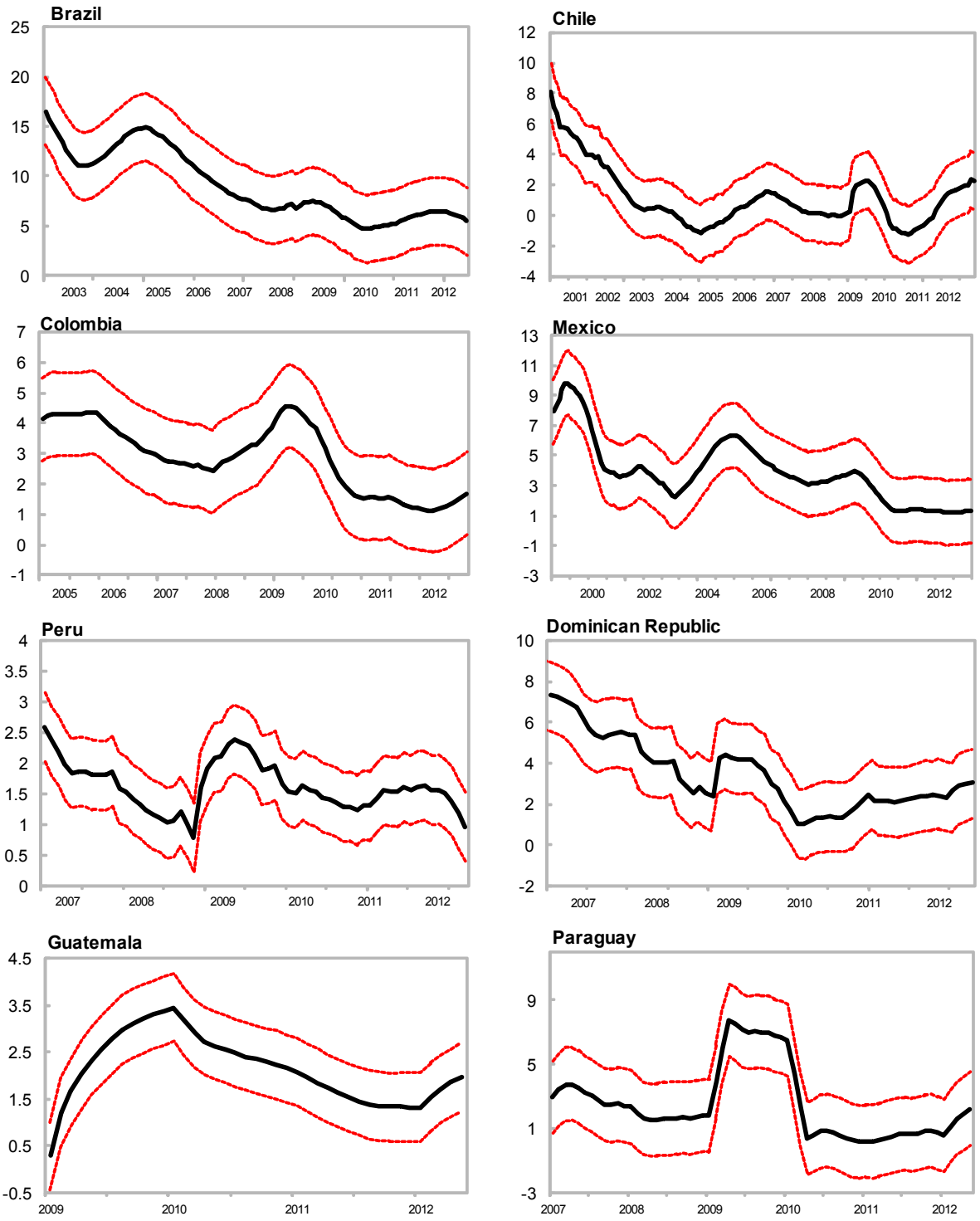


Source:

[1]± 1 Standard deviation is shown by red dotted lines.

Source: Authors' calculations.

Figure 4. NRIR: Expected-Inflation Augmented Taylor Rule[1]

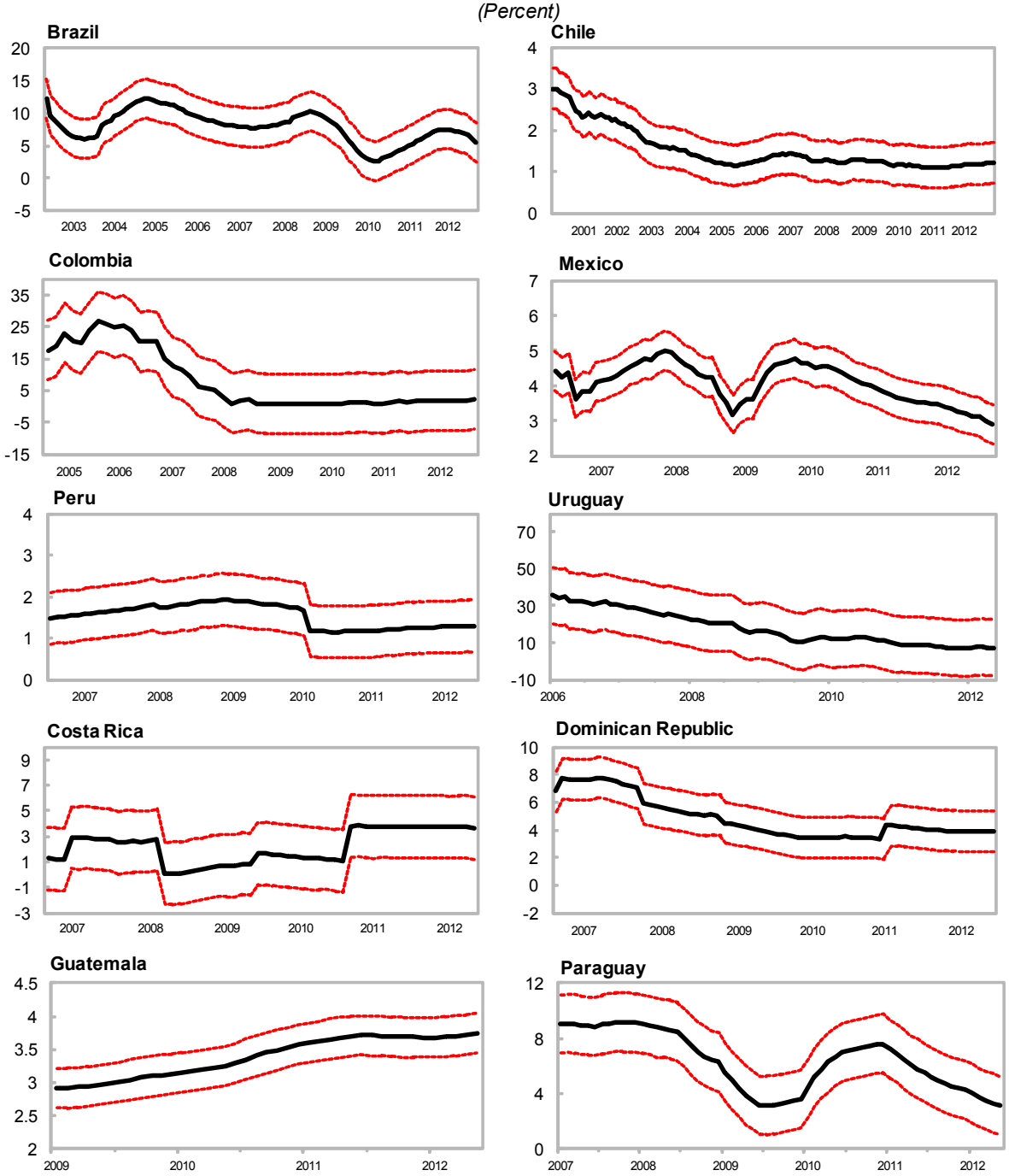


Source:

[1]± 1 Standard deviation is shown by red dotted lines.
Source: Authors' calculations.

Figure 5. NRIR: General Equilibrium Model[1]

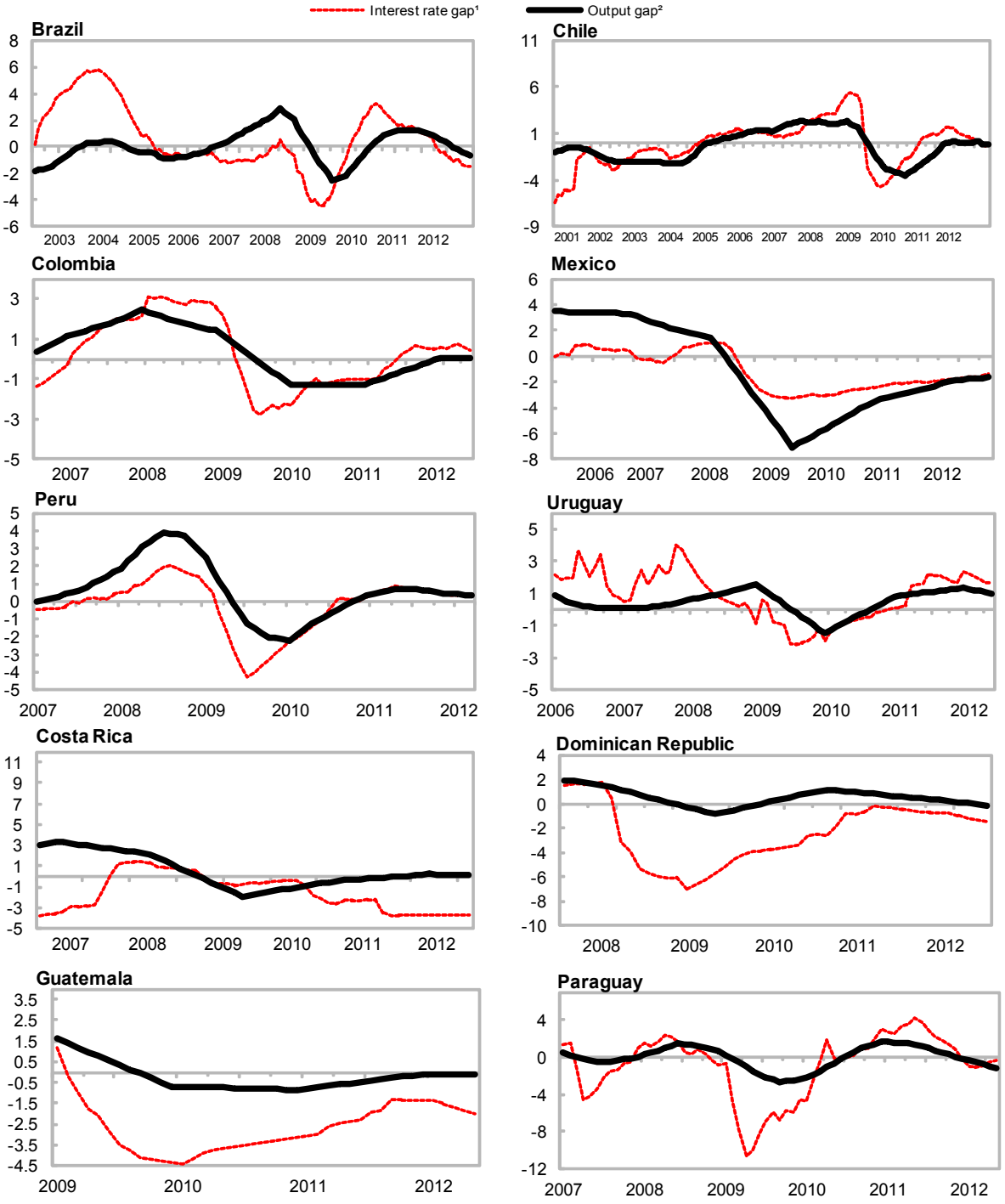
(Percent)



[1]± 1 Standard deviation is shown by red dotted lines.
Source: Authors' calculations.

Figure 6. Latin America: Interest and Output Gap

(Percent)



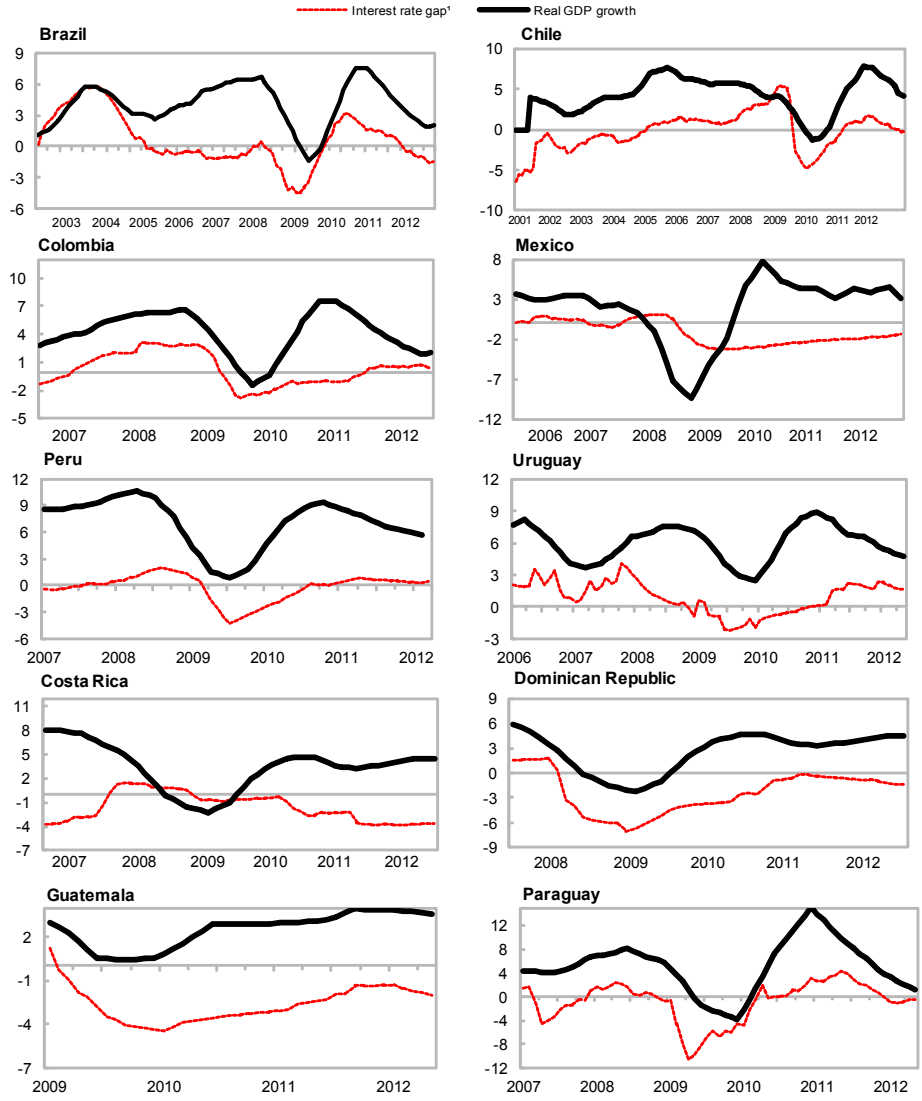
Source: Authors' calculations.

¹ Difference between actual and neutral real interest rate. Increasing gap implies monetary policy tightening and vice-versa.

² Difference between actual and potential real GDP as a percent of potential GDP.

Figure 7. Latin America: Interest Gap and Economic Growth

(Percent)

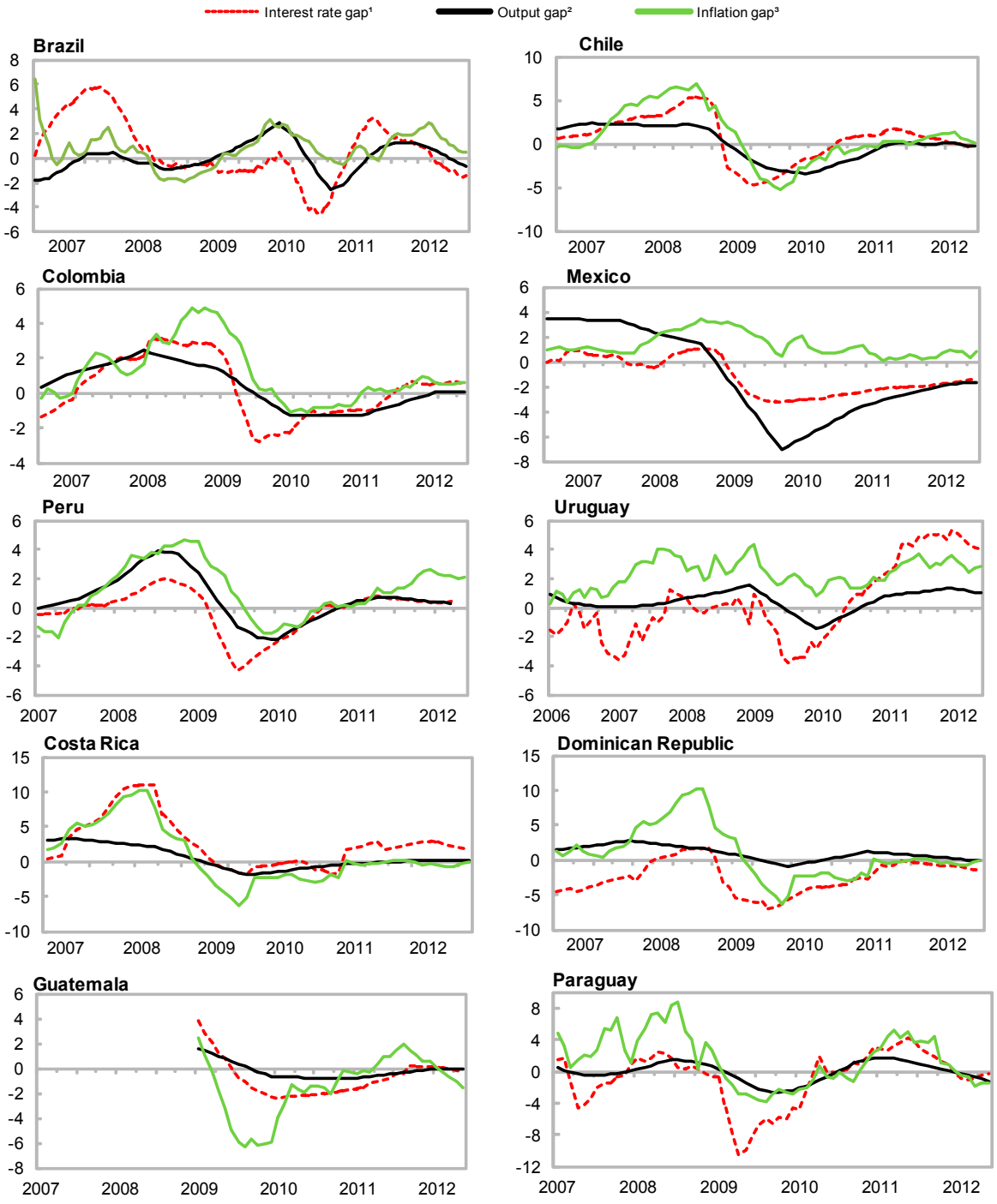


Source: Authors' calculations.

¹ Difference between actual and neutral real interest rate. Increasing gap implies monetary policy tightening and vice-versa.

Figure 8. Latin America: Output, Interest, and Inflation Gaps

(Percent)



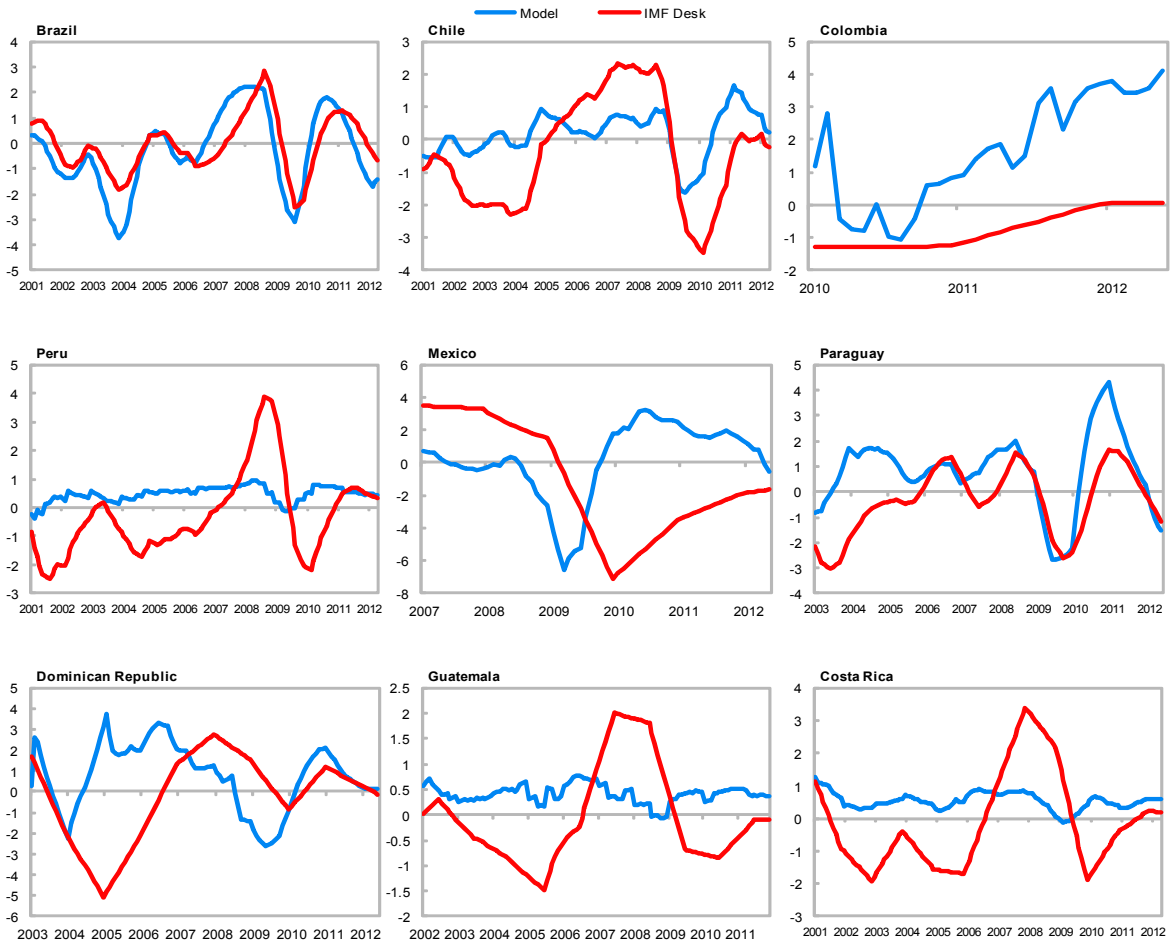
Source: Authors' calculations.

¹ Difference between actual and neutral real interest rate. Increasing gap implies monetary policy tightening and vice-versa.

² Difference between actual and potential real GDP as a percent of potential GDP.

³ Difference between actual and target inflation.

Figure 9. Model and IMF Desk's Output Gap Estimations
(In percent)



Sources: Authors' calculations; and IMF staff calculations.

Appendix I: Recent Macroprudential Measures in Brazil and Peru

Table A2. Recent Macroprudential Policies in Peru (2006-2012) (cont.)

Date	Instrument	Policy Change	Reason
Apr-06	**Quantitative easing:** Widening the definition of securities allowed for repo auctions.	Widen the definition of securities allowable for temporary repos and allowed private sector non-financial securities in local currency to be used for direct repos.	To improve access to short-term funding for financial entities.
May-06	**Quantitative easing:** Increasing instruments maturity.	Increase the maturity on repos to up to three months and make placements of 20-year nominal sovereign bonds for the first time.	To widen the yield curve.
Apr-08	**Changes in legal minimum reserve requirements**	Increase the legal reserve requirements from 7 to 8 percent.	As a complement to policy changes.
May-08		Increase the ratio to 8.5 percent.	
Jul-08		Increase the ratio to 9 percent.	
Dec-08		Decrease the ratio to 7.5 percent.	
Mar-09		Decrease the ratio to 6 percent.	
Jul-10		Increase the ratio to 7 percent.	
Aug-10		Increase the ratio to 8 percent.	
Sep-10		Increase the ratio to 8.5 percent.	
Oct-10		Increase the ratio to 9 percent.	
Oct-10		Increase the ratio to 9.5 percent.	
Apr-08	**Changes in marginal reserve requirements for domestic currency deposits**	Increase ratio from 15 to 20 percent.	To manage capital flows.
Jul-08		Increase ratio to 25 percent.	
Aug-10		Decrease ratio to 12 percent.	
Sep-10		Increase ratio to 15 percent.	
Oct-10		Increase ratio to 25 percent.	
May-12		Increase ratio to 30 percent.	
Jan-07	**Reserve requirements to long-term external liabilities (in foreign currency, more than two years)**	Decrease the ratio to zero percent from 30 percent.	To manage capital flows and build a accumulate a buffer stock of international reserves.
Jul-08		Increase the ratio to 9 percent.	
Oct-08		Decrease the ratio to zero percent.	
Mar-08	**Differentiated reserved requirements for foreign currency:** general regime, marginal requirement for foreign currency deposits	Increase the reserve ratio from 30 percent to 40 percent.	To increase availability of international liquidity for local banks.These measures are also intended to avoid short term capital inflows and liquidity to translate into an unsustainable expansion of credit.
May-08		Increase the ratio to 45 percent.	
Aug-08		Increase the ratio to 49 percent.	
Oct-08		Decrease the ratio to 35 percent.	
Dec-08		Decrease the to 30 percent.	
Jun-10		Increase the ratio to 35 percent.	
Aug-10		Increase the ratio to 45 percent.	
Sep-10		Increase the ratio to 50 percent.	
Oct-10		Increase the ratio to 55 percent.	

Table A1. Recent Macroprudential Policies in Brazil (cont.)

Date	Instrument	Policy Change	Reason
Feb-10	**Sector-dependent asset risk weights:** Higher risk weights for certain automobile and personal loans.	Higher risk weights were introduced for certain categories of automobile and personal loans with longer maturies and higher loan-to-value ratios.	To increase the risk-sensitivity of capital requirements in a scenario of rapid growth in credit to these sectors.
Feb-10	**Loan-to-value and maturity-dependent asset risk weights:** Higher risk weights for certain automobile and personal loans.	Higher risk weights were introduced for certain categories of automobile and personal loans with longer maturies and higher loan-to-value ratios.	To increase the risk-sensitivity of capital requirements in a scenario of rapid growth in credit to these sectors.
Nov-11		A recalibration lowered the capital requirements for consumer loans according to their maturity, removing the loan-to-value ratio criteria.	
Oct-08	**Varying reserve requirements:** changes to required bank reserves	Decrease in required bank reserves, with liquidity channeled to smaller financial institutions.	To increase or decrease liquidity in the financial system.
Feb-10		Increase in required bank reserves.	
Dec-10		Increase in required bank reserves.	
Dec-11		Large banks may acquire small banks using reserve requirements on time deposits—initially a temporary measure taken in October 2008.	It allows large banks to use the non-remunerated part of the required reserves on time deposits to acquire small bank assets.
Jul-12		Cut the "additional" bank-reserve requirements on cash deposits to 6 percent from 12 percent and raise the requirement for credit directed to the farm sector to 34 percent from 28 percent.	fshort

Sources: IMF (2011c), Mihalijek and Sybelyte (2011), Tovar, Garcia-Escribano, and Vera-Martin (2012), and authors' research based on national sources.

Table A2. Recent Macroprudential Policies in Peru (2006-2012)

Date	Instrument	Policy Change	Reason
Dec-08	**Countercyclical/dynamic provisioning**: Countercyclical tool that builds up a cushion against expected losses in good times so that they can be released in bad times.	Introduce generic provision to banking and non-banking loans (microfinance). There are three activation rules, the most important one is when GDP growth for the last 30 months is 5 percent or higher.	To reduce the procyclicality of the banking business.
Feb-10	**Limits on net open currency positions**	Long position: 75%; Short position: 15% of capital	To mitigate foreign exchange risk in banks' balance sheets, thus raising the solvency of the financial system.
Nov-10		Long position: 60%; Short position: 15% of capital	
Dec-06	**Foreign exchange policy measures**: Limits to foreign investment by domestic pension funds.	Increase the limit from 10.5 percent to 12 percent.	Reduce the appreciation of the domestic currency.
Mar-07		Increase the limit to 13.5 percent.	
Jun-07		Increase the limit to 15 percent.	
Feb-08		Increase the limit to 16 percent.	
Jan-08		Increase the limit to 17 percent.	
Apr-08		Increase the limit to 20 percent.	
Oct-09		Increase the limit to 22 percent.	
Jan-10		Increase the limit to 24 percent.	
Jun-10		Increase the limit to 26 percent.	
Jul-10		Increase the limit to 28 percent.	
Sep-10		Increase the limit to 30 percent.	
Jun-10	**Limits to foreign currency purchase of domestic pension funds.**	Daily and weekly limits: 0.85 percent and 1.95 percent of Assets Under Management.	Reduce the volatility of the domestic currency.
Jan-06	**Foreign exchange policy measures:** Intervention to stabilize exchange rate volatility	Sale of US$ 364 million.	To avoid excessive exchange rate volatility.
Feb-06		Purchase of US$59 million.	
May-06		Purchase of US$0.5 million.	
Jun-06		Purchase of US$2.5 million.	
Jul-06		Purchase of US$600 million.	
Aug-06		Purchase of US$1.41 billion.	
Sep-06		Purchase of US$166 million.	
Nov-06		Purchase of US$696 million.	
Dec-06		Purchase of US$610 million.	

Table A2. Recent Macroprudential Policies in Peru (2006-2012) (cont.)

Date	Instrument	Policy Change	Reason
Apr-06	**Quantitative easing:** Widening the definition of securities allowed for repo auctions.	Widen the definition of securities allowable for temporary repos and allowed private sector non-financial securities in local currency to be used for direct repos.	To improve access to short-term funding for financial entities.
May-06	**Quantitative easing:** Increasing instruments maturity.	Increase the maturity on repos to up to three months and make placements of 20-year nominal sovereign bonds for the first time.	To widen the yield curve.
Apr-08	**Changes in legal minimum reserve requirements**	Increase the legal reserve requirements from 7 to 8 percent.	As a complement to policy changes.
May-08		Increase the ratio to 8.5 percent.	
Jul-08		Increase the ratio to 9 percent.	
Dec-08		Decrease the ratio to 7.5 percent.	
Mar-09		Decrease the ratio to 6 percent.	
Jul-10		Increase the ratio to 7 percent.	
Aug-10		Increase the ratio to 8 percent.	
Sep-10		Increase the ratio to 8.5 percent.	
Oct-10		Increase the ratio to 9 percent.	
Oct-10		Increase the ratio to 9.5 percent.	
Apr-08	**Changes in marginal reserve requirements for domestic currency deposits**	Increase ratio from 15 to 20 percent.	To manage capital flows.
Jul-08		Increase ratio to 25 percent.	
Aug-10		Decrease ratio to 12 percent.	
Sep-10		Increase ratio to 15 percent.	
Oct-10		Increase ratio to 25 percent.	
May-12		Increase ratio to 30 percent.	
Jan-07	**Reserve requirements to long-term external liabilities (in foreign currency, more than two years)**	Decrease the ratio to zero percent from 30 percent.	To manage capital flows and build a accumulate a buffer stock of international reserves.
Jul-08		Increase the ratio to 9 percent.	
Oct-08		Decrease the ratio to zero percent.	
Mar-08	**Differentiated reserved requirements for foreign currency:** general regime, marginal requirement for foreign currency deposits	Increase the reserve ratio from 30 percent to 40 percent.	To increase availability of international liquidity for local banks.These measures are also intended to avoid short term capital inflows and liquidity to translate into an unsustainable expansion of credit.
May-08		Increase the ratio to 45 percent.	
Aug-08		Increase the ratio to 49 percent.	
Oct-08		Decrease the ratio to 35 percent.	
Dec-08		Decrease the to 30 percent.	
Jun-10		Increase the ratio to 35 percent.	
Aug-10		Increase the ratio to 45 percent.	
Sep-10		Increase the ratio to 50 percent.	
Oct-10		Increase the ratio to 55 percent.	

Table A2. Recent Macroprudential Policies in Peru (2006-2012) (cont.)

Date	Instrument	Policy Change	Reason
Apr-08	**Reserve requirements to domestic currency liabilities of domestic banks with non-residents**	Increase the reserve requirement ratio to 40 percent from 15 percent.	To mitigate short-term capital flows and exchange rate volatility, by reducing the use of bank´s deposits in domestic currency as a vehicle to take long positions in Soles.
Jul-08		Increase the ratio to 120 percent.	
Mar-10		Decrease the ratio to 35 percent.	
Jul-10		Increase the ratio to 40 percent.	
Aug-10		Increase the ratio to 50 percent.	
Sep-10		Increase the ratio to 65 percent and subsequently to 120 percent.	
Mar-08	**Reserve requirements to short-term external liabilities (in foreign currency, up to two years):** In case the regulator considers that the bank is not evaluating adequately this risk.	Increase the ratio to 40 percent from 30 percent.	To mitigate short-term capital flows and exchange rate volatility by extending the maturity of foreign debt of domestic bank, thus increasing domestic bank´s resilience to sudden stops.
Apr-08		Increase the ratio to 45 percent.	
Jul-08		Increase the ratio to 49 percent.	
Oct-08		Decrease the ratio to zero percent.	
Mar-10		Increase the ratio to 35 percent.	
Jul-10		Increase the ratio to 40 percent.	
Aug-10		Increase the ratio to 50 percent.	
Sep-10		Increase the ratio to 65 percent.	
Oct-10		Increase the ratio to 75 percent.	
May-12	**New reserve requirement**	Introduce a new special reserve requirement for holders of long-term instruments, such as bonds, excluding sol-denominated mortgage bonds, that exceed two and a half times the effective capital of the financial entity.	To moderate credit growth and prevent future demand pressures on the economy.
2009	**Other measures**	Ban on foreign investors' purchases of central bank bills.	Restrict foreign investors' access to central bank instruments.
2010		Increased fee on foreign purchases of central bank liquidity draining instruments to 400 basis points.	
Jan-10		Governmemnt imposed a 30 percent tax on foreign investors' profits from short term currency futures.	Avoid volatility of the domestic currency.
Jan-11	**Limits on net derivative position of financial institutions**	Introduce a limit of either 40 percent of assets or S/.400 million, whichever is the highest.	To manage foreign exchange risks.
Oct-11		Tighten the limit to 30 percent of assets or S/.350 million, whichever is the highest.	

Sources: IMF (2011c, 2012d); Mihalijek and Sybelyte (2011); Rossini, Quispe and Rodriquez (2011); Tovar, Garcia-Escribano, and Vera-Martin (2012); and authors' research based on national sources.

Appendix II: Data Sources and Description

Variable	Source	Comments
Inflation	Haver Analytics	For the period 2012M6-2013M12, projections from the 2012 April WEO were interpolated. Data was seasonally adjusted using an X-12 ARIMA additive seasonal adjustment.
Policy rate	Haver analytics, SECMCA for GTMtemala BRA: Selic Target Rate CHL:Monetary policy rate COL: BDLR Intervention Rate CRI: Policy rate; changes in the deposit rate (30-90 days) was used to interpolated historical data DOM: Overnight rate; interbank loan rate was used as a proxy for historical data GTM: Policy rate, changes in the maximum deposit rate (from International Financial Statistics) was used to interpolate historical data MEX: Target rate. TIIE prior to 2008. PER: Reference rate, changes in the overnight deposit interest rate was used to interpolate historical data PRY: Letras Regulacion Monetaria URU: Policy rate; money market rate was used as a proxy for historical data	In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used.
12-month ahead inflation expectations	2012 April WEO	Data was interpolated by obtaining the 12-month ahead inflation projection of the corresponding year.
Inflation target	National Authorities and Haver Analytics	For the period prior to the publication of an official inflation target the average yearly inflation number was used as the target for the year. For 2012M6-13M12 the last published value was repeated.
Emerging Markets Bond Indices	JP Morgan through Bloomberg LP	For PRY the EMBI of a country with similar sovereign rating was used.
M0, M1, M2	Haver Analytics, except for: PRY: National Authorities COL, MEX for M0: International Financial Statistics	
International reserves	International Financial Statistics.	
Exchange rate	International Financial Statistics.	
Real effective exchange rate	Information Notice System.	
Oil inflation	Haver Analytics: BRA: Fuels for personal transport CHL: Gas COL: Fuels and Public Services CRI: Average of housing, transportation and electricity (pre-2006) and fuel for transportation thereafter. DOM: Weighted average of gas, electricity and fuels for personal transport GTM: Housing, Rent, Water, Electric/Gas MEX: Transportation PER: Fuels PRY: Fuels URY: Electricity, gas, and other fuels.	In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used. Data was seasonally adjusted using an X-12 ARIMA additive seasonal adjustment.
Core inflation	Haver Analytics, except for Dominican Republic: BRA: IPCA core CHL: CPIX1 COL: CPI less perishables, fuels, and utilities CRI: Core DOM: National Authorities GTM: Dynamic Core Consumer Price Index MEX: Core PER: Core PRY: Core CPI: Ex Fruits, Vegetables, Taxed Services and Fuels URY: Authors' calculations using CPI excluding Food and Non-alcoholic and Electricity, Gas and Other Fuels.	In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used. Data was seasonally adjusted using an X-12 ARIMA additive seasonal adjustment.

Data Sources and Description (cont.)		
Variable	**Source**	**Comments**
Potential GDP	2012 April WEO and author's calculations. DOM, GTM, PRY, and URY: IMF desks' calculations as reported to Fiscal Template (the non-agriculture real GDP was used for PRY).	
Short-term interest rate	BRA: Swaps Reference Rate: Daily: 90 days., EMED. CHL: PDBC 90 days, Haver Analytics. COL: 90 day certificate of deposit, Haver Analytics. CRI: 90-180 day Central Directo por plazos de vencimiento, Central Bank. PER: Peru 3-month bond. PRY: Money Market rate, International Financial Statistics DOM: Interbank loan rate, Haver Analytics. GTM: Rate on open-market operations, National Authorities. MEX: CETES 91 days, EMED. URY: ITLUP 90 days, Bolsa Electronica de Valores del UruGTMy.	Historical data were interpolated, if possible. A 12-month moving average was used. In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used.
Long term rate	BRA: 10-year bond, Datastream. CHL: BCP 5 year, Haver Analytics. COL: 8 year bond, Bloomberg LP. CRI: 5 year BEM offer rate, National Authorities. PER: Peru 8-year bond. PRY:Lending rate (foreign currency), IFS DOM: Certificado de inversión especial, 7 años, National Authorities. URY: ITLUP 1080 days, Bolsa Electronica de Valores del UruGTMy. GTM: 10 year yield, primary market, National Authorities. MEX: 9 year bond, Bloomberg LP.	Historical data were interpolated if possible. A 12-month moving average was used. In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used.
Population	2012 April WEO for all countries.	
Commodity price index	Commodity Research Bureau through Haver Analytics. World Integrated Trade Solutions, 2011.	A commodity index was constructed for each country based on the country's trade shares for each commodity. In order to calculate 2012M6-13M12 an ARIMA post estimation dynamic forecasting was used. Data was seasonally adjusted using an X-12 ARIMA multiplicative seasonal adjustment.
Credit to the private sector:	BRA, CHL, COL, MEX; PRY, URY: EMED CRI, DOM, GTM: Secretaría del Consejo Monetario Centroamericano.	In order to calculate 2012M6-13M12 an ARIMA post Data was seasonally adjusted using an X-12 ARIMA multiplicative seasonal adjustment.
Real and Nominal GDP, Public consumption	2012 April WEO.	Yearly/quarterly actual and projected data was interpolated. Data was seasonally adjusted using an X-12 ARIMA seasonal adjustment.
Public Debt	2012 April WEO	Yearly actual and projected data was interpolated. Data was seasonally adjusted using an X-12 ARIMA seasonal adjustment.

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