New Frontiers for Monetary Policy in Chile*

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Abstract

This paper assesses the efficiency of the current Inflation Targeting (IT) scheme in place at the Central Bank of Chile, in the context of a small macroeconomic model of the Chilean Economy. Our main results are as follows: (i) an efficient monetary policy requires a bias towards output stabilization around its long run trend; (ii) the switch to forecast-targeting, implicit in the current IT scheme in Chile, results in gain in efficiency; (iii) targeting core inflation is not efficient; (iv) efficiency could be enhanced if monetary policy leans against the wind when facing international interest rate shocks.

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1 Introduction

Inflation targeting (IT) can be broadly defined as a framework for the conduct of monetary policy (MP) in which the central bank guides its instruments in order to maintain close to or bring inflation back to a pre-announced target.[1] Although understanding the framework is straightforward, its practical implementation is not. In the real world Central Bankers can practice only a rough version of the Tinbergen-Theil targets and instruments approach to economic policy. We have very imperfect knowledge of the MP transmission mechanism (magnitudes and lags), it is a very difficult task to agree on any moment of the probability distribution of exogenous variables, and there is no single objective function in society or even at the Central Bank to optimize. However, autonomous Central Banks must make decisions based on this imperfect set of information, and then convincingly explain the rationale for those measures to financial markets, the legislature and the general public.

This paper focuses on some of the practicalities of implementing inflation targets using empirical evidence for Chile. The goal of this paper is to look for evidence on which type of MP rule is likely to be efficient when used as a guideline for monetary policy in Chile. Some of the relevant issues are: Should MP react to unemployment or the output gap in this framework? If so, how much should it react? Should it focus on current headline inflation, core inflation, or a forecast of one of them? If a forecast, over what horizon? Should the Central Bank restrict monetary policy when faced to a hike in oil prices? Should it track changes in the international interest rate or should it lean against them? What should be the role of the exchange rate in the monetary policy rule? All of these questions have arisen at one point or another in the implementation of IT in Chile and none of the answers can be answered without a specific model that describes the mechanics of the economy.

This paper analyses some of these issues using a small macroeconometric model of the Chilean economy, which allows us to calculate the performance of alternative MP rules through stochastic simulation. These simulations allow us to calculate the level of both inflation and output volatility that arise from a series of alternative MP rules given a fixed distribution for the exogenous shocks. Using these volatilities it is possible to

[1]The framework usually includes other ingredients such as strong commitment with the primary objective of controlling inflation, an increase in transparency and accountability, direct and abundant communication with the public, and reliance on a broad set of indicators.

assess, for instance, whether MP gains efficiency when reacting to the output gap even when inflation is the sole central bank objective.

Furthermore, using these volatilities we calculate the envelope of efficiency frontiers for different *families* of policy rules and evaluate whether in general — that is, regardless of preferences about inflation and output volatility, persistence, or activism — is it possible to gain efficiency with simple changes in the MP reaction function. In particular, we evaluate whether it is convenient to react to core instead of headline inflation, to react to inflation (model consistent) forecasts instead of actual inflation, or to include the international interest rate in the MP rule.

This exercise parallels similar studies undertaken for other countries [2] and other inflation targeting countries. All of them evaluate the efficiency of simple monetary policy rules in the context of an specific models, and also their robustness across different models (Levin, Wieland and Williams, 1999). In some respects, our results parallels those in industrial countries. However, there are some specific features of the Chilean economy such as the degree of openness of the economy, the volatility of supply shocks and the extent of price and wage indexation that require some special attention to verify the robustness of simple MP rules.

Some related research for the case of Chile can be found in Valdés and Medina (2000a), (2000b).However, some important differences must be emphasized. Mainly, the search for *optimal* instead of *efficient* rules highlights the importance of the definition of the appropriate loss function to be maximized. This is a particularly difficult issue to settle within Central Banks. Moreover, focusing on the efficiency of different rules is enlightening in that it shifts the focus from preferences to outcomes.

For example, whether to include or not the output gap in the loss function of the Central Bank can go against many preconceived notions of how an autonomous MP should be conducted. However, including the output gap in the policy rule is much less debatable, due to the impact of aggregate demand conditions on inflationary pressuress

The macro-econometric model we use in this paper is a simple open economy IS-LM-AS with rational expectations. The model is simple enough to allow us to track the key parameters that influence some of the results and make a preliminary assesement of their robustness. It comprises 5 main equations: (i) an output equation; (ii) a forward looking long term interest rate; (iii) an exchange rate equation based on uncovered interest parity

[2]For example, see Rudebusch and Svensson (1999), Batini and Haldane (1999)

(iv) a forward looking acceleracionist Phillips curve for core inflation; and (v) a MP rule. The model also includes some simple pricing rules for non-core CPI items such as fuels and perishables. Besides equation innovations, uncertainty takes account of innovations for exogenous variables such as world output, international interest rates, sovereign spreads, terms of trade, oil prices, and fiscal policy.

Some word of caution regarding how general are our results is appropriate. By construction, the model we consider assumes perfect credibility — it includes rational expectations and a known MP rule — and therefore it cannot address issues such as lack of confidence. In our opinion, however, this limitation is more relevant only when inflation is converging towards a steady state level (not when it is at its steady state level). Indeed, it could be argued that discussing whether MP should react to core or headline inflation is quite irrelevant when the IT framework is in a converging path. In that case, credibility issues dominate. But it can also be argued that the contrary happens when inflation has already converged to its steady state level. Also the model used to carry this exercise grant us only partial immunity from the Lucas critique. It includes explicit expectations components in the inflation, exchange rate and interest rate equation. However, some parameters as the degree of indexation and the backward component in the price equation or the dynamics of the exchange rate pass-through may also depend on the monetary policy framework.

The paper is organized as follows. Section 2 describes the model we use. Section 3 discusses the comparative efficiency of some prototypical MP rules, and the dynamic response of the economy under each rule. Section 4 goes further and generalizes the analysis to a fuller set of parameters that define each MP rule, and evaluates whether focusing on headline, forecast, or core inflation yields better results and whether reactions to international interest rates improve MP efficiency. Finally, section 5 presents the main conclusions.

2 A small macroeconomic model for the Chilean economy

This paper relies on a small macroeconometric model along the lines of an open-economy IS-LM-AS with rational expectations. Indeed, the model shares many of the strengths and pitfalls of short-term aggregate-demand driven models.

The model is based on empirically based equations that are not explicitly derived from first principles. Recent research on dynamic neo-Keynesian models shows, however, that a version of the IS-LM-AS model results from the combination of an intertemporal Euler equation for aggregate demand with the "New Phillips Curve", that embeds Calvo-style price setting as well as rational expectations.

This models abstracts from many of the transmission channels of monetary policy, but emphasizes the following ones:

1. The effect on the level and structure of market interest rates, and from there to aggregate demand pressures and inflation. .

2. The effects on current and expected exchange rate dynamics, and hence on imported inflation.

3. The effect of expectations on current inflation.

Other channels of monetary policy are excluded from this model. Most notably, the impact on credit and money markets is not modeled. Also, the impact of monetary policy on asset prices other that the exchange rate is not considered. This sets up a definite area for future research, in particular on the role of the credit channel in an open economy. Also, the recent international financial crises highlight the importance of these transmission channels, for example the balance sheet effect. Although there has been theoretical progress on these issues, the need for an adequate empirical counterpart for policy evaluation is still unsatisfied.

2.1 Basic structure

The output equation ('IS' curve) relates the difference between quarterly GDP growth and its trend to the deviations from steady state of a set of domestic and external variables. Among the former, it includes real interest rates, both short r and long R, the real exchange rate e , fiscal policy f and the lagged output gap. The later consist of international real interest rates adjusted for Chile's sovereign spread r^*, the growth of the terms of trade tt, and GDP growth of Chile's five main trading partners y^*. In the following equation, all variables are in logs and overlines indicate trend or equilibrium values. Newey-West standard errors were used to calculate t-stats, in parentheses below OLS estimates.

$$\Delta y = \Delta\overline{y} - \underset{(-1.601)}{0.116}(y_{-1} - \overline{y}) - \underset{(-7.993)}{0.490}(r_{-1} - \overline{r}) - \underset{(-2.504)}{0.459}(R_{-1} - \overline{R})$$
$$- \underset{(-5.141)}{0.884}(r^*_{-1} - \overline{r}^*) + \underset{(0.665)}{0.035}(\Delta tt_{-1} - \Delta\overline{tt}) + \underset{(5.284)}{1.382}(\Delta y^*_{-1} - \Delta\overline{y^*})$$
$$+ \underset{(3.033)}{0.221}(f_{-1} - \overline{f}) + \underset{(5.057)}{0.296}(e_{-1} - \overline{e}) - \underset{(-4.132)}{0.891}\Delta y_{-1} \quad (1)$$

Several modeling assumptions are noteworthy. First, the level of real interest rates (short, long, and foreign) affect the rate of change of output. Although at a first glance this is conceptually similar to the DNK version of an IS curve, we do not include the expected level of output on the right hand side, which would be the theoretically consistent approach with an Euler equation.

Second, the real exchange rate misalignment (instead of its rate of change) impacts growth. This implies that when the exchange rate its equilibrium or fundamental value (i.e. is overdepreciated), it has an expansionary impact on aggregate demand.

Third, the current cyclical position acts as a brake or accelerator; growth is higher when the economy is recovering from a downturn. This allows for mean reversion in growth rates towards full employment.

Fourth, although capital flows are not modeled, the international interest rate effect is very strong. This can be interpreted either as a proxy for capital inflows or outflows or as a reflection of a segmented market for investment finance, where some (larger) firms tap the dollar-denominated international bond markets while other (smaller) firms need are restricted to domestic financing.

Fifth, this equation shows negative autocorrelation. This implies that there is a short-term real overshooting to policy shifts. The trend effects are around half the instantaneous impact. This is a feature of having first differences of output as the dependent variable. Indeed, annual rates of change tend to exhibit positive serial correlation, which tends to obscure the short-term dynamics.

As mentioned above, this model does not focus on money demand as an important transmission channel. Thus, instead of having a LM block, the model includes a relation between short and long-term real rates, determined by a variant of the rational expectations hypothesis, as in Herrera and Magendzo (1997). The exclusion of the LM curve is not a substantial deviation from traditional Keynesian modeling.[3]

[3]Romer (2000) shows how one can have a model without the LM, but with a policy rule. This is precisely the kind of framework that we follow.

This relationship implies that current long rates provide information about the future path of short rates. However there is widespread evidence of the failure of the yield-curve hypothesis in its simple form. This failure is reflected by the existence of a risk premium (or maturity premium) that affects the slope of the yield curve, that can also be autocorrelated.[4] This autocorrelation is probably due to the lack of liquidity in Chile's financial markets.

In practice, the model assumes an exogenously given maturity premium, relating short and long rates in equilibrium: $\overline{R} = \overline{r} + \xi$. The dynamics of long rates are given by the following equation, with parameters obtained through instrumental variables estimation

$$R = \overline{R} + \underset{(6.501)}{0.446}(R_{-1} - \overline{R}) + \underset{(7.374)}{0.498}(R_{+1} - \overline{R}) + \underset{(2.667)}{0.053}(r - \overline{r}) \tag{2}$$

Hence leads and lags of the long rate, as well as the monetary policy stance, determine long rates. Solving this equation forward, and assuming that $R(-1) = R$, it is easy to show that the current deviations of the long rate from its steady-state value reflects the discounted sum of future expected deviations of the policy stance from its neutral position. In the short run the interest rate dynamics display some degree of inertia.

Over the long run, exchange rates display substantial deviations from purchasing-power parity. Moreover, in the short run, uncovered interest parity fails miserably at tracking the dynamics of monetary policy and exchange rates. Although this poses a challenge for exchange-rate modeling, one has to take account of the existing theoretical knowledge. We take a pragmatic approach, allowing convergence of the real exchange rate to its long-run equilibrium, but with some overshooting dynamics combined with some degree of inertia.

$$e = 0.6\,(E[e_{+1}] + r^* - r) + 0.3(e_{-1} + r_{-1} - r^*_{-1}) + 0.1\overline{e} \tag{3}$$

Again, by solving this equation forward and assuming $e = e(-1)$ one can show that the current deviation of the real exchange rate from its fundamental or long-run value is equal to the discounted sum of expected real interest rate differentials. In the short run, however, there is a degree of inertia that affect the dynamic adjustment.

In the model core-CPI inflation π^χ is determined through an accelerationist Phillips curve, which implies:

[4] For evidence on this fact for the Chilean economy, see Fernández (2000)

$$\pi^{\chi} = \underset{(2.455)}{0.690}\pi^{\chi}_{-1} + \underset{(1.622)}{0.200}\pi^{\chi}_{+1} + \underset{(1.896)}{0.110}\Delta\epsilon + \underset{(2.204)}{0.046}(y_{-1} - \overline{y}) + \underset{(2.445)}{0.480}(\pi_{-1} - \pi^{\chi}_{-1}) \tag{4}$$

Hence core inflation is related to its own lags and leads, and imported inflation given by the sum of nominal exchange rate devaluation and foreign (dollar) inflation. The equation is homogenous of degree one in these determinants, reflecting long-term neutrality.

Three other aspects influence core CPI inflation. One is the output gap. This is obviously a reduced form, while a more general framework would include wage setting and unemployment as determinants. A positive output gap tends to accelerate inflation, and the coefficient might very well depend on the level of inflation itself. Hence the slope of the Phillips curve changes with disinflation. The coefficient shown on the equation is consistent with the current level of inflation in Chile.

Other considerations might be relevant regarding the effect of the output gap on inflation. For example, the existence of speed limits implies a convex Phillips curve. That is, over a certain output-gap threshold inflation shoots up much faster. Conversely, it is hard to deflate below a certain negative output gap.

The second feature is the gap between headline and core inflation. Direct indexation of core inflation is already taken care of with the inclusion of a lag. However, in Chile indexation to headline inflation is widespread, including wages and housing rents. Thus non-core CPI shocks are likely to feedback into core inflation through this indexation process.

The model takes an ad-hoc approach to markups, assuming that they are a constant fraction of total costs.

Non-core CPI includes products such as fuels, regulated services and perishables, which follow simple price setting rules. For example, for the case of fuels these take the form of the law of one price for long run prices $\overline{p}^f$.

$$\overline{p}^f - \overline{p}^f_{-1} = (\epsilon - \epsilon_{-1}) + \left(p^{oil} - p^{oil}_{-1}\right) \tag{5}$$

The short term dynamics on the other hand are calibrated through an error correction model, based on exploratory regressions. This takes the form

$$p^f - p^f_{-1} = 0.41(p^{oil} - p^{oil}_{-1}) + 0.70(p^f_{-1} - p^f_{-2}) - 0.11(p^f_{-2} - p^f_{-3}) - 0.11(p^f_{-1} - \overline{p}^f_{-1}) \tag{6}$$

A similar approach is used with regulated services and utilities, depending on fuel prices as well as the exchange rate. For perishables, we assume a constant growth rate of 3%, that allows for transitory deviations along the lines of an error correction mechanism like the one described above for the case of fuels.

To close the model, we specify the conduct of the Central Bank in terms of a generic policy rule:

$$r - \overline{r} = \theta \left[(\gamma/\tau) \sum_{i=0}^{\tau} (\lambda \pi_{4,+i} + (1-\lambda)\pi^{\chi}_{4,+i} - \overline{\pi}_4) + (1-\gamma)(y - \overline{y}) \right] + \eta(r^* - \overline{r}^*) + \rho(r_{-1} - \overline{r}) \quad (7)$$

This rule is general enough in that it allows a wide choice of parameters that determine MP reactions. For example, it accomodates different degrees of *anti-inflationary zeal*, captured by the parameter $0 < \gamma < 1$, and *activism*, given by $\theta > 0$. The latter indicates the size of the interest rate reaction to weighted deviations of output and inflation from their targets, while the former represents the relative weight of inflation on the MP rule. This does not necessarily imply that output *per-se* is an argument in the Central Bank's implicit loss function. However, it is consistent with the case in which the Central Bank either targets full employment $\overline{y}$ or cares about the volatility of output around this long term trend. A very different set of issues - out of the scope of this work - arise if the Central Bank targets a level of output inconsistent with full employment.

This rule also encompasses different horizons τ for the evaluation of whether inflation is on target or not. Moreover, even though the inflation target itself is defined in terms of headline inflation, this rule allows for a weighted average (given by $0 < \lambda < 1$) of core and headline inflation to determine the reaction of MP. Monetary policy is also allowed to respond to international interest rates, thus possibly smoothing their inflationary or deflationary impact.

Note that two forces are at play in a framework of floating exchange rates. On the one hand, movements in international interest rates tend to affect the exchange rate in the short run but also possibly in the long run. On the other hand, there is a strong effect from international interest rates to domestic activity, that operates in the opposite direction in terms of inflationary consequences. Therefore, it is not easy to pinpoint beforehand the sign of η.

Finally, the *persistence* of the policy stance is measured by $0 < \rho < 1$: in the case of $\rho = 0$, deviations of the policy interest rate from a neutral stance are of a completely transient nature, while if $\rho = 1$ changes in the policy stance are fully persistent and MP does not revert to its neutral stance.

2.2 Five families of policy rules

The database and model are calibrated to yield a steady state trajectory for all the variables. This steady state is defined broadly to conform with the current macroeconomic situation in Chile.

Moreover, we define five families of policy rules, depending on whether monetary policy targets core or headline inflation, whether it focuses on contemporaneous or forecast deviations from target, and whether it shadows international interest rates. In terms of the notation of the model above, these cases are as follows:

- *Case CH - Contemporaneous headline targeting:*

$$r - \overline{r} = \theta \left[\gamma(\pi_4 - \overline{\pi}_4) + (1-\gamma)(y - \overline{y})\right] + \rho(r_{-1} - \overline{r})$$

- *Case CC - Contemporaneous core targeting:*

$$r - \overline{r} = \theta \left[\gamma(\pi_4^{\chi} - \overline{\pi}_4) + (1-\gamma)(y - \overline{y})\right] + \rho(r_{-1} - \overline{r})$$

- *Case FH - Forecast headline targeting:*

$$r - \overline{r} = \theta \left[(\gamma/\tau)\sum_{i=0}^{\tau}(\pi_{4,+i} - \overline{\pi}_4) + (1-\gamma)(y - \overline{y})\right] + \rho(r_{-1} - \overline{r})$$

- *Case FH^+ - Forecast headline targeting with positive shadowing of international interest rates:*

$$r - \overline{r} = \theta \left[(\gamma/\tau)\sum_{i=0}^{\tau}(\pi_{4,+i} - \overline{\pi}_4) + (1-\gamma)(y - \overline{y})\right] + \rho(r_{-1} - \overline{r}) + \eta(r^* - \overline{r}^*)$$

- *Case FH^- - Forecast headline targeting with negative shadowing of international interest rates:*

$$r - \overline{r} = \theta \left[(\gamma/\tau) \sum_{i=0}^{\tau} (\pi_{4,+i} - \overline{\pi}_4) + (1-\gamma)(y - \overline{y}) \right] + \rho(r_{-1} - \overline{r}) - \eta(r^* - \overline{r}^*)$$

We think it is useful to split this way the parameter space that spans all the MP rules, because it allows to separate the problem into smaller bits. This way it is possible to ask which of these five families leads to a more efficient MP, *independently* of the degree of persistence, activism or inflationary-zeal that the policy maker might choose. This is the focus of Section 4. However, before moving further, it is useful to examine how specific examples of these MP rules illustrate most of the more generic results found in that section. Also, it is interesting to highlight the dynamic response of the economy to different kinds of shocks under specific examples of the policy rule above. This is the point of next Section.

3 Efficiency of some specific MP rules

In this section we focus on specific tradeoffs between output and inflation volatility. We proceed by fixing two out of the three parameters (θ, γ, ρ), and varying the third one. These tradeoffs can then be compared across families of MP rules. Most of the results of the paper are apparent from this simple exercise.

We derive four main results. These are the following:

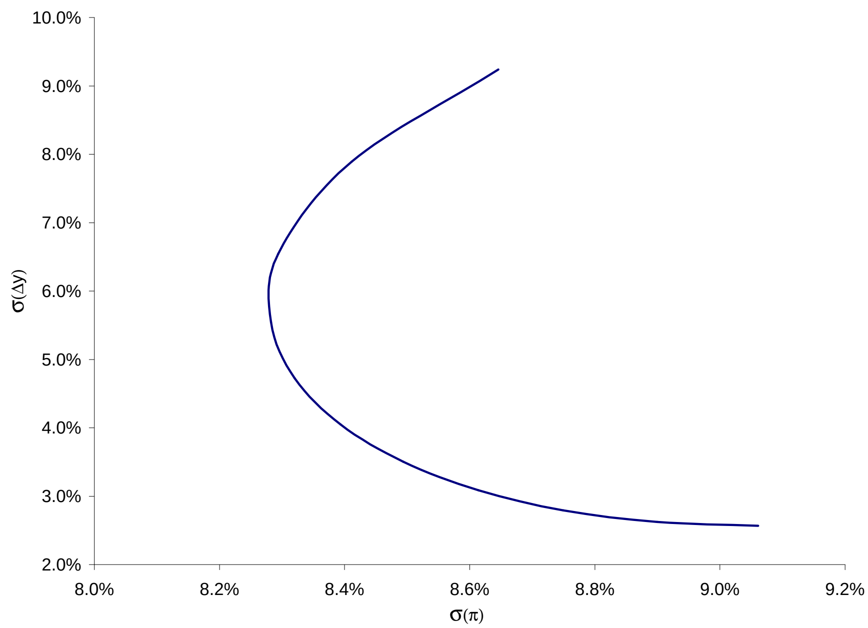
- ***Biasing MP responses towards output stabilization is efficient.***

A consistent result of the different exercises is that to achieve an efficient trade-off between inflation and output volatility quite a large weight must be put on output stabilization. In terms of our policy rule, there is a threshold value for γ, the anti-inflationary zeal of monetary policy, over which both output and inflation volatility increase. The reason for this is straightforward, and has been widely highlighted in the literature on Taylor rules: given the importance of the output gap on accelerating inflation, stabilizing output is a direct way to stabilize inflation. Graphically, Figure 1 shows a typical backward-bending CH tradeoff, corresponding to $\rho = 0.4$ and $\theta = 40$.

Thus, the first feature of this particular MP rule is that at at some point, increasing the weight on inflation *increases* both output and inflation volatility. For this case, the threshold value of γ is between 0,4 and 0,5.

A second feature of this MP rule is that the cost, in terms of output volatility, of putting some weight on inflation seems rather small, while the gain in reduced inflation volatility is large. This comes probably from the reduced volatility of the nominal exchange rate if some weight is put on inflation.

Figure 1: **CH tradeoff** [$\theta = 40$, $\rho = 0.4$]

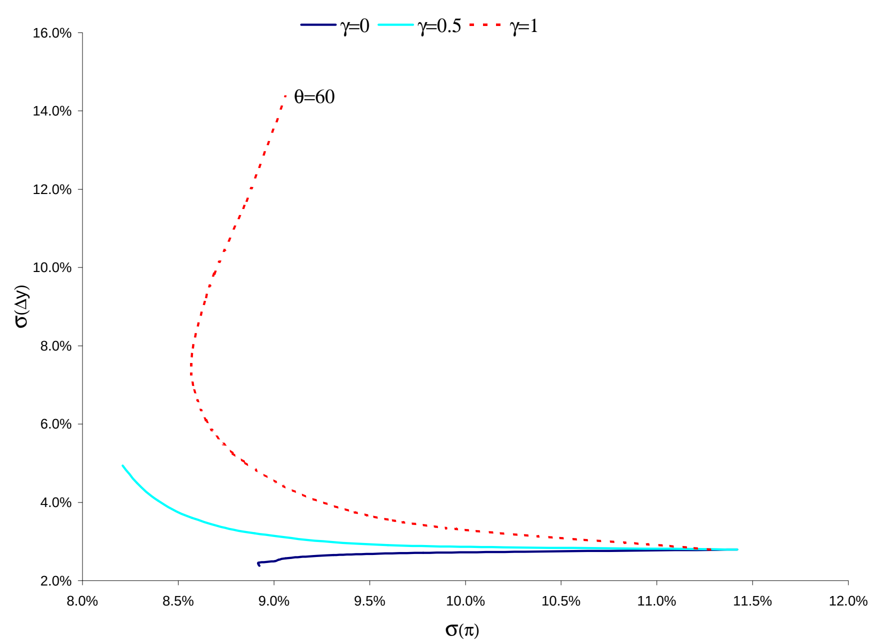


Another way of looking at the efficiency of a biased weight on output stabilization comes from checking other tradeoffs that are of interest. Most notably, MP can be more or less aggressive, which in our context is captured by the size of θ. A large θ implies that MP reacts strongly to the weighted deviations of output and inflation. Figure 2 shows the output-inflation trade-offs of varying activism, for three different values of γ.

The first striking result is that even if $\gamma = 0$, that is all weight is put out output stabilization, there is a lower threshold that output and inflation volatility cannot breach. Thus, no matter how aggressive monetary policy is, if it only reacts to output eventually there is little gain in reduced inflation *and* output volatility. More can be achieved is some weight is put on inflation. The tradeoff for $\gamma = 0.5$ is shown on the graph, and it is apparent that inflation volatility can be reduced by a more aggressive MP, at a cost in terms of output volatility though.

The case that highlights the efficiency of some weight on output stabilization is shown by the tradeoff when $\gamma = 1$. First, this MP rule is fully dominated by a more "soft" approach on inflation: less inflation and output volatility can be achieved if a positive weight is put on output stabilization. Secondly, increased activism runs into the backward-bending part of the tradeoff sooner. Thus, no only this hawkish MP is dominated, but it also restricts the degree of activism that MP might pursue.

Figure 2: **CH policy rules**



- ***It is not efficient to target core inflation.***

The recent adoption of a formal IT scheme has not been without some degree of confusion regarding the specifics of the target. In particular, even though the objective of price stability is defined in terms of headline inflation, there has been an explicit focus on the evolution of core inflation. This has led some observers to think that the target was defined in terms of *core* inflation.

This is not a far-fetched deduction: many IT central banks explicitly define their target in terms of core inflation. [5] The rationale for such a decision lies in the convenience not to over-react to price shocks that a-priory have no bearing on the permanent path of inflationary. Moreover, it can even be argued that because of their contractionary effect, large supply shocks might even require a more flexible monetary stance.

Of course. the key element in this respect is the likelihood that price shocks that are unrelated to the underlying supply and demand conditions in the economy might feed back into inflation expectations and wage and price indexation. Because of a long history of high and variable inflation, automatic indexation clauses are widespread in the Chilean economy. Moreover, casual evidence shows the prevalence of backward-looking price setting behaviour both from firms and workers.

Thus it is possible to argue that targeting core inflation, at least in the case of Chile, is a dangerous proposition in terms of efficiency. Our results confirm this finding. Indeed, for the parametrization $\theta = 40$ and $\rho = 0.4$, Figure 3 show that *CH* dominates *CC*. Thus, to stabilize output and inflation, the focus on headline targeting is correct.

As expected, the differences between *CC* and *CH* are small when the weight on the output gap is large.

- ***It is efficient to target the forecast of headline inflation.***

However, it is still the case that non-core inflation shocks not necessarily imply an acceleration in core inflation. The new IT scheme in place at the Central Bank of Chile recognises this fact, by setting the monetary policy stance such that forecasted inflation is within the 2% to 4% range. As Figure 3 shows, *FH* dominates *CH*.

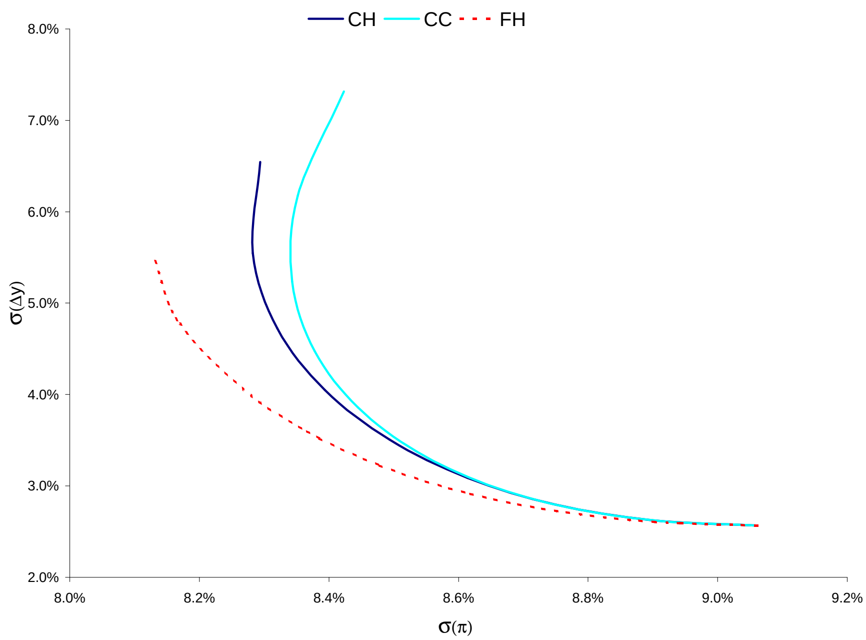
There are a number of interesting issues that we do not tackle on this research, such as the appropriate time horizon for the forecast. [6] We took a conservative approach, only using five quarters ahead. Due to the fact that the typical lag between the MP decisions and inflation is around four quarters, this does not seem like an extreme assumption.

However, it is possible also to include forecasted deviations of output from trend in the MP rule. This probably enhances the efficiency of policy, given the three quarter lag with which MP affects output.

[5] referencia al respecto?

[6] For example, see Haldane and Cunningham, 1999

Figure 3: **CC and FH policy rules** [$\theta = 40$, $\rho = 0.4$]



Some researchers have stressed a downside risk in using forecast inflation in setting policy rules, mainly arguing that inflation indeterminacy can result from this type of policy (e.g. Wieland 2000) This is indeed the case if the argument in the policy rule is, for example, annual inflation two years from now. We have explicitly avoided this problem by using as the argument average annual inflation over the whole of the forecast horizon. Therefore, the price level is safely anchored in known information, avoiding such indeterminacy.

Again, as expected, the differences between CC and CH are small when the weight on the output gap is large.

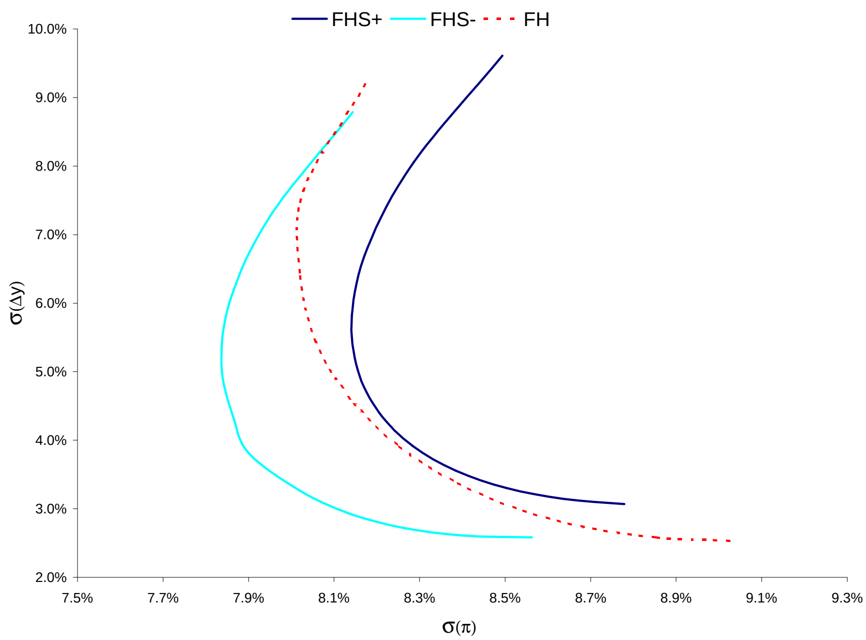
- ***Lowering interest rates when the international interest rate increase can be an efficient response.***

Under fixed exchange rates, domestic interest rates must shadow the developments in international interest rates. This can be an automatic reaction, in the case of a currency board, or more of a policy option in the case of a less firm peg. The implied loss of an autonomous MP is one of the arguments advanced for the convenience of a flexible arrangement. Currently the Chilean peso floats freely, and in terms of the model the exchange rate is determined by a simple variant of uncovered interest parity. The relevant policy question is: Should MP track changes in the international interest rate or should it lean against them? What should be the role of the exchange rate in the monetary policy rule?

A simple way of tackling these issues is how the output-inflation variance tradeoff changes when MP is allowed to respond to deviations of the international interest rate to its long run level. We compare these tradeoffs for particular cases of the families of MP rules FH^+, FH^- and FH. The resulting curves are shown in Figure 3.

In this particular case, leaning against the wind appears to be the efficient MP response to international interest rates. This result stems from the particular assumptions in the model used for the simulations. Indeed, the inflationary effect of international interest rate shocks works through two channels. The direct channel through exchange rates is small, given that the equilibrium real exchange rate is independent of international interest rates. On the other hand, the indirect channel through the effect on the output gap is large. Indeed, international real interest rates have a larger effect on growth than domestic real interest rates.

Figure 4: **FH policy rules with shadowing** $[\theta = 50,\ \rho = 0.4]$



Therefore, on balance the impact of an increase in international interest rates is *deflationary*. The efficient response thus involves a reduction in domestic interest rates, which is captured by the FH^- policy rule.

This result comes from the particular set of assumptions that feed the model. In this respect, the key assumption is the zero correlation between the equilibrium real exchange rate and international interest rates. Relaxing this assumption, for example by endogenizing the accumulation of net foreign assets, would imply that international interest rates have income and wealth effects, implying as well movements in equilibrium real exchange rates. In this alternative environment, the direct inflationary impact of international interest rates is magnified.

More generally, because the model we consider assumes perfect credibility — it includes rational expectations and a known MP rule — it cannot address issues such as lack of confidence. This can be a key issue in emerging economies such as Chile, which have weak links to international financial markets. This can be exacerbated even more if MP follows some type of exchange rate targeting.

In that case, the credibility of the exchange rate commitment becomes the cornerstone of MP. The framework used on this paper for analyzing MP issues is of little value in such a setting.

4 The efficiency of the different families of MP rules [To be written]

In this section we describe the main findings that result from extensive stochastic simulations of the macroeconomic model described above, for a wider set of parameters than the ones used in the simulations in the last section.[7] This approach allows to answer more general questions about the efficiency of specific rules. Indeed, it could be argued that the results above are sensitive to the choice of persistence, activism, and inflationary bias in each simulation. As will be apparent below, this is not the case.

[7] In total, we conducted 2325 stochastic simulations, which on average took about 20 minutes running on WinSolve 3.40 on a Pentium III/350 Mhz PC. This adds up to more than a month of computer time.

5 Conclusions and directions for future research [To be written]

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