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PARTIAL DOLLARIZATION: A CURRENCY-MATCHING RULE AND ITS IMPLICATIONS FOR MONETARY POLICY AND WELFARE•

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Abstract:

This paper contributes to previous studies of partially-dollarized economy inflation targeting by incorporating the effect of a currency-matching rule. Specifically, such a rule implies imposing a restriction to credit dollarization in order to guarantee that any form of foreign-currency-denominated debt (or bank credit) is solely allocated to the export business sector of the eco nomy. The results are straightforward. When the economy is not financially exposed to real exchange rate risk: (i) the volatility of the major macroeconomic variables is reduced, reflecting gains in terms of welfare, and (ii) the optimal policy reaction function becomes less responsive to changes in the risk premium and the foreign interest rate, and more reactive to movements in the output gap and expected inflation. The consequences from (i) and (ii) suggest that the advice that calls for liability de-dollarization in small open economies, should solely apply to the non-export business sector.

Key words: Financial (partial) dollarization; currency-matching rule; fear of floating; "original sin".

Economic turbulence and incoherence are associated with both deep depressions and severe inflations: they lead to serious systemic deviations of output from potential output. Whereas the orthodox theory finds that decentralized market processes lead to optimums, the financial instability hypothesis holds that the outcomes of capitalist market processes are often seriously flawed. However, the full effect of these flaws, such as deep and long depressions, can be contained by apt economic policies". H. Minsky (1994, p.4)

1. INTRODUCTION

Most emerging market economies which still issue a local currency exhibit high levels of partial dollarization[1]. This phenomenon, which in most cases was

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[1] Partial or Financial Dollarization refers to a dollarization process related to asset substitution and not currency substitution. Therefore, as Broda and Levy (2001) indicate, it is associated to the savings component of broad money.

originated during the hyperinflationary experiences of past decades, still persists today. In this sense, the most relevant literature has associated such a persistence (the so-called hysteresis[2]) to: (i) the existence of an "original sin"[3], and (ii) the permanence of high volatility in both inflation and local interest rates.

Agents belonging to open emerging market economies usually dollarize a proportion of their financial assets through either continuous capital outflows (which will be referred to hereafter as *off-shore dollarization*) or also (when legally permitted) through domestic deposit and credit dollarization (which will be referred to hereafter as *partial domestic dollarization*). In any case, the dollarization of a proportion of the domestic economy's assets either internally or off-shore is a reality which reflects the inability of most local currencies to act as a store of value.

In the case of domestic dollarization, and specifically, when credit dollarization or other form of foreign-currency-denominated debt is available for domestic corporate firms, a delicate issue arises concerning the implementation of monetary policy. As highlighted by Krugman (1999 and 2000) and Aghion, Bachetta and Banerjee (2000), when domestic firms hold a large proportion of their liabilities in foreign currency, the practice of monetary policy becomes very problematic.

The reason is that while a reduction in local interest rates might generate an expansionary effect through the so-called "credit channel", the resulting real exchange rate depreciation from such an interest rate cut, might have a perverse (contractive) consequence attributed to a firms' "balance sheet effect".

In this sense, the monetary authority in a partially-dollarized economy faces a complexity when taking policy decisions in response to shocks[4]. That is, depending on the size of the shock, the need to cut down interest rates in order to stabilize output is mitigated by the adverse effect that such an interest rate cut might

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[2] See Honohan and Shi (2002) for an explanation to the existence of hysteresis or a "ratchet effect".

[3] In the terms of Eichengreen and Hausmann (1999), most currencies from emerging-market economies have an "original sin". This implies that they cannot be used either to borrow abroad or to borrow long-term even in the local market.

[4] See, for instance, Aghion, Bachetta and Banerjee (2000) who discuss the optimal monetary response to a productivity shock. See also, Calvo and Reinhart (2000) who discuss the different responses to foreign demand shocks under "fear of floating".

have upon the real exchange rate and therefore upon firms' balance sheets. Calvo and Reinhart (2000) have labelled this phenomenon the "Fear of Floating".

The partial dollarization condition is therefore crucial to the analysis. This is due to the fact that under the absence of partial dollarization or when dollarization is full, there cannot be a balance sheet effect[5]. This is because when both the asset side and the liability side of a firm's balance sheet are denominated in the same currency, there is no exposure to currency mismatches, and therefore to exchange rate risk.

The above mentioned fact is the reason for the great debate among those who propose full dollarization and those who propose complete de-dollarization. On the one hand, those who propose full dollarization tend to stress the benefits of dollarization in terms of: lower inflation, greater credibility, lower interest rates, lower transaction costs in trade and investment, and the full elimination of exchange rate risk. On the other hand, those who oppose full dollarization, and instead propose complete de-dollarization underline: the loss of an independent monetary policy under full dollarization, the loss of seigniorage and inflation tax, the more costly adjustment to asymmetric shocks, and the lack of a lender of last resort[6].

Recently, however, an intermediate (or middle) position in the debate has arisen with the intention to preserve most of the benefits from both proposals. Specifically, such an intermediate position recognizes the need to retain an independent monetary policy[7], and as well, the need to develop a financial market in local currency. However, the same position also acknowledges the importance of retaining the benefits of partial dollarization in terms of greater financial deepening and access to international credit. In the end, it is clear that any inconvenience related to partial dollarization might arise only from the liability side (due to

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[5] However, Chang and Velasco (2000) and Roubini (2001) warn that under full dollarization it is still possible to observe balance sheet effects. I will return to this specific point later on.

[6] This will be discussed further.

[7] An independent monetary policy (e.g. inflation targeting) is feasible given the fact that partial dollarization does not imply the presence of currency substitution for real markets transactions such as the purchase of commodities, payments of wages, etc., and therefore, the monetary authority is still able to conduct an efficient monetary policy in order to stabilize the inflation rate and the output gap.

currency-mismatches), while the benefits might come from both the liability side and the asset side[8].

This paper examines and proposes the introduction of a "currency-matching rule"[9]. In practice, such a rule implies imposing a restriction to credit dollarization in order to guarantee that any form of foreign-currency-denominated debt (mainly bank loans and corporate bonds) is solely allocated to the export business sector of the economy. This should eliminate the firms' balance sheet effect and therefore reduce the *fear of floating*. This is evident from the fact that the balance sheet of export business firms does not usually present currency mismatches, since both, their assets and liabilities are mainly denominated in the same (foreign) currency. When currency mismatches are completely eliminated from the economy[10], the exchange rate risk disappears and real exchange rate depreciations become unambiguously expansionary. Therefore, the practice of monetary policy can be facilitated, while the benefits of partial dollarization are retained.

This paper studies the implications of the introduction of the proposed *currency-matching* rule for monetary policy and welfare. Specifically, the paper compares the resulting optimal monetary policy response and the volatility of the major macroeconomic variables under the presence of the *currency-matching* rule, to the case in which the rule is absent.

The model in this paper is a small open-economy macroeconomic model. It was previously merged by Morón and Winkelried (2002), who combined an endogenous risk premium from Cespedes and others (2000) with Svensson's (2000) original model.

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[8]The benefits from the asset side are mainly related to the fact that domestic deposit dollarization provides a protection against the devaluation risk of the local currency, and therefore an alternative to capital out-flights (off-shore dollarization), which in turn, allows for the deepening of domestic financial markets and the extension of bank loans maturities. The benefits from the liability side are that partial dollarization increases the economy's access to international credit markets, mainly through the global banking system and their ability to create virtual electronic money.

[9] See Goldstein (2002) for an alternative proposal based on hedging instruments and other mechanisms.

[10] This statement assumes that no major currency-mismatch is present either at the public sector level or at the household level.

As in Svensson (2000), the conventional transmission channels for monetary policy are the *aggregate-demand channel* and the *expectations channel*. In the first case, given nominal rigidities, the central bank can affect short-term real interest rates. This, in turn affects the aggregate demand (with a lag), and finally inflation (with an additional lag). Through the *expectations channel*, monetary policy affects expectations about future inflation, which through the practice of price and wage setting finally affects actual inflation (with a lag).

The role of the real exchange rate in the model is crucial. Given the fact that most small-open economies present a high share of imported final goods, variations in the exchange rate have a great impact upon CPI inflation through the so-called *direct exchange rate channel*.

Additionally, as the real exchange rate affects the relative price between domestic goods and foreign goods, and it, therefore affects both the domestic and foreign demand for domestically produced goods, it also has an impact upon the *aggregate-demand channel* in the transmission of monetary policy. Finally, as in the case of final imported goods, exchange rate movements which have an impact upon the domestic price of imported inputs, affect the cost of domestically produced goods.

An additional importance of the exchange rate is that, as an asset price, it responds to a forward-looking behaviour, which makes expectations about this variable a fundamental mechanism for the economy. Moreover, the exchange rate reacts immediately in response to certain external shocks such as to foreign inflation and international interest rates.

The incomplete pass-through from the exchange rate to domestic prices is fundamental[11]. This occurs because unanticipated real exchange rate depreciations affect the endogenous risk premium through two different channels. Firstly, a real exchange rate depreciation increases the competitiveness of domestically produced products. This in turn, reduces the risk premium. On the contrary however; an unanticipated real exchange rate depreciation deteriorates the balance sheet of non-export business firms. This instead, increases investors' risk premium.

[11] If the pass-through from the exchange rate to domestic prices is complete, there would not be a balance sheet effect. This is due to the fact that any exchange rate depreciation would be immediately transferred to domestic prices offsetting the effect of any increase in the domestic-currency value of firms' liabilities.

Therefore, these two antagonistic channels mean that the result from a real exchange rate depreciation is ambiguous for the economy. Only in the case when the balance sheet effect is not present, the effect of a real exchange rate depreciation becomes diaphanously expansionary. It is in this sense, that this paper examines the implications of a *currency-matching* rule for monetary policy and welfare.

The paper is summarized as follows. Section 1.1 briefly discusses the literature review on closed-economy inflation targeting. Section 1.2 covers the appealing debate on full and partial dollarization, currency regimes, and exchange rate risk. Section 1.3 deals with the extension of inflation targeting schemes to the partially-dollarized economy. Section 2.1 introduces and discusses the theoretical model. Section 2.2 presents the endogenously-determined risk premium. Section 2.3 introduces the loss function. Section 3.1 presents the parameters of the model. Section 3.2 presents the results, and Section 4 concludes and considers areas for further research.

1.1 On Closed-Economy Inflation Targeting

After a long period of predominance of monetarism and exclusive attention to the study of the implications of real factors for the business cycle, a new torrent of literature and empirical work has successfully initiated research on the effect of monetary determinants upon the real economy. Moreover, the recent literature which has been mainly originated in the late 1980's, presents evidence in favour of the short-run non-neutrality condition of money.

A critical issue which has determined the deviation from the orthodox business cycle theory is the explicit introduction of nominal rigidities in the formation of prices (see, for instance, Calvo (1983) for a simplified staggered price-setting behaviour). Therefore, the study of the realistic conditions under which prices and wages are set, becomes fundamental. Under sticky prices, monetary policy can affect the course of the real economy in the short-run. However, in the long-run when prices are completely flexible (adjustable) the effect of monetary policy is observed in the nominal variables, such as wages and prices.

It is this debate regarding price and wage-setting behaviour, and the progress gained in the study of dynamic general equilibrium models which lead to a surge in the attention to topics on monetary policy.

Among the major recent working papers on closed-economy monetary policy, John Taylor's proposal of a simple interest rate rule in Taylor (1993), and the support from Bernanke and Mishkin (1997) for inflation targeting represent wellknown examples. Additionally, the paper from Clarida, Galí, and Gertler (1999) constitutes a remarkable summary of the relevant literature on positive and normative aspects related to the practice and art of monetary policy.

Specifically, Clarida, Galí, and Gertler (1999) present a closed-economy macroeconomic model, in which a short-term interest rate becomes the instrument of monetary policy[12]. The policy reaction function of the central bank is derived from the minimization of a quadratic (welfare) loss function. The monetary policy problem in such a model is to describe the way the instrument adjusts to the conditions of the economy. In this sense, the presence of nominal rigidities becomes fundamental given the influence that monetary policy has upon the short-term real interest rate. Therefore, as in Fischer (1977) and Taylor (1980), Clarida, Galí, and Gertler (1999) also present a Phillips curve which is derived from staggered nominal price setting.

Additionally, in their model (and precisely in the aggregate demand equation), current output gap depends not only on the real interest rate but also on expected future output. Given consumers' preferences for smoothing consumption, an increase in expected future consumption (associated to higher expected permanent income) causes an increase in current consumption. This in turn, precipitates an increase in current demanded output. Furthermore, in the aggregate demand, the negative impact of movements in the short-term real interest rate, captures the effect of the intertemporal substitution of consumption. Equivalently, the disturbance in the same equation reflects expected changes in the government's expenditure plans.

In the case of the supply (Phillips) curve, inflation depends completely on current and expected future conditions. Therefore, no inflationary inertia is present. Changes in marginal costs are fundamentally related to changes in excess demand. However, a "cost-push" shock is added to capture any other variation in marginal costs not associated with excess demand.

A relevant complexity is therefore introduced when private sector's behaviour, depends not only on the current evolution, but as well on the expected future path of monetary policy. Particularly, in their model, the output gap depends on the current and future course of the interest rate, and therefore, inflation depends on the current and expected future path of the output gap. As initially stated

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[12] As Clarida, Galí, and Gertler (1999) indicate, the selection of a short-term interest rate, as the instrument of monetary policy, responds to the fact that the experience of using broad money aggregates, suggests that those indirect indicators are too instable.

by Kydland and Prescott (1977); under the above mentioned conditions, credibility of future policy objectives represents a fundamental aspect in the analysis.

In this situation, agent's beliefs about the future level of the interest rate, becomes relevant since both households and firms show a forward looking behaviour. For example, when a central bank is credible, a commitment to a low-inflation policy in the future, may allow the central bank to reduce current inflation with a lower cost in terms of output contraction than might otherwise be necessary in the absence of commitment. This occurs because such a commitment allows the central bank to credibly influence private sector's beliefs about the future course of monetary policy and therefore of the state of the economy.

However, under discretion, which represents the case when the central bank is not trusted and therefore, cannot credibly commit itself to a fix monetary policy rule, the implications are fundamentally different. Specifically, under the absence of commitment and therefore of a fix monetary policy rule, the optimal policy involves inflation targeting. This occurs since under the absence of commitment, the resulting adjustment to the optimal inflation rate is gradual. Such a gradual adjustment is due to the worse short-run output/inflation trade-off observed under the case of discretion. The implications for the optimal monetary policy rule, is that the central bank should modify the nominal rate more than one-for-one, in relation to changes in expected future inflation. That is, when expected inflation increases, the central bank should increase nominal rates sufficiently to generate an increase in the real interest rate.

An additional implication of the case under discretion is that the central bank is able to choose the interest rate by reoptimizing every period. This occurs since under the absence of commitment, central bank's previous measures and announcements do not constrain current or future policy. In contrast, under a commitment to a specific monetary policy rule, the central bank chooses and (abides by) an unvarying strategy describing the future path for interest rates. Even though interest rates might respond in reaction to changes in the state of the economy, both the sign and intensity of the reaction do not vary over time.

Another major difference between the case of commitment and the case of discretion is that, in the former case, the central bank's binding promise is what makes the policy credible in equilibrium. In contrast, in the case of discretion, given the fact that the central bank is free to reoptimize every period, agents form their expectations by taking into consideration the way the central bank modifies its policy. An interesting issue which arises from this case is that the resulting long-run rational expectations equilibrium guarantees that the central bank has no incentive to change its strategy in an unexpected way, even though it has the option to do so. The literature has labelled this particular characteristic of the equilibrium under discretion as "Dynamic (or Time) Consistent Equilibrium".

The consequence of the rational expectations equilibrium under discretion is that the central bank takes private sector's expectations as given, which is the equivalent of saying that agents are able to anticipate central bank's movements and therefore cannot be (continuously) fooled.

The findings from Clarida, Galí, and Gertler (1999) also show that as long as a "cost push" inflation disturbance exists, there is a short-run trade-off between inflation and output volatility[13]. As mentioned before, they also illustrate that under discretion, the resulting optimal policy (inflation targeting) requires a gradual convergence of inflation to its target. This involves a sufficiently active response to changes in expected inflation, in order to affect real interest rates to push inflation back to its path. However, when a "cost push" inflation disturbance is not present or when the monetary authority is extremely "conservative" and therefore has no concern for output volatility, then the optimal policy is "extreme" inflation targeting implying not a gradual but immediate convergence of inflation to its target.

Another major result is that while the monetary policy should offset demand shocks, it should only accommodate productivity shocks by maintaining interest rates constant. The rationale is simple, by offsetting demand shocks, output and inflation return to their correct path. However, in the case of a positive productivity shock, an increase in productivity generates an increment in permanent income, which in turn, affects consumption in a way that both, potential and demanded output increase, while leaving the output gap and inflation rate intact.

Regarding the issue of credibility and the benefits from commitment, the initial work of Kydland and Prescott (1977), and the subsequent works from Barro and Gordon (1983), and Rogoff (1985) represent the most prominent research. Regarding the discussion on credibility, two major issues are emphasized. Firstly, when a central bank has a concern for output volatility, and specifically, when it has the desire to increase output above its natural level, then it is said that a persistent inflationary bias is present in the monetary policy. Secondly, when a central bank is not publicly perceived as committed to fighting inflation, then the cost of disinflating may be more severe than might otherwise be. In both cases, the link to the credibility problem is that as long as wage and price-setting beha-

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[13] See Woodford (1998) for a case in which the inflation/output trade-off arises due to the addition of an interest rate (smoothing) target into the conventional central bank's loss function.

viour is forward-looking, inflation depends on the expected future course of the monetary policy.

In this sense, both issues share a common consequence. That is, if a central bank is able to enhance its credibility by establishing a commitment, then it will be able to reduce inflation at a lower cost in terms of output contraction. This occurs because under commitment, the central bank exploits the ability to manipulate (guide) private sector's expectations of the future.

The findings from Clarida, Galí, and Gertler (1999) also reveal that when the central bank desires to push output above its natural level, the resulting equilibrium is suboptimal, given that the economy shows an inflation rate above its target without any gain in terms of output. This result arises because the private sector incorporates central bank's true aspirations, in order to perfectly forecast future inflation. As originally indicated by Rogoff (1985), they also find that designating a "conservative" central banker with a greater distaste for inflation than the rest of the society, reduces the effect of the inefficient inflationary bias, observed under discretion. However, they also argue that this is not a magic solution, because designating an ultraconservative central banker might also reduce overall welfare, given the (previously mentioned) inflation/output trade-off.

Probably, one of the major illuminating ideas from Clarida, Galí, and Gertler (1999) is their explanation regarding the gains from enhancing credibility. Indeed, they show that even under the absence of an inflationary bias, as long as price-setting behaviour depends on expectations of the future state of the economy, then the gains from commitment arise because the short-run trade-off between inflation and output is improved. They also demonstrate that in such a case, the optimal result from commitment is similar to the solution under discretion, when the central bank assigns a greater cost to inflation than the society as a whole.

Another difference between the case of commitment and the case of discretion is the resulting response function of the interest rate. The response in the case of constrained commitment[14] is even more reactive to changes in expected inflation. That is, under commitment, inflation converges more rapidly to its target. The reason is that given the improved output/inflation trade-off, the central bank can afford to increase interest rates by a larger amount, in response to an increment in expected inflation.

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[14] In terms of Clarida, Galí, and Gertler (1999), the constrained commitment represents the case in which the choice of the (optimal) level of output gap is restricted to depend on the contemporaneous value of the cost push shock.

A rather different case is the one under *unconstrained* commitment. It represents the case in which the optimal choice of the level of output gap is not restricted to depend on the contemporaneous value of the cost push shock, but instead it is allowed to depend on its entire history. The difference is that, in principle, in the case of unconstrained commitment, the reaction function requires an adjustment in the *change* of the output gap as opposed to its *level*.

In this sense, it is relevant to say that under unconstrained commitment to a fix monetary policy rule, the intertemporal optimization problem requires, initially choosing (only in the first period) the optimal level of the output gap, in response to changes in inflation, exactly in the same way as it is done under discretion. However, as previously said, for subsequent periods, the policy reaction function will depend on the *change* of the output gap instead of its level.

The implication from above is, that while the optimal response under discretion, is to reduce output gap in reaction to an increase in inflation, and then, allow the output gap in subsequent periods to return back to its trend as inflation falls; the optimal reaction under unconstrained commitment is to keep reducing the output gap (in subsequent periods) as long as inflation persists above its target. As mentioned before, this is due to the ability the central bank has of manipulating agents' expectations, and by doing so, of benefiting from an improved output/inflation trade-off. This in turn, (relative to the case of discretion) accelerates the process of convergence of inflation to its target.

Probably, the most evident conclusion from the case of commitment is that when the monetary authority sticks to a fix policy rule, the resulting monetary policy is not "time consistent". This is because if the monetary authority were free to reoptimize in every subsequent period, evidently, it would opt for the same policy it carried out initially; the one which replicates the rule under discretion for the first period only.

In addition, Clarida, Galí, and Gertler (1999) show that the result from unconstrained commitment requires the central bank to partially adjust aggregate demand, in response to an increase in inflation. Such a result reflects the benefits from the strong dependence of current inflation on expected future demand. Additionally, they show that such a result is superior to any other result under discretion, even when the appointment of a "conservative" central banker is considered.

Additionally, Clarida, Galí, and Gertler (1999) also study the case of imperfect information and parameter uncertainty. The resulting conclusions from the case of imperfect information and parameter uncertainty imply that the optimal policy rules represent the certainty equivalent versions of the case under perfect information, which in practice, requires the use of forecasts for the target variables instead of their ex-post observed values. They also claim that, relative to what the economic theory suggests, the smoother path of the interest rates, observed in practice, might well be explained by the presence of parameter uncertainty.

In addition, they propose that in the case when *small* output gap deviations involve a greater cost than *small* departures of inflation from its target, then the optimal approach to disinflation should be "opportunistic". In practice, it implies that the central bank should follow an inflation targeting policy around a zone instead of targeting inflation around a particular value.

Finally, Clarida, Galí, and Gertler (1999) demonstrate the robustness of their results by analyzing the case with endogenous output and inflation persistence. The findings show that the results under discretion also apply under the presence of endogenous output and inflation inertia. However, one of the major differences is that in the case of endogenous output and inflation persistence, the resulting monetary policy affects not only the gap between inflation and its target, but also the speed (or rate) of convergence of inflation to its target.

1.2 On Full And Partial Dollarization And Exchange Rate Risk

Perhaps the most remarkable debate during the recent years has been the discussion concerning currency regime choices for emerging-market economies. Calvo and Reinhart (2000 and 2001) and Hausmann, Panizza, and Stein (2000) have put forward the argument in favour of full dollarization and against floating. In contrast, Edwards (2001) has accused the defenders of full dollarization of engaging in "misleading advertising".

On the other hand, Hanke (2002) and Ghosh, Gulde, and Wolf (1998) have made the case for currency boards. Williamson (2000) has recommended a "BBC" regime combining a basket peg, a band, and a crawl. In addition, Larrain and Velasco (2001) have emphasized the benefits from managed floating against "hard pegs". Finally, Crokett (1994), Eichengreen (1994), Summers (2000), and Fischer (2001) have all defended the "bipolar"[15] perspective of currency regimes[16].

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[15] The "bipolar" point of view, regarding currency regime choices, asseverates that the only sustainable currency regimes for emerging-market economies heavily affected by private capital markets are either a "float" or a "hard fix". A hard fix is usually associated to either currency boards or agreements in which a country abandons its national currency. Regularly, the abandonment of a national currency involves either becoming a member of a currency union or adopting the currency of another country (which is referred to throughout this paper as full dollarization).

In terms of Goldstein (2002), there are three major findings regarding the discontent with currency regimes. Firstly, "soft pegs" and simple "crawls" have exhibited a very low resistance to crises. In deed, as expressed by Fischer (2001) the majority of the financial crises during the 1990's, have been related to either a fixed peg or crawling band exchange rate regimes[17]. Secondly and particularly brought to light during the recent crisis in Argentina, a "hard fix" (e.g. a currency board) is neither free of speculative attacks, nor does give the impression to count on a practical policy instrument for overcoming recessions when monetary policy is directed from abroad. This occurs since the inflexibility associated to those currency regimes, makes it impossible to counter liquidity crises, external debt fragilities or even worse to avoid a real exchange rate overvaluation.

Finally, as previously shown by Calvo and Reinhart (2000) and Hausmann, Panizza, and Stein (2000); Goldstein (2002) also indicates that independently of the publicly declared currency regime, emerging-market economies have not been able to float in the same way industrial countries have. Additionally, all these authors indicate that in comparison to the industrialized economies, developing countries have been urged to rely more heavily on interest rate policy and on exchange rate market interventions to control the variation of the nominal exchange rate[18]. Moreover, many other authors have also pointed out that emerging-market economies have perceived less benefit from floating than what industrialized countries have.

In this sense, Hausmann, Panizza, and Stein (2000) and Calvo and Reinhart (2001) present empirical evidence suggesting that real exchange rate depreciations in emerging-market economies have usually been contractionary and have been accompanied by relatively substantial downgrades in credit ratings[19]. Therefore, the authors state that the independence of monetary policy in emerging-

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[16] Evidently, there are also other general positions such as in Frankel (1999) and Kenen (2001) who argue that "no single currency regime is right for all countries at all times".

[17] For examples: Mexico in 1994; Indonesia, Thailand and South Korea in 1997; Brazil and Russia in 1998; Argentina, and Turkey in 2000-2001.

[18] In terms of a quadratic (welfare) loss function of the central bank; this is the equivalent of saying, that some central banks from developing countries have been urged to make the exchange rate an additional objective of monetary policy.

[19] The downgrade in credit ratings is fundamental for the analysis of the effect of a real exchange rate depreciation. In the model this is captured by an increase in the endogenously-determined risk premium.

market economies is not evidently any greater in floating rate countries than in fixed rate ones. They also indicate that depreciations in emerging-market economies have been coupled with a greater exchange rate pass-through than in the case of industrialized countries. Additionally, they find that exchange rate variability has a larger negative effect on foreign trade in developing countries, and also that floaters have registered less significant increases in the depth of their financial markets.

Goldstein (2002) wisely indicates that under the above mentioned conditions, emerging-market economies seem to be facing a "no-win situation in their choice of currency regimes". He argues that if they decide in favour of soft pegs, the result is a very high probability of a painful currency collapse. Instead, if they opt for either a hard peg or a *conventional* managed floating regime, even though they might enjoy a lower vulnerability to currency crises, the "fear of floating" combined with a high exposure to private capital market movements, or simply an inconvenient debt profile, may well be sufficient to cause unsatisfactory economic performance.

It is for this reason that the recent controversial discussion regarding currency regime choices for developing countries has been concentrated on the bipolar (corner) solution. As mentioned before, such a corner solution involves two alternatives (see footnote 14). Firstly, on one extreme, it could imply the incorporation of a "hard fix" which (in order of preference) would mean, (i) either joining a currency union, (ii) establishing full dollarization or (iii) adopting a currency board. On the other extreme, the establishment of a *sophisticated* managed float with certain specific characteristics (under partial dollarization) represents the final outstanding corner solution.

On the one hand, joining a currency union is certainly the first best in any case[20]. However in practice, such a solution might not always be feasible, given the fact that it requires either the coincidence of political interests in the institution of a regional central bank, or simply the accomplishment of the membership itself[21]. On the other hand, the recent failure of the currency board in Argentina

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[20] The major reason is that as opposed to the cases of full dollarization or currency boards, under a currency union, the countries which abandon their national currencies do not necessarily lack an independent monetary policy. This occurs because even though the monetary policy is centralized and harmonized from abroad, such a monetary policy responds to the common interests of all members.

[21] Indeed, many steps must be taken before forming a currency union. The most basic one is reaching sufficiently high levels of intraregional trade.

has made such a solution a prohibitive one. For those reasons, the bipolar alternatives leave us with two final options: (i) either adopting full dollarization or (ii) establishing a very *specific* managed floating regime under partial dollarization. In this paper, this last alternative is presented as the optimal *second best* solution, or in other words, as the *first best available* solution[22].

Regarding the case of full dollarization, the developing country has to be willing to give up its own national currency (and therefore its monetary policy) in order to adopt the currency (and monetary policy) from another country. On the one hand, such a solution represents a gain in terms of international trade. This is because even though the evidence shows no reliable connection between short-run exchange rate volatility and the volume of trade for the case of industrial countries[23], in the case of emerging-market economies, the variability of relative prices seems to be fundamental in the explanation of movements in the volume of international trade[24].

Another evident benefit from full dollarization is that due to the absence of an exchange rate, currency mismatches are completely eliminated from the economy. Equivalently, the absence of a local currency (to attack) eliminates the possibility of a currency crisis. However, as Chang and Velasco (2000) and Roubini (2001) argue, the absence of currency mismatches does not necessarily imply that a balance sheet effect would not take place (see footnote 5). This is because under full dollarization, it is still possible to gradually affect nominal domestic prices. Indeed, if a change in relative prices is required, a gradual fall in the nominal prices (rather than a swift nominal exchange rate reaction under a float) increases the real value of the debt service relative to the price of non-tradable goods. This in turn, deteriorates corporate and bank balance sheets. In the view

[22] The reader must bear in mind that the first best solution has said to be the joining of a currency union. However, the reader should also keep in mind that such a solution might not always be feasible. That is why a second best solution or a first best available solution is considered.

[23] See Goldstein (1995) and Frankel (1999) for suitable explanations to this matter. In the case of Goldstein (1995), the author infers that in the case of industrial countries, the absence of a significant connection between exchange rate variability and international trade might be related to the development of hedging instruments and the growth of multinational corporations.

[24] See also McCallum (1995), Engel and Rogers (1996) and Rose (2000) for studies which argue that the presence of a common currency seems to have a larger impact upon the volume of trade than the degree of exchange rate volatility per se.

of Chang and Velasco (2000) and Roubini (2001) the adjustment could take longer under full dollarization, but it will definitely occur.

Another argument in favour of full dollarization is that it might diminish the risk of banking crises. The argument is as follows: in the absence of expectations of future devaluation, there will not be sudden bank runs (or at least those) initiated by the need to convert local-currency denominated deposits into foreign currency. However, as Rojas-Suarez (2000) argues, full dollarization would probably make it more difficult to overcome a banking crisis given the fact that the possibility of reducing the real value of bank liabilities by inflating or depreciating the currency would not exist.

In summary, the most valid arguments in favour of full dollarization seem to be those related to the gains in terms of lower inflation, greater credibility, lower interest rates, lower transaction costs in trade and investment, and the full elimination of exchange rate risk.

Regarding the disadvantages of full dollarization, probably one of the most evident shortcomings is the fact that under full dollarization, the economy lacks an independent monetary policy. This in turn, imposes restrictions in terms of the absorption of fiscal crises (when substantial fiscal deficits and debt burdens are present), or simply in response to general asymmetric shocks.

Fully dollarized economies also suffer from not having an instrument to deal with domestic financial crises since the absence of a national monetary authority makes it impossible to print money, either to act as a lender of last resort or for any other purpose. An additional outstanding disadvantage from full-dollarization is that the government from a fully dollarized economy loses the revenue from seigniorage, that is, the proceeds the central bank enjoys from issuing non-interest-bearing debt in the form of money base.

Regarding the *second best* solution, or *first best available* solution, the establishment of a *specific* managed floating regime[25] under partial dollarization seems to be the most favourable present alternative. The reason why it has to consider and include the presence of partial dollarization is because, as mentioned in the Introduction, most emerging market economies which still issue a domestic currency, exhibit high levels of partial dollarization.

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[25] In order to agree with the label assigned by Goldstein (2002) such a regime could be referred to as “Managed Floating Plus”.

As mentioned before, most currencies from emerging-market economies have an "original sin". In terms of Eichengreen and Hausmann (1999), this implies that "…the domestic currency cannot be used to borrow abroad or to borrow long term, even domestically". In practice, this means that there are only a few currencies worldwide which can play the role of being universal stores of value[26].

Table 1. Percentage of External Debt
Denominated In Local Currency as of December 1999

LoansfromInternationalBanks			*InternationalDebtSecurities*		
Country	*Banks*	*OtheBorrowers*	*Corporate Issuers*	*Financial Institutions*	*Public Sector*
Argentina	5	-	3	1	2
Chile	8	-	-	-	-
China	-	9	-	-	-
Colombia	3	-	-	-	-
CzechRepublic	23	5	-	-	-
HongKong	3	18	14	18	25
Hungary	4	1	-	-	-
India	9	2	-	-	-
Indonesia	-	7	2	-	-
Israel	1	1	-	-	-
Mexico	9	-	-	-	-
Peru	2	-	-	-	-
Poland	14	3	12	-	-
Russia	27	1	-	-	-
SaudiArabia	4	3	-	-	-
SouthAfrica	30	11	37	73	-
SouthKorea	2	8	-	-	-
Thailand	3	7	-	28	1
Venezuela	8	1	-	-	

Cont.

[26] At the time of writing this paper, the currencies considered universal stores of value are: the U.S. dollar, the euro, the yen, and the pound.

Memorandum					
Germany[27]	61	62	64	56	99
Japan	61	29	44	28	16
USA	10	26	44	36	13
UK	81	85	78	83	95

Source: Hawkins and Turner (2000).

Table 1, which is available from Hawkins and Turner (2000)[28], shows that emerging market economies have much smaller percentages of external debt denominated in their own local currency. Moreover, in the specific case of international debt securities, apart from a few evident cases like Hong Kong, and South Africa, the percentage of external debt issued by corporate firms, the public sector or through financial institutions is either zero or very low. It also shows that local currency-denominated external debt is more extensive in the case of international bank loans than in any other case. However, for most of the countries, apart from the case of Czech Republic, Poland, Russia, and South Africa, such percentages do not exceed a single digit.

In this sense, Table 1 presents evidence of the so-called "original sin"[29]. Moreover, in the absence of hedging instruments, which seems to be the case in most emerging market economies, and following Eichengreen and Hausmann (1999), it is inferred that as long as an "original sin" remains present, investments in emerging market economies are inexorably accompanied by either currency mismatches or maturity mismatches.

Thus, regarding again the *first best available* solution in terms of currency regimes, the establishment of a *specific* managed floating regime under partial dollarization should address the problem of currency mismatches. This can be done in terms of Goldstein (2002) by developing hedging instruments in the emerging market economies. However, it is the view of this paper that as developing a market for hedging instruments in the emerging market economies might take some time; imposing a *currency-matching* rule to the private sector in order

[27] As of December 1999, the German mark was still considered a universal store of value at least for the case of the European Union.

[28] For some developing countries, the results might have been overestimated because it is assumed that all loans which have not been denominated in a major foreign currency are denominated in the country's local currency.

[29] See Knight, Schembri, and Powell (2000), Kenen (2001), and Goldstein (2002) for positions which rather conclude that the "original sin" hypothesis can be excessively pessimistic.

to reduce the “fear of floating” can facilitate the introduction of a currency regime, able to retain the benefits from both a partial dollarization under floating, and an independent monetary policy.

Finally, regarding the monetary policy framework, even though it has to be acknowledged that emerging market economies confront greater obstacles in the implementation of inflation targeting than industrialized countries, such a framework seems to have interested most developing countries. Thus, for example Truman (2001) includes in his group of “potential” candidates for inflation targeting: Argentina, China, Ecuador, Hong Kong, Hungary, India, Indonesia, Malaysia, Nigeria, the Philippines, Romania, Singapore, Taiwan, Turkey, and Venezuela. In this sense, the following section deals directly with the discussion regarding the extension of inflation targeting schemes to the partially-dollarized open economy.

1.3 On Partially-Dollarized Economy Inflation Targeting

Certainly, Svensson’s (2000) work represents one of the major contributions to the study of open economy inflation targeting. He describes the monetary regime under inflation targeting as a framework which usually counts on: (i) a clearly defined quantitative inflation target, (ii) an “inflation-forecast-targeting” procedure, and (iii) a high degree of transparency and accountability.

Regarding the inflation target, it usually implies either a range or a specific point target. In the case of a range target, regularly it fluctuates (across countries) from 1.5 to 3.0 percent (per year). In relation to the inflation-forecast-targeting procedure, it is characterized by an inflation forecast estimate which depends upon current available information, a specific interest rate path, the central banks’ structural model and further discretional adjustments derived from extra-model information.

It is the lags in the transmission of monetary policy, the central bank’s incomplete control of inflation and the need to incorporate a forward-looking dimension, which makes it necessary to use of an inflation-forecast-targeting procedure. However, the resulting inflation forecast estimate is used only as an intermediate target variable. Additionally, the interest rate path is designed to be consistent with a predetermined target assigned to the inflation forecast (the so-called intermediate target).

Such an intermediate target can be explicit or implicit; however, in any case, at some particular horizon, it has to coincide with the (announced) quantitative inflation target. Therefore, the designed interest rate path determines the rule for current interest rate setting. Nevertheless, such interest rate rule is not a prescribed (or predetermined) one, but instead, it results from an endogenously determined response function, which makes the interest rate depend on all the relevant information. Indeed, in the case of the open economy, the interest rate also depends on external variables such as international interest rates, foreign output and foreign inflation.

Regarding transparency and accountability, Svensson (2000) indicates that under an inflation targeting framework, central banks frequently issue “Inflation Reports”, which are mainly meant to stimulate, notify and explain to the general public the adopted decisions regarding the course of the monetary policy. In most cases, such reports explain (if necessary) the reasons for the presence of deviations from the originally announced targets, as well as the appropriate future measures to be taken in order to correct such deviations.

As previously outlined in Svensson (1998), Svensson (2000) also suggests that inflation targeting can be seen as the “explicit announcement and assignment of a relatively specific loss function to be minimized by the central bank”. Additionally, he conjectures that the inflation targeting procedure can be seen as a mechanism which guarantees that the first order conditions from the minimization of the (welfare) loss function are approximately accomplished.

Finally, Svensson (2000) also considers the transparency and accountability observed under an inflation targeting framework as a means to let the general public validate the achievement of such first order conditions. Moreover, Faust and Svensson (1997) claim that a greater transparency makes the reputation of the central banks more vulnerable, and therefore increases the cost from modifying the originally announced policy. In that sense, Svensson (2000) believes that inflation targeting relative to any other policy regime, embodies the strongest commitment to an optimizing policy, and therefore it can be perfectly represented as a minimization process of a specific (welfare) loss function.

Svensson (1998 and 2000) introduces a small-open economy macroeconomic model with a forward-looking behaviour. Specifically, the model includes realistic lags and imperfect control of inflation. As in the closed economy, the conventional transmission channels for monetary policy are the *aggregate-demand channel* and the *expectations channel*. However, in the open economy, the exchange rate introduces additional channels, the dynamics of which involve diverse lags.

In the case of the conventional channels, and particularly, in the case of the aggregate demand channel, given nominal rigidities, the central bank can affect short-term real interest rates. This, in turn affects the aggregate demand (with a lag), and finally inflation (with an additional lag). Through the *expectations channel*, monetary policy affects expectations about future inflation, which through the practice of price and wage setting finally affects actual inflation (with a lag).

The connotation of the real exchange rate in the model is vital. Given the fact that most small-open economies present a high share of imported final goods, exchange rate variations have a great impact upon CPI inflation through the so-called immediate *direct exchange rate channel*.

Additionally, as the real exchange rate affects the relative price between domestic goods and foreign goods, and consequently, as that has an effect on both the domestic and foreign demand for domestically produced goods, the exchange rate contributes to the *aggregate-demand channel* in the transmission of monetary policy. Finally, as in the case of final imported goods, exchange rate variations which have an impact upon the domestic price of imported inputs, affect the cost of domestically produced goods.

An additional importance of the exchange rate is that, as an asset price, it responds to a forward-looking behaviour, which makes expectations about this variable a fundamental mechanism for the economy. Moreover, given the flexibility of the exchange rate, it reacts immediately in response to certain external shocks, such as shocks to foreign inflation and international interest rates.

As previously defined in Svensson (1998), Svensson (2000) also differentiates between "strict inflation targeting" and "flexible inflation targeting"[30]. In the first case, the central bank's welfare loss function incorporates inflation stabilization as the unique objective of monetary policy. In the case of flexible inflation targeting, other objectives enter into the loss function. For instance, among others, such objectives might include: a concern for output stabilization or simply for interest rate smoothing. The implications are that, under strict inflation targeting the monetary policy is more responsive and therefore, inflation converges more rapidly to its target. On the contrary, under the case of flexible inflation targeting, that is, when the central bank is also concerned with output stabilization or any additional goal, the convergence of inflation to its target is more gradual.

Certainly, most inflation-targeting-countries have preferred targeting CPI inflation than just domestic inflation. The difference between CPI inflation and domestic inflation is that domestic inflation only considers the inflation of

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[30] Recall that in terms of Clarida, Galí, and Gertler (1999) "strict inflation targeting" is equivalent to the case of "extreme inflation targeting".

domestically produced goods, while CPI inflation includes in addition to regular domestic inflation, the inflation (in domestic prices) of final imported goods. Thus, under CPI inflation targeting, the direct exchange rate channel becomes extremely relevant.

In this sense, when the central bank is only concerned with stabilizing inflation, that is, when the central bank operates under strict CPI inflation targeting, the direct exchange rate channel represents an effective instrument to achieve inflation stabilization at a reasonably short horizon. As mentioned before, the consequences of strict CPI inflation targeting is a more rapid convergence of inflation to its target, and a greater frequency of adjustment of interest rates. However, the cost of strict CPI inflation targeting is that it may cause a potentially greater variability in other macroeconomic variables.

In the case of flexible CPI inflation targeting, that is when output or any other variable represents an additional concern for the central bank, the resulting policy usually implies a lower frequency of adjustments of the interest rate, and probably also a lower variability in other macroeconomic variables.

Svensson (2000) also considers the case of the so-called “Monetary Policy Indices” (MCIs). MCIs usually combine a short-term interest rate and the exchange rate in an index which attempts to capture the impact of monetary policy on both the aggregate demand and inflation. Svensson (2000) gives only limited support for a specific MCI. In his model the resulting specific index (which only has an impact upon aggregate demand) combines the expected real exchange rate and the expected long real interest rate rather than the observable current rates. Thus, he argues that “The monetary policy impact on inflation, which is transmitted via several different channels with different lags, is too complex to be summarized by any single index”.

Regarding the problems related to the implementation of an inflation targeting framework, in the case of the partially-dollarized economy, the major inconvenience is (as previously argued) the existence of a “fear of floating”. When a “fear of floating” is present, there are incentives to make the exchange rate an additional objective of the monetary policy[31]. As previously mentioned, this is related to both the probability of occurrence of balance sheet problems, and also

[31] On the one hand, if the degree of pass-trough is very high, that is if a nominal depreciation causes swift proportional nominal price increases, then the fear of floating is related to the repercussions upon inflation. In the opposite case, when the degree of pass-trough is very low, the concern regarding a nominal depreciation is the deterioration of firms’ balance sheets given the presence of foreign-currency-denominated liabilities.

(implicit from previous comments) to the relative importance of the degree of exchange rate pass-through to domestic prices, which in turn, affects inflation. In the last case, given that the degree of exchange rate pass-through depends on wage and price setting behaviour, this problem cannot be addressed easily, and probably it might require the development of hedging instruments or additional mechanisms. However, in the case of balance sheet problems, this paper addresses this difficulty by imposing the previously-called *currency-matching* rule.

As long as there are no balance sheet problems at the corporate and bank firms' level, and assuming that both households and (mainly) the public sector are covered against exchange rate risk, then the monetary policy would not face contradictory objectives. The major relevance of the nominal exchange rate would then be its impact upon domestic prices and nominal interest rates.

The next section introduces the model and the endogenous risk premium. In the absence of the *currency-matching* rule, the risk premium behaviour reacts to two ambiguous exchange rate effects: the competitiveness effect, and the balance sheet effect. When the *currency-matching* rule is present, the balance sheet effect disappears and overall performance is considerably improved.

2.1 An Open-Economy Macroeconomic Model

The following model was previously merged by Morón and Winkelried (2002) who combined an endogenous risk premium from Cespedes and others (2000) with Svensson's (2000) original model[32]. As previously explained the model considers lags in the transmission of monetary policy and imperfect control of inflation. The role of the exchange rate in the model is crucial to both the transmission of monetary policy and the determination of the investors' risk premium.

Specifically, the endogenous risk premium in Cespedes and others (2000) captures the two ambiguous effects from a real exchange depreciation: the competitiveness (or substitution) effect and the balance sheet effect. Finally, as previously explained, the forward-looking behaviour is fundamental in the determination of the aggregate demand, inflation and the exchange rate.

The short-run aggregate supply (Phillips) curve takes the following form:

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[32] For those readers interested with the microfoundations, Svensson (1998) presents the derivation of the aggregate supply (Phillips) curve and the aggregate demand equation, and Cespedes and others (2000) present the derivation of the endogenous risk premium.

$$\Pi_{t+2} = a_{\Pi}\, \Pi_{t+1} + \left(1 - a_{\Pi}\right)\Pi_{t+3/t} + a_y\, y_{t+1/t} + a_q\, q_{t+2/t} + e_{t+2} \qquad (1)$$

In order to obtain a stationary system all variables (except the interest rate) have been expressed in logs as a measure of deviation from their long-run equilibrium (natural) level. Throughout this paper, the notation $V_{t+t/t}$ refers to the rational expectations of "V_{t+t}" using all the relevant information available at time "t". Moreover, Π_t refers to domestic inflation at time "t" which is a variable predetermined two periods in advance. Equivalently, y_t denotes the output gap at time "t" which is a variable predetermined one period in advance (see equation (2)). All the above coefficients are positive constants. Particularly, in the case of the inflationary inertia coefficient, this is less than one ($0 \pi a_{\Pi} \pi 1$). Finally, e_{t+2} denotes a "cost-push" shock assumed to be *i.i.d.* and of mean zero.

The aggregate demand equation (in terms of the output gap) is as follows:

$$y_{t+1} = \beta_y\, y_t - \beta_r\, r_{t+1/t} + \beta_y^* y_{t+1/t}^* + \beta_q\, q_{t+1/t} - \beta_\varphi\, \varphi_{t+1/t} + \eta_{t+1} \qquad (2)$$ [33]

Equivalently, as before, all coefficients are positive (with $0 \le b_y \pi 1$), and h_{t+1} is a zero mean *i.i.d* shock. The variables y_t^*, r_t, and j_t refer to foreign demand, the short-term real interest rate, and the risk premium respectively, while q_t is the real exchange rate and by definition is expressed as:

$$q_t \equiv s_t + p_t^* - p_t \qquad (3)$$

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[33] Note that this equation differs from the one in Svensson (1998) in that this includes a short-term real rate instead of a long-term real rate. Additionally, they also differ in that this incorporates (in an arbitrary way) the negative effect caused by an increase in the expected exchange rate risk. It is arbitrary because Morón and Winkelried (2002) do not present the corresponding underlying microfoundations. However, the negative effect upon output caused by an increase in the expected exchange rate risk can be interpreted as the result from an anticipated reduction in profits, which in turn reduces the expected availability of internal funds for investment, and hence causes a fall in output. Note also that from Svensson (1998), h_{t+1} is equivalent to $-\left(g_y^n - b_y\right)y_t^n + h_{t+1}^d - h_{t+1}^n$.

where p_t , p_t^*, and s_t are the domestic price level, the foreign price level, and the nominal exchange rate respectively.

Also by definition, the output gap is expressed as:

$$y_t \equiv y_t^d - y_t^n \quad (4)$$

where y_t^d is the aggregate demand, and y_t^n is the natural rate of output which is assumed to follow an exogenous stochastic process:

$$y_{t+1}^n = g_y^n \, y_t^n + h_{t+1}^n \quad (5)$$

in which $0 \leq g_y^n \, \pi \, 1$, and h_{t+1}^n represents a zero-mean (serially uncorrelated) productivity shock to the natural rate of output.

The Fisher equation holds:

$$r_t = i_t - \Pi_{t+1/t} \quad (6)$$

where i_t is the short-term nominal interest rate and represents the central banks' monetary policy instrument.

The nominal exchange rate (s_t) satisfies the interest parity condition:

$$i_t - i_t^* = s_{t+1/t} - s_t + j_t \quad (7)$$

in which i_t^* is the foreign nominal interest rate considered to be exogenous and determined by a Taylor rule:

$$i_t^* = f_\Pi^* \, \Pi_t^* + f_y^* \, y_t^* + x_{i,t}^* \quad (8)$$

where all coefficients are positive.

Both foreign output (y_t^*) and inflation (Π_t^*) are also exogenous. Equivalently, for simplicity, both are assumed to follow a first-order autoregressive process (AR (1)):

$$y_{t+1}^* = g_y^* \, y_t^* + h_{t+1}^* \tag{9}$$

$$\Pi_{t+1}^* = g_\Pi^* \, \Pi_t^* + e_{t+1}^* \tag{10}$$

where the above coefficients are all positive and less than one ($0 \, \pi \, g_y^*, g_\Pi^* \, \pi \, 1$), and the disturbances (h_{t+1}^* and e_{t+1}^*) are also (by assumption) *i. i. d.*

Finally, combining (3) and (7) in order to eliminate the non-stationary nominal exchange rate, the resulting real interest parity condition is given by:

$$q_{t+1/t} = q_t + i_t - \Pi_{t+1/t} - i_t^* + \Pi_{t+1/t}^* - j_t \tag{11}$$

where j_t is the endogenous risk premium.

2.2 An Endogenuous Risk Premium

As in Morón and Winkelried (2002), this paper incorporates an endogenous risk premium from Cespedes and others (2000) into Svensson's (2000) original model. In Cespedes and others (2000) as in Bernanke and Gertler (1989), firms' net worth determines the risk premium. Particularly, the model in Cespedes and others (2000) represents a general equilibrium model in which wages are sticky (in terms of local currency), and firms have dollarized liabilities. In such a framework the investors' risk premium can be interpreted as an exchange rate risk premium.

Under the above mentioned conditions, there is channel through which a real exchange rate depreciation can become contractionary. As a real exchange rate depreciation increases the domestic value of foreign liabilities, the net worth of non-export business firms is reduced. This in turn, increases the risk premium. However, as a real exchange rate depreciation also reduces the dollar value of real domestic output, a competitiveness effect is also present. Therefore, the overall effect of real exchange rate variations is ambiguous. In terms of Cespedes and others (2000), a *financially robust* economy is one in which the net effect of a real exchange depreciation is expansionary. In the opposite case, the economy is said to be *financially vulnerable*.

Under liability dollarization, the equilibrium cost of external funding to firms engaged in investment projects depends on the foreign interest rate (which is exogenously determined), plus the risk premium which is determined as follows[34]:

$$j_{t+1} - j_t = -y_2 X_t + y_2 (y_t - q_t) - y_3 \{[y_t - y_{t/t-1}] - [q_t - q_{t/t-1}]\} \qquad (12)$$

As before, all coefficients are positive.

From (12), the change in next period's risk premium is explained by three major factors. Firstly, for a given level of output, an increase in the exports demand (X_t) requires a lower level of domestic investment, which in turn implies a lower level of external funding, and therefore a lower risk premium. On the other hand, a second effect, which in particular can be interpreted as the substitution or competitiveness effect, implies that a decrease in the dollar value of real output (resulting from either a reduction in y_t or an increase in q_t) requires lower levels of investment, which as well, implies a lower level of external funding, and therefore a smaller risk premium.

Finally, the last term in (12) captures the so-called balance sheet effect resulting from an unanticipated depreciation, which causes a reduction in firms net worth due to an unexpected fall in the dollar value of real output. Thus, the balance sheet effect can be caused by either a sudden decrease in the value of real output (firms' real income), or also by an unexpected real exchange rate depreciation which increases the burden of dollarized liabilities in terms of domestic currency. However, in any case, the deterioration of firms' balance sheets increases investors' risk premium.

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[34]Cespedes and others (2000) assume underdevelopment of the local financial market. Under such conditions, firms which have limited resources to auto-finance investment projects will have to compensate lenders with a larger risk premium. Such a risk premium represents the difference between the cost of external funding and the opportunity cost of internal funding. Thus, the risk premium depends inversely on firms' net worth.

By assuming that exports (X_t) are proportional to foreign demand, that is, exports are a linear function of foreign demand, and that the risk premium is exposed to *i.i.d* shocks(ξ_{jt+1}), (12) can be reparameterized as:

$$j_{t+1} = j_t - y_1 \, y_t^* + (y_2 - y_3)\,(y_t - q_t) + y_3 \left\{\left[y_{t/t-1} - q_{t/t-1}\right]\right\} + x_{j,t+1} \quad (13)$$

The elasticity of the risk premium to the real exchange rate is then given by:

$$\frac{\partial (j_{t+1} - j_t)}{\partial q_t} = y_3 - y_2 = l \quad (14)$$

Following Cespedes and others (2000), in a *financially vulnerable* economy λ is positive implying a lower competitiveness effect (ψ_2) relative to the balance sheet effect (ψ_3), in which case a real depreciation is contractionary for the economy. Inversely, when λ is negative implying a greater competitiveness effect (ψ_2) relative to the balance sheet effect (ψ_3), a real depreciation is expansionary and hence the economy is *financially robust*.

For instance, consider the case in which the state of the economy requires the central bank to reduce the interest rate in order to stabilize output. Given such a reduction in the interest rate, it can be inferred from equation (**11**) that in order to maintain the portfolio balance; the real exchange rate must have to depreciate.

Now assume that the economy is financially exposed to real exchange rate risk, that is that λ is positive, and therefore the economy is *financially vulnerable*. In such a case, as mentioned before, a current real exchange rate depreciation causes a net increase in the expected value of next period's risk premium. This is in turn predetermines next period's fall in output through two different channels (see equation (2)). Firstly, through the indirect *interest rate* channel, the expected increase in next period's risk premium causes an increment in the expected value of next period's real interest rate (offsetting the effect of the previous interest rate cut exercised by the central bank) and therefore contributes to the predetermination of next period's output reduction. However, through the direct *wealth* channel, the expected increase in next period's risk premium also predetermines a fall in output.

As mentioned before (see footnote 33) the direct *wealth* channel can be interpreted as an anticipated future reduction in firms' profits, which in turn reduces the expected future availability of internal funds for investment, and therefore contributes to next period's output reduction.

Now consider the other case of interest in which a *currency-matching* rule is implemented. In such a case, $\psi_3 = 0$ implying that λ is always negative (given ψ_2 is positive). In other words, it implies that the economy is not financially exposed to real exchange rate risk. This means that in such a case, a real exchange rate depreciation always reduces next period's risk premium and therefore, produces an expansionary effect upon next period's output.

In contrast to the previous case, an expected decrease in next period's risk premium predetermines a rise in next period's output. In this case such a rise in output is explained by a larger reduction in real interest rates through the *interest rate* channel. However, the rise in next period's output is also explained by the positive effect resulting from the anticipated increase in future firms' profits, which in turn causes an increment in the expected future availability of internal funds for investment, and therefore contributes to next period's rise in output (through the direct *wealth* channel –see footnote 33).

In short, under a currency-matching rule, and particularly in the case when the central bank is implementing a policy of low interest rates, the resulting real depreciation causes a reduction in next period's risk premium. This in turn, reinforces the initial interest rate cut, through a further reduction in the expected future level of the real interest rate and therefore predetermines a rise in next period's output.

Consider now the case in which the state of the economy requires the central bank to increase the interest rate in order to reduce inflation. As the increase in the interest rate causes a real appreciation, in the case of the *financially vulnerable* economy, the result is a reduction in next period's risk premium. Consequently, the reduction in next period's risk premium partially offsets the initial rise in the interest rate (by decreasing the expected value of next period's real rate) and therefore partially annuls central bank's original effort.

Finally consider again the case in which a currency-matching rule is implemented. As the increase in the interest rate causes a real appreciation, the result is instead an increase in next period's risk premium. Consequently, the increase in next period's risk premium again reinforces the initial rise in the interest rate (by increasing the expected value of next period's real rate) and therefore contributes to reinforcing central bank's original effort.

In short, under a currency-matching rule, and particularly in the case when the central bank is implementing a policy of high interest rates, the resulting real appreciation causes an increase in next period's risk premium. This in turn, reinforces the initial rise in the interest rate, through a further increase in the expected future level of the real interest rate and therefore predetermines a decrease in next period's output reinforcing central bank's original effort[35].

DIAGRAM 1. EFFECT OF AN INTEREST RATE POLICY UNDER A CURRENCY-MATCHING RULE: COMPARISON WITH THE CASE OF A FINANCIALLY VULNERABLE ECONOMY

$i_t \downarrow \Leftrightarrow q_t \uparrow \Leftrightarrow$

- for the *financially vulnerable* economy: $j_{t+1/t} \uparrow$ and therefore, $r_{t+1/t}\,?$ and $y_{t+1}\,?$
- under a *currency-matching* rule: $j_{t+1/t} \downarrow$ and therefore, $r_{t+1/t} \downarrow$ and $y_{t+1} \uparrow$

The original policy is reinforced

$i_t \uparrow \Leftrightarrow q_t \downarrow \Leftrightarrow$

- for the *financially vulnerable* economy: $j_{t+1/t} \downarrow$ and therefore, $r_{t+1/t}\,?$ and $y_{t+1}\,?$
- under a *currency-matching* rule : $j_{t+1/t} \uparrow$ and therefore, $r_{t+1/t} \uparrow$ and $y_{t+1} \downarrow$

The original policy is reinforced

Regarding the mechanisms of monetary policy, as mentioned before in the previous section, the model includes realistic lags and imperfect control of inflation[36]. The closed-economy conventional transmission mechanisms for monetary policy: the *aggregate-demand channel* and the *expectations channel* are present. The exchange rate contributes with other transmission mechanisms through: the *direct exchange rate channel*, the *aggregate-demand channel*, and also through the effect of variations in the cost of imported inputs. An additional importance of the exchange rate is that, as an asset price, it responds to a forward-looking behaviour, which makes expectations about this variable a fundamental mechanism for the economy.

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[35] See Diagram 1.

[36] See previous section for details regarding the transmission channels of monetary policy.

2.3 The loss function and the optimal policy

The central bank's preferences are described by a quadratic (welfare) loss function *a` la* Barro-Gordon, in which CPI Inflation and output gap represent the target variables. As the targets are assumed to coincide with their natural (long-run) equilibrium levels, no inflationary bias is present. The loss function is expressed as follows:

$$L_t = \Pi_t^{c\,2} + c\, y_t^{\,2} \tag{15}$$

where the parameter c measures the central bank's concern about stabilizing output. When the central bank is only concerned about inflation, that is under strict CPI inflation targeting, c is zero. Conversely, under flexible CPI inflation targeting c is greater than zero.

It is assumed that a fraction w represents the share of imported goods, so that:

$$\Pi_t^c = (1-w)\Pi_t + w\Pi_t^f \tag{16}$$

where Π_t^f is the domestic-currency inflation of imported final goods, which fulfils:

$$\Pi_t^f = p_t^f - p_{t-1}^f = \Pi_t^* + s_t - s_{t-1} = \Pi_t + q_t - q_{t-1}\ , \tag{17}$$

where

$$p_t^f = p_t^* + s_t \tag{18}$$

Thus, CPI inflation is given by:

$$\Pi_t^c = \Pi_t + w\left(q_t - q_{t-1}\right) \tag{19}$$

The central bank's problem is to choose i_t under discretion in order to minimize its intertemporal loss function:

$$E_t \sum_{t=0}^{\infty} \left[d^{t} L_{t+t} \right] \tag{20}$$

where $0 \pi d \pi 1$, implying that in (20), when $d \rightarrow 1$, the limit is equivalent to:

$$E[L_t] = \text{var}\left(\Pi_t^c\right) + c \ \text{var}\left(y_t\right) \tag{21}$$

3.1 Parameters of the model

The model requires to be solved numerically as the solution cannot be described analytically. The parameters from the model are the same presented by Morón and Winkelried (2002). They estimate the model parameters for both the *financially vulnerable* economy and the *financially robust* economy[37]. However, in order to analyse the effect of a *currency-matching*, this paper concentrates on the parameters associated to the *financially vulnerable* economy in Morón and Winkelried (2002). Table 2 presents such parameters.

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[37] Morón and Winkelried (2002) used: Australia and New Zealand as the representatives of *financially robust* economies, and Perú and Uruguay as the representatives of *financially vulnerable* economies.

TABLE 2. Parameters of the model

Aggregate Supply (1)		*Aggregate Demand* (2)	
a_{Π}	0.500	b_y	0.440
a_y	0.050	b_r	0.031
a_q	0.085	b_y^*	0.352
		b_q	0.025
		b_j	0.148
Risk premium (8)		*External Variables* (9), (10) and (13)	
y_1	0.528	f_{Π}^*	0.760
y_2	0.340	f_y^*	0.430
	0.509	g_y^*	0.900
FVE[38] Ψ_3	0.000	g_{Π}^*	0.950
CMR[39] y_3			

As in Morón and Winkelried (2002), in this paper it is assumed that $c = 0.5$ which implies a regime of flexible CPI inflation targeting. Moreover, also as in Morón and Winkelried (2002), the variance of all perturbations has been set to 0.5 (except in the cases of the aggregate supply and aggregate demand equations for which it has been set to 1.0). Equivalently, it is assumed that the share of imported goods in CPI inflation is $w = 0.3$.

[38] FVE refers to the case of the *financially vulnerable* economy.

[39] CMR refers to the case under a *currency-matching* rule.

3.2 Solution and results

The Appendix outlines how the model can be presented in a suitable state-space form. As in Svensson (2000) and Morón and Winkelried (2002), let X_t and Y_t denote the column vectors of predetermined variables and target variables respectively. Let as well x_t denote the vectors of forward-looking variables, and v_t the column vector of innovations to the predetermined variables.

$$X_t = \left(\Pi_t, y_t, \Pi_t^*, y_t^*, i_t^*, j_t, y_t^n, q_{t-1}, i_{t-1}, \Pi_{t-1/t}, q_{t/t-1}, q_{t-1/t-2}, \Pi_{t/t-1}, \varepsilon_{t-1}, y_{t/t-1}\right)'$$

$$x_t = \left(q_t, \rho_t, \Pi_{t+2/t}\right)'$$

$$Y_t = \left(\Pi_t^c, y_t\right)'$$

$$v_t = \left(\varepsilon_t, \eta_t^d - \eta_t^n, \varepsilon_t^*, \eta_t^*, f_\Pi^* \varepsilon_t^* + f_y^* \eta_t^*, \xi_{i,t}^*, \xi_{j,t}, \eta_t^n, 0, 0, \alpha_\Pi \varepsilon_t + \alpha_y \beta_y \left(\eta_t^d - \eta_t^n\right), 0, 0, 0, 0, 0\right)'$$

As in Svensson (2000) and Morón and Winkelried (2002), let $Z_t = \left(X_t', x_t'\right)'$ be the vector of predetermined state variables and the forward-looking variables, where $'$ denotes transpose. Denote the dimensions of X_t, x_t, Y_t, and Z_t by $n_1 = 15$, $n_2 = 3$, $n_3 = 2$, and $n = n_1 + n_2 = 18$ respectively. Then the model can be expressed as:

$$\begin{bmatrix} X_{t+1} \\ x_{t+1/t} \end{bmatrix} = A \begin{bmatrix} X_t \\ x_t \end{bmatrix} + \mathrm{B}_0 i_t + \mathrm{B}_1 i_{t+1/t} + \begin{bmatrix} v_{t+1} \\ 0 \end{bmatrix}$$

or equivalently as:

$$\begin{bmatrix} X_{t+1} \\ x_{t+1/t} \end{bmatrix} = A Z_t + \mathrm{B}_0 i_t + \mathrm{B}_1 i_{t+1/t} + \begin{bmatrix} v_{t+1} \\ 0 \end{bmatrix}$$

$$Y_t = C_Z Z_t + C_i i_t$$

$$L_t = Y_t' K Y_t$$

where A is an $n \times n$ (18×18) matrix; B_0 and B_1 are $n \times 1$ (18×1) column vectors; C_Z is an $n_3 \times n$ (2×18) matrix; C_i is an $n_3 \times 1$ (2×1) column vector; and K is an $n_3 \times n_3$ (2×2) diagonal matrix with all off-diagonal elements being zero, and with the diagonal: $(1, c)$. See the Appendix for a detailed explanation regarding all matrices.

The solution to the model involves a standard linear stochastic regulator problem[40]. The only inconvenience is the presence of the term $B_1 \, i_{t+1/t}$; however this is also resolved in the Appendix. The standard problem is solved in Oudiz and Sachs (1985), Backus and Driffill (1986), Currie and Levine (1993), and Svensson (1994 and 1998).

This paper considers the case of discretion. The reason is because it captures better reality. As Clarida, Galí, and Gertler (1999) indicate: "no major central bank makes any type of binding commitment over the future course of its monetary policy". Additionally, it also reflects the credibility problem associated to many emerging market economies.

In the case of discretion, the forward-looking variables are linear functions of the predetermined variables:

$$x_t = H X_t$$

where the matrix H is an $n_2 \times n_1$ (3×15) endogenously-determined matrix. The optimal response function is also linear in the predetermined variables:

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[40] The Appendix gives the details on the procedure regarding the linear stochastic regulator problem.

$$i_t = f\ X_t$$

where also the matrix f is endogenously-determined with dimension: $1\text{x}\,n_1\ (1\text{x}15)$.

Thus, in general, the dynamics of the economy can be summarized as follows:

$$X_{t+1} = \mathrm{M}_{11} X_t + v_{t+1}$$

$$x_t = H\ X_t$$

$$i_t = f\ X_t$$

$$Y_t = \left(C_{Z1} + C_{Z2}\ H + C_i\ \ f\right) X_t$$

where the n x n $(18\text{x}18)$ matrix M is defined by:

$$\mathrm{M} \equiv \left(I - \mathrm{B}_1 F\right)^{-1} \left(A + \mathrm{B}_0 F\right)$$

and $F = (f, 0,0,0)$ is a $1\text{x}\,n$ $(1\text{x}18)$ vector resulting from the addition of $n_2 = 3$ zeros to the $1\text{x}\,n_1\ (1\text{x}15)$ f (original) vector[41].

where M and C_z are partitioned in relation to X_t and x_t :

$$\mathrm{M} = \begin{bmatrix} \mathrm{M}_{11} & \mathrm{M}_{21} \\ \mathrm{M}_{12} & \mathrm{M}_{22} \end{bmatrix}, \text{ and } \quad C_z = \begin{bmatrix} C_{z1} \\ C_{z2} \end{bmatrix}$$

[41] The $n_2 = 3$ zeros have been added in order to have a final $1\text{x}\,n$ $(1\text{x}18)$ vector without affecting the forward-looking variables.

In the case of discretion, and in the presence of forward-looking variables, the solution involves almost all the variables contained in the model. Given the fact that all parameters are identical to the ones presented in Morón and Winkelried (2002), the results regarding the *financially vulnerable* economy coincide with the ones previously presented by them. Table 3 shows the results corresponding to the case in which a *currency-matching* rule is implemented in comparison to the case of the *financially vulnerable* economy.

TABLE 3. Optimal policy response

Economy / Condition	Π_t	y_t	Π_t^*	y_t^*	i_t^*
Financially Vulnerable	1.369	0.067	-0.587	0.432	0.524
Currency-matching rule	1.392	0.103	-0.568	0.417	0.498
Economy / Condition	j_t	q_{t-1}	$\Pi_{t+1/t}$	$q_{t/t-1}$	$y_{t/t-1}$
Financially Vulnerable	1.197	-0.411	0.071	-0.291	0.343
Currency-matching rule	0.833	-0.409	0.103	0.000	0.000

The results vary considerably, even though the *financially vulnerable* economy and the economy under the *currency-matching* rule share most of the parameters from the model. The unique (and fundamental) exception is ψ_3 which takes the value of zero under the *currency-matching* rule. Thus, Table 3 shows that the optimal policy reaction function becomes slightly more sensitive to changes in current inflation and output gap when the *currency-matching* rule is implemented. Additionally, the function also becomes slightly more reactive to changes in expected inflation when the *currency-matching* rule is present.

As expected, the reaction function became less reactive to changes in the risk premium. However, an unexpected result is that under the *currency-matching* rule, the policy response function becomes also less reactive to changes in the foreign interest rate. As anticipated, the coefficients on previous expectations of current output and real exchange rate are zero. This is due to the elimination of the balance sheet effect (or equivalently because $y_3 = 0$, see equation 13).

The resulting policy reaction function seems to exploit the reinforcing properties of the *currency-matching* rule facilitating the practice of monetary policy. To illustrate this point, recall from equation (14), that the elasticity of the risk premium to the real exchange rate (λ) is always negative in the case of a *currency-matching* rule (due to $\psi_3 = 0$). Consider the case in which the central bank is interested in reducing the interest rate in order to stabilize output. The resulting real exchange rate depreciation causes a decrease in the risk premium. This in turn, reduces the expected value of next period's real interest rate reinforcing the initial policy. Equivalently, consider now the case in which the central bank is interested in increasing the interest rate in order to put inflation back on its co-rrect path. The resulting real exchange rate appreciation causes an increase in the risk premium. This in turn, increases the expected value of next period's real interest rate reinforcing again the initial policy.

Consider again the case in which a sudden fall in output takes place requi-ring immediate reaction from the central bank. To illustrate the following point, let's take the elasticity of the risk premium to the output gap:

$$\frac{\partial\left(j_{t+1}-j_{t}\right)}{\partial y_t}=y_2-y_3=\Phi \qquad (22)$$

Under the *currency-matching* rule, Φ is always positive (due to $\psi_3=0$). This implies that a sudden fall in output reduces next period's risk premium. In turn, this reduces the expected value of next period's real interest rate, which finally reinforces the central bank's initial low-interest rate policy. Equivalently, consider again the case in which an unexpected increase in output takes place, calling for an immediate reaction from the central bank in order to offset any positive effect on inflation. The sudden rise in output increases next period's risk premium. This in turn, increases the expected value of next period's real interest rate reinforcing again the initial policy.

A fundamental additional result is the gains in terms of welfare observed un-der the implementation of the *currency-matching* rule. To illustrate this, Table 4 presents the results in terms of the unconditional standard deviation of the major macroeconomic variables. Under the *currency-matching* rule, all variables show a lower volatility.

TABLE 4. Comparison of unconditional standard deviations of major macroeconomic variables under the optimal policy rule

Economy / Condition	Π_t^C	Π_t	y_t	i_t	r_t	q_t	$E[L_t]$
Financially Vulnerable	3.265	2.044	2.189	3.216	5.410	8.888	**6.574**
Currency-matching rule	2.985	1.842	2.080	2.835	4.730	7.845	**5.845**

4. CONCLUSIONS

This paper contributes to previous studies of partially-dollarized economy in-flation targeting by incorporating the effect of a *currency-matching* rule. Specifically, such a rule implies imposing a restriction to credit dollarization in order to guarantee that any form of foreign-currency denominated debt (or bank credit) is solely allocated to the export business sector of the economy.

The model in this paper is a small open-economy macroeconomic model. It was previously merged by Morón and Winkelried (2002) who combined an endogenous risk premium from Cespedes and others (2000) with Svensson's (2000) original model. The model considers lags in the transmission of monetary policy and imperfect control of inflation. The role of the exchange rate is crucial to both the transmission of monetary policy and the determination of the risk premium.

The model suggests that under conditions of liability dollarization, currency mismatches, and incomplete pass-trough from the exchange rate to domestic prices, the effect of a real exchange rate depreciation becomes ambiguous for the economy, as both a favourable competitiveness effect and an unfavourable balance sheet effect have an impact upon the risk premium and the aggregate demand.

However, under the *currency-matching* rule, the model shows that real exchange rate depreciations become diaphanously expansionary, suggesting an expected reduction in the *fear of floating*, and therefore a decline in the complexity of the monetary policy. The rationale is simple, under the *currency-matching* rule, the economy is not financially exposed to real exchange rate risk, and therefore the balance sheet effect is eliminated. Thus, the only remaining effect of a real exchange rate depreciation is the favourable competitiveness effect.

The paper also compares the optimal monetary policy response and the volatility of the major macroeconomic variables, under the presence of the currency-matching rule to the case in which the rule is absent. The results are straightforward. When the economy is not financially exposed to real exchange rate risk: (i) the volatility of the major economic variables is reduced reflecting gains in terms of welfare, and (ii) the optimal policy reaction function becomes less responsive to changes in the risk premium and the foreign interest rate, and more reactive to movements in the output gap and expected inflation. The consequences from (i) and (ii) suggest that the advice that calls for liability dedollarization in small open economies, should then solely apply to the non-export business sector.

The resulting policy reaction function seems to exploit the reinforcing properties of the *currency-matching* rule, facilitating the practice of monetary policy. For instance, when the central bank is interested in reducing the interest rate in order to respond to a sudden fall in output, the *currency-matching* rule guarantees, that both the sudden fall in output itself, and the resulting real exchange depreciation, associated to the low-interest rate policy, will cause a decline in the investors' risk premium. This in turn, will have the effect of reducing the expected value of next period's real interest rate and therefore reinforces the central bank's initial policy.

Equivalently, when the central bank is interested in increasing the interest rate in order to respond to the increasing inflation resulting from a sudden increase in output (for instance, due to a demand shock), the *currency-matching* rule guarantees, that both the sudden increase in output itself, and the resulting real exchange rate appreciation associated to the high-interest rate policy, will cause an increase in the risk premium. This in turn, will increase the expected value of next period's real interest rate and hence will reinforce the central bank's original policy.

Regarding the discussion on currency regimes, this paper presented support for a *sophisticated* managed floating regime under partial dollarization. The reason why it has to consider and include the presence of partial dollarization is because, as previously mentioned, most emerging market economies which still issue a domestic currency, exhibit high levels of partial dollarization. However, such a regime requires the implementation of a *currency-matching* mechanism, for instance: the *currency-matching* rule proposed throughout this paper, or others such as the one proposed by Goldstein (2002) involving hedging instruments, and other methods.

As previously mentioned, the reason why a *currency-matching* mechanism has to be put into practice is to eliminate the exchange rate risk, and hence the balance sheet effect. This in turn, will simplify the implementation of monetary policy, and maintain the benefits of partial dollarization.

This paper has concentrated on the liability side of partial dollarization; however, further research should see more profound studies regarding the implications of asset dollarization under imperfect market conditions, and asymmetric information. Another motivating topic is the study of the role of the global banking industry in the expansion of international credit. Finally, other appealing areas might include: the study of the implications of domestic deposit-dollarization for the growth and stabilization of international reserves, the role of the central bank in the setting of the reserve-backing rate on dollar-deposits, and its effect upon liquidity, exchange rate stabilization, and therefore upon overall macroeconomic stability.

REFERENCES

Aghion, P., Bacchetta, P., and A. Banerjee (2000), "A Simple Model of Monetary Policy and Currency Crises", *European Economic Review*, Papers and Proceedings 44, 728-738.

Backus, D. and Driffill, J. (1986), "The Consistency of Optimal Policy in Stochastic Rational Expectations Models", *CEPR discussion paper No. 124*.

Barro R. and Gordon D. (1983), "A Positive Theory of Monetary Policy in a Natural Rate Model," *J. Polit. Econ.*, 91:4, pp. 589–610.

Bernanke, B. and Mishkin F. (1997), "Inflation Targeting: A New Framework for Monetary Policy?" J. Econ. Perspect., 11:2, pp. 97–116.

Broda Ch. and Levy E. (2001), "Endogenous Financial Dollarization*", Massachusetts Institute of Technology, Working Paper MIT*.

Calvo, G. (1983). "Staggered prices in a utility-maximizing framework", *Journal of Monetary Economics* 12, 383–398.

Calvo, G., and Reinhart C. (2000), "Fear of Floating", *University of Maryland,* w*orking paper*.

Calvo, G., and Reinhart C. (2001), "Fixing for Your Life", *Brookings Trade Policy Forum 2000: Policy Challenges in the Next Millennium,* Washington Brookings Institution.

Céspedes, L., Chang R. and Velasco A. (2000), "Balance Sheets and Exchange Rate Policy", *NBER Working Paper* 7840.

Chang, R. and Velasco A. (2000), "Exchange Rate Policy for Developing Countries", *American Economic Review,* papers and proceedings 90, No. 2, 71-75.

Clarida R., Galí J., and Gertler M. (1999), "The Science of Monetary Policy: A New Keynesian Perspective", *Journal of Economic Literature*, Vol. XXXVII (December 1999), pp. 1661–1707.

Crokett A. (1994), "Monetary Policy Implications of Increased Capital Flows", *Changing Capital Markets: Implications for Monetary Policy,* Federal Reserve Bank of Kansas City.

Currie, D. and Levine, P. (1993), "Rules, Reputation and Macroeconomic Policy Coordination", *Cambridge University Press*, Cambridge.

Eichengreen B. (1994), "International Monetary Arrangements for the 21st. Century", Washington Brookings Institution.

Eichengreen, B. and R. Hausmann (1999), "Exchange Rates and Financial Fragility", *NBER working paper 7418.*

Engle Ch. and Rogers J. (1996), "How wide is the Border?". *American Economic Review* 86, 1112-1125.

Faust J. and Svensson, L. (1997), "Credibility and Transparency: Monetary Policy with Unobservable Goals". *Working paper*.

Fischer S. (2001), "Exchange Rate Regimes: Is the Bipolar View Correct? *Journal of Economic Perspectives*, Vo. 50, No. 2, 3-24.

Frankel J. (1999), "No Single Currency Regime is Right for all Countries or at all Times" *Princeton Essays on International Finance 215,* International Finance Section, Department of Economics, Princeton University.

Ghosh A., Gulde A., and Wolf H. (1998), "Currency Boards: The Ultimate Fix", *IMF working paper,* 98/08.

Goldstein M. (2002), "Managed Floating Plus", *Institute for International Economics,* Policy Analyses in International Economics 66.

Hanke S. (2002), "Currency Boards", *The Annals of the American Academy of Political and Social Science*, January, 87-105.

Hausmann, R., Panizza U. and Stein E. (2000), "Why do Countries Float the Way They Float?", *IADB working paper 418*.

Hawkins J. and Turner P. (2000), "Managing Foreign Debt and Liquidity Crises in Emerging Economies: An Overview", *Managing Foreign Debt and Liquidity Risks*, Bank of International Settlements.

Honohan P. and Shi A. (2002). "Deposit Dollarization and the Financial Sector in Emerging Economies*". Development Research Group. The World Bank,* Working Paper No. 2748.

Kenen P. (2001), "The International Architecture: What's New, What's Missing?", *Washington Institute for International Economics*.

Knight M., Lawrence S. and Powell J. (2000), "Reforming the Global Financial Architecture: Just Tinkering around the Edges?", presented at conference on reforming the architecture of global economic institutions sponsored by the Bank of England, London (5-6 May).

Kydland, F. and Prescott E. (1977), "Rules Rather Than Discretion: The Inconsistency of Optimal *Plans," J. Polit. Econ*., 85, pp. 473–91.

Krugman, P. (1999), "Balance Sheets, the Transfer Problem and Financial Crises", *International Finance and Financial Crises*, P. Isard, A. Razin and A. Rose (eds.), Kluwer Academic Publishers.

Krugman, P. (2000), "Analytical Afterthoughts on the Asian Crisis", *Massachusetts Institute of Technology, working paper MIT*.

Larrain F. and Velasco A. (2001), "Exchange Rate Policy in Emerging Markets: The case for Floating", *Harvard University*, Cambridge.

McCallum J. (1995), "National Borders Matter: Regional Trade Patterns in North America", *American Economic Review* 85, 615-623.

Minsky, H. (1994), "Financial Instability and the Decline (?) of Banking: Public Policy Implications", *The Jerome Levy Economics Institute of Bard College,* working paper No. 127.

Morón E. and Winkelried D. (2003). "Monetary Policy Rules for Financially Vulnerable Economies", *IMF working paper,* 03/39.

Oudiz, G. and Sachs, J. (1985), "International policy coordination in dynamic macroeconomic models", *Buiter, W.H., Marston, R.C. (Eds.), International Economic Policy Coordination*, Cambridge University Press, Cambridge.

Rogoff K. (1985), "The Optimal Degree of Commitment to an Intermediate Monetary Target", *Quart. J. Econ.*, 100: 4, pp. 1169–89.

Rose A. (2000), "One Money, One Market: Estimating the effect of Common Currencies on Trade", *Economic Policy 30*, 7-45.

Roubini N. (2001), "Should Argentina Dollarize or Float: The Pros and Cons of Alternative Exchange Rate Regimes and their Implications for Domestic and Foreign Debt Restructuring", *New York University*.

Söderlind P. (1999), "Solution and estimation of RE macromodels with optimal policy", *European Economic Review 43*, 813-823.

Summers L. (2000), "International Financial Crises: Causes, Prevention and Cures, *American Economic Review*, papers and Proceedings 90, No. 2, 1-16.

Svensson, L. (1998), "Open Economy Inflation Targeting", to be presented at the Sveriges Riksbank-IIES Conference on Monetary Policy Rules, Stockholm, June 1998.

— (2000). "Open Economy Inflation Targeting". *Journal of International Economics*, 50, pp.155-183.

Taylor, J. (1993), "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conf. Ser. Public Policy*, 39, pp. 195–214.

Truman, E. (2001), "Inflation Targeting and the International Financial System: Panacea or Poison Pill?", *Washington Institute for International Economics*.

Williamson J. (2000), "Exchange Rate Regimes for Emerging Markets: Reviving the Intermediate Option", *Institute for International Economics*. Policy Analyses in International Economics 60.

APPENDIX

Initially, from rational expectations:

$$\Pi_{t+1} = \Pi_{t+1/t} + e_{t+1} \qquad (23)$$

$$\Pi_{t+2/t+1} = \Pi_{t+2/t} + a_{\Pi} e_{t+1} + a_y b_y \left(h_{+1}^{d} - h_{+1}^{n}\right)^{42} \qquad (24)$$

Taking the expectations of equation (1) in period t , and solving for: $(1 - a_{\Pi})\Pi_{t+3/t}$

$$(1 - a_{\Pi})\Pi_{t+3/t} = \Pi_{t+2/t} - a_{\Pi}\Pi_{t+1/t} - a_y y_{t-1/t} - a_q q_{t+2/t} \qquad (25)$$

After finding the appropriate expressions for $y_{t-1/t}$ and $q_{t+2/t}$, and substituting into (25):

$$\begin{aligned}(1-\alpha_{\Pi})\Pi_{t+3/t} = {} & (1+\beta_r+\alpha_q)\Pi_{t+2/t} - (\alpha_{\Pi}+\beta_q+\alpha_q)\Pi_{t+1/t} \quad + \\ & (-\alpha_y\beta_y + \alpha_y\beta_{\varphi}\psi_2 - \alpha_q\psi_2)y_t \quad + \\ & -(\beta_r+\alpha_q)i_{t+1/t} + (\beta_q-\alpha_q)i_t - (\beta_q+\alpha_q)i_t^{*} \quad + \\ & \left\{(-a_y)\left(b_y^{*}g_y^{*} + b_j y_1\right) + a_q\left(f_y^{*}g_y^{*} + y_1\right)\right\}y_t \quad + \\ & \left\{(-\alpha_y)(\beta_q + \beta_{\varphi}\psi_2) - \alpha_q(1-\psi_2)\right\}q_t \quad + \end{aligned}$$

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[42] See footnote 33.

$$\left\{\left(-a_y\right)\left(b_q g_{\Pi}^{*}\right)-a_q g_{\Pi}^{*}\left(1+g_{\Pi}^{*}-f_{\Pi}^{*} g_{\Pi}^{*}\right)\right\}\Pi_t^{*} \quad +$$

$$\left\{a_y\left(b_q+b_j\right)+2a_q\right\} j_t \tag{26}$$

The matrices corresponding to the following state-space form:

$$\begin{bmatrix} X_{t+1} \\ x_{t+1/t} \end{bmatrix} = A \begin{bmatrix} X_t \\ x_t \end{bmatrix} + \mathrm{B}_0\, i_t + \mathrm{B}_1\, i_{t+1/t} + \begin{bmatrix} v_{t+1} \\ 0 \end{bmatrix} \tag{27}$$

are given by:

$$A = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & b_{\mathrm{y}} - b_j y_2 & b_{\mathrm{q}} g_{\Pi}^{*} & b_{\mathrm{y}}^{*} g_y^{*} + b_j y_1 & -b_{\mathrm{q}} & -\left(b_j + b_q\right) & 0 & 0 & 0 & -b_q & 0 & 0 & 0 & 0 & 0 & b_{\mathrm{q}} + b_j y_2 & 0 & b_{\mathrm{r}} \\
0 & 0 & g_{\Pi}^{*} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & g_y^{*} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & f_{\Pi}^{*} g_{\Pi}^{*} & f_y^{*} g_y^{*} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & y_2 - y_3 & 0 & -y_1 & 0 & 1 & 0 & 0 & 0 & 0 & -y_3 & 0 & 0 & 0 & y_3 & -\left(y_2 - y_3\right) & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & g_y^{\mathrm{n}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\
0 & 0 & g_{\Pi}^{*} & 0 & -1 & -1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
a_{\Pi} & a_y & a_q g_{\Pi}^{*} & 0 & -a_q & -a_q & 0 & 0 & 0 & -a_q & 0 & 0 & 0 & 0 & 0 & a_q & 0 & 1-a_{\Pi} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & b_{\mathrm{y}} - b_j y_2 & b_{\mathrm{q}} g_{\Pi}^{*} & b_{\mathrm{y}}^{*} g_y^{*} + b_j y_1 & -b_{\mathrm{q}} & -\left(b_j + b_q\right) & 0 & 0 & 0 & -b_q & 0 & 0 & 0 & 0 & 0 & b_{\mathrm{q}} + b_j y_2 & 0 & b_{\mathrm{r}} \\
0 & 0 & g_{\Pi}^{*} & 0 & -1 & -1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
\mathrm{A} & \mathrm{B} & \mathrm{C} & \mathrm{D} & \mathrm{E} & \mathrm{F} & \mathrm{G} & \mathrm{H} & \mathrm{I} & \mathrm{J} & \mathrm{K} & \mathrm{L} & \mathrm{M} & \mathrm{N} & \mathrm{O} & P & \mathrm{Q} & \mathrm{R}
\end{bmatrix}$$

where the elements corresponding to the last row are given by:

$$\mathrm{A} = 0$$

$$\mathrm{B} = \left\{-a_y b_y + a_y b_j y_2 - a_q y_2\right\} \div \left\{1 - a_{\Pi}\right\}$$

$$\mathrm{C} = \left\{-a_y\left(b_q^{*} g_{\Pi}^{*}\right) - a_q g_{\Pi}^{*}\left(1 + g_{\Pi}^{*} - f_{\Pi}^{*} g_{\Pi}^{*}\right)\right\} \div \left\{1 - a_{\Pi}\right\}$$

$$\text{D} = \left\{ -a_y \left(b_y^* g_\Pi^* + b_j y_1 \right) - a_q \left(f_y^* g_y^* + y_1 \right) \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$\text{E} = \left\{ -\left(b_q + a_q \right) \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$\text{F} = \left\{ a_y \left(b_q + b_j \right) + 2a_q \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$\text{G} = 0$$

$$\text{H} = 0$$

$$\text{I} = 0$$

$$\text{J} = \left\{ -\left(a_\Pi + b_q + a_q \right) \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$\text{K} = 0$$

$$\text{L} = 0$$

$$\text{M} = 0$$

$$\text{N} = 0$$

$$\text{O} = 0$$

$$\text{P} = \left\{ -a_y \left(b_q + b_j y_2 \right) - a_q \left(1 - y_2 \right) \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$\text{Q} = 0$$

$$\text{R} = \left\{ 1 + b_r + a_q \right\} \div \left\{ 1 - a_\Pi \right\}$$

$$B_0 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 1 \\ 0 \\ \alpha_q \\ 0 \\ 0 \\ 1 \\ -1 \\ [\beta_q - \alpha_q] \div [1 - \alpha_\Pi] \end{bmatrix} \qquad B_1 = \begin{bmatrix} 0 \\ -\beta_r \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ -\beta_r \\ 0 \\ 0 \\ -[\beta_r + \alpha_q] \div [1 - \alpha_\Pi] \end{bmatrix}$$

$$K = \begin{bmatrix} \mathbf{1} & \mathbf{0} \\ \mathbf{0} & x \end{bmatrix} \qquad C_i = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$C_z = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & -w & 0 & 0 & 0 & 0 & 0 & 0 & 0 & w & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

The case of discretion involves a linear regulator problem with forward-looking variables and expected future controls, which implies choosing i_t in period t to minimize (20) with $0 \pi d \pi 1$ and subject to:

$$\begin{bmatrix} X_{t+1} \\ x_{t+1/t} \end{bmatrix} = A \begin{bmatrix} X_t \\ x_t \end{bmatrix} + B_0\, i_t + B_1\, i_{t+1/t} + \begin{bmatrix} v_{t+1} \\ 0 \end{bmatrix}, \qquad (27)$$

$$L_t = Y_t^{'} K\, Y_t\ , \qquad (28)$$

$$Y_t = C_Z\, Z_t + C_i\, i_t \qquad (29)$$

$i_{t+1} = f_{t+1}\ X_{t+1}$,and (30)

$x_{t+1} = H_{t+1}\ X_{t+1}$ (31)

where f_{t+1} and H_{t+1} are determined by the decision problem in period $t+1$. Initially, on combining (27) and (30) in order to eliminate the term: $i_{t+1/t}$ gives the new simplified system:

$$\begin{bmatrix} X_{t+1} \\ x_{t+1/t} \end{bmatrix} = \tilde{A}_t \begin{bmatrix} X_t \\ x_t \end{bmatrix} + \tilde{B}_{0t}\ i_t + \begin{bmatrix} v_{t+1} \\ 0 \end{bmatrix}, \qquad (32)$$

where:

$$\tilde{A}_t \equiv \left(I - B_1 F \right) A$$

$$\tilde{B}_{0\,t} \equiv \left(I - B_1 F \right) B_0$$

where as previously said, $F = \left(f, 0,0,0 \right)$ is a $1 \text{x}\, n$ $(1\text{x}18)$ vector resulting from the addition of $n_2 = 3$ zeros to the $1\text{x}\, n_1\, (1\text{x}15)$ f vector.

In order to derive the solution, recall that in the discretionary case, the policy maker is free to reoptimize every period. When the central bank reoptimizes in every period, it takes private sector's expectations as given. Therefore, private agents' expectations will necessarily be consistent with actual policy. Given the fact that the model is linear-quadratic, the solution in period $t+1$ gives both, a value function which is quadratic in the state variables $X'_{t+1} V_{t+1} X_{t+1} + w_{t+1}$ (where V_{t+1} is a positive semidefinite matrix, and w_{t+1} is a scalar); and also a linear relation between the forward looking variables and the state variables $x_{t+1} = H_{t+1}\ X_{t+1}$. Private agents form expectations about x_{t+1} accordingly. The value function of the central bank in time t satisfies the Bellman equation:

$$X'_t V_t X_t + w_t = \min_{i_t} \left\{ Z'_t\ Q\ Z_t + 2Z'_t\ U\ i_t + i'_t R i_t + d\ E_t \left(X'_{t+1}\ V_{t+1} X_{t+1} + w_{t+1} \right) \right\} \quad (33)$$

s. t. $x_{t+1/t} = H_{t+1} X_{t+1/t}$, given equation (32) and X_t.

where $Q \equiv C_z^{'} K C_z$, $U \equiv C_z^{'} K C_i$, and $R \equiv C_i^{'} K C_i$.

The combination of the two restrictions: $x_{t+1} = H_{t+1} X_{t+1}$ and equation $(\mathbf{32})$; and the partition of the matrices $\widetilde{A}_t$, $\widetilde{B}_{0t}$, Q and U in accordance to $(X_t^{'}, x_t^{'})'$ into:

$$\widetilde{A}_t = \begin{bmatrix} \widetilde{A}_{t11} & \widetilde{A}_{t12} \\ \widetilde{A}_{t21} & \widetilde{A}_{t22} \end{bmatrix}, \quad \widetilde{B}_{0t} = \begin{bmatrix} \widetilde{B}_{0t1} \\ \widetilde{B}_{0t2} \end{bmatrix}, \quad Q = \begin{bmatrix} Q_{11} & Q_{12} \\ Q_{21} & Q_{22} \end{bmatrix}, \quad U = \begin{bmatrix} U_1 \\ U_2 \end{bmatrix}$$

allow to rewrite (33) as:

$$X_t^{'} V_t X_t + w_t = \min_{i_t} \left\{ X_t^{'} Q^* X_t + 2 X_t^{'} U^* i_t + i_t^{'} R^* i_t + \delta E_t \left(X_{t+1}^{'} V_{t+1} X_{t+1}^{'} + w_{t+1} \right) \right\} \quad (34)$$

s.t. $X_{t+1} = A_t^* X_t + B_{0t}^* i_t + v_{t+1}$, given X_t.

where the starred matrices are defined by the following algorithm:

$$D_t = \left(\widetilde{A}_{t22} - H_{t+1} \widetilde{A}_{t12} \right)^{-1} \left(H_{t+1} \widetilde{A}_{t11} - \widetilde{A}_{t21} \right)$$

$$G_t = \left(\widetilde{A}_{t22} - H_{t+1} \widetilde{A}_{t12} \right)^{-1} \left(H_{t+1} \widetilde{B}_{0t1} - \widetilde{B}_{0t2} \right)$$

$$A_t^* = \widetilde{A}_{t11} + \widetilde{A}_{t12} D_t$$

$$B_{0t}^* = \widetilde{B}_{0t1} + \widetilde{A}_{t12} G_t$$

$$Q_t^* = Q_{11} + Q_{12} D_t + D_t^{'} Q_{21} + D_t^{'} Q_{22} D_t$$

$$U_t^* = Q_{12} G_t + D_t' Q_{22} G_t + U_1 + D_t' U_2$$

$$R_t^* = R + G_t' Q_{22} G_t + G_t' U_2 + U_2' G_t$$

$$f_t = -\left(R_t^* + dB_{0t}^{*'} V_{t+1} B_{0t}^*\right)^{-1} \left(U_t^{*'} + dB_{0t}^{*'} V_{t+1} A_t^*\right)$$

$$H_t = D_t + G_t f_t$$

$$V_t = Q_t^* + U_t^* f_t + f_t' U_t^{*'} + f_t' R_t^* f_t + d\left(A_t^* + B_{0t}^* f_t\right)' V_{t+1}\left(A_t^* + B_{0t}^* f_t\right)$$

Finally, the algorithm implies an iteration backwards in time until convergence to the steady-state point (f, H, V) is achieved [43].

[43] For further details, see Söderlind P. (1999) or his webpage: http://home.tiscalinet.ch/paulsoderlind/