The Role of the Exchange Rate in Inflation-Targeting Emerging Economies

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Contents

Tables

The following conventions are used in this publication:

• In tables, a blank cell indicates "not applicable," ellipsis points (. . .) indicate "not available," and 0 or 0.0 indicates "zero" or "negligible." Minor discrepancies between sums of constituent figures and totals are due to rounding.

• An en dash (–) between years or months (for example, 2007–08 or January–June) indicates the years or months covered, including the beginning and ending years or months; a slash or virgule (/) between years or months (for example, 2007/08) indicates a fiscal or financial year, as does the abbreviation FY (for example, FY2008).

• "Billion" means a thousand million; "trillion" means a thousand billion.

• "Basis points" refer to hundredths of 1 percentage point (for example, 25 basis points are equivalent to ¼ of 1 percentage point).

As used in this publication, the term "country" does not in all cases refer to a territorial entity that is a state as understood by international law and practice. As used here, the term also covers some territorial entities that are not states but for which statistical data are maintained on a separate and independent basis.

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Preface

This Occasional Paper explores the role of exchange rates in emerging economies with inflation-targeting regimes, an issue that has become especially germane during the current episode of financial turmoil and volatile capital flows. Under inflation targeting, the interest rate is the main monetary policy tool for influencing activity and inflation. However, there is little agreement about the appropriate role of the exchange rate. The need for further understanding of this issue is manifest in the wide array of exchange rate practices undertaken by emerging market economies, the dearth of academic analysis of this issue, and the high demand for IMF technical assistance on exchange rate issues among emerging economies that currently have inflation-targeting regimes or intend to adopt inflation targeting. This paper benefits from the unique perspective available to the IMF as a result of its near-universal membership and its cross-country analytical and operational work on the role of the exchange rate, which is at the core of the IMF's work on surveillance. This paper benefited from discussions with Karl Habermeier, the contribution of Carlos José Garcia Toledo to the modeling, and the research assistance of Harald Anderson and Claudia Jadrijevic.

The opinions expressed in this paper are solely those of the authors and do not necessarily reflect the views of the International Monetary Fund or its Executive Directors.

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I Executive Summary

The exchange rate plays a more important role in monetary policy for emerging economies that have adopted inflation targeting than for their advanced economy counterparts. Inflation-targeting emerging economies generally have less flexible exchange rate arrangements and intervene more frequently in the foreign exchange market. The enhanced role of the exchange rate reflects these economies' greater vulnerability to exchange rate shocks and their less developed financial markets. However, their sharper focus on the exchange rate may cause some confusion about the commitment of their central banks to the inflation target and may also complicate policy implementation. These tensions were heightened by the inflation pressures, greater exchange rate volatility, and financial stress arising from the global financial turmoil that began in mid-2007 and the subsequent economic crisis.

This paper explores the policy and operational role of the exchange rate within the broader monetary framework of inflation-targeting emerging economies. It also examines how emerging economies with other anchors make the transition to inflation targeting. The analysis is based on case studies and detailed documentation of exchange rate practices in a variety of countries and on simulations using a small model tailored to open, inflation-targeting economies. The key findings are these:

- Model-based analysis provides measured support for an explicit but limited role for the exchange rate in the inflation-targeting frameworks of emerging economies under certain circumstances.

- The benefits of a more explicit policy role for the exchange rate depend on the structure of the economy, the shocks to which it is exposed, and how the exchange rate is taken into account in the policy rule.

- Intervening in the foreign exchange market plays a larger role in policy implementation for inflation-targeting emerging economies than for advanced economies, but it is a special challenge for emerging economies, and modalities diverge considerably among them.

- The country experience suggests that a systematic, transparent, and market-based policy implementation approach can help reduce policy conflicts.

- A more systematic and market-based role for the exchange rate greatly enhances the transition of those emerging economies moving toward an inflation-targeting regime.

- The inflation episode of 2007–08 and the economic crisis that intensified in late 2008 confirm the relatively large role played by exchange rate policy for inflation-targeting emerging economies and, so far at least, demonstrate the resilience of inflation targeting to major global shocks.

Summary of Key Findings

An Enhanced Role for the Exchange Rate in Inflation-Targeting Emerging Economies

The enhanced role of the exchange rate in inflation-targeting emerging economies reflects strong, uncertain, and heterogeneous exchange rate channels. First, pass-through from the exchange rate to inflation is especially important for emerging economies, in part reflecting lower policy credibility. Second, many emerging economies manage the exchange rate to mitigate the impact on output of relatively short-term currency movements. A third, longstanding motivation for active management of the exchange rate is to promote financial stability, particularly against the impact of a potential depreciation on balance sheets with currency mismatches. Fourth, exchange rate management can also help avoid or mitigate the adverse consequences for external stability of a sudden stop in capital inflows. Fifth, underdeveloped domestic financial markets reduce the scope for exchange rate flexibility by amplifying exchange rate shocks and constraining policy implementation. Finally, a high degree of overall policy credibility frees up the exchange rate to float and enhances policy implementation and thus is necessary for the adoption of a full-fledged inflation-targeting nominal anchor.

The Appropriate Role for the Exchange Rate in the Monetary Policy Rule

A quantitative assessment of the trade-offs among monetary policy objectives demonstrates the circum-

stances under which different roles for the exchange rate in the policy rule can improve macroeconomic performance. The policy trade-offs are gauged in this paper using a small economic model to simulate the impact of shocks on advanced and emerging economies under different policy rules. The model demonstrates that inflation/output volatility is inherently higher for emerging economies. In general, the analysis tends to confirm the finding of earlier analyses that advanced, financially robust economies have little to gain from including the exchange rate explicitly in their policy reaction function, particularly in response to demand shocks.

At the same time, the analysis suggests that financially vulnerable emerging economies might benefit from including the exchange rate in the reaction function in a limited way, but that too much emphasis on the exchange rate is likely to be harmful. Including the exchange rate in the policy reaction function appears to help mitigate the impact of risk-premium shocks and cost-push shocks, especially by dampening interest rate and exchange rate volatility. These results do not amount to a ringing endorsement of active exchange rate management in inflation-targeting emerging economies, but they do shed some light on why the exchange rate plays an important role for most of these economies. Of course, it is not possible to draw strong policy conclusions for diverse economies on the basis of simulation results using small and necessarily simplified models, and there is great scope for further work.

The Role of Foreign Exchange Market Intervention in Inflation Targeting

An effective role for the exchange rate in policy implementation under an inflation-targeting framework can reduce conflicts between the inflation objective and other considerations. However, establishing strong policy implementation can be especially challenging for inflation-targeting emerging economies due to their policy legacy and their less developed financial markets. Under inflation targeting, the interest rate is the main monetary policy tool for influencing activity and inflation. Country experience suggests that foreign exchange market intervention should be implemented in the most systematic way possible. Transparency for the role of the exchange rate with respect to policy objectives, operational procedures, and ex post evaluation reduces the possibility of confusion about the inflation target. Of course, there are limits to the transparency of foreign exchange policy implementation, and country experience offers some sound policy transparency practices. The existence of deeper foreign exchange and domestic money markets enhances the effectiveness of changes in the policy stance, including through better signaling of policy intentions. Money market development makes it possible to use domestic monetary instruments rather than relying excessively on foreign exchange intervention, and it also facilitates sterilization.

The Role of the Exchange Rate during the Transition to Inflation Targeting

The exchange rate plays an important yet ill-defined role in the policy framework of emerging economies that have a flexible exchange rate but not a full-fledged inflation-targeting framework (referred to here as "emerging economies with other anchors"). These economies manage the exchange rate more actively, and policy implementation tends to be based on foreign exchange intervention that is more ad hoc and less market based. Exchange rate channels are probably stronger and more uncertain for typical emerging economies with other anchors because they are less financially developed, are more dollarized, and have less overall credibility compared to inflation-targeting emerging economies.

Establishing a more systematic, consistent, and market-based role for the exchange rate is a key to making the transition to inflation targeting. Model simulations suggest that giving the exchange rate a larger weight in the interest rate reaction function, or using the exchange rate as the operating policy target, can generate better macroeconomic performance than using a policy reaction function dominated by the interest rate. The degree of domestic money market development helps shape the choice of the operating target during the transition. Reducing the weights of the exchange rate in the reaction function over time is a sensible way to transition to an inflation-targeting regime. Central banks moving toward inflation targeting generally need to strengthen their macroeconomic analysis and develop a systematic approach to policy decision-making. Financial market development improves policy implementation by reducing the need to depend on foreign exchange intervention and by facilitating sterilization.

Implications of Recent Global Shocks

The inflation episode of 2007–08 and the subsequent global economic crisis had several broad implications for the role of the exchange rate in inflation-targeting emerging economies. First, these economies were more vulnerable to exchange rate pressures than inflation-targeting advanced economies. Second, foreign exchange intervention has been more prominent among inflation-targeting emerging economies, and some of this intervention has been nonmarket based. Third, inflation-targeting regimes have been broadly resilient to the shocks, with just two economies having adjusted their inflation target ranges and only Iceland, the smallest inflation-targeting economy, having dropped the regime altogether.

II   Introduction

The exchange rate plays a larger role in monetary policy for inflation-targeting emerging economies than for inflation-targeting advanced economies. Inflation-targeting emerging economies have less flexible exchange rate arrangements and intervene more frequently and less transparently. The exchange rate plays a more important role for a number of reasons, including high pass-through from changes in the exchange rate to inflation, the impact on output of relatively short-term exchange rate movements, balance sheet currency mismatches, underdeveloped financial markets, and lower overall policy credibility.

The enhanced role of the exchange rate poses specific challenges for inflation-targeting emerging economies. Using the exchange rate to smooth output or to address financial and external stability can set up trade-offs between price and output stability that can be difficult to gauge and are not well understood. Furthermore, an active role for the exchange rate may cause confusion about the commitment of the central bank to the inflation target in an environment of weak policy implementation, including when there is no fully integrated central bank decision-making process, a lack of transparency, undeveloped financial markets, and little or no inflation-targeting track record.

Global economic conditions further exacerbate the exchange rate challenges for inflation-targeting emerging economies. The ratcheting up of inflation pressures worldwide during 2007–08 led nearly all inflation-targeting emerging economies to overshoot their inflation targets. Increasingly volatile capital inflows raised exchange rate volatility.[1] The global crisis that accelerated in late 2008 poses formidable macroeconomic and financial stability challenges to inflation-targeting emerging economies and thus elevates the importance of having a properly designed monetary and exchange rate policy.

This paper sheds light on the policy and operational role of the exchange rate within the broad monetary framework for inflation-targeting emerging economies. It also examines how emerging economies with flexible exchange rates but without a full-fledged inflation-targeting framework (emerging economies with other anchors) can transition to inflation targeting.[2]

The bottom line is that, for emerging economies, an explicit but limited role for the exchange rate may improve macroeconomic performance, especially if implemented in a systematic, transparent, and market-friendly manner. For emerging economies with other anchors, the main policy challenge is to develop a more systematic approach to monetary and exchange policy in transitioning to an inflation-targeting framework.

This paper is unusual in that it explicitly brings together analysis of the policy formulation aspect and the implementation aspect of the monetary policy framework, which is important but not always easy to do. It is more challenging for inflation-targeting emerging economies because of the multiplicity and strength of exchange rate channels, the complexity of monetary operations under inflation targeting, and the crucial role of transparency. However, because policymakers must both formulate and implement policy, this paper seeks a more integrated understanding of the role of the exchange rate under inflation targeting.

The integrated approach of this paper is made possible by the use of two complementary analytical approaches. First, case studies and detailed documentation of exchange rate practices are used to identify the motivations for and consequences of exchange rate management and to assess policy implementation. Second, a quantitative model tailored for open-economy inflation-targeting countries is used to assess the macroeconomic motivations for and consequences of an active exchange rate policy. Model simulations provide explicit comparisons of the impact on macroeconomic performance of the most common shocks faced by robust and financially vulnerable economies that have flexible exchange rates and an inflation-targeting framework. In addition, the paper outlines the general implications of

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[1]The policy challenge from high inflation during this period is the subject of Habermeier and others (2009).

[2]The term "emerging economies with other anchors" as used here is a misnomer in that it does not encompass emerging economies that have fixed exchange rate arrangements.

Box 2.1. Country Groups Used in the Analysis[1]

This paper focuses on two country groups:[2]

- *Full-fledged inflation-targeting emerging economies:* They have a floating exchange rate (independent float or managed float), and they make a clear commitment to an inflation target.

- *Non-inflation-targeting emerging economies:* They have a flexible exchange rate (managed float, crawling peg, or crawling band) and do not make a clear commitment to an explicit inflation target.

In addition, two groups of countries are used for comparison: inflation-targeting and other advanced economies, and conventional-pegged-exchange-rate emerging economies.

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[1]The exchange rate arrangements and country groupings are based on the IMF's de facto classification system as of mid-2007.

[2]Countries with less than $17 billion of GDP and $1,345 in per capita GDP as of 2006 are excluded because exchange rate flexibility and inflation targeting are less of an option for them. These thresholds were based on the full-fledged inflation targeter with the lowest GDP (Iceland) and with the lowest per capita income (the Philippines).

Full-fledged Inflation-Targeting Emerging Economies (16)	
Brazil	Peru
Chile	Philippines
Colombia	Poland
Czech Rep.	Romania
Guatemala	Slovak Rep.
Hungary	South Africa
Indonesia	Thailand
Mexico	Turkey

Non-Inflation-Targeting Emerging Economies (15)	
Algeria	Kazakhstan
Angola	Malaysia
Argentina	Russia
Azerbaijan	Serbia
Costa Rica	Sri Lanka
Croatia	Tunisia
Dominican Rep.	Uruguay
Iran	

Inflation-Targeting and Other Advanced Economies (11)	
Australia	Norway
Canada	Singapore
Iceland	Sweden
Israel	Switzerland
Korea	United Kingdom
New Zealand	

Conventional-Pegged-Exchange-Rate Emerging Economies (17)	
Belarus	Qatar
China	Saudi Arabia
Egypt	Syrian Arab Rep.
Kuwait	Trinidad and Tobago
Latvia	Turkmenistan
Lebanon	Ukraine
Libya	United Arab Emirates
Morocco	Venezuela
Oman	

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the two recent global shocks for inflation-targeting emerging economies.

Some basic facts demonstrate the key differences among various possible roles for the exchange rate. Box 2.1 describes the key differences between inflation-targeting advanced economies, inflation-targeting emerging economies, and emerging economies with other anchors.

- *Exchange rate arrangement:* Almost all inflation-targeting advanced economies have an independent float, whereas both groups of emerging economies have less flexible arrangements (Table 2.1).

- *Exchange rate volatility:* Nevertheless, emerging economies have exhibited considerably more volatile monthly exchange rate behavior compared with inflation-targeting advanced economies (Table 2.2).

- *Interest rate reaction function:* Research on the interest rate reaction functions of emerging economies suggests that many respond to the exchange rate.[3]

- *Intervention frequency:* The inflation-targeting advanced economies intervene much less frequently than their inflation-targeting emerging economy

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[3]Mohanty and Klau (2004) estimated interest rate reaction functions for 13 emerging and transition economies and concluded that for 11 of them the coefficient of the real exchange rate was significant. Aizenman, Hutchison, and Noy (2008) estimated reaction functions for 16 emerging market economies and found that the inflation-targeting economies responded to the real exchange rate significantly and by more than the non-inflation-targeting economies. According to Edwards (2006), economies with a history of higher inflation and more real exchange rate variability seem to have a higher coefficient for the real exchange rate in their Taylor rules.

Table 2.1. Exchange Rate Arrangements and Foreign Exchange Intervention Practices (Selected Countries)[1]

	Inflation-Targeting and Other Advanced Economies (11)	Flexible-Exchange-Rate Emerging Economies	
		Inflation-targeting (16)	Non-inflation-targeting (15)
Exchange rate arrangement			
Conventional fixed peg			1
Pegged with horizontal bands		2	
Crawling peg			2
Managed floating	1	5	14
Independently floating	10	7	
Intervention frequency			
Never	9	5	
Weekly or more	1	2	7
Monthly	1	5	
Undisclosed		2	10
Intervention objective			
Competitiveness			3
Exchange rate alignment	8	3	3
Manage volatility	5	9	10
Financial stability	1		1
Manage foreign exchange reserves	1	4	5
Price stability	2	1	2
Slow appreciation			2
Signal monetary policy	1		
Foreign exchange market development			
Shallow			12
Emerging	2	14	5
Developed	9		
Intervention disclosure			
Confirm interventions	6		
Report intervention data		4	5
Manage foreign exchange reserves	11	14	12
SDDS subscribers[2]			
Yes	10	14	9
No	1		8

Sources: See Appendix I.

[1]The number of countries is given in parentheses; figures within each category may sum to more than the number of countries owing to multiple practices.

[2]SDDS = Special Data Dissemination Standard, established by the IMF to guide member countries that have or might seek access to international capital markets in the provision of their economic and financial data to the public.

counterparts (see Table 2.1), according to official documents.

• *Intervention objectives:* The most common intervention objective for the inflation-targeting advanced economies is to correct an exchange rate misalignment, whereas smoothing volatility is the most common objective for both groups of emerging economies (see Table 2.1). Furthermore, the emerging economies with other anchors also aim to promote competitiveness and limit the pace of currency appreciation.

This research and analysis reflects the strengthened mandate of the IMF to work on exchange rate issues, which is motivated in large part by the challenges faced by emerging economies.[4] The role of the exchange rate in the monetary policy framework is always at the core of the IMF's work on surveillance, and the demand for

[4]Previous work by the IMF on the role of the exchange rate for inflation-targeting emerging economies includes Roger and Stone (2005); Duttagupta, Fernandez, and Karacadag (2004); and Ötker-Robe and Vávra (2007).

Table 2.2. Exchange Rate and Reserve Volatility, 1996–2007 (Selected Countries)

	NEER[1]		REER[2]				U.S. Dollar		Reserve Volatility			
Months:	1	3	3	12	18	24	1	3	3	12	18	24
Inflation-targeting advanced economies (9)												
Median	0.06	0.07	0.08	0.08	0.07	0.08	0.12	0.13	0.29	0.29	0.30	0.32
Standard deviation	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.17	0.18	0.19	0.19
Inflation-targeting emerging economies (16)												
Median	0.13	0.14	0.13	0.13	0.14	0.14	0.18	0.19	0.29	0.29	0.29	0.37
Standard deviation	0.27	0.28	0.05	0.05	0.05	0.05	0.26	0.27	0.23	0.23	0.25	0.25
Non-inflation-targeting emerging economies (15)												
Median	0.24	0.27	0.12	0.11	0.13	0.11	0.29	0.30	0.60	0.58	0.65	0.62
Standard deviation	0.27	0.28	0.05	0.05	0.05	0.05	0.26	0.27	0.23	0.23	0.25	0.25
Pegged-exchange-rate emerging economies (17)												
Median	0.10	0.10	0.09	0.09	0.08	0.09	0.02	0.02	0.46	0.46	0.50	0.47
Standard deviation	0.37	0.38	0.12	0.13	0.13	0.12	0.48	0.50	0.25	0.26	0.27	0.27

Source: IMF staff estimates.

[1]NEER = nominal effective exchange rate (unadjusted, weighted average value of a currency relative to all major currencies).

[2]REER = real effective exchange rate (weighted average of a currency relative to an index or basket of other major currencies).

technical assistance in this area has been especially strong in recent years. The need for enhanced exchange rate surveillance was emphasized in several key IMF policy documents, including the Medium Term Strategy and the 2007 Surveillance Decision.

This Occasional Paper is structured as follows. Section III elaborates the reasons why the exchange rate plays a relatively large role for inflation-targeting emerging economies. Section IV presents a typology of inflation-targeting approaches to the exchange rate, describes the macroeconomic model, and summarizes the simulation results across approaches and shocks. Because macroeconomic models are not well-suited to addressing policy implementation issues, Section V documents the role of foreign exchange market intervention in inflation-targeting policy implementa-tion and makes some positive recommendations for inflation-targeting emerging economies. The myriad aspects of transitioning to an inflation-targeting framework are covered in Section VI. Section VII assesses the implications of recent global shocks for inflation-targeting emerging economies, and Section VIII discusses the four basic questions posed by the role of the exchange rate in the broad monetary framework for inflation-targeting emerging economies. Case studies of the role of the exchange rate in the overall policy framework of selected economies are in Section IX, and Section X documents the foreign exchange market intervention practices of both inflation-targeting emerging economies and emerging economies with other anchors. Appendix II presents in detail the macroeconomic model and results.

III   Why the Exchange Rate Plays a Large Role in Emerging Economies

This section addresses why the exchange rate plays a more important policy and operational role for emerging economies than for advanced economies. In short, the channels between the exchange rate and economic and financial performance tend to be larger and more uncertain for emerging economies. The following section models the stronger exchange rate channels, and the implications for implementation are addressed in Section V. This section is necessarily qualitative and draws on the research literature, the country and foreign exchange intervention case studies, and descriptive data.

Pass-Through from the Exchange Rate to Inflation

The pass-through from changes in the exchange rate to inflation is important for any relatively open flexible-exchange-rate economy. Pass-through operates directly through the effect of exchange rate movements on prices and indirectly through the impact of exchange rate movements on aggregate demand and prices. Generally, the empirical literature finds that pass-through from exchange rate changes into import prices is less than one (the law of one price does not hold) owing to a variety of factors, particularly transport costs, distribution costs, and price discrimination.

Pass-through has been on a trend decline around the world (Helbling, Jaumotte, and Sommer, 2006). Gagnon and Ihrig (2004) find a threefold decline in pass-through during the 1990s. The reasons for the decline include worldwide disinflation (Taylor, 2000; Choudhri and Hakura, 2001; and Gagnon and Ihrig, 2004), pricing to market, and credibility gains (Mishkin and Savastano, 2001, 2002; and Schmidt-Hebbel and Werner, 2002).

Pass-through is relatively important for emerging economies with shorter track records and other factors that lead to relatively low credibility (Frankel, Parsley, and Wei, 2005; and Ho and McCauley, 2003). Per capita income and distance from trading partners seem to be the most robust determinants of pass-through (Frankel, Parsley, and Wei, 2005).

Other determinants include inflation and exchange rate volatility (Gagnon and Ihrig, 2004). Pass-through seems to decrease with the level of development and increase with openness, and emerging economies have higher and more variable inflation, experience greater exchange rate volatility, and are more dollarized (Honohan and Shi, 2003). A regime change to full-fledged inflation targeting has been found to reduce pass-through (Gagnon and Ihrig, 2004; Reyes, 2007; and Nogueira Júnior and León-Ledesma, 2008a, 2008b). This suggests that the emerging economies with other anchors have to deal with larger exchange rate pass-through.

Large, rapid, and uncertain pass-through can lead central banks to put weight directly on the exchange rate to reduce the level and volatility of inflation.[5] A change in the exchange rate can rapidly raise inflation and inflation expectations, thus compelling the central bank to quickly take action to influence the exchange rate by changing interest rates or intervening in the foreign exchange market. However, these actions may give the impression that the central bank cares about the exchange rate above and beyond its impact on inflation. Pass-through is modeled explicitly in Section IV, including by simulating the exchange rate in the reaction function. Foreign exchange intervention is covered in Section V.

Output Stability

Many emerging economies aim to manage the exchange rate in order to mitigate the impact on output of relatively short-term (monthly or quarterly) exchange rate movements. A number of IMF staff reports on flexible-exchange-rate emerging economies find that intervention is used to limit exchange rate volatility, although the reasons for such intervention are not always fully articulated. Some empirical studies show

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[5]During 2007–08, exchange rate policy played some role in containing inflation pressure in a number of inflation-targeting emerging economies, particularly where there was strong exchange rate pass-through to inflation, as discussed in Section VII.

that exchange rate volatility has a significant but small negative effect on trade.[6]

As noted, using the exchange rate to smooth output volatility can create confusion regarding the commitment to an inflation target or objective. Full-fledged inflation-targeting economies with long track records can be relatively transparent and find it easier to credibly explain to the markets the rationale for exchange-rate-smoothing interventions. In contrast, economies with less of a commitment to an inflation target and a shorter track record have a harder time intervening to smooth volatility in a way that is clear to the market. Conceptually, such intervention should be aimed at temporary exchange rate shocks, which raises the challenge of judging the duration of such shocks. The trade-offs posed by managing the exchange rate in order to smooth output volatility are modeled explicitly in Section IV.

Financial and External Stability

Promoting financial and external stability has long been a motivation for active management of the exchange rate, mainly to limit depreciation. In recent years, balance sheets with currency mismatches have been an important channel for large exchange rate depreciations (Allen and others, 2002). Governments are exposed to the extent that their foreign currency debt (foreign and domestic) exceeds their foreign reserves. Banks are exposed directly through their net asset positions and indirectly when borrowers themselves have balance sheet mismatches. Firms and households can have large, negative financial accelerator effects for the economy as a whole.

Emerging economies are typically more exposed to exchange rate fluctuations than advanced economies. The bulk of their international borrowing is denominated in foreign exchange. Currency crises can cause severe recessions (Kaminsky and Reinhart, 2000), especially if coupled with a banking crisis (Hutchison and Noy, 2005). The exchange rate policies of Asia were largely shaped by the crisis of 1997–98. In 2007, the National Bank of Kazakhstan undertook large-scale interventions which helped limit the depreciation prompted by worldwide financial developments.

Dollarization can exacerbate financial stability concerns arising from exchange rate depreciations. Dollarization can raise credit risks when banks lend in

Table 3.1. Dollar Deposits, Percent of Total (Selected Countries)

Inflation-targeting advanced economies	
Median	15.0
Standard deviation	4.3
Inflation-targeting emerging economies	
Median	14.1
Standard deviation	20.1
Flexible-exchange-rate, non-inflation-targeting emerging economies	
Median	44.6
Standard deviation	26.2
Pegged-exchange-rate emerging economies	
Median	25.2
Standard deviation	17.9

Sources: See Appendix I.

foreign currencies while borrowers' salaries are in local currency. The relatively high level of dollarization of the emerging economies with other anchors may help explain why they have a more active exchange rate policy compared with the advanced economies and the inflation-targeting emerging economies (Table 3.1). In Peru, to prevent risks associated with dollarization, the authorities tend to avoid excess exchange rate volatility, particularly abrupt depreciation, which may have facilitated dedollarization.

In some countries, systemic financial stress arising from an underdeveloped banking system affects exchange rate policy. Rapid credit growth in Romania and South Africa contributed to current account imbalances, exchange rate appreciation, and inflation pressures. Prudential risks and vulnerabilities in the banking system present challenges when moving toward a flexible-exchange-rate arrangement. There are risks posed by a lack of incentives to manage exchange rate risk, rapid credit growth, and rising exposure of unhedged borrowers. Balance sheet mismatches can lead central banks to have implicit thresholds below which they will not let the exchange rate depreciate. Extended intervention to support such a threshold may run down reserves and reduce the credibility of monetary and exchange rate policy in general.

The threat to external stability of a sudden stop of capital inflows is a special concern for many emerging economies. Many of those emerging economies that have been intervening during the past several years in the face of heavy capital inflows cite concerns that exchange rate overshooting could be followed by a sudden stop and a large contractionary depreciation (for example, Romania). A period of strong capital inflows may cause domestic booms in credit and demand (justi-

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[6]Theoretical work on the impact of exchange rate volatility on trade is ambiguous, reflecting that the nature of shocks that cause exchange rate changes can lead to changes in other macroeconomic variables that offset the impact of the movement in the exchange rate (Clark and others, 2004; Koren and Szeidl, 2003). Aghion and others (2007) find that real exchange rate volatility reduces long-term productivity growth for countries with undeveloped financial markets but has a limited effect on financially developed countries.

Table 3.2. Market Development Indicators (Selected Countries)
(Ratio to GDP)

	Stock Market Turnover	Broad Money	Foreign Exchange Market Turnover
Inflation-targeting advanced economies			
Median	79.3	85.8	1,022.7
Standard deviation	52.4	37.9	597.2
Inflation-targeting emerging economies			
Median	10.8	45.6	197.9
Standard deviation	24.6	21.0	191.2
Flexible-exchange-rate non-inflation-targeting economies			
Median	2.2	34.1	112.5
Standard deviation	15.3	27.1	173.2
Pegged-exchange-rate emerging economies			
Median	4.3	42.3	56.4
Standard deviation	56.0	51.5	17.5

Sources: See Appendix I.

fying a tighter monetary policy stance), but it may also cause an appreciation of the currency and a widening of the current account deficit that together make policy-makers hesitant to tighten. Prolonged foreign exchange intervention to stabilize the exchange rate can lead the authorities to take on a large share of currency risk, encouraging further (excessive) capital inflows and increasing the risk of a sudden stop. Emerging economies have used blunter tools, such as reserve requirements and even capital controls, to control liquidity, but these are not consistent with inflation targeting and generally are not effective (Roger and Stone, 2005).

There are trade-offs between using exchange rate management to address financial and external stability concerns and using it to promote price and output stability. These trade-offs are modeled explicitly in Section IV.

Underdeveloped Financial Markets

Underdeveloped domestic financial markets reduce the scope for exchange rate flexibility by amplifying exchange rate shocks and constraining policy implementation. The clear differences in the levels of market development across the groups of countries probably help explain the different exchange rate policy approaches (Table 3.2; see also Table 2.1).

Underdeveloped financial markets can lead to more active management of the exchange rate to promote price, output, and financial stability. Uncompetitive markets with thin volume and limited or no derivatives

instruments are less able to absorb shocks without wide exchange rate fluctuations. The lack of instruments for managing the exchange rate risk leaves foreign exchange users vulnerable to wider exchange rate movements. These considerations can compel the authorities to choose a more rigid exchange rate arrangement. Extended intervention to stabilize the exchange rate can remove incentives for the private sector to develop currency risk-management tools.

The case studies suggest that a more developed foreign exchange market reduces the need for foreign exchange intervention, provides hedging instruments, and facilitates the signaling channel. In Chile, the foreign exchange market offers a developed market for hedging through foreign exchange forwards and is deep enough to smooth exchange rate volatility, thus alleviating the burden on monetary policy and allowing infrequent and transparent foreign exchange intervention. In Colombia, the developed foreign exchange market allows a sophisticated and transparent approach to foreign exchange intervention. In New Zealand, the very deep foreign exchange market and the central bank's stringent intervention criteria help limit the need to intervene. In Serbia, the role of the central bank in the foreign exchange market remains important, and intervention objectives are focused on supporting the transition to a fully developed interbank market. In Turkey, the developed foreign exchange market helps the central bank participate only in response to extraordinary events because the availability of risk-management instruments helps market participants manage exchange rate volatility in the interbank market.

Table 3.3. Indicators of Credibility (Selected Countries)

	Average Consumer Price Index Inflation			Standard & Poor's Rating of Long-Term Local-Currency-Denominated Government Debt
	1997–2007	2002–07	2005–07	
Inflation-targeting advanced economies (11)				
Median	2.3	1.9	1.8	AAA
Standard deviation	1.1	1.1	1.3	
Inflation-targeting emerging economies (16)				
Median	6.6	5.1	4.9	BBB+
Standard deviation	11.6	4.3	2.5	
Non-inflation-targeting emerging economies (15)				
Median	9.9	11.0	9.4	BB+
Standard deviation	29.6	10.6	4.5	
Pegged-exchange-rate emerging economies (17)				
Median	3.7	5.6	7.5	BBB
Standard deviation	18.6	6.4	4.2	

Sources: International Financial Statistics database, and Standard & Poor's.

Developed money markets and government security markets also provide more policy options. Weak interest rate transmission from underdeveloped money markets can compel a leading policy role for the exchange rate. Furthermore, underdeveloped money and security markets can raise the costs of sterilization and result in large liquidity creation from capital inflows. Finally, the absence of developed money markets can inhibit the adoption of inflation targeting under which a short-term interest rate is used as the operating target.

The implications of underdeveloped financial markets for policy implementation are elaborated in Section VI, and the case studies and examples of good implementation practices are documented in Sections IX and X.

Credibility

A reasonably sized and developed country with a supportive set of economic and structural policies allows for a credible commitment to an inflation target and less reliance on managing the exchange rate. A large dose of credibility is needed for an emerging economy to reap the benefits of a full-fledged inflation-targeting nominal anchor, which frees the exchange rate to float and also facilitates policy implementation. Furthermore, economies with flexible exchange rates that have yet to adopt explicit inflation targets can be considered in transition to a single nominal anchor, and completing this transition requires establishing the groundwork for a credible commitment to the inflation target.

To better understand the differences in credibility across economies with different monetary and exchange rate regimes, credibility is crudely proxied here by the actual inflation outturn and by market ratings of long-term local-currency-denominated government debt. The inflation-targeting economies have much better inflation outturns (Table 3.3). Low inflation signals that a central bank can make a credible commitment to an inflation target. Furthermore, low and positive inflation is supportive of high and stable long-term growth (see, for example, Sarel, 1996), and a monetary policy supportive of long-term growth can be more credible. The lowest inflation rates in recent years have been in the inflation-targeting advanced economies, followed by the inflation-targeting emerging economies; the emerging economies with other anchors have had the highest inflation rates. The inflation-targeting economies have higher ratings of long-term local-currency-denominated government debt.[7] This gauge is forward looking and directly captures market perceptions of the degree of long-term market confidence in the stability

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[7]It would be preferable to use market-based measures of central bank credibility, but such measures are available for only a few economies. In addition, comparisons of actual versus targeted inflation are precluded by the absence of firm quantitative targets for many economies. Indicators of the stability of inflation expectations in the face of inflationary shocks would be another good gauge of credibility, but cross-country data are not available.

of a currency, which ultimately is the responsibility of the central bank even though it reflects factors beyond the scope of monetary policy. The inflation-targeting advanced economies have the highest ratings, followed by the inflation-targeting emerging economies and the emerging economies with other anchors. These indicators of credibility, while rough, suggest that higher credibility is associated with a smaller role for the exchange rate.

The underlying elements of credibility for inflation targeting have been extensively examined and are not directly addressed in this paper.[8] All inflation-targeting economies are fairly large and developed, which suggests that inflation targeting requires size and a somewhat advanced economy. An inflation-targeting central bank needs a mandate to pursue the inflation target and sufficient discretion and autonomy to set its monetary instruments accordingly. A strong fiscal position is essential: it is not good enough that monetary policy not be dominated by fiscal priorities, because even suboptimal policies can hurt credibility in a country with high debt and a short history of sound fiscal management (Blanchard, 2005; and Schabert and Van Wijnbergen, 2006).

Other Exchange Rate Policy Channels

This paper does not address the issue of managing the exchange rate to maintain export competitiveness. Recent IMF staff reports have discussed such intervention by emerging economies with flexible exchange rates in order to limit exchange rate appreciation for reasons including competitiveness (Argentina, Azerbaijan, Indonesia, Kazakhstan, Korea, Russia, Tunisia, Ukraine, and

Uruguay). In Hungary, the center of the exchange rate band was adjusted as part of other government economic policy measures to support exporters. In general, competitiveness is driven by the real exchange rate which, over the medium and long term, is beyond the control of monetary and exchange rate policy. Of course, there is a thin line between, on one hand, intervention to smooth the impact of monthly or quarterly exchange rate changes on the relative price of exports and on output volatility and, on the other, intervention to maintain competitiveness over the long term. In most circumstances, a depreciated nominal exchange rate will feed into higher inflation and a higher real exchange rate, ultimately undermining competitiveness.

Nor does this paper consider new rationales for maintaining a weak currency that are based on positive growth structural channels. Johnson, Ostry, and Subramanian (2007) find that avoiding prolonged periods of exchange rate overvaluation helps sustain growth, although this may have more to do with the degree of capital account openness and structural policies than with monetary policy. Rodrik (2007) asserts that there is a systematic relationship between growth and undervaluation for emerging and developing economies. In these economies, tradables are different as a result of market failures (information and coordination externalities) and the impact on them of institutional weakness and contracting incompleteness. Levy-Yeyati and Sturzenegger (2007) find that in recent years exchange rate intervention has been asymmetrically aimed at stemming appreciation and that depreciation benefits economic growth not through the traditional channel of increasing net exports but rather by boosting domestic savings and capital accumulation. These channels involve changes in the equilibrium steady state of the economy, which are not modeled in this paper.

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[8]See Batini, Kuttner, and Laxton (2005); and Schaechter, Stone, and Zelmer (2000).

IV Different Roles for the Exchange Rate and the Policy Trade-Offs

This section uses a model-based approach to evaluate the performance of different inflation-targeting approaches.[9] First, a taxonomy of inflation-targeting approaches is developed, modifying the conventional approach to take more explicit account of the role of exchange rate considerations in monetary policy formulation. Then, the performance of these approaches is evaluated in different types of economies and for handling different types of shocks.

Research focusing mainly on models of industrial economies suggests that including the exchange rate in the central bank's policy reaction function is unlikely to deliver significant benefits. Taylor (2001) suggests that this may reflect the fact that exchange rate movements are already taken into account indirectly in a standard inflation-targeting framework and also that the appropriate response to the exchange rate depends on the nature of the underlying shock. Nonetheless, both Taylor (2000) and Mishkin (2000) underscore the need for further research in this area, particularly for emerging economies.

More recent research tends to focus on whether particular characteristics of emerging economies might justify including the exchange rate directly in the reaction function. Batini, Levine, and Pearlman (2007) find that no weight should be put on the exchange rate in a financially vulnerable economy and argue that, because dollarization weakens the output gap channel of transmission relative to the exchange rate channel, nothing should be done to limit the flexibility of the exchange rate in order to achieve the inflation target. Ravenna and Natalucci (2008) also caution against putting much weight on exchange rate stabilization, particularly in the event of productivity shocks. Others, including Morón and Winkelried (2005) and Cavoli and Rajan (2006), suggest that there may be some benefit in including the exchange rate in the reaction function in financially vulnerable economies, but they also find that the optimal weight is low. Leitemo and Söderstöm (2005) consider the choice of policy rules when there is exchange rate uncertainty and find that a plain vanilla rule is slightly more robust than an open-

economy rule, whereas Wollmershäuser (2006), examining a wider range of rules and uncertainties, comes to the opposite conclusion. McCallum (2006) also finds that an exchange-rate-based approach to inflation targeting may be beneficial in a very open economy.

A Taxonomy of Inflation-Targeting Approaches

This subsection outlines a taxonomy of approaches for bringing the exchange rate into the inflation-targeting framework:

- the conventional open-economy inflation-targeting framework—plain vanilla inflation targeting—in which exchange rate movements are taken into account only indirectly;

- an open-economy approach, which adds an explicit exchange rate objective to the plain vanilla approach;

- inflation targeting with an explicit exchange rate band; and

- inflation targeting with the exchange rate rather than a short-term interest rate as the policy instrument.

These approaches have three important features in common. The first is that stabilizing inflation around the target rate is the overriding policy objective over the medium term.[10] Second, the central bank may also seek to reduce the volatility of output, interest rates, and the exchange rate, but it must do so in a way that is consistent with the medium-term inflation target.[11] Third, the various rules involve a systematic approach to policy in the sense that the elements of the central

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[9]See Roger, Restrepo, and Garcia (2009) for a full description of the model and analysis in this section and Appendix II.

[10]Essentially, this requires that the policy instrument reacts strongly enough to a gap between the inflation forecast and the target to ensure that inflation will return to the target rate over the long term.

[11]In this context, it is important to distinguish clearly between *targets* and *objectives*. The central bank has a target for the steady-state level of inflation, but it has no target for either output or the exchange rate (either level or rate of change). The inflation target is distinct from the objective of minimizing variations in inflation around the target and variations in output, interest rates, and the exchange rate from their steady-state values.

bank's policy reaction function, and the weights placed on the elements, are stable over time.

Plain Vanilla Inflation Targeting in an Open Economy

The plain vanilla approach describes the conventional open-economy inflation-targeting framework practiced in advanced economies.[12] Monetary policy formulation involves periodic adjustments in a target policy interest rate, guided primarily by deviations of projected inflation from the target and, to a lesser extent, by the deviation of actual GDP from potential GDP (the output gap). Typically, the central bank also seeks to smooth the path of interest rates. This approach to policy formulation is represented here by the policy reaction function:

$$\hat{i}_t = \int \lambda \hat{i}_{t-1} + (1-\lambda)\left[\alpha\hat{\pi}_t + \beta\hat{y}_t\right] + v_t \qquad (4.1)$$

where:

$\hat{i}_t \equiv i_t - (\bar{r} + \pi^T)$ is the deviation of policy target interest rate i in period t from its long-run steady-state value, defined as the long-run equilibrium real interest rate $\bar{r}$, plus the target inflation rate π^T;

$\hat{\pi}_t \equiv (\pi_t^f - \pi^T)$ is the deviation of the period t inflation forecast, π_t^f, from the inflation target π^T;

$\hat{y}_t \equiv (y_t - \bar{y}_t)$ is the deviation of real output y from $\bar{y}$, the estimated level of potential output, in period t;

v_t represents additional policy judgment as well as imprecision in policy implementation.

Key features of the plain vanilla reaction function are the following.

- The exchange rate does not appear explicitly in the policy reaction function. However, exchange rate developments and prospects are taken into account implicitly because they affect the inflation forecasts and output.[13]

- To ensure that the central bank's actions are consistent with achieving the inflation target, the value of α should be greater than 1, so that the real interest rate changes by at least as much as any change in deviation of projected inflation from target.[14]

- Although the central bank does not have a long-run target for the level of output or growth, it places some weight on dampening output volatility around

the sustainable, noninflationary level of output (potential output) to ensure long-run consistency with the primary inflation objective.[15]

- The parameter λ characterizes the degree of policy inertia. If λ is high, the central bank will normally adjust the policy stance only gradually in response to economic developments or prospects.

Open-Economy Inflation Targeting

Open-economy inflation targeting involves explicitly taking exchange rate developments into account in the central bank's policy reaction function, rather than doing so only indirectly through the effects on output and the inflation forecast. The exchange rate enters the reaction function in essentially the same way as output: there is no target for the exchange rate, but some weight is placed on dampening exchange rate volatility:[16]

$$\hat{i}_t = \lambda\hat{i}_{t-1} + (1-\lambda)\left[\alpha\hat{\pi}_t + \beta\hat{y}_t + \gamma(\hat{q}_t - \phi\hat{q}_{t-1})\right] + v_t \quad (4.2)$$

where:

$\hat{q}_t$ is the deviation of the real exchange rate in period t from its steady-state equilibrium value.

This specification allows for dampening volatility in the level of the exchange rate relative to the long-run equilibrium rate, dampening changes in the exchange rate, or both:

- If $\phi = 0$, the central bank systematically dampens deviations in the level of the real exchange rate from the steady-state equilibrium rate.[17]

- Alternatively, if $\phi = 1$, the central bank dampens changes in the real exchange rate, consistent with limiting exchange rate volatility.

- More generally, if $0 < \phi < 1$, the central bank places some weight on dampening rapid changes in the exchange rate and some weight on limiting exchange rate misalignment.

Including the exchange rate in the reaction function does not imply the establishment of an exchange rate target. Indeed, it is essential that policy measures to dampen exchange rate volatility be conducted in a manner that is consistent with the noninflationary long-

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[12]See, for example, Mishkin (2000) and Truman (2003) for overviews of the framework and Svensson (2000) for a model-based analysis of policy formulation.

[13]See, for example, Brook (2001), Ragan (2005), and Taylor (2001).

[14]The distinction between "strict" and "flexible" inflation targeting discussed in Svensson (2000) partly hinges on whether α is much greater than β.

[15]Caution is needed in interpreting the weights in the reaction function. These do not necessarily reflect the central bank's preferences regarding stable inflation versus other objectives. For example, even if the central bank has no interest in stabilizing output per se, it might put some weight on dampening output volatility if this contributed to stabilizing inflation.

[16]See, for example, Ball (2000); Batini, Harrison, and Millard (2001); and Taylor (2001).

[17]Note that the steady-state value of the real exchange rate may have an upward or downward trend over time, particularly in emerging economies that experience significant structural change.

term equilibrium of the economy. This is particularly important if the policy responds to deviations in the level of the exchange rate around the estimated steady-state value, because errors in estimating the long-term equilibrium level may lead to both a systematic bias in the policy stance and a conflict between the inflation and exchange rate objectives.[18]

In practice, many inflation-targeting emerging economies appear to adjust interest rates systematically in response to exchange rate movements, consistent with an open-economy inflation-targeting approach.[19] Several case studies (including Peru) suggest that monetary policy in these countries might be better characterized as open-economy inflation targeting than as plain vanilla inflation targeting, insofar as the central banks have shown a fairly systematic tendency to "lean against" significant movements in their exchange rates.

Inflation Targeting with an Exchange Rate Band

Inflation targeting with an exchange rate band involves setting limits on the acceptable range of movement for the exchange rate. In the case of a symmetric exchange rate band, the policy reaction function can be represented as follows:[20]

$$\hat{i}_t = \lambda \hat{i}_{t-1} + (1 - \lambda)\left[\alpha \hat{\pi}_t + \beta \hat{y}_t + (\gamma + \theta)(\hat{q}_t - \phi \hat{q}_{t-1})\right] + \nu_t \quad (4.3)$$

where:

$\theta = 0$ if $|\hat{q}_t| < q'$

$\theta \neq 0$ if $|\hat{q}_t| \geq q'$

q' is half the width of the exchange rate band.

Within the band, the approach works essentially like the open-economy inflation-targeting approach, but once the edge of the band is reached, the inflation objective is overridden by the exchange rate objective.[21] Clearly, if the exchange rate band is wide relative to the typical magnitude of exchange rate changes, then the band is rarely binding and the approach is similar to open-economy inflation targeting. If the

band is relatively narrow, however, the regime may appear similar to an exchange rate peg (a crawling peg if the equilibrium exchange rate is moving over time or some kind of peg to a composite if the real effective exchange rate is used). The nonlinearity of the policy response to exchange rate movements that is implied by this framework is difficult to incorporate in a simple model, and for this reason it is not included in the model simulations.

Several countries have used this approach, especially to transition to inflation targeting. Chile (1990–99) and Israel (1992–96) used this framework in their transitions from relatively high-inflation, exchange-rate-based regimes to low-inflation, full-fledged inflation-targeting frameworks.[22] Recent examples include Hungary (until early 2008) and the Slovak Republic.

Exchange-Rate-Based Inflation Targeting

The exchange rate rather than an interest rate can be used as the operating instrument or proximate target for monetary policy. In this case, the central bank's policy reaction function can be described as follows:

$$\hat{q}_t = \lambda \hat{q}_{t-1} + (1 - \lambda)\left[\alpha \hat{\pi}_t + \beta \hat{y}_t\right] + \nu_t \quad (4.4)$$

As in the plain vanilla and open-economy approaches, the coefficient on the inflation objective, α, must be high enough to ensure that inflation is brought back to target over the medium term. In principle, this approach could be implemented directly through unsterilized intervention in the foreign exchange market. Alternatively, the central bank could use a very short-term domestic interest rate to move the exchange rate to the desired level.[23]

To date, only two countries have used the exchange-rate-based approach: New Zealand during the early 1990s and Singapore currently.[24] In both cases, use of the exchange rate as the operational target substantially reflected the openness of the economies and consequently the importance of the exchange rate relative to interest rates in the monetary policy transmission mechanism.[25]

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[18]Of course, this applies equally to dampening fluctuations in the actual level of output relative to the estimated level of potential output.

[19]See, for example, Mohanty and Klau (2004); Frömmel and Schobert (2006); and Leiderman, Maino, and Parrado (2006).

[20]See Morón and Winkelried (2005).

[21]As long as the deviation of the real exchange rate from the steady-state equilibrium, $\hat{q}_t$, is less than some amount q', then policy is based on an open-economy inflation-targeting approach (or a plain vanilla approach if the exchange rate coefficient γ is set to zero). However, if the exchange rate reaches the q' threshold, then the interest rate response to further exchange rate deviation, $(\gamma - \theta)$, is much stronger, overriding the inflation objective.

[22]See Leiderman and Bufman (2000), and Morandé and Schmidt-Hebbel (2000).

[23]In this case, the exchange rate can be described as a proximate or operational target, intermediate between the operating instrument and the inflation objective.

[24]The classification of the monetary and exchange rate framework in Singapore is somewhat uncertain. One study, by Parrado (2004a), estimates that there is a very high degree of exchange rate smoothing, which may not be fully consistent with inflation targeting. Moreover, the Singapore authorities themselves do not describe their framework as an inflation-targeting regime.

[25]See Monetary Authority of Singapore (2001), Grimes and Wong (1994), and Mayes and Riches (1996).

Evaluation of Alternative Inflation-Targeting Approaches

In this subsection, a small open-economy model is used to evaluate the performance of alternative inflation-targeting approaches in financially robust advanced economies and financially vulnerable emerging economies. The analysis begins with a brief description of the model, focusing on structural differences between the stylized advanced and emerging economies. This is followed by a discussion of the results of the model simulations, which compare how different policy rules perform in the different types of economies and in response to different kinds of economic disturbances.

The main purpose of the analysis is to provide a more systematic comparison of the performance of alternative approaches. In most studies, alternative rules are compared in the context of a particular type of economy or shock (see, for example, Batini, Harrison, and Millard, 2001; Cavoli and Rajan, 2006; McCallum, 2006; and Ravenna and Natalucci, 2008). Other studies compare the performance of particular rules across economies but do not specifically address the issue of the benefits of including the exchange rate in the reaction function (for example, Morón and Winkelried, 2005). Finally, the range of shocks used to evaluate different rules and different economies varies considerably from study to study. This analysis compares the performance of a range of simple policy rules in both financially robust economies and financially vulnerable economies and in response to a standard set of shocks.

Model Characteristics

The analysis is based on a conventional, small, open-economy model. Standard features of such models include forward-looking optimizing behavior by households and firms, together with nominal and real rigidities that generate sluggish adjustments to economic disturbances. These rigidities provide scope for monetary policy to have real effects in the short term but not over the long term. The open-economy nature of the model is reflected both through the importance of international trade in aggregate demand and by the effects of international trade and financial flows on interest rates and the exchange rate. The model is discussed in greater detail in Appendix II, but some important features are particularly relevant:

- Aggregate demand includes domestic and foreign demand components; higher real interest rates dampen demand, whereas a weaker currency boosts demand.

- Firms use labor and imported inputs in production. Real wages are procyclical so that stronger aggregate demand increases production costs. A weaker currency also boosts production costs and induces substitution toward the use of more labor and fewer imports in production.[26]

- Inflation is largely determined by the price-setting behavior of firms. Prices are adjusted periodically and reflect past changes and forward-looking expectations about costs.

- The relationship between the exchange rate and the interest rate comprises (1) a conventional uncovered interest parity (UIP) condition that links domestic risk-free interest rates to foreign rates and to the expected change in the exchange rate; (2) a risk premium reflecting the current account balance; (3) the level of external debt relative to GDP; and (4) the vulnerability of corporate balance sheets to exchange rate movements.

Two versions of the model are calibrated to create stylized representations of a financially robust advanced economy and a financially vulnerable emerging economy. The main differences between the stylized economies reflect the following:

- *Domestic financial system development:* In the emerging economy, interest rates are assumed to be less effective in influencing demand than in the advanced economy, reflecting a less developed financial system.

- *External financial vulnerability:* In the emerging economy, the differential between domestic and foreign interest rates is assumed to be more sensitive to the evolution of external debt and the current account balance than in advanced economies, consistent with less stable capital mobility and asset substitutability.[27] In addition, the emerging economy is assumed to have a high proportion of financial liabilities denominated in foreign currency, making it vulnerable to strong balance sheet effects resulting from exchange rate changes. These balance sheet effects are assumed to outweigh the more conventional macroeconomic effects of exchange rate changes.[28]

- *Policy credibility:* In the emerging economy, price setting by firms is assumed to be more backward looking than in the advanced economy. This

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[26]The model does not include direct exchange rate pass-through from foreign to domestic prices. Pass-through is indirect via the cost of imported goods used in production. The magnitude of pass-through therefore depends on the openness of the economy (the share of imported inputs in production) as well as the extent to which changes in costs can be passed on to consumers.

[27]In other words, the risk premium depends partly on the external-debt-to-GDP ratio and on the current external balance, and in the financially vulnerable economy the coefficients on these terms are assumed to be larger than in the financially robust economy.

[28]This approach to modeling external financial vulnerability follows Céspedes, Chang, and Velasco (2004) and Morón and Winkelried (2005).

reflects weaker policy credibility as a legacy of higher inflation and more limited central bank independence.[29]

Model Simulations

Three kinds of model simulations are conducted, with each focused on a slightly different question:

- How do different roles for the exchange rate affect the trade-off between the variability of inflation and output?

- How do changes in the weight placed on the exchange rate in the policy reaction function affect the variability of inflation and output?

- How do different roles for the exchange rate affect the variability of a wider range of macroeconomic and financial variables?

How do different roles for the exchange rate affect the trade-off between the variability of inflation and output?

The simulations distinguish between different economic structures in the financially robust advanced economy and the financially vulnerable emerging economy and different types of economic shocks, including demand shocks, cost-push shocks, and risk-premium shocks.[30]

The variability of output and inflation and the trade-offs between them differ substantially according to the nature of the shocks and the structure of the economy. Figure 4.1 shows policy trade-offs for plain vanilla inflation targeting in robust advanced economies and vulnerable emerging economies. The curves, or frontiers, show the combinations of inflation and output variability achievable by varying the relative weights on inflation and output in the plain vanilla inflation targeting policy rule (see Equation 4.1).

The volatility of output and/or inflation is typically significantly higher in the vulnerable emerging economy than in the robust advanced economy for comparably sized shocks of all kinds, reflecting differences in economic structure.[31] In both types of economies, the scope for a trade-off between inflation and output vari-

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[29]Rudebusch and Svensson (1998) argue that backward-looking expectations may be an appropriate specification in the early stages of inflation targeting when agents are still learning about the regime.

[30]Details of the simulation methodology are described in Appendix II.

[31]In particular, the ability of the central bank in the advanced economy to achieve low inflation and output volatility is facilitated by the more forward-looking behavior of agents and the greater effectiveness of the interest rate and exchange rate channels of transmission.

Figure 4.1. Plain Vanilla Inflation Targeting in a Robust Advanced Economy and a Vulnerable Emerging Economy

Source: IMF staff estimates.

ability depends greatly, and in a broadly similar way, on the nature of the economic disturbances:

- In the case of demand disturbances, the "L" shaped trade-off curves indicate that there is only a limited trade-off between inflation and output variability, especially in the robust advanced economy. Indeed, in the advanced economy, a portion of the slope becomes positive, indicating that putting a very high weight on dampening inflation and a very low weight on stabilizing output may lead to higher volatility in both variables, rather than to a trade-off. Essentially, in the event of demand disturbances, reducing output volatility tends to dampen inflation volatility and vice versa. In both types of economies, reducing the volatility of inflation beyond some point typically leads to sharp increases in output volatility, and vice versa. This finding supports the view that putting some weight on smoothing deviations between actual output and potential output, in addition to countering deviations of projected inflation from the target, is sensible in both advanced and emerging economies.

- In the case of risk-premium disturbances, there is likewise only limited scope for a trade-off between inflation and output variability in either the advanced or the emerging economy. But there is clearly a significant difference between the impact that risk-premium disturbances have on the levels of inflation and output variability in the two types of economy.

- In the case of cost-push disturbances, the lengthy downward-sloping efficiency frontiers show that there is much more scope for a trade-off between output and inflation variability. In the case of the advanced economy, the steep slope indicates that putting a fairly heavy weight on stabilizing output comes at relatively little cost in terms of higher inflation variability. With relatively well-anchored inflation expectations, the central bank can afford to largely "look through" transient cost-push shocks. In the emerging economy, however, with weaker policy credibility, cost-push shocks tend to feed into ongoing inflation so that the trade-off is more evenly balanced, making it more costly in terms of inflation variability for the central bank to focus on stabilizing output.

Differences between the various inflation-targeting frameworks can have a significant impact on the inflation output trade-off. Figure 4.2 compares the performances of alternative policy reaction functions in the robust advanced and vulnerable emerging economies. For the advanced economy, the plain vanilla approach performs best in handling demand shocks, but some dampening of exchange rate changes is better in handling cost-push and risk-premium shocks. Responding to

the *level* of the exchange rate, however, performs poorly when coping with demand or risk-premium shocks.

These results are generally consistent with conventional views about the best inflation-targeting framework for an advanced economy. Ragan (2005) observes that exchange rate movements associated with disturbances that directly affect demand tend to offset the output and inflation effects of the shock. Consequently, rules that dampen exchange rate adjustments to demand disturbances tend to be counterproductive. In the case of risk-premium shocks, the exchange rate movements are destabilizing, so that including some dampening of exchange rate changes in the rule outperforms the plain vanilla approach. This is consistent with Ragan's argument that, in the case of risk-premium shocks, an inflation-target-oriented monetary policy should aim to offset the induced demand effects of the shock in order to dampen the inflation consequences. This can be achieved by allowing the interest rate to rise just enough to offset the demand stimulus of a weaker currency.[32] Including the exchange rate in the rule works in this direction and thus outperforms the plain vanilla approach.

For the financially vulnerable emerging economy, an open-economy inflation-targeting approach appears to perform about as well as plain vanilla inflation targeting. This result appears to stem primarily from the perverse demand effects of exchange rate changes that are associated with a high degree of liability dollarization. In these circumstances, exchange rate changes associated with demand shocks do not have the stabilizing effect on demand described by Ragan (2005). Consequently, some exchange rate dampening tends to yield better outcomes than plain vanilla inflation targeting in the event of both demand and risk-premium shocks. Moreover, the more L-shaped frontiers associated with the open-economy inflation-targeting framework also indicate that the rule tends to reduce the scope for a trade-off between output and inflation volatility, making them more complementary as objectives, as in the robust advanced economy.

The open-economy inflation-targeting approaches that work best in a robust advanced economy appear to differ in an important way from those that work best in a vulnerable emerging economy. In the advanced economy, the open-economy rule that works best focuses on dampening exchange rate *changes*, and performance is worsened by including the *level* of the exchange rate, such as the "half-and-half" rule (which puts equal weight on changes in and the level of the exchange rate). Conversely, in the emerging economy, putting some weight

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[32]This is precisely the logic underlying the design and use of a Monetary Conditions Index (MCI), which was designed to offset the impact of exogenous exchange rate shocks on aggregate demand, with the relative weights in the index reflecting the relative importance of interest rate and exchange rate changes in affecting aggregate demand.

Figure 4.2. Alternative Policy Rules and the Variability of Inflation and Output in Advanced and Emerging Economies[1]
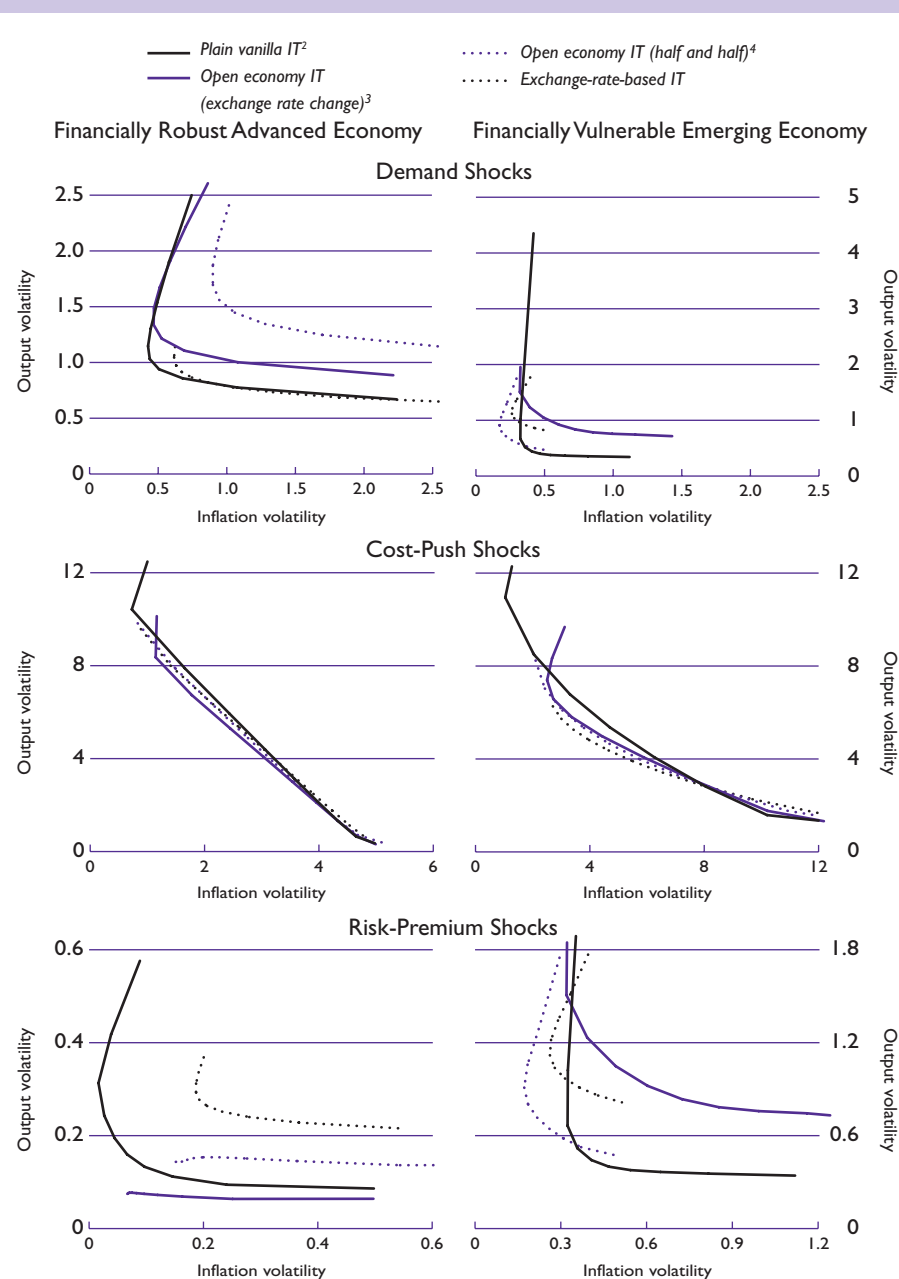
Source: IMF staff estimates.

[1]Frontiers are derived by varying the relative weights of inflation and output objectives in the policy reaction function while holding the coefficient on the exchange rate objective at 0.3 and the coefficient on instrument smoothing at 0.7.

[2]IT = inflation targeting.

[3]focused on changes in the exchange rate (XR).

[4]Splits weight between change in and the level of the exchange rate.

on the level of the exchange rate greatly improves the performance of the open-economy approach. The key difference between these rules is the persistence of the policy response to an exchange rate movement. The rule that focuses only on exchange rate changes results in a much briefer policy response than a rule focusing on the level of the exchange rate. It appears that a more sustained response to exchange rate movements is needed in the vulnerable emerging economy than in the advanced economy, perhaps reflecting the more backward-looking process of price setting.[33]

In the vulnerable emerging economy, incorporating the exchange rate into the policy rule also affects the trade-off between output and inflation in the event of supply shocks. As discussed previously in the context of plain vanilla inflation targeting, emerging economies tend to face a higher cost in terms of inflation volatility when they seek to dampen output volatility associated with supply shocks. Active exchange rate policy frameworks appear to tilt the trade-off somewhat further in this direction, suggesting that if the exchange rate is included in the policy framework, it may also be appropriate to increase the weight placed on inflation relative to output smoothing.

The analysis in this section suggests that the plain vanilla rule, which performs well in advanced economies primarily affected by demand shocks, may not perform as well as a default rule in many emerging economies. The choice of policy rule should reflect the predominant kinds of shocks to which the economy is exposed, as well as the structure of the economy. In reality, monetary policymakers are faced with an array of different kinds of shocks of different magnitudes that may occur simultaneously. Moreover, there is often substantial uncertainty surrounding the nature of the shocks. In such circumstances, it makes sense for the central bank to have a "default" rule that is likely to perform reasonably well in response to the types of disturbances to which the economy is typically exposed.

How do changes in the weight placed on the exchange rate affect the variability of inflation and output?

If the exchange rate is taken explicitly into account in an inflation-targeting framework, an important issue is how much weight to put on the exchange rate relative to inflation and output objectives. In the preceding simulations, the weight placed on the exchange rate was fixed. The second set of simulations focus on how the variabil-

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[33]Wollmershäuser (2006) also finds that a mixed rule outperforms alternatives, even with forward-looking expectations. He attributes the superior performance of this type of rule to the fact that both the current and the previous value of the exchange rate contain useful forward-looking information that is not being captured in the central bank's incorrect model of the economy.

ity of inflation and output is affected by changing the weight given to the exchange rate while holding fixed the weights given to the inflation and output objectives.

Figure 4.3 shows how the policy trade-off—the variability in inflation and output—shifts as the weight on the exchange rate is increased. The starting point for each curve is the plain vanilla rule, with a weight of zero on the exchange rate. In the case of the open-economy inflation-targeting framework, the rule focusing on exchange rate changes is used for the advanced economy, while the half-and-half rule, with equal weight on the change in and the level of the exchange rate, is used for the emerging economy (reflecting the results of the previous simulations). The curves in the panels basically trace how the inflation-output volatility trade-off shifts as the weight on the exchange rate in the policy rule increases. In other words, they show whether the trade-off curves in Figure 4.2 move closer to or further away from the origin as the exchange rate objective increases in importance. In the first panel of Figure 4.3, for example, the curve for the advanced economy shows that as the weight on the exchange rate is increased from zero (the plain vanilla rule), the volatility of output rises quite rapidly, while inflation volatility increases only slightly. The curve for the emerging economy shows that increasing the weight on the exchange rate from zero first leads to a decline in inflation volatility and a slight increase in output volatility, but later raises the volatility of both inflation and output. The results suggest that, even when it is beneficial to include the exchange rate in the reaction function, the weight placed on it should be quite small:

- In the vulnerable emerging economy, putting a small weight on the exchange rate (around 0.3, compared with weights of 0.5 on output and 1.5 on inflation) tends to dampen inflation volatility while slightly increasing output variability in the event of demand and risk-premium shocks. If more than a small weight is placed on the exchange rate, however, both output and, especially, inflation performance deteriorate substantially. In the event of cost-push shocks, there is a more sustained trade-off, with the efficiency frontier shifting toward greater inflation volatility and less output volatility as the weight placed on the exchange rate in the policy rule increases.

- In the robust advanced economy, putting any weight on the exchange rate worsens performance in the event of demand disturbances. In the event of cost-push disturbances, however, putting some weight on the exchange rate reduces inflation variability with virtually no impact on output variability. With risk-premium disturbances, placing a small weight on the exchange rate slightly reduces output volatility and increases inflation volatility, but as the weight on the exchange rate is increased, both output and inflation volatility increase.

Figure 4.3. The Impact of an Exchange Rate Objective on the Variability of Inflation and Output in Robust Advanced and Vulnerable Emerging Economies[1]

Source: IMF staff estimates.

[1]Frontiers are derived by varying the coefficient on the exchange rate objective between zero (plain vanilla inflation targeting) and 3 while holding weights on inflation and output objectives at 1.5 and 0.5, respectively.

[2]For the advanced economy, the open-economy inflation-targeting rule includes the change in the exchange rate; for the emerging economy, the rule includes the "half and half" rule of weight on change in and level of the exchange rate.

The results also suggest that exchange-rate-based inflation targeting should only involve a moderate degree of exchange rate smoothing. For the exchange-rate-based inflation-targeting framework, increasing the degree of exchange rate smoothing raises the volatility of inflation and especially output in both advanced and emerging economies. However, as long as the degree of smoothing is fairly low (a smoothing parameter of less than about 0.6), the deterioration in output and inflation performance is very limited.

How do different roles for the exchange rate affect the variability of a wider range of macroeconomic and financial variables?

Although inflation-targeting central banks may be principally concerned with stable inflation and growth, they also typically seek to avoid inducing high variability in interest rates, the exchange rate, and international trade performance. The third set of simulations therefore focuses on the impact of alternative frameworks on the volatility of a wider range of variables than just output and inflation. In these simulations, the weights placed on the inflation, output, and exchange rate objectives use the combination of weights shown in the previous simulations to minimize output and inflation volatility.[34]

The results suggest that inflation-targeting frameworks with an active role for the exchange rate may significantly reduce financial and external volatility in financially vulnerable emerging economies but offer little benefit to robust advanced economies. The "cobweb" charts in Figure 4.4 show the variability in output and inflation, real interest rates, the real exchange rate, and the real trade balance for different inflation-targeting rules in advanced and emerging economies.

- The vulnerable emerging economy is characterized by significantly higher macroeconomic and financial volatility than the robust advanced economy. This applies even more to real interest rates, the real current account balance, and especially the real exchange rate than to inflation and output (see Figure 4.1).

- In the vulnerable emerging economy, the open-economy half-and-half rule and the exchange-rate-based inflation-targeting approach both lead to sharp reductions in exchange rate volatility compared with the plain vanilla approach, as well as more modest reductions in interest rate and trade volatility. These reductions in volatility are also associated with a slight decrease in inflation vari-

ability and a slight increase in output variability in the event of demand or risk-premium shocks (see Figure 4.3). In the event of cost-push shocks, output variability is reduced and inflation variability increases relative to the plain vanilla rule.

- In the advanced economy, including the exchange rate shows no significant benefit in terms of macroeconomic or financial performance relative to the plain vanilla inflation-targeting framework. Indeed, the exchange-rate-based approach and the half-and-half open-economy approach lead to a slight worsening of performance in most dimensions.

General Assessment

The simulations support the conventional wisdom that financially robust advanced economies have relatively little to gain by including the exchange rate directly in the policy reaction function. If the economy is mainly affected by demand shocks, a plain vanilla approach outperforms the alternatives. However, if the economy is vulnerable to cost-push and risk-premium shocks, an active role for the exchange rate may be preferable. In these circumstances, the analysis suggests that the focus should be on dampening changes in the exchange rate, not on its level.

At the same time, the analysis suggests that financially vulnerable emerging economies might benefit by including the exchange rate in the reaction function in a limited way. An active role for the exchange rate may lead to slightly better output and inflation performance than a plain vanilla approach. Putting weight on the exchange rate appears to offer more substantial benefits by reducing volatility in the exchange rate, interest rate, and trade balance, particularly in the event of cost-push and risk-premium disturbances. Because these countries may be much more exposed to such disturbances than financially robust advanced economies, this is an important advantage.

Nonetheless, the analysis also suggests that the weight put on the exchange rate should be small relative to the weights given to inflation and output. The simulations indicate that putting more than a modest weight on dampening exchange rate volatility is likely to significantly worsen macroeconomic performance.[35]

The analysis suggests that an exchange-rate-based approach to inflation targeting may work almost as

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[34]Specifically, the weights used in the simulations are 1.5 for inflation, 0.5 for output, and 0.3 for the exchange rate objective. The coefficient on instrument smoothing is 0.7.

[35]In the model, macroeconomic performance tends to deteriorate significantly if the weight put on exchange rate smoothing is more than about half the weight placed on output smoothing. This is consistent with the results in Ravenna and Natalucci (2008), who find that putting a large weight on exchange rate smoothing is disadvantageous in handling sectoral productivity shocks. It may be noted that in their model, the "flexible" exchange rate rule uses a weight on the exchange rate of 0.1, relative to weights of 0.4 on output and 1.0 on inflation.

Figure 4.4. Performance of Alternative Policy Rules on Macroeconomic and Financial Volatility in Advanced and Emerging Economies[1]
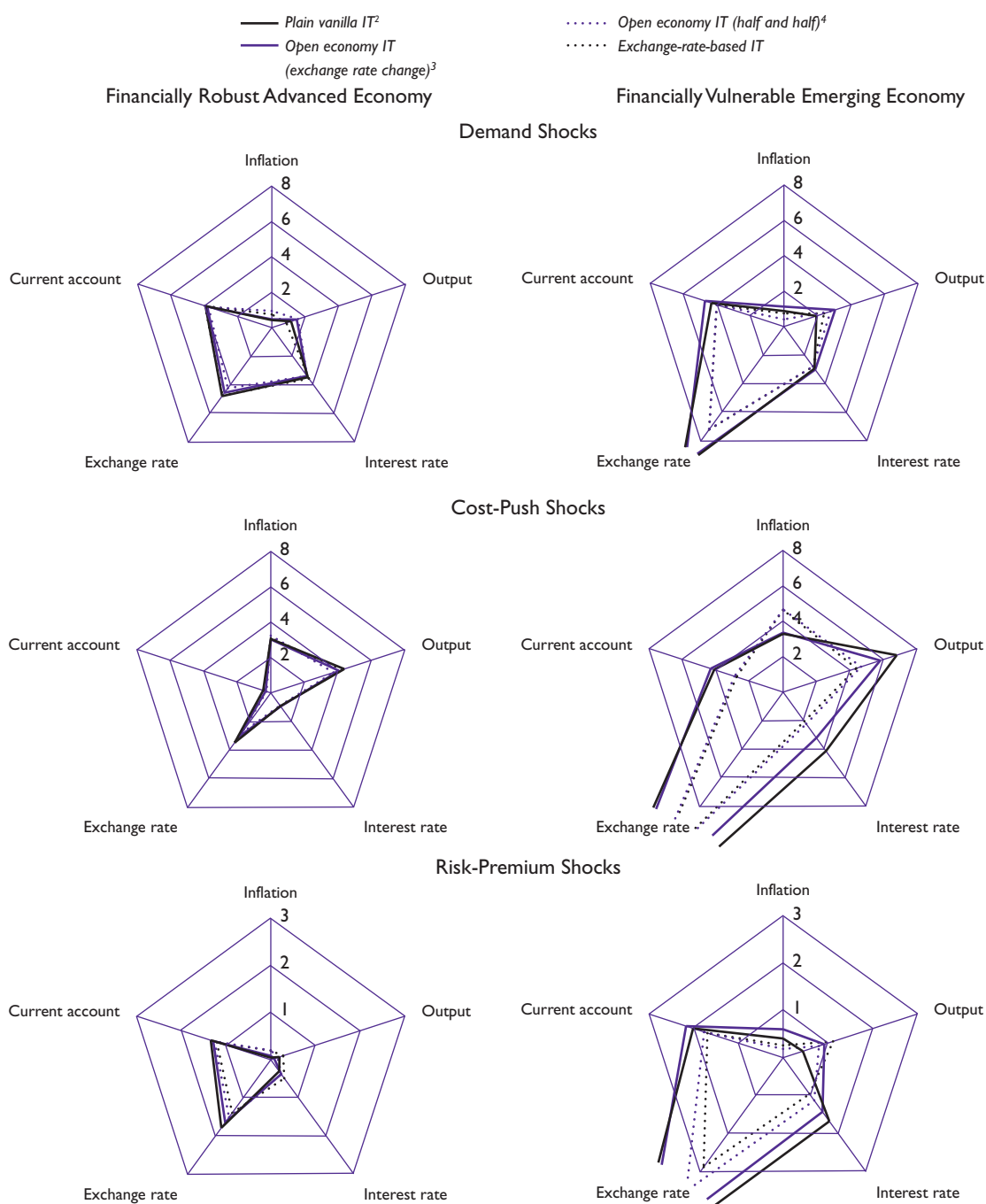
Source: IMF staff estimates.
[1]Based on weights on inflation, output, and exchange rate objectives of 1.5, 0.5, and 0.3, respectively.
[2]IT = inflation targeting.
[3]Focused on change in the exchange rate (XR).
[4]Splits weight between change in and the level of the exchange rate.

well as an open-economy approach in financially vulnerable emerging economies, particularly by lowering the volatility of the exchange rate, interest rate, and trade balance. However, the analysis also indicates that a high degree of exchange rate smoothing is likely to harm macroeconomic performance. In addition, such a framework may be problematic from an operational perspective. In particular, the framework could be prone to speculative pressures in advance of periodic resets of the exchange rate, resulting in high interest rate volatility, pressure on foreign exchange reserves, or both.

For inflation-targeting emerging economies that are in a relatively robust financial position, a framework with an active role for the exchange rate is likely to be less beneficial than in more vulnerable economies. In many emerging economies, dollarization is limited, so that the net impact on demand of exchange rate changes is in the same direction as in an advanced economy.[36] Under these circumstances, the case for an exchange rate role is weaker than in more financially vulnerable economies. However, such economies may still be more exposed than most advanced economies to cost-push and risk-premium shocks, and these are the types of shocks for which plain vanilla inflation targeting may be outperformed by the alternatives. Moreover, the best inflation-targeting rule may be different in a robust emerging economy than in a robust advanced economy. In particular, if inflation expectations are less well anchored, the best approach may be to put some weight on the level as well as on the change in the exchange rate.

Caveats

As for any small model, the one used in this analysis has important limitations. These constrain the kind of questions or issues that can be addressed and also mean that caution is warranted in drawing firm conclusions on the generalizability of the results. Indeed, the analysis itself points to the need for caution, because there can be substantial differences in the effects of various types of shocks and in the implications of variations in economic structure or policy rules. Some important issues that are not addressed within the model include the following:

- *Policy credibility:* The representation of policy credibility in the model is highly simplified. Because credibility is set exogenously, it is not possible to evaluate how different policy rules affect policy credibility, and vice versa.[37] In this regard,

endogenizing credibility would facilitate examination of two issues of particular interest: whether including the exchange rate in the policy rule undermines policy credibility, and how credibility affects exchange rate pass-through effects.

- *The long-run equilibrium, or steady state, of the economy:* In this model, the steady state of the economy is exogenous. Consequently, the model cannot readily compare the performance of alternative policy frameworks in handling changes in the steady state of the economy, nor can it assess possible effects of different policy approaches on the steady state. A particular example concerns possible hysteresis effects of real exchange rate movements on potential output, implying that temporary shocks can have permanent effects. It is not clear, however, whether such limitations of the model would, on balance, strengthen the case for whether and how to include the exchange rate in the monetary policy reaction function.

- *Uncertainty regarding the steady state:* Because the model is specified in terms of deviations of variables from steady-state values, it implicitly assumes that the steady-state values are known. Errors in estimating steady-state values will result in policy mistakes and greater macroeconomic volatility. However, it is not clear that this is an argument for excluding the exchange rate from the reaction function. There has been extensive analysis of an analogous issue—the implications of misestimating potential output. In general, research on this issue indicates that even if potential output is misestimated, it is better to include the output gap in the policy reaction function.[38] An additional consideration is whether errors in the estimates of the steady-state values of the real interest rate, real exchange rate, and output gap are likely to be correlated with one another. In principle, at least, inclusion of the exchange rate in the reaction function might improve policy if errors in measuring the steady state of the output gap typically offset errors in measuring steady-state values of the other variables.

- *Uncertainty regarding the correct model of the economy:* Although there is always uncertainty about how best to model the economy, the problem may be more acute in emerging economies undergoing extensive structural change, and for which data availability and quality may be weaker, than in more advanced economies. In this case, it is desirable to have policy rules that are robust to modeling errors. In this regard, Wollmershäuser (2006) finds that an open-economy inflation-targeting rule is

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[36]See, for example, Tovar (2006), who finds that for the Korean economy, the stimulative effects of devaluation outweigh balance sheet effects.

[37]Céspedes and Soto (2005) find that, in a model with endogenous policy credibility, weak credibility tends to shorten the effective policy horizon as well as to decrease policy aggressiveness.

[38]See, for example, Drew and Hunt (2000) and Ehrmann and Smets (2003).

more robust than a plain vanilla rule to a range of errors in specifying the correct model of the exchange rate.[39]

- *Linearity of the model:* This is a standard property of most models but has some important implications for this analysis. In particular, it means that the model cannot take into account threshold effects or asymmetries that may be important in transmission of financial disturbances or exchange rate movements. It also limits the ability to deal with the implications of uncertainty for the design and choice of a policy framework. In particular,

the model is not really able to address the consequences for different policy rules of uncertainties regarding different shocks or the steady state of the economy.

- *Model parameters:* The model parameters are imposed rather than estimated. Although most parameters are drawn from the relevant literature, the two country models are deliberately intended to highlight differences. Thus the emerging economy model is calibrated to ensure financial vulnerability. In view of this, the findings of the analysis should not be seen as prescriptions for policy in any particular economy. To translate the analysis into policy, the kind of policy rules examined in this analysis would need to be adapted to reflect the structure of specific economies.

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[39]Moreover, the rule that performs best is a mixed rule that puts some weight on both the level of and the change in the exchange rate.

V   Foreign Exchange Market Intervention in Inflation-Targeting Policy Implementation

This section documents the role of foreign exchange market intervention in inflation-targeting policy implementation and makes some positive recommendations for inflation-targeting emerging economies. The previous section made the case that taking the exchange rate into account in the monetary policy rule can improve the macroeconomic performance of inflation-targeting emerging economies under certain circumstances. However, although appropriate macroeconomic circumstances are a necessary condition for a fully effective role for the exchange rate, they are not sufficient.

A strong policy implementation framework is also required, especially to ensure that an active role for the exchange rate does not lead to confusion about the commitment of the central bank to the inflation target. If the central bank decision-making process is not fully integrated, the result may be that foreign exchange interventions are not coordinated with domestic monetary operations. Low operational transparency may lead markets to question whether a change in the policy interest rate or a foreign exchange market intervention is aimed at supporting the inflation target or only at managing the exchange rate itself. With undeveloped financial markets, foreign exchange intervention operates primarily through the portfolio balance channel, which is relatively unpredictable, rather than through the signaling channel, which fits much better with inflation targeting.

However, establishing a strong policy implementation framework can be especially challenging for inflation-targeting emerging economies. The conditions for transparency are not as favorable for them, and they have shorter inflation-targeting track records. Further, many have a history of managed or fixed exchange rate arrangements and active exchange rate intervention, which can raise questions about whether the exchange rate is subordinate to the inflation target.

Foreign exchange intervention is stressed in this section because it is the main exchange rate policy implementation tool. Generally, the monetary and exchange rate policy implementation framework covers the intermediate target, the operating target and monetary instruments, the modalities of transparency and accountability, and the institutional practices of the central bank. The objectives of foreign exchange intervention are described

in Box 5.1, and Box 5.2 summarizes foreign exchange intervention in emerging economies.

Foreign exchange intervention under inflation targeting is not amenable to macroeconomic modeling, and so this chapter is largely based on case studies. Macroeconomic models are not well suited to assessing policy implementation for several reasons. First, there seem to be no models rich enough to incorporate both an interest rate instrument and foreign exchange market intervention. The challenge of explicitly modeling the channels of foreign exchange intervention is especially formidable. Second, there has been limited analysis of the impact of market development or the trade-offs posed by a transparent policy role for the exchange rate. Third, macroeconomic models are typically parameterized at a quarterly frequency and thus cannot capture intervention for daily or weekly exchange rate smoothing. Therefore, foreign exchange market intervention is addressed qualitatively here, based primarily on the case studies (Sections IX and X) and the implementation literature, although other sources are used as well.

This section is organized according to the role of the exchange rate under the inflation-targeting taxonomy outlined in the previous section. This is because the different approaches broadly correspond to implementation frameworks. Furthermore, effective implementation frameworks are those that are tailored to the levels of market and infrastructure development, which are shaped by the same factors that explain different policy approaches. The assessment of policy implementation under inflation targeting focuses in particular on market friendliness and transparency. Policy implementation under inflation targeting tends to be market based and market supporting given the role of money markets in monetary operations and the importance of asset markets for monetary transmission. Targets and instruments under inflation targeting are typically as transparent as feasible because an inflation-guided policy is inherently forward looking, and making policymakers' views and intentions transparent fosters signaling and ex post accountability. Exchange rate implementation is usually relatively less transparent than other aspects of monetary policy (Box 5.3). The discussion of foreign exchange intervention transparency is discussed here in terms of (1) disclosure of the objectives of intervention;

Box 5.1. Foreign Exchange Intervention: Matching Objectives and Practices

There are five purposes for foreign exchange intervention.

- *To directly affect the exchange rate for policy purposes:* The most common reason for intervening in the foreign exchange market is to maintain some form of exchange rate peg or, under a float, to address exchange rate misalignment, reduce the speed of appreciation or depreciation, or support financial stability. These goals usually involve different implementation techniques, and the way a central bank conducts its foreign exchange interventions can help reveal its goals and whether these are consistent with the ultimate objectives of monetary policy. For example, interventions to address exchange rate misalignment tend to be less frequent but more sizable.

- *To smooth foreign exchange market conditions:* Smoothing excess volatility normally produces more frequent and smaller transactions, often in both directions.

- *To manage international reserves:* Interventions to manage international reserves are usually guided by principles of transparency and predictability and are normally designed to minimize the exchange rate impact. Ambiguity in the implementation of these transactions carries the risk of making their use seem like an intervention tool. Many countries choose to make these interventions through announced auctions (Turkey and Mexico) rather than through discretionary transactions, in order to minimize the potential impact on the exchange rate. Central banks also seek to time these transactions so as to minimize the exchange rate impact. For example, foreign exchange reserves would normally be accumulated when there are strong capital inflows. Even for discretionary operations, the timing would normally be announced.

- *To conduct official transactions:* Many central banks conduct foreign exchange transactions on behalf of the government or directly as a counterparty to other public sector entities, such as state-owned enterprises. The type and extent of official foreign exchange flows managed by the central bank vary among countries. In developed economies, the most common transactions relate to managing foreign-currency-denominated debt or other government receipts and payments in foreign currency. In emerging economies, the central bank may also be the only foreign exchange agent for state-owned enterprises. In Mexico, for example, the central bank is the counterparty to the state-owned oil company Pemex. Initially, these foreign exchange inflows were used to service external debt and to increase official reserves, but they have recently been partly resold into the interbank market to slow the pace of reserve accumulation. To prevent confusion about the objectives of these transactions, and therefore reduce the risk of policy confusion, the central bank resells a fixed amount of foreign exchange through daily auctions.

- *To develop markets:* Central banks may participate in the foreign exchange market to promote development of an interbank market. The central bank may take on the role of temporary market maker to create more confidence in the interbank market. In such cases, the central bank should be a market maker of last resort and should have a well-developed exit policy so that it does not remain a market maker longer than necessary. In other cases, the lack of a deep and liquid market may require the central bank to clear market imbalances due to lumpy foreign exchange flows, the domination of a single export commodity, or an interbank market structure that is dominated by a few large banks. This is the case in Azerbaijan, where a few players dominate foreign exchange flows, which are related to a single export commodity. In Serbia, the central bank discontinued fixing sessions to develop the interbank market but retains the right to participate for market stabilization purposes.

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(2) disclosure of the procedures for intervention such as the central bank's counterparties, the instruments and terms, and the reporting of intervention operations on an ongoing basis; and (3) disclosure of quantitative and qualitative information on intervention operations, sometimes with a considerable lag.

Plain Vanilla Inflation Targeting

Plain vanilla inflation targeting serves as a natural point of departure because the exchange rate plays a relatively limited role in its implementation.[39] The clear commitment of plain vanilla inflation-targeting economies to a single nominal anchor is made possible by their high degree of policy credibility. Under this regime, a short-term policy interest rate serves as the operating target and is adjusted to influence an intermediate inflation target and, ultimately, to maintain price stability. The policy interest rate works through its impact on liquidity and on other interest rates and as a signal that bears on expectations. Repos are usually used to set the interest rate operating target. Inflation targeting is quite transparent compared to other regimes (see Table 3.3 in Roger and Stone, 2005) in facilitating accountability by the central bank. Exchange rate developments are generally not explicitly factored into plain vanilla inflation-targeting policy implementation, although exchange rate developments are implicitly incorporated through their

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[39]Policy implementation under inflation targeting is reviewed by Schaechter, Stone, and Zelmer (2000), and Schmidt-Hebbel and Tapia (2002).

Box 5.2. Foreign Exchange Intervention in Emerging Economies

The general literature on foreign exchange intervention in emerging economies is limited, reflecting the lack of data, and the results are mixed regarding its effectiveness. In a large cross-country study, Lall and others (2007) concluded that resisting nominal exchange rate appreciation through sterilized intervention is likely to be ineffective when capital flows are persistent. Guimarães and Karacadag (2004) find that intervention tends to increase exchange rate volatility for Mexico and Turkey. Disyatat and Galati (2005) find weak evidence that intervention is effective in the Czech Republic. Kramer, Poirson, and Prasad (2008) analyze recent intervention by five large Asian emerging market economies and find modest evidence that sterilized intervention dampens volatility.

Sterilized intervention generally operates through three main channels, which seem to work differently for emerging economies. Unsterilized interventions are effectively equivalent to open market operations and thus work through conventional monetary policy channels. The three channels for sterilized intervention are the following:

- *The signaling or expectations channel* affects the exchange rate through a change in market expectations about future fundamentals. The assumption is that central banks have more information about relevant fundamentals and can influence the exchange rate by signaling through intervention. In particular, if intervention signals a change in monetary policy, it is expected to affect the exchange rate through the change in expectations about future interest rates. The signaling channel may be weaker in most emerging economies because central banks have a shorter track record and relatively less credibility (see, for example, Domac and Mendoza, 2002, for Mexico and Turkey). Thus, effective signaling for emerging markets may require larger interventions (Canales-Kriljenko, Guimaraes, and Karacadag, 2003).

- *The portfolio balance channel* works when a change in the relative supply of domestic versus foreign currency assets causes a portfolio reallocation that changes the relative price of the two assets. This requires that domestic and foreign assets be imperfect substitutes so that a change in the relative supply triggers an increase in the expected return for holding one rather than the other. In deep and liquid foreign exchange markets, economic theory argues that the effectiveness of this channel is less obvious because the intervention capacity of central banks is too small compared with the size of domestic and foreign assets. Dominguez and Frankel (1993) and Sarno and Taylor (2001) are more open to the general possibility that the portfolio balance channel is effective in affecting the exchange rate in larger markets. Galati and Melick (2002) point out that the portfolio balance channel is potentially more effective in smaller, less developed financial markets where the possible scale of central bank intervention is comparatively large.

- *The order flow channel* reflects how order flows affect price formation. Detailed order flows seem to better predict prices than news releases on conventional fundamentals (Evans and Lyons, 2002). Furthermore, the price impact of financial institutions' order flows is stronger vis-à-vis the orders of nonfinancial institutions. Under this channel, the size of the intervention relative to market turnover is an important determinant of its effectiveness, which suggests that this channel may be more effective in emerging economies where markets are less liquid. Emerging economy central banks could potentially alter order flows through intervention, because they have access to market information not available to other participants, including from reporting requirements, especially if the market is relatively thin. Scalia (2004) finds a significant impact from order flows on the exchange rate using Czech data. Azañero Saona (2003) provides supporting evidence for Peru.

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impact on inflation forecasts and on output. Because almost all of the inflation-targeting advanced economies (see Box 2.1) can be viewed as practicing plain vanilla inflation targeting, summary information for this group is used to gauge foreign exchange market intervention practices under this regime, although a few emerging economies also practice plain vanilla inflation targeting.

Inflation-targeting advanced economies intervene infrequently and usually to signal that the exchange rate is misaligned or to smooth short-term volatility. Only two inflation-targeting advanced economies intervene monthly or more (see Table 2.1). Intervention to influence exchange rate misalignment often operates through the signal channel (Australia, Chile, New Zealand), sometimes with the volatility condition

associated with exchange rate misalignment. Sweden is a bit different in that foreign exchange intervention may be used to signal monetary policy, with interest rate changes consistent with the direction of monetary policy in the aftermath of an intervention episode. A majority of inflation-targeting advanced economies sterilize foreign exchange interventions, a reflection of the important signaling role of the operating interest rate (see Table 2.1).

Intervention and the role of the exchange rate is naturally more transparent under plain vanilla inflation targeting. The inflation-targeting advanced economies have clearly stated goals for intervention and are transparent (announcing actions after the fact, reporting reserves often, and in some cases announc-

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Box 5.3. Transparency of Foreign Exchange Intervention

In 1999, the IMF Interim Committee adopted the Code of Good Practices on Transparency in Monetary and Financial Policies: Declaration of Principles. Case studies of implementation of the code in 16 IMF member countries (Camilleri, Nyawata, and Stone, 2005) indicate that foreign exchange intervention practices are less transparent than domestic monetary operations and that this mainly reflects uncertainty. Too much transparency is thought to trigger a market response leading to foreign exchange market instability, and an element of surprise is needed for an intervention to be effective. On the other hand, too little transparency is seen to cause confusion regarding the commitment to a flexible exchange rate. Transparency about the way interventions have been carried out is widely seen as beneficial.

In a survey of 10 advanced economy central banks, Chiu (2003) finds a large degree of variation in central banks' disclosure practices, even among those with the same exchange rate regime. The survey participants also stressed the role of uncertainty. Furthermore, Chiu concludes, ex post disclosure of actual intervention operations improves policy effectiveness, as does greater clarity of the objectives of foreign exchange intervention, whereas intervention tactics can perhaps be constructively kept obscure, especially in floating exchange rate regimes.

Many of the reasons given to explain reduced transparency of foreign exchange interventions seem to be especially germane to emerging economies. Dominguez and Frankel (1993) argue that central banks may not want to disclose information on intervention resulting from political pressure because this would undermine policy credibility. They also posit that central banks may want to create a sense of broad two-way trades in markets dominated by one-way bets.

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ing intervention in advance or while it is under way). Indeed, the Central Bank of Chile considers its transparency and clear rules as means to help ensure that foreign exchange interventions become an exceptional tool. The clear communication by the Central Bank of Iceland about its concern over exchange rate and economic developments in 2006 may have facilitated subsequent adjustment.

Developed financial markets help make possible the relatively limited policy implementation role of the exchange rate for plain vanilla inflation-targeting countries (see Table 3.1). Deep money markets allow use of an interest rate operating target for signaling and provide the means for sterilization, thus enhancing policy predictability. Developed foreign exchange markets also reduce destabilizing exchange rate movements and provide hedging instruments, thus reducing the need for a policy response to exchange rate pressures.

Open-Economy Inflation Targeting

Open-economy inflation-targeting countries actively respond to exchange rate movements. Most of the inflation-targeting emerging economies use an open-economy inflation-targeting regime, and so the description of policy implementation practices under this regime draws on their experience. The policy interest rate is the primary means by which monetary policy influences inflation, as it is for inflation-targeting advanced economies. However, inflation-targeting emerging economies have less flexible exchange rate arrangements than their advanced economy counterparts (see Table 2.1). In addition, they intervene rela-

tively frequently, usually to manage excess volatility or to promote financial stability. Their intervention objectives include smoothing excess volatility (Brazil, Colombia) and maintaining financial stability (Peru) in dollarized economies. The higher frequency of intervention may reflect a strong portfolio balance channel in the context of thinner foreign exchange markets than in inflation-targeting advanced economies. It may also reflect the signal channel.

Inflation-targeting emerging economies' foreign exchange intervention is generally less transparent than in inflation-targeting advanced economies (see Table 2.1). Frequent intervention and the absence of clear, transparent implementation frameworks can make it more difficult for markets and the public to assess whether excess volatility or the level of the exchange rate is the focus of intervention. What is considered excess volatility is usually not defined, and the intervention pattern is not always consistent with volatility developments.

The conflicts that can arise from the more active role of the exchange rate for open-economy inflation-targeting economies can be alleviated to some extent by well-designed implementation frameworks. In particular, developed financial markets and greater transparency positively feed back into the policy framework by allowing the central bank to put less weight on the exchange rate and more on the inflation target.

Deeper foreign exchange and domestic money markets enhance policy implementation by reducing exchange rate volatility, facilitating foreign exchange risk transfer, and better signaling policy intentions. Deeper markets may make the portfolio balance channel less effective, but at the same time, they strengthen the signaling channel. There should be a common strat-

egy for foreign exchange and money market development in order to exploit the many synergies (Ferhani and others, 2009). The move toward more market-based monetary and debt-management frameworks played an important role in the development of foreign exchange hedging markets in the Czech Republic and Poland. In Turkey, the development of foreign exchange risk-management instruments to help market participants manage exchange rate volatility may help the central bank limit intervention. The lack of a yield curve initially slowed the introduction of foreign exchange derivatives in Serbia.

The recent spate of foreign exchange liquidity-easing measures undertaken by emerging economies highlights the thin line that sometimes exists between macroeconomic and lender-of-last-resort (LOLR) objectives. As discussed in Section VII, most of these economies took nonmarket measures to ease the acute foreign exchange pressures during fall 2008 (Stone and others, 2008). A sharp increase in the demand for foreign exchange can be met simply by the sale of central bank foreign reserves into the foreign exchange market, with the market distributing liquidity to the institutions that need it most. However, in the event of a market breakdown, reflecting asymmetric information, the central bank may be better off providing liquidity directly to key institutions that are important for overall economic activity (Calvo, 2005). However, LOLR provision of foreign exchange is problematic because the absence of a legal central bank monopoly requires that foreign exchange must come in the first instance from a sale of international reserves, which shrinks reserve money. Sterilization through a simultaneous injection of domestic liquidity may be limited by the potential for currency switching and capital outflow.

Transparency about the role of the exchange rate—objectives, procedures, and evaluation—brings important advantages to open-economy inflation-targeting countries. A central bank can explicitly communicate that foreign exchange intervention aimed at influencing the exchange rate is separate from domestic monetary operations intended to steer expected inflation, including by conducting sterilization separately from foreign exchange intervention. This can shield the central bank from outside pressure to depreciate when appreciation raises concern about competitiveness.

Transparency also facilitates the signaling channel, particularly when central banks communicate the purpose for intervention unrelated to monetary policy (such as reserve management, fiscal agent transactions, and foreign exchange market development). Disclosure of quantitative and qualitative information about intervention operations fosters accountability by the central bank to the inflation target, with limited risk.

Of course, there are limits to the extent of transparency for foreign exchange implementation. Real-time reporting of intervention operations during periods of

high uncertainty, and in the context of relatively thin markets, can lead to speculative behavior that can contribute to exchange rate volatility and can compel the central bank to react to market expectations, either to validate or counteract them. Another caveat is that balance sheet vulnerabilities may pose a trade-off between being clear about the commitment to the inflation target and support for financial stability. An announcement by the central bank that it is intervening to limit exchange rate depreciation to reduce risks arising from balance sheet currency mismatches could cause a speculative attack. Thus, significant balance sheet mismatches may mitigate against transparency with respect to pending intervention and ongoing operations.

The central banks of Colombia and Mexico have used mechanisms to accumulate reserves that limit the impact of reserve purchases and sales on the foreign exchange market; without these, markets could interpret such transactions as aimed at managing the exchange rate. Turkey, under normal circumstances, limits intervention to predictable daily foreign exchange purchase auctions of small amounts, in order to build up reserves.

Inflation Targeting with Exchange Rate Bands

Exchange rate objectives and foreign exchange intervention interact closely in inflation-targeting economies with an exchange rate band. Policy implementation is basically the same as in plain vanilla inflation-targeting countries, except that the explicit exchange rate constraint on policy can sometimes necessitate a policy response. Chile, Israel, and Poland employed an exchange rate band during their transition to inflation targeting. The two most recent practitioners of this regime, Hungary and the Slovak Republic, are prospective entrants to the euro area.[40] The interest rate is their main instrument to implement the inflation target and to maintain the exchange rate band.

Conflicts between meeting those two goals is the unique policy challenge for those countries following this regime. Chile, Israel, and Poland used an exchange rate band to help stabilize expectations but at times had to widen the band in response to shocks. Of course, the wider the band, the less effective it is as a stabilizer. The ERM II countries have a somewhat different reason for employing a band, and they enjoy a relatively high degree of credibility, but a sudden shift in investor sentiment leading to an appreciation can compel

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[40]Under the Maastricht criteria, the exchange rate of prospective euro area members must stay within the "normal fluctuation margins" of the European exchange rate mechanism (ERM II) for at least two years. ERM II establishes a ±15 percent band for exchange rate fluctuations around an agreed central parity. Slovakia is a member of ERM II, whereas Hungary is not.

a decrease in interest rates that can result in a breach of the inflation target. The Slovak Republic occasionally intervenes to counter exchange rate pressures, and in March 2007, it revalued the central parity rate. In Hungary, speculative attacks on the exchange rate triggered interventions and a widening of the band, and, ultimately, led to abandonment of the band.

Country experience suggests that the policy goal should be to keep the exchange rate in the middle of the band. The central parity rate may need to be adjusted if fundamentals move the exchange rate toward one edge of the band. Furthermore, under most circumstances, exchange rate intervention should be used primarily to offset temporary shocks that move the exchange rate to the edge of the band, with the interest rate used as the operating target otherwise.

The inherent conflict between implementing the inflation target and maintaining the exchange rate band poses some difficult issues for transparency. Obviously, transparency about the objectives of exchange rate policy is crucial under this regime to assure markets that the central bank is committed to the band. However, procedural and ongoing operational transparency may be less appropriate when central bank intervention is required to keep the exchange rate in the middle of the band and may attract speculation (Enoch, 1998). In fact, explicit statements about where the exchange rate should be within the band can trigger speculation, as in Hungary.

Exchange-Rate-Based Inflation Targeting

In exchange-rate-based inflation targeting, monetary policy implementation is centered on the exchange rate.

Singapore manages a trade-weighted exchange rate within an undisclosed target band, with the primary objective of maintaining low inflation.[41] The Monetary Authority of Singapore (MAS) intervenes to keep the exchange rate within the band. The interest rate is not used as either an operating target or a signaling tool, unlike under other regimes. Money market operations are largely neutral with respect to domestic interest rates, and thus under normal circumstances, foreign exchange intervention can be said to be sterilized in a broader sense. There have been a few occasions when the MAS left its intervention unsterilized in an attempt to thwart speculative pressure.

Singapore has increased transparency in recent years about how policy is formulated (Khor, Robinson, and Lee, 2004). The MAS reports on how macroeconomic developments feed into the formulation of policy, including through publication of semiannual monetary policy statements.

However, exchange-rate-based inflation targeting may be naturally less transparent than the other regimes. Unlike under regimes with short-term interest rate operating targets, policy decisions may affect the viability of current exchange rate targets, given the potential for large gains from exchange rate arbitrage. This suggests that authorities will be under pressure to adjust the target once markets clearly expect such a change, particularly when there is substantial capital mobility. It also suggests that it may be difficult to clearly announce information regarding the current target, the frequency of target changes, and the rationale behind such changes.

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[41]During the early 1990s, New Zealand also adopted this framework, but unlike Singapore, a settlement cash target was used to guide the exchange rate operationally.

VI   Transitioning to Full-Fledged Inflation Targeting

This section addresses how the role of the exchange rate can be designed to facilitate the transition to inflation targeting for emerging economies. Many emerging economies with other anchors are transitioning or aiming to transition to an inflation-targeting framework (Stone, 2003; Roger and Stone, 2005). They operate with a flexible exchange rate and some sort of inflation objective, although the central bank is not held formally accountable and the priority of policy objectives can be unclear. The policy framework is relatively ad hoc in many respects, with the exchange rate playing an important yet poorly defined role. Compared with inflation-targeting economies, these economies' policy frameworks are less amenable to modeling and pose a qualitatively different set of policy challenges. This section addresses how these countries can improve policy effectiveness and, ultimately, transition to inflation targeting.[42]

The available information suggests that emerging economies with other anchors manage their exchange rates more actively than inflation-targeting economies. In addition, their exchange rate regime arrangements are somewhat more rigid, they have much higher reserve volatility, and they have more volatile nominal exchange rates than inflation-targeting emerging economies (see Tables 2.1 and 2.2). They also have relatively stable real effective exchange rates, indicating that pass-through is high and monetary policy credibility is relatively low. In some cases, this could also indicate real exchange rate targeting.

These economies' relatively high levels of exchange rate management and volatility suggest they may be more vulnerable to exchange rate shocks. Indeed, as noted in Section III, the emerging economies with other anchors that have flexible exchange rates are typically less financially developed and more dollarized and their monetary policy credibility indicators are generally weaker. Their less systematic approach to policy can result in shifting monetary policy objectives that can also contribute to exchange rate volatility.

The monetary operations of emerging economies with other anchors tend to be based on foreign exchange intervention and are more ad hoc and less market based than those of inflation-targeting advanced or emerging economies (see Table 2.1). Their announced intervention objectives are oriented toward stabilizing markets, smoothing exchange rate fluctuations, and enhancing competitiveness. The intervention framework is less transparent, and the link between intervention activities and policy objectives is usually not explicit. Intervention is often unsterilized, which may be the result of a lack of sterilization instruments and undeveloped money markets rather than an explicit policy choice. Sterilization may also be limited by the costs to the central bank or to the government of issuing liquidity-absorbing instruments.

Policy is generally less transparent in emerging economies with other anchors than in countries with full-fledged inflation targeting (see Table 3.3; Roger and Stone, 2005). The multiplicity of objectives and uncertainty regarding the linkage between policy objectives and policy instruments make it more difficult for policymakers to explain their policy actions, especially when their objectives shift over time. The relative lack of transparency may also reflect the unwillingness of central banks to state their intervention objectives in the context of dollarization and balance sheet mismatches. One problem arising from the lack of transparency is that, in the event of a failed policy action, it may be impossible to distinguish whether the failure was due to unforeseen events or a lack of commitment.

The more ad hoc nature of policy implementation by emerging economies with other anchors can also limit policy effectiveness. A large operational role for the exchange rate, induced by market deficiencies and less formal central bank internal institutional arrangements, can keep the central bank focused on the short-term stability of the foreign exchange market at the expense of the long-term stability of the macroeconomy. The credibility of the central bank's commitment to price stability

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[42]This section does not deal with all the policies that constitute the foundation for moving to full-fledged inflation targeting, which include political support for the inflation target, a strong fiscal position, institutional independence of the central bank, flexible prices and wages, a sound financial system, and reasonably well developed monetary policy implementation tools (Roger and Stone, 2005; Carare and others, 2002). Of course, most of these ingredients are important for any successful monetary policy framework, especially for economies for which it is not feasible to adopt full-fledged inflation targeting. Duttagupta, Fernandez, and Karacadag (2004) and Ötker-Robe and Vávra (2007) comprehensively examine moving from a fixed to a floating exchange rate.

can be weakened, along with the short-term effectiveness of its operations. Unsterilized intervention is inherently inconsistent and thus complicates the attainment of policy objectives and policy communication.

Over the longer term, emerging economies with other anchors should aim to transition to a single nominal anchor, which in most cases will be an inflation target. A single, firm nominal anchor better concentrates inflation expectations and, over time, establishes and entrenches policy credibility. Money anchors are used by only a very few emerging economies; the main candidate anchors are the exchange rate and a full-fledged inflation target. In recent years, a great deal of experience has been gained about how to transition to full-fledged inflation targeting (Roger and Stone, 2005; Schaechter, Stone, and Zelmer, 2000). More emerging economies with other anchors have switched to a full-fledged inflation-targeting regime than to other regimes (Stone and Bhundia, 2004).

In sum, the main challenge for an emerging economy with another anchor is to develop a more systematic approach to monetary and exchange rate policy. This involves developing a more open and market-friendly approach focused on a single operating target, fostering financial and external stability, developing the institutional setting, and, if feasible, transitioning to a single nominal anchor. These changes lead to consistency between objectives over time and, ultimately, to more policy credibility.

The Policy Role of the Exchange Rate

The open-economy inflation-targeting and exchange-rate-based inflation-targeting approaches can be sensible transition options for emerging economies with other anchors.[43] Moving to a single operating target imposes a unifying discipline on the operating framework. At the same time, the exchange rate plays an important role in the policy framework owing to these economies' structure and vulnerability to shocks. The simulation results of Section IV show that, for a financially vulnerable emerging economy, either the open-economy or exchange-rate-based inflation-targeting approach can generate better inflation and output volatility performance than the plain vanilla approach (which has no explicit role for the exchange rate) or a policy reaction function dominated by the exchange rate.

The degree of domestic money market development helps shape the choice between an open-economy inflation-targeting approach and an exchange-rate-based inflation-targeting approach. The former may be preferable in countries with developed money markets because this approach employs an interest rate operating target implemented with domestic monetary instruments (usually repos). In countries with undeveloped domestic money markets, an exchange-rate-based inflation-targeting approach may make most sense because foreign exchange operations are the most viable policy instruments.

Reducing the weight of the exchange rate in the reaction function over time effects the transition toward inflation targeting. For the open-economy inflation-targeting approach, this means reducing the importance of the exchange rate and output and raising the weight of the inflation target in interest rate policy. Shifting to exchange-rate-based inflation targeting entails shifting from the lagged exchange rate and output to the inflation rate in the exchange rate reaction function.[44]

Central Bank Policymaking

Developing an integrated and systematic policy role for the exchange rate facilitates the transition to inflation targeting. In some emerging economies with other anchors, policy objectives shift over time, and foreign exchange and domestic operations are not integrated. Thus, an important challenge for the central banks in these economies is to move toward decision-making frameworks that embody a consistent approach to adjusting policy in response to economic developments and changing prospects. This requires establishing a process for integrating economic and financial analysis into policymaking. In general, a macroeconomic model plays a key role. Effective use of the model requires establishing effective two-way communication between the senior managers of the central bank and the economists involved in forecasting and policy analysis.[45]

Transparency

The circumstances for emerging economies with other anchors are less favorable for transparency, especially with respect to the exchange rate. This reflects the

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[43]Pursuing inflation targeting within an exchange rate band is a less attractive option than other approaches. Fundamentally, this is because the inflation-targeting objective can come into conflict with and be subordinated to the exchange rate objective. This can lead to sharp reversals in policy stance and can significantly complicate policy communication, which is highly important in a forward-looking policy framework. As a consequence, it may be difficult to build credibility and anchor expectations, which may provoke speculative behavior in financial markets, challenging the sustainability of the dual objectives. The experiences in Chile, Hungary, and Israel suggest that the central bank may eventually come under pressure from the markets to choose between the primacy of the inflation or the exchange rate objective (Leiderman and Bufman, 2000).

[44]This transition is similar to changing from a backward-looking exchange rate crawl regime, under which the crawl is based on past inflation, to a forward-looking crawl based on expected inflation.

[45]See Laxton and Scott (2000), and Nelson (2008).

need to maintain flexibility in light of economic vulnerabilities and uncertainties, less developed markets, and lower policy credibility. However, moving toward more transparent policy implementation can increase the effectiveness of policy and build awareness of the challenges posed by multiple objectives, thus garnering support for a single nominal anchor. One way to enhance transparency is for the central bank to make explicit its foreign exchange and domestic operations, for example, by announcing a schedule of auctions and clarifying the terms. Regular communication between the central bank and banks also helps improve the understanding of policy. Monetary policy reports help make thinking about policy formulation and implementation more systematic and also educate the public and the markets about the benefits of moving to inflation targeting.

Financial Market Development

In many emerging economies with other anchors, foreign exchange interventions play a more important role than domestic operations. Although the foreign exchange markets of many such economies are thin and underdeveloped compared to those of their inflation-targeting counterparts, they are more developed than the domestic markets. When central banks use foreign exchange operations as the main instrument, the markets may assume that exchange rate management is a priority even when this is not the case.

Financial market development improves policy implementation and can reduce policy conflicts. Market development is typically less costly and more practical than other structural reforms (fiscal, labor market) that bear on monetary and exchange rate policy, and the payoff can be especially high for emerging economies with other anchors, given their generally low level of market development.

Foreign exchange market development often requires changing the central bank's role from market-controlling to market-supporting (Ferhani and others, 2009). Such a reduction of the role of the central bank often requires shifting the handling of official foreign exchange receipts from the central bank to the market, discontinuing foreign exchange market practices that are not based on market-oriented techniques (Serbia), moving toward more market-supporting trading mechanisms, shifting market-making from the central bank to commercial banks, and developing a market-supportive framework for the central bank's own foreign exchange operations. In Israel, the multilateral trading session managed by the central bank was gradually replaced by an interbank system to allow more exchange rate flexibility in the transition to a crawling band.

However, emerging economies with other anchors often face a chicken-and-egg dilemma over market development versus exchange rate policy flexibility (Ötker-Robe

and Vávra, 2007; Ferhani and others, 2009). Foreign exchange market development is inhibited by a lack of movement in the exchange rate, but moving toward a more flexible exchange rate regime is constrained by a thin market. In Azerbaijan, the strong focus on exchange rate stability, coupled with the lack of foreign exchange market development, seems to have triggered an ad hoc intervention style. On the other hand, active management of the exchange rate challenges the further development of the foreign exchange market because it creates a disincentive for developing risk-management instruments. This dilemma can be addressed by use of specific measures to promote development of risk-management instruments and by financial regulation and supervision that is designed to account for foreign exchange risk.

Market players should begin to find it in their interest to drive development as the central bank reduces its role and the exchange rate becomes more flexible. This can involve industry agreements on trading rules and formation of dealer associations. The technical infrastructure should be developed so as to facilitate continuous postings of bid and offer prices and ensure the transparency of the price-formation process. Electronic trading platforms increase operational efficiency and improve market transparency. A domestic security market yield curve is necessary for the introduction of forward instruments.

Money market development reduces the need to use foreign exchange intervention for reasons unrelated to monetary policy and facilitates sterilization. Roger and Stone (2005) and Ferhani and others (2009) identify a sequence of reforms that support the introduction of money market operations but which must be tailored to each country's particular circumstances.

Financial and External Stability Policies

For emerging economies with other anchors, enhancing financial stability can come into conflict with other policy objectives. Enoch and Ötker-Robe (2007) provide an overview of macroeconomic, supervisory, and prudential policies to address the risks arising from rapid credit growth and balance sheet currency mismatches. Kazakhstan introduced supervisory measures to reduce credit growth partly to mitigate conflicting monetary and exchange rate objectives. Several countries have successfully reduced dollarization (Kokenyne and Veyrune, 2008), primarily through macroeconomic stabilization.

The model simulations in Section IV suggest that structural policies that improve financial and external stability can allow for a smaller role for the exchange rate. Policies to reduce balance sheet exposure to currency changes, develop the financial sector, and build overall credibility can, according to the model results, markedly reduce the variability of the exchange rate and the current account.

VII   Implications of Recent Global Shocks

This section discusses the implications of the two recent global shocks for the role of the exchange rate in inflation-targeting emerging economies. The inflation episode of 2007–08 and the global financial and economic crisis that accelerated in late 2008 each serve in very different ways as severe stress tests of inflation-targeting frameworks. Broadly, these two episodes confirm the larger and more varied role played by exchange rate policy for inflation-targeting emerging economies than for inflation-targeting advanced economies. Furthermore, inflation targeting as a regime proved resilient to the inflation shocks of 2007–08. As of mid-2009, inflation-targeting economies had not made major adjustments to their regimes, although the global crisis was far from over.

Inflation Pressure and Capital Inflows[46]

Inflation in emerging economies was buoyed by inflationary global supply and demand shocks that crested in 2007. Capital inflows rose sharply, and rapid growth of private credit boosted demand and spurred above-trend aggregate growth. Labor markets tightened and wage pressures increased in some economies, reflecting growing supply constraints.

As a result, broad-based inflation rose and exchange rates appreciated. Inflation rose for 14 of the 16 emerging economies included in this study[47] by a median of 3.4 percent, and inflation exceeded official targets for all but one of the inflation-targeting emerging economies, by significant margins in some cases. From December 2006 to August 2008, exchange rates appreciated for 14 of the 16 emerging economies, by a median of 7.6 percent (Table 7.1). Concern arose that the sharp rise in food and energy prices and increasing core inflation was leading to second-round effects. The surge in inflation and upward pressure on the exchange rate were seen to be the first significant test of inflation-targeting regimes in emerging economies.

In response, most central banks tightened monetary policy by raising interest rates and buying foreign exchange, notwithstanding the conflicts raised by this policy mix. Policy interest rates were raised by 12 of the central banks.[48] Further, all central banks bought large amounts of reserves, with percentage changes ranging from 16 percent to 139 percent from December 2006 to August 2008, indicating strong policy resistance to upward exchange rate pressure.[49] A number of central banks were hesitant to raise interest rates more aggressively, owing to fears that such a move could lead to further exchange rate appreciation and capital inflows, fueling credit growth and higher inflation. Some tightened monetary policy using other tools.[50]

The inflation episode of 2007 to mid-2008 led to only limited changes in inflation-targeting regimes. No emerging (or advanced) economy dropped inflation targeting. Two (Guatemala and Turkey) raised their officially announced inflation targets. All other inflation-targeting economies maintained their original targets and associated parameters (target band width, targeted index, and target horizon), partly reflecting concerns about damaging credibility and possibly unmooring inflation expectations. Most inflation-targeting economies enhanced communication, explaining the nature of the supply shock and the central bank's policy response.

Inflation-targeting advanced economies were less vulnerable to the commodity price shocks and undertook more limited policy responses. Inflation rose for

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[46]This subsection draws on Habermeier and others (2009).

[47]Guatemala is not included because data were not available; the Slovak Republic is not included because it joined the Euro area in January 2009.

[48]Some countries tightened monetary policy using other tools (in addition to or in place of higher interest rates), reflecting (to different degrees) capital inflows, weak monetary transmission, or costly sterilization.

[49]In some inflation-targeting economies, nominal appreciation of the domestic currency limited the pass-through of imported inflation pressures, whereas in others, depreciation of the currencies vis-à-vis the euro validated inflation.

[50]Colombia and Peru increased reserve requirements on deposits and raised reserve requirements on external liabilities to limit capital inflows. Colombia and Thailand introduced capital inflow controls in the form of unremunerated reserve requirements in 2006–08, to curb the appreciation of their currencies caused by strong portfolio inflows, but the effects were mixed and these measures were subsequently reversed. The use of tools in addition to or in place of higher interest rates and reserve sales reflected (to different degrees) capital inflows, weak monetary transmission, or costly sterilization.

Table 7.1. Inflation-Targeting Economies, Macroeconomic and Policy Developments, December 2006–August 2008

	Headline Inflation, Aug. 29, 2008	Headline Inflation Compared to Inflation Target,[1] Aug. 29, 2008	Change in Headline Inflation, Dec. 2006– Aug. 2008	Exchange Rate Depreciation, Dec. 29, 2006– Aug. 29, 2008	Change in Reserves Dec. 2006– Aug. 2008	Depreciation + Change in Reserves	Policy rate, Aug. 31, 2008	Real Rate (Headline Inflation), Aug. 2008	Interest Rate (PR): Change Dec. 2006– Aug. 2008
Emerging economies									
Brazil	6.2	√	3.0	23.7	139.0	162.6	13.0	6.8	−0.3
Chile	9.3	+5.2	6.7	3.9	15.1	18.9	7.8	−1.6	2.5
Colombia	7.9	+3.1	3.4	13.6	53.2	66.8	10.0	2.1	2.5
Czech Republic	6.4	+2.6	4.8	18.8	17.6	36.4	3.5	−2.9	1.0
Hungary	6.6	+1.8	0.1	15.2	18.1	33.3	8.5	1.9	0.5
Indonesia	11.8	+6.7	5.2	−1.7	37.0	35.3	9.0	−2.8	−0.8
Mexico	5.6	+1.5	1.5	4.9	27.2	32.1	8.3	2.7	1.3
Peru	6.2	+3.3	5.1	7.6	104.7	112.3	6.0	−0.2	1.5
Philippines	12.4	+7.3	8.1	6.1	60.0	66.1	5.8	−6.6	−1.8
Poland	5.0	+1.0	3.6	21.8	68.3	90.1	6.0	1.0	2.0
Romania	8.0	+2.8	3.1	6.1	35.3	41.4	10.3	2.2	1.5
South Africa	11.0	+5.1	6.2	−9.8	34.0	24.2	12.0	1.0	3.0
Thailand	6.5	+2.6	3.1	3.5	51.2	54.6	3.8	−2.8	0.3
Turkey	11.8	+1.6	2.1	16.4	25.1	41.5	16.8	5.0	−0.8
Median	*6.6*	*…*	*3.4*	*7.6*	*37.0*	*41.5*	*8.3*	*1.0*	*1.0*
Advanced economies									
Australia	5.0	+2.0	1.7	−8.8	−46.6	−55.4	7.3	2.3	1.0
Canada	3.5	+0.4	1.8	8.8	21.5	30.2	3.0	−0.5	−1.3
Israel	5.0	+2.5	5.1	15.0	16.6	31.6	4.3	−0.8	−0.3
Korea	5.6	+1.6	3.5	−17.1	1.8	−15.3	5.3	−0.4	0.8
New Zealand	5.1	+2.1	2.4	0.5	0.5	0.9	8.0	2.9	0.8
Norway	4.5	+2.8	2.3	13.1	−16.3	−3.2	6.8	2.3	1.3
Singapore	6.4	+1.2	5.6	7.7	24.8	32.6	1.3	−5.2	−2.2
Sweden	4.3	+1.4	2.7	5.8	13.7	19.5	4.5	0.2	1.5
Switzerland	2.9	+2.9	2.3	9.7	18.9	28.6	2.8	−0.2	0.8
United Kingdom	4.8	+3.0	0.3	7.0	6.7	13.7	5.0	0.2	0.0
Median	*4.9*	*…*	*2.4*	*7.4*	*10.2*	*16.6*	*4.8*	*0.0*	*0.8*

Source: IMF staff estimates.

[1] √ denotes inflation is within the target band.

Table 7.2. Inflation-Targeting Economies, Macroeconomic and Policy Developments, August 2008–March 2009[1]

	Headline Inflation, Latest	Headline Inflation Compared to Inflation Target, Latest[2]	Change in Headline Inflation, Jun. 30, 2008– March 2009	Exchange Rate Depreciation, Sept. 12, 2008– March 2009	Change in Reserves Aug. 29, 2008– March 2009	Depreciation + Change in Reserves	Policy rate, Latest	Real Rate (Headline Inflation)	Interest Rate: Change Sept. 12, 2008– March 2009
Emerging market economies									
Brazil	5.9	√	–0.1	–24.3	–7.2	–31.5	11.3	5.4	–2.5
Chile	5.0	+1.0	–4.4	–10.2	2.4	–7.8	1.8	–3.3	–6.5
Colombia	6.5	+2.0	–0.7	–12.9	–0.7	–13.7	7.0	0.5	–3.0
Czech Republic	2.3	√	–4.4	–21.9	–0.3	–22.3	1.7	–0.5	–1.8
Hungary	2.9	√	–3.8	–37.0	–11.0	–48.0	9.5	6.6	1.0
Indonesia	7.9	+2.4	–3.1	–15.2	–13.4	–28.5	7.5	–0.4	–1.8
Mexico	6.0	+2.0	0.8	–24.2	–7.2	–31.5	6.0	0.0	–2.3
Peru	4.8	+1.8	–0.9	–3.5	–11.5	–15.0	6.0	1.2	–0.3
Philippines	6.4	+1.9	–5.0	–4.4	5.9	1.6	4.8	–1.6	–1.3
Poland	3.9	+0.4	–0.8	–44.9	–24.1	–69.1	3.8	–0.2	–2.3
Romania	6.7	+2.2	–1.9	–28.8	–12.4	–41.1	10.0	3.3	–0.3
South Africa	9.2	+3.2	–1.2	–11.4	–1.6	–13.0	9.5	0.3	–2.5
Thailand	–0.2	√	–9.0	–2.6	11.9	9.3	1.2	1.4	–2.5
Turkey	7.9	√	–2.7	–31.6	–10.1	–41.7	9.8	1.9	–7.0
Median	*6.0*	*…*	*–2.3*	*–18.5*	*–7.2*	*–25.4*	*6.5*	*0.4*	*–2.3*
Advanced economies									
Australia	3.7	+0.7	–0.8	14.0	–0.5	13.5	3.0	–0.7	–4.0
Canada	1.2	√	–1.9	–16.6	1.4	–15.2	0.3	–1.0	–2.8
Iceland	15.1	+15.1	2.4	–46.6	–15.9	–62.5	15.5	0.4	0.0
Israel	–1.5	√	–6.3	–17.5	30.0	12.5	0.5	2.0	–3.8
Korea	3.9	+0.4	–1.7	–21.5	–17.1	–38.7	2.0	–1.9	–3.3
New Zealand	3.4	+0.4	–0.6	16.6	–11.1	5.5	3.0	–0.4	–4.5
Norway	2.5	√	–0.9	–17.4	4.8	–12.6	3.0	0.5	–3.8
Singapore	1.8	√	–5.7	–5.1	–3.9	–8.9	0.8	–1.0	–0.5
Sweden	0.2	√	–4.1	–25.7	–16.8	–42.5	0.5	0.3	–4.3
Switzerland	–0.4	√	–3.3	–2.8	–1.4	–4.2	0.3	0.7	–2.5
United Kingdom	–0.4	√	–5.0	19.1	–10.1	9.0	0.5	0.9	–4.5
Median	*1.8*	*…*	*–1.9*	*–16.6*	*–3.9*	*–8.9*	*0.8*	*0.3*	*–3.8*

Source: IMF staff estimates.
[1]Developments through March 2009 or latest data.
[2]√ denotes inflation is within the target band.

all of them from December 2006 to August 2008, by a median of 2.4 percent (Table 7.1). Perhaps surprisingly, the median exchange rate appreciation was 7.4 percent—almost exactly the same as for the inflation-targeting emerging economies. In contrast, median reserve accumulation was about 10 percent, just over a quarter of the median for the emerging economies. The median interest rate increase was about the same for both advanced and emerging economies.

The Global Financial and Economic Crisis

Beginning in mid-September 2008, the main policy focus shifted abruptly from containing inflation to addressing the tightening of liquidity and the contraction in global growth (Table 7.2). Emerging economies were buffeted by an abrupt tightening of dollar liquidity, a sudden decline in global demand, and sharp falls in commodity prices. The unexpected closure of Lehman Brothers on September 12, 2008, quickly dried up funding markets for emerging market banks. The global economy rapidly contracted, and available measures of inflation expectations for the large emerging economies began to fall by mid-November.

The tightening of global liquidity quickly led to exchange rate depreciations, reserve sales, and other foreign exchange liquidity-alleviation measures. From September 12 to October 31, 2008, the exchange rates of all emerging economies depreciated, by a median of 13 percent. By October, all had sold official reserves to stem the depreciation, and reserve sales generally continued into early 2009. Many countries took systemic foreign exchange liquidity-easing measures in addition to intervening in foreign exchange markets. These measures—reinforced in some cases by foreign exchange liquidity provided by advanced economy central banks—showed some success in alleviating short-term liquidity pressures.[51] Several of the large inflation-targeting emerging economies provided liquidity to specific markets and sectors, in addition to providing foreign exchange liquidity using standard foreign exchange market intervention. The willingness of inflation-targeting economies to use foreign exchange sales and other measures to soften downward pressure on the exchange rate, even in the context of their inflation-targeting regimes, reflects the magnitude of the external shock and possibly a view that it would be short-lived. Countries whose external vulnerability deteriorated the most sold more foreign exchange reserves (Figure 7.1).

Figure 7.1. Emerging Market Inflation-Targeting Economies, External Vulnerability and Foreign Exchange Intervention

Source: IMF staff estimates.
[1]CDS = credit default swap.
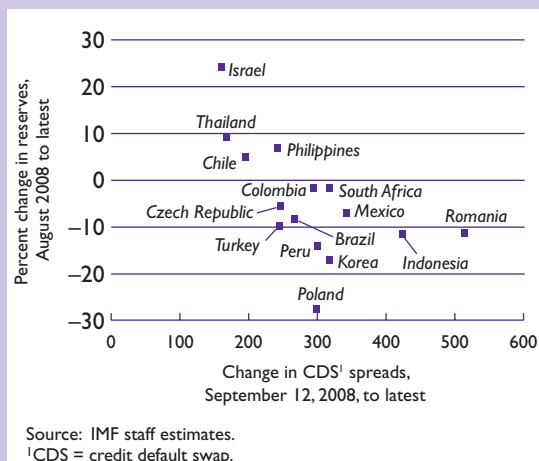
By November 2008, the magnitude of the global contractionary pressure became clear, and the inflation-targeting emerging economies began to lower policy interest rates.[52] From August 2008 to March 2009, inflation declined for most economies, by a median of 2.3 percent. Furthermore, industrial production began to fall in most economies and quite rapidly in several. Credit-default swap (CDS) spreads for many countries rose sharply. All but three inflation-targeting emerging economies lowered their policy interest rates after September. The sharp fall in interest rates in the United States, Japan, and United Kingdom (the Group of Three, or G3, economies) gave more scope to emerging economies for easing domestic monetary policy without undermining the stability of their currencies. As of April 2009, real interest rates were at a median of below zero.

The less externally vulnerable inflation-targeting emerging economies seem to have had more scope for easing interest rates. Those with smaller increases in their sovereign CDS spreads after September 12, 2008, had lower real policy interest rates (see Figure 7.1). This demonstrates the important differences within this group of economies.

Inflation-targeting advanced economies sharply loosened their domestic monetary policy stances using conventional and unconventional measures. Inflation fell even more quickly for the advanced economies than for the emerging economies. Exchange rate pres-

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[51]These measures are documented in Stone and others (2008). Brazil, Hungary, Mexico, and Poland agreed on foreign exchange swaps with advanced economy central banks.

[52]Sales of official foreign exchange reserves preceded declines of domestic interest rates for 12 of the emerging economies.

sure was substantial, albeit about two-thirds the level for inflation-targeting emerging economies. Reserves were decumulated by a median 2.6 percent, about one-third the level for the inflation-targeting emerging economies. Policy interest rates dropped to historically low levels, well below those of the emerging economies, reflecting their relatively high degree of credibility and relative exchange rate stability. For several central banks, the advent of zero or near-zero policy interest rates has blocked the interest rate channel and led to use of "unconventional measures" to boost credit and economic activity, including cross-central-bank foreign exchange swaps. Switzerland is the advanced economy with probably the most active exchange rate policy.[53]

Like the emerging economies, the advanced economies have made only relatively limited adjustments to their inflation-targeting regimes. The only country that has abandoned inflation targeting is Iceland, which is by far the smallest inflation-targeting advanced economy in terms of population and the most financially open.[54] In other advanced economies, no inflation targets have been adjusted, although the bursting of the global asset price bubble has reinvigorated the debate about the role of asset prices in inflation targeting and the length of the policy horizon.

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[53]Beginning in March 2009, the National Bank of Switzerland announced that it would undertake unsterilized sales of foreign exchange to prevent any further appreciation of the Swiss franc against the euro.

[54]The GDP of Iceland was $19 billion in 2008; the next smallest inflation targeter was the Slovak Republic (until adopting the euro in January 2009) with GDP of $100.6 billion.

Implications

The two recent global shocks have the following broad implications for the role of the exchange rate for inflation-targeting emerging economies:

- *Inflation-targeting emerging economies experience larger swings in capital flows and risk premiums than inflation-targeting advanced economies.* This difference, which can be gauged by the simple sum of changes in exchange rates and foreign exchange reserves, is also an assumption of the model used in this paper.

- *Foreign exchange intervention plays a bigger role for the emerging economies as a result of more volatile capital flows.* Interestingly, the exchange rate changes for each country group are broadly similar. However, the much larger changes in reserves mean that the emerging economies more actively resist exchange rate pressures, especially during periods of capital inflows. Relatedly, nonstandard exchange rate intervention plays a bigger role for the emerging economies. The more vulnerable economies have less scope to lower interest rates. These patterns are consistent with the results of the macroeconomic model.

- *Inflation-targeting regimes have been broadly resilient to the shocks.* Only two countries have adjusted their inflation-target ranges, and only Iceland, the smallest inflation-targeting economy, suspended its regime. Of course, the crisis that accelerated in September 2008 is far from over, and further regime changes may well be in the offing.

VIII   Conclusions

The role of the exchange rate in the broad monetary framework for inflation-targeting emerging economies raises four questions, which are addressed in turn in this section:

- Why are emerging economies particularly concerned about the exchange rate?
- How should the exchange rate be taken into account in an inflation-targeting framework?
- What is the appropriate role of foreign exchange market intervention in inflation-targeting policy implementation?
- What key issues warrant further work?

Why Are Emerging Economies Particularly Concerned about the Exchange Rate?

The exchange rate plays a major role in the broad monetary policy framework of most inflation-targeting emerging economies, in contrast to most inflation-targeting advanced economies, according to descriptive data and the case studies. Inflation-targeting emerging economies generally do not have an independent float exchange rate arrangement, do not intervene regularly, and seem to take the exchange rate into account when setting the policy interest rate. The more prominent role for the exchange rate in these economies reflects strong exchange rate channels, which in turn can be attributed to greater vulnerability to shocks, lower policy credibility, concerns about financial and external stability, and underdeveloped domestic financial markets.

How Should the Exchange Rate Be Taken into Account in an Inflation-Targeting Framework?

The model-based analysis in this paper provides modest support for an explicit role for the exchange rate in some inflation-targeting emerging economies but also cautions against active exchange rate man-agement. The analysis indicates that the benefit of an explicit role for the exchange rate in policy formulation depends not only on the structure of the economy, but also on the types of shocks to which it is exposed and the particular way in which the exchange rate is taken into account in the policy rule. In general, the analysis tends to confirm the finding of earlier analyses that financially robust advanced economies have little to gain from including the exchange rate explicitly in their policy reaction function, particularly if the main source of macroeconomic disturbance is aggregate demand.

At the same time, the analysis suggests that financially vulnerable emerging economies may benefit from including the exchange rate in the policy reaction function in a limited way, but that too much emphasis on the exchange rate is likely to be harmful. Including the exchange rate in the policy reaction function appears to be particularly helpful in mitigating the impact of risk-premium shocks and cost-push shocks, especially by dampening interest rate and exchange rate volatility. These results do not amount to a ringing endorsement of active exchange rate management in inflation-targeting emerging economies, but they do shed light on why the exchange rate plays an important role for most of them. Furthermore, putting some priority toward avoiding significant exchange rate misalignments may also improve macroeconomic performance, particularly for financially vulnerable emerging economies. Of course, it is not possible to draw strong policy conclusions for diverse countries on the basis of simulation results using small and necessarily simplified models. Therefore, there is much room for further work, as described below.

What Is the Appropriate Role of Foreign Exchange Market Intervention in Inflation-Targeting Policy Implementation?

Appropriate policy implementation helps support an effective role for the exchange rate, but foreign exchange intervention poses especially difficult challenges for inflation-targeting emerging economies. Case studies

indicate that they use intervention more than the interest rate to influence the exchange rate. Smoothing volatility is an intervention objective for most, and some also intervene to correct exchange rate misalignment and manage reserves. For most, intervention is more frequent and less transparent, and in general, the role of the exchange rate in policy implementation is less systematic, reflecting their less developed financial markets.

The case studies suggest that a systematic, transparent, and market-based policy implementation approach can help reduce conflicts between the inflation objective and other considerations in an inflation-targeting framework. Use of the interest rate as the main monetary tool to influence inflation is crucial for maintaining the clarity of the commitment to the inflation target. As a general rule, implementation should be as transparent as possible, recognizing that there are delicate trade-offs for emerging economies created by their vulnerability to large shocks and financial stability concerns, especially in the context of exchange-rate-based inflation-targeting regimes. Developed foreign exchange and domestic money markets improve policy implementation by reducing exchange rate volatility and facilitating foreign exchange risk transfer. Developed markets also foster the signaling channel of intervention, which fits well within the inflation-targeting framework.

What Key Issues Warrant Further Work?

Much more analytical work remains to be done on the role of the exchange rate in inflation targeting for emerging economies. The robustness of policy rules to uncertainty regarding the structure of the economy and key parameters in the transmission mechanism is particularly relevant for emerging economies. Embodying key aspects of financial structure in the framework in order to clarify its role in policy transmission and the implications for the inflation-targeting framework is a second area for further work. A third is to look more closely at the evolution of expectations and the implications for policy transmission and the role of the exchange rate.

Similarly, there is wide scope for further work on the role of foreign exchange intervention in policy implementation. Of particular importance is identifying operational ways to improve transparency—intervention rules, for example—with a minimal increase in uncertainty. The gradual steps being taken by central banks toward improving communication and transparency may offer important lessons. Another area is whether to use the policy interest rate or foreign exchange market intervention to influence the exchange rate.

IX   Case Studies in the Role of the Exchange Rate in Inflation-Targeting Emerging Economies

This section chronicles exchange rate management practices of selected inflation-targeting emerging economies and emerging economies with other anchors. The case studies focus on recent episodes involving tension between the inflation objective and exchange rate practices and are not meant to provide up-to-date descriptions. The case study countries were chosen to cover the spectrum of inflation-targeting regimes in which the exchange rate plays an important role (open-economy inflation targeting, inflation targeting with an explicit exchange rate band, inflation targeting with an exchange rate policy instrument) as well as the spectrum of emerging economies with other anchors.

Guatemala

The new central bank law strengthened Guatemala's monetary policy framework by clarifying that price stability is a primary objective, and the Bank of Guatemala (BoG) has tried to incorporate consideration of the exchange rate into its policy analysis. At the same time, in January 2005, the BoG adopted a rule-based mechanism for intervention in the foreign exchange market, which effectively establishes the exchange rate objective. Episodes during 2005–06 with high inflation and appreciation pressures reveal potential tension between the two objectives.

Monetary and Exchange Rate Policy Framework

The BoG has established an explicit inflation goal under the framework of its monetary policy. Since 1991, the BoG's monetary board announced an inflation goal in terms of annual consumer price index (CPI) growth for the coming year. Monetary policy is formulated to achieve this goal. The current framework is outlined below.

- At the end of each year, the monetary board determines the monetary, exchange rate, and credit policy for the subsequent year, and presents the basic strategy in terms of both a policy goal as well as various indicative variables. The policy goal is described in the form of a CPI target for the next two years; for example, 5.5 percent ±1.5 percent was set for December 2008, and 5.5 percent ±1 percent for December 2009.

- The monetary board decides on a policy rate, namely the seven-day certified term deposit rate of the central bank, at a previously specified monthly meeting. The decisions are based on analyses of various economic indicators as well as a comparison of the inflation forecast with the CPI target.

- The BoG conducts monetary operations to manage systemic liquidity to ensure that money market conditions are consistent with the policy rate, thereby helping to achieve the inflation goal. Currently, weekly withdrawal operations (monetary stabilization operations) are the primary tool, given the systemic excess liquidity.

A new central bank law, enacted in 2002, strengthened Guatemala's monetary framework. The new law clearly establishes the maintenance of price stability as a primary objective of the central bank.[54] Other responsibilities and functions of the BoG are subject to the price stability objective. The law also enhances operational autonomy by introducing an executive committee that is responsible for monetary policy implementation, and transparency is improved through various measures such as a governors' biannual report to Congress on monetary policy.

The BoG has identified the exchange rate as one of the transmission channels for monetary policy. In its assessment of monetary policy, the BoG uses a Taylor-rule-type reaction function, which incorporates an adjustment of the nominal exchange rate in addition to inflation differentials and an output gap.[55] A monetary condition index—a composite index that combines an interest rate and a foreign exchange

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[54]The central bank law stipulates that the BoG's fundamental objective is "to contribute to the creation and maintenance of the most favorable conditions for the orderly development of the national economy, for which, it will propitiate the monetary, exchange and credit conditions that promote stability in the general level of prices."

[55]Details such as equilibrium exchange rate and other parameters are not disclosed.

rate—is also cited in the analysis of monetary easiness or tightness. These analytical frameworks are based on the assumption that the exchange rate has an important influence on economic activity and inflation developments.

The BoG adopted a rule-based mechanism for intervention in the foreign exchange market in January 2005. The rule, integrated into the annual monetary, exchange rate, and credit policy, clarifies that the purpose of intervention is to moderate the volatility of the nominal exchange rate without affecting its tendency, while assuming that the exchange rate is determined by supply and demand conditions in the market. Initially, the rule was established only for the purchase of foreign currency, in light of upward pressure on the currency (quetzal) at that time, but it was followed by the introduction of a similar rule for intervention to address depreciation pressures. The rule provides some conditions that trigger intervention, but these are asymmetrical between cases of appreciation and depreciation; the purchase of U.S. dollars is always available as long as the quetzal has appreciated 0.5 percent more than the five-day moving average. On the other hand, sale of U.S. dollars can be undertaken only when the quetzal has depreciated below a certain level.[56] Depending on the resistance threshold against depreciation, this indicates the BoG's stronger stance of leaning against the appreciation trend.

Policy and Exchange Rate Developments in 2005–06

Experiences in 2005–06 illustrate the BoG's attempt to deal simultaneously with high inflation and appreciation pressures. The BoG chose a policy mix of moderate monetary tightening and intervention in the foreign exchange market, which might create tension between the inflation and exchange rate objectives.

High inflation and appreciation pressures

Guatemala's inflation rate moved well above the central bank's target range. Higher oil prices and relatively easy monetary conditions caused high inflation, which registered over 8 percent in 2005 despite the inflation goal of 4–6 percent. In 2006, inflation declined significantly to the lower part of the range because of weak oil prices and the lagged effect of monetary tightening.[57]

A sharp rise in worker remittances, together with capital inflows, put upward pressure on the quetzal. The quetzal was on an appreciation trend during 2005–06. This, along with other supply-side and external demand factors, contributed in part to the trade deficit and slow export growth, leading to the authorities' concerns about competitiveness.

The BoG's policy responses

To contain inflation pressures, the BoG continually raised its benchmark interest rate. The leading interest rate of monetary policy was increased by a total of 170 basis points (bps), to 4.25 percent, on seven occasions in 2005, and further raised by 75 bps, to 5 percent, in 2006. These actions were based on an expected overshooting of the inflation target and aimed at moderating inflation expectations and limiting the second-round effect of the imported inflation.[58] As a result, inflation decreased into the central bank's target range toward end-2006, but short-term interest rates remained negative in real terms.

Meanwhile, the BoG intervened in the exchange market to stem the appreciation pressures according to the established rule. In 2005, when the new intervention rule was introduced, the BoG bought US$466.6 million, and in 2006 it purchased US$130.5 million. It should be noted that interventions were conducted only against abrupt appreciation, as specified in the rule stated above.[59] These operations helped lead to the accumulation of foreign reserves, but at the same time appear to have been conducive to rapid money and credit expansion.

Implications

The BoG recognizes that the exchange rate is an important channel in the pursuit of the explicit inflation goals, but it faces conflicts. The new central bank law strengthened Guatemala's monetary policy framework, clarifying price stability as a primary objective, under which the BoG tried to incorporate exchange rate considerations into its policy analysis. But, in the face of high inflation and appreciation pressures, the BoG was forced to conduct a conflicting policy combination of monetary tightening and U.S. dollar purchase interventions, resulting in still relatively easy monetary conditions.

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[56]Details of the rule are reviewed every year. Under the current rule, when the exchange rate is equal to or less than the moving average in the previous five business days minus a fluctuation margin of 0.5 percent, the BoG convenes an auction to purchase U.S. dollars. On the other hand, when the exchange rate is equal to or greater than Q 7.815 per US$1, a dollar sale auction is offered when the exchange rate is equal to or greater than the five-day average plus 1 percent margin.

[57]However, inflation recently edged up again, moving well above the upper limit of the inflation goal.

[58]Policy statements did not mention the exchange rate developments and their impact on inflation and growth.

[59]In 2005, no rule was prepared for the sale of U.S. dollars. As for 2006, the resistance threshold, Q 7.70 per US$1, was indeed not reached during the year, nor was the the 2007 current threshold (Q 7.815 per US$1).

A clear rule for foreign exchange intervention, despite increasing transparency, has complicated policy implementation. According to the current rule, interventions can be triggered automatically, based on exchange rate developments, which effectively establishes a kind of exchange rate objective. This arrangement makes unclear the role of the exchange rate in pursuit of the inflation objective, causing potential tension between the two.

Hungary

Hungary, an open transition economy, adopted an inflation target with a ±15 percent exchange rate band in 2001. This reflects the importance of the exchange rate channel in a transmission mechanism and also the authorities' planned entry into the European Economic and Monetary Union (EMU). Under the framework, the Magyar Nemzeti Bank (MNB) guides the exchange rate in line with the inflation objective by maneuvering the policy interest rate. The MNB was explicit about its preferred exchange rate target in the initial stage of the regime. However, speculative attacks and deterioration of market confidence in 2003 caused conflicts between the inflation target and exchange rate management. A preferred exchange rate was no longer announced after 2004. Furthermore, to make clear the MNB's primary objective of price stability, the exchange rate band was abandoned in February 2008.

Monetary and Exchange Rate Policy Framework

To achieve and maintain its price stability objective, Hungary adopted: (1) an inflation target in 2001, and (2) a ±15 percent intervention band for the exchange rate. In the process of economic transition in the 1990s, the (crawling) peg arrangement succeeded in bringing down the inflation rate from 30 percent to 10 percent. However, disinflation came to a halt as a result of higher prices for imports during 1999–2000, boosting inflation expectations, which required a new monetary policy regime. The key elements adopted in 2001 were the following:

- In agreement with the government, the MNB widened the fluctuation band of the exchange rate from ±2.25 percent to ±15 percent (May 2001), which is compatible with the European exchange rate mechanism II (ERM II).[60,61] The central par-

ity, pegged to the euro, was Ft 276.1 per €1.[62] Subsequently, the crawling peg was abandoned (October 2001). Under this exchange rate regime, the MNB was occasionally explicit about its preferred exchange rate (narrower band), but this practice was abandoned around the beginning of 2004, as discussed below.

- The forint was declared fully convertible, and the existing restrictions on foreign exchange transactions were lifted (June 2001).

- The MNB introduced inflation targeting (June 2001). The consumer price index targets were set jointly with the government at 7 percent ±1 percent for December 2001 and 4.5 percent ±1 percent for December 2002. Afterward, the targets were determined on a yearly basis until the end of 2006, followed by the introduction of the medium-term target at 3 percent for the period starting in 2007.[63]

- The new Central Bank Act defined that the primary objective is to achieve and maintain price stability, and reinforced the central bank's operational independence, which is consistent with European Union requirements (effective July 2001).

The MNB's monetary council is responsible for setting the key policy rate to guide the exchange rate in line with the inflation target. The council convenes at least twice a month according to an announced schedule, and the two-week policy rate is set by a simple majority vote.[64] A change in the MNB's policy rate is aimed primarily at affecting the foreign exchange rate, which has a considerable impact on aggregate demand and inflation in Hungary.[65] For example, when the council judges that developments in the exchange rate jeopardize meeting the inflation target, it raises (or cuts) the policy rate to expand (or reduce) the forint-euro interest rate differential, which in turn is supposed to stimulate an appreciation (or depreciation). At the same time, the MNB makes clear that it does not focus

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[60]The ERM II is a regime under which every country planning to join the EMU has to participate for at least two years before introducing the euro. As one of the convergence criteria for the eventual adoption of the euro, the ERM II requires a currency fluctuation band of ±15 percent around the central rate against the euro. Hungary does not yet participate in ERM II.

[61]According to the central bank law, the government, in agreement with the MNB, determines the exchange rate regime and all

parameters thereof, in particular, the width of the fluctuation band, the central parity, and the composition of the currency basket. The law also says that changes in the exchange rate system shall be made without prejudice to the MNB's primary objective of achieving and maintaining price stability.

[62]This was devalued to Ft 282.36 per €1, as described below.

[63]The medium-term target, announced in August 2005, was set at a level consistent with price stability for a longer period. The target is to be reviewed at the time of Hungary's entry into ERM II, or after three years, whichever is sooner.

[64]As of mid-2004, the council made an interest rate decision at its second meeting each month; it could hold an extraordinary meeting at any time to decide on changes in the rate.

[65]The exchange rate is thought to influence prices of durables and import costs of fuels and energy, accounting for more than one-third of the consumer basket, and also indirectly to affect service prices and processed food prices. The MNB finds that exchange rate movements pass through to tradable goods' prices very quickly.

exclusively on changes in the exchange rate but on all factors that affect inflation.

The MNB, in principle, refrains from intervening in the foreign exchange market, although it is entitled to conduct interventions within the exchange rate band. Indeed, in the initial period of widening the band in 2001, the MNB allowed the exchange rate to appreciate strongly to find a new equilibrium. In the face of speculative attacks in early 2003, the MNB intervened in the exchange market to counteract them, but announced in May 2003 that it had ended such operations and would conduct interventions only in cases of market disturbances in the future. This effectively clarified the MNB's intention to influence exchange rate movements mainly through changes in the policy interest rate.

The MNB provides the general public with various kinds of information about monetary policy. The monetary council announces its decision and the underlying reasons in the form of a policy statement or press release on the day of the previously announced meeting. Abridged minutes of the rate-setting meetings (that is, the second meeting of each month) are released regularly, before the next rate-setting meeting takes place. In addition, the Quarterly Report on Inflation[66] presents the MNB's inflation forecasts, which play the role of an intermediate target for the monetary framework.

Policy and Exchange Rate Developments in 2003

After a successful two-year implementation of the inflation target, speculative attacks and a deterioration in market confidence in 2003 posed challenges to the conduct of monetary policy. The MNB missed the target for the first time in 2003; year-end inflation stood at 5.7 percent, whereas the target was 3.5 percent ±1 percent.

Speculative currency attacks in early 2003

In January 2003, there was a massive inflow of speculative capital aimed at forcing a revaluation of the exchange rate band. To defend the band, the MNB lowered its key interest rate from 8.5 percent to 6.5 percent in two phases. Changes were also made to monetary policy instruments by widening the overnight interest rate corridor and putting a temporary limit on the availability of the deposit facility at the MNB. Further, the MNB intervened actively in the exchange market. As a result of these measures, the MNB succeeded in defending the currency band and fending off the speculative capital by May 2003, when

the end of the currency attack was announced explicitly by the monetary council. However, the consequences were lower interest rates and a weaker exchange rate, which boosted inflation pressure during the latter part of the year.

Depreciation pressures after devaluation of the parity in June 2003

The unexpected devaluation of the exchange rate band undermined market confidence, resulting in considerable depreciation of the forint. In June 2003, at the government's request, the MNB agreed to devalue the central parity of the band by 2.26 percent, to Ft 282.36 per €1. This was initiated as part of a series of economic policy measures, resulting in support for exporters. However, it caused considerable confusion, and rising risk premiums caused the forint to take a sharp downward turn. In order to counter these developments, the MNB raised its key policy rate by 3 percentage points, to 9.5 percent, in two stages in June. The interest rate actions, together with the government's announcement of Hungary's euro changeover in 2008,[67] stabilized the forint rate, with marginal appreciation until October. But the market shifted its attention to imbalances in the Hungarian economy, particularly the budget and current account deficits, which fueled downward pressure on the exchange rate again in November 2003, representing a threat to the inflation target. As a result, the MNB was forced to raise the key policy rate by another 3 percentage points, to 12.5 percent, to offset the increasing risk premiums and stop the forint from depreciating further.

In the course of these developments, the MNB explicitly announced the narrower preferred range of the exchange rate apart from its wider ±15 percent band. In the policy statements and press releases, the monetary council repeatedly expressed its view that the exchange rate should stay in the (upper) range of Ft 250–260 per €1 in order for the inflation objectives to be met. This was supposed to stabilize inflation expectations by presenting the desirable exchange rate level. However, as this range became increasingly untenable in the face of strong depreciation pressure in late 2003, the announcement of the preferred range turned out to be ineffective. The narrower target was no longer announced after 2004.

Implications

In open transition economies like Hungary, the exchange rate plays an important role in inflation targeting. With a more open economy, the exchange rate chan-

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nel is stronger, making it more relevant for achieving the targeted inflation rate. Moreover, during the transition process, with the authorities' lower credibility, the exchange rate can function well as a nominal anchor to reduce high inflation rates in the absence of alternative monetary control systems. Furthermore, countries planning to enter the EMU have a particular concern about their exchange rates, which must eventually be fixed to the euro. For these countries, the exchange rate is an important factor driving monetary policy.

However, sudden changes in the market environment, characterized as risk-premium shocks, may cause tension between inflation targeting and the exchange rate consideration. Counteracting exchange market movements brings about large fluctuations in the policy interest rate. Particularly in the case of appreciation pressure, efforts to defend the exchange rate band can result in unintended monetary expansion, thereby undermining the inflation objective.

Presenting the preferred level of the exchange rate to the public makes policy intentions unclear. Although the measure is aimed at enhancing the transparency of the policy, it may deliver an ambiguous signal about whether monetary policy decisions are oriented toward the inflation target or the exchange rate objective. In addition, this can trigger speculative attacks aimed at revaluating the targeted exchange rate level. This is typically the case with narrower ranges of an announced specific target.

Recognizing this potential tension, the MNB abandoned the ±15 percent band in February 2008. The MNB judged that limiting exchange rate fluctuation under an inflation-targeting regime would not help to firmly anchor long-term inflation expectations. This move is seen as enhancing the credibility of the MNB's inflation-targeting regime in the face of inflation rising above the target level.[68]

Iceland

The Central Bank of Iceland (CBI) takes the exchange rate into account in its inflation-targeting regime, recognizing that the effects of its actions on inflation are significant. Because the CBI does not attempt to manage the exchange rate by aiming at a specific level, there is not much tension between exchange rate considerations and a price-stability objective. The CBI simply responds to the impact of exchange rate movements on inflation and inflation expectations in order to attain the inflation target. An episode of financial turbulence in 2006

highlights how the CBI incorporates the exchange rate in the conduct of monetary policy.

Monetary and Exchange Rate Policy Framework

Iceland introduced an inflation target in March 2001 with adoption of a floating exchange rate regime.[69] The framework is outlined as follows:

- The CBI aims at an average rate of inflation, measured as the annual increase in the headline consumer price index, of as close to 2½ percent as possible.

- The tolerance limit is now ±1½ percent above or below the target. The upper tolerance has been narrowed step by step since introduction of the inflation target; it was +3½ percent in 2001 and +2 percent in 2002.

- If inflation deviates by more than ±1½ percent from the target, the CBI is obliged to submit a report to the government explaining the reasons for the deviation, how the CBI intends to react, and how long it will take to reach the inflation target again in the CBI's assessment. The report must be made public.[70]

- The CBI provides an inflation forecast, projecting inflation two years into the future. The projection is outlined in its Monetary Bulletin, which is published three times a year.

The CBI's inflation target takes priority over other objectives. The CBI cooperates with the government policies insofar as they do not conflict with the inflation target. The CBI also undertakes tasks that are consistent with its central banking functions, such as maintaining foreign reserves, promoting an effective and reliable financial system, issuing notes and coins, and regulating foreign exchange markets.[71]

Monetary policy is decided by the board of governors of the CBI on previously announced dates. Interest rate decisions are currently made six times a year, approximately every two months, three of which are

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[68]The MNB admits that the exchange rate will continue to play an important role in influencing inflation even after removal of the ±15 percent band. It also acknowledges that the abandonment of the band constitutes a step toward the adoption of the euro, because a floating exchange rate provides better conditions to meet the nominal convergence criteria and finally to enter into the ERM.

[69]Before introduction of the inflation target, the CBI adhered to a fixed exchange rate regime with some tolerance limits, which were gradually extended to ±9 percent early in 2000.

[70]Three reports to the government on inflation beyond the tolerance limit have been published, dated June 20, 2001; February 18, 2005; and September 19, 2005. When the consumer price index increased beyond the tolerance limit in September 2007, a detailed report was not published, as it was deemed that the necessary explanation was already presented in the CBI's Monetary Bulletin.

[71]The central bank law grants the CBI authority to establish the basic exchange rate policy by saying "with the consent of the Prime Minister, the Central Bank determines the policy according to which the value of the Icelandic króna against foreign currencies is determined."

Table 9.1. CBI: Exchange Rate Considerations in Monetary Policy during 2006

Date/Decision	References to the Exchange Rate in Policy Statements	Inflation Rate[1] Exchange Rate[2]
Jan. 26 +0.25%	. . . inflation measured slightly higher than had been forecast in December. For most of this period the króna has also been marginally weaker than forecast. . . . The highest real exchange rate since the 1980s and record current account deficit indicate sizable inflation pressures ahead . . .	4.4% 100.43
Mar. 30 +0.75%	The inflation outlook has deteriorated . . . To a significant degree this can be attributed to a substantial depreciation of the króna in recent weeks. . . . [T]he inflation outlook is correspondingly less favorable . . ., especially in light of the adverse effect that recent exchange rate developments have had on the prospects for attaining the inflation target. . . . Now the króna has depreciated sooner and faster than was generally expected. Inflation expectations have risen as a result . . .	4.5% 118.36
May 18 +0.75%	. . . the króna has depreciated substantially, inflation has risen, and the medium-term inflation outlook has deteriorated accordingly. . . . Large current account deficit . . . indicates a risk of further downward pressure on the króna in the months ahead. In order to moderate its effects on domestic inflation it is essential to maintain a very restrictive monetary policy stance . . .	7.6% 125.32
July 6 +0.75%	The (króna) depreciation has already contributed to soaring inflation and will keep it high over the coming months. . . . A less favorable exchange rate development than expected could lead to even higher inflation, requiring an even higher policy rate to rein it in.	8.4% 132.21
Aug. 16 +0.50%	No reference to the exchange rate.	8.6% 123.21
Sep. 14 +0.50%	No reference to the exchange rate.	7.6% 122.16
Nov. 2 unchanged	Disinflation over the past two months is partly the result of the sustained tight monetary stance . . ., a wider interest rate differential with the rest of the world, and an appreciation of the króna. However, . . . the appreciation of the króna . . . (is) a volatile measure and can be reversed.	7.3% 119.11
Dec. 21 +0.25%	Assuming that the exchange rate of the króna remains relatively stable, the outlook is for somewhat lower inflation over the early part of the forecast period. . . The tight monetary stance has . . . contributed to exchange rate stability . . . Inflation prospects and the monetary stance depend heavily on the króna remaining relatively strong.	7.0% 125.60

Source: IMF staff.
[1]Annual change in consumer price index in the month.
[2]Exchange rate index of the króna on the date; Dec. 31, 1991 = 100.

associated with publication of the Monetary Bulletin containing the inflation forecast. Policy decisions are published on the scheduled dates, followed by a press conference by the chairman of the board.

The inflation target is to be attained through the CBI's monetary operations, with controlling the short-term interest rate as an operating target. A main instrument is collateral loan agreements with financial institutions. Auctions of seven-day instruments are held every week, the interest rate on which constitutes the CBI's policy rate. In addition, the CBI provides a number of facilities available for financial institutions at their discretion, which prevents excessive swings in money market rates. These include remunerated current accounts, certificates of deposit with a maturity of 90 days, and overnight loans.

Foreign exchange market intervention became rarer after the exchange rate target was abandoned in 2001. The intervention is employed only if the CBI considers

this necessary in order to promote its inflation target or sees exchange rate fluctuations as a potential threat to financial stability (Table 9.1).[72]

The CBI recognizes the exchange rate as an important transmission channel. Inflation targeting is understood to mean that a currency appreciation contributes to lower import prices, which has a direct effect on reducing inflation. The appreciation also makes imported goods and services relatively cheaper than domestic ones, decreasing demand for domestic products, which leads to lower inflation. This indicates that monetary policy is likely to

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[72]Separately, the CBI makes a weekly purchase of $6 million in the interbank market, to meet Treasury foreign debt service needs and to strengthen the CBI's foreign reserves. Monthly data regarding the foreign exchange market suggest that the CBI's foreign exchange operations are limited to these regular purchases, which currently account for only about 0.5 percent of total market turnover.

accommodate currency movements if they are associated with demand shocks. The CBI's macroeconomic model incorporates this exchange rate channel,[73] in addition to interest rate and asset price channels. The assessments of price developments and inflation forecasts that are included in the Monetary Bulletin also provide a great deal of analysis on the impact of exchange rate movements.

Recent Episode of Policy Responses to Exchange Rate Developments

In 2006, Iceland experienced turbulence in its financial markets, in particular large swings in the exchange rate, in the face of mounting inflation pressures. This episode highlights how the CBI takes exchange rate movements caused by risk-premium shocks into account when conducting its inflation target. A distinctive feature is that the CBI did not attempt to manage the exchange rate but instead responded to the impact of exchange rate movements on inflation and inflation expectations.[74] The following divides the period into pre-2006 and post-2006.

Toward the end of 2005

A rapid expansion in domestic demand led to strong inflation pressures. The expansion was driven by new investment projects in the aluminum sector, introduced in late 2004. Consumption and housing demand were also promoted by active bank lending after structural changes in the mortgage market. As a result, in 2005 the current account deficit reached 16½ percent of GDP and the annual inflation rate edged up above 4 percent, the upper tolerance of the CBI's inflation target. The economic expansion, together with favorable global market conditions, enabled Icelandic banks to extend their activities abroad, with a significant increase in foreign liabilities.

Higher interest rates caused the króna to appreciate, and it ended up at a historical high in late 2005. In response to growing inflation pressures, the CBI steadily raised its policy rate from 5.3 percent in spring 2004 to 10.5 percent at the end of 2005, inducing the currency appreciation. Indeed, monetary tightening was channeled primarily through the exchange rate, which was amplified by a large interest rate differential with the rest of the world. The real exchange rate reached its highest level since 1988. Nevertheless, bank credit continued to grow both in households and firms owing to relatively easy access to mortgage and global financing; thus, inflation had yet to be fully contained.

The CBI expressed concern about the sustainability of the appreciation of the króna. Given the large current account deficit, the CBI felt that a strong króna was unlikely to be maintained in the long run. It outlined in its Monetary Bulletin that a substantial part of the adjustment of imbalances would take the form of a króna depreciation, and it incorporated this view in its inflation forecast. The CBI concluded that a tighter monetary stance was needed for an extended period in order to meet the inflation target. Inflation targeting also emphasized that monetary policy was aimed at ensuring that the inevitable exchange rate adjustment would not result in a higher inflation rate than is compatible with the target.

Financial turbulence in 2006

Against the background of accumulating imbalances, a series of negative reports from rating agencies triggered financial turbulence in the first half of 2006. These reports, citing concerns over macro imbalances and vulnerabilities in the highly leveraged financial sector, caused a sharp depreciation of the króna by one-quarter and a fall in stock prices, also by one-quarter. Bond prices of banks fell significantly as well, hindering their access to foreign credit markets.

As the inflation outlook deteriorated owing to the króna depreciation, the CBI tightened its monetary stance sharply by raising its policy rate by 3.75 percentage points during 2006. Monetary tightening took place on seven out of eight policy decision dates, two of which were added to originally scheduled ones. Throughout these decisions, the CBI signaled a firm commitment to bring inflation back to the target after it had risen substantially. The CBI took into account the foreign exchange rate in its assessment and forecast of inflation, but did not set a specific target on the rate (Table 9.1).

In addition, the CBI enhanced communication about the economy and financial stability. In the Monetary Bulletin and annual Financial Stability Report, the CBI provided more detailed and comprehensive explanations of the economy and the financial system, which helped international audiences follow the situation in Iceland. Moreover, the CBI, in cooperation with the financial supervisory authority, strengthened monitoring of banks' financing, liquidity, and risk management.

Although financial markets had calmed significantly by mid-2006, inflation pressures remained, calling for a sustained tight monetary stance. The real exchange rate returned to close to the 25-year average in late 2006, and the króna has been fairly stable since. However, economic activity continues to be robust in all regards, and underlying inflation is still high, forcing the CBI

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[73]In the CBI's quarterly macroeconomic model, raising the policy rate by 1 percentage point causes immediate appreciation of the króna by 0.2 percent and leads to continuous appreciation with a peak at 0.8 percent after five quarters (Monetary Bulletin, November 2006).

[74]The CBI appeared not to have intervened in the exchange market in this period.

to maintain the higher policy rate. Because the króna began gradually appreciating again in the beginning of 2007, the CBI has been cautious about the increasing probability of an eventual depreciation of the króna, a potential risk to inflation.[75]

Implications

Pursuing price stability in a consistent manner is crucial for maintaining policy credibility. During the above-mentioned period, the CBI repeatedly cautioned against the idea that a tight monetary policy can be avoided by temporarily relaxing the inflation target. Such a "volte-face" policy would immediately raise inflation expectations, fuel higher wage increases, and result in a further depreciation of the króna and more inflation. The cost of such a policy is thought to be huge. On the contrary, the CBI chose to adhere to the inflation target to avoid making inflation a persistent problem.[76]

Setting no exchange rate target can successfully avoid tensions between exchange rate considerations and the inflation target. Even though it takes account of the exchange rate in monetary policy, the CBI does not intend to manage it. The CBI simply reacts to the impact on inflation of exchange rate developments. This consistent policy prevents discrepancies within the monetary framework.

Financial stability provides a basis for a stable exchange rate and low inflation. Episodes in 2006 and early 2008 suggest that financial vulnerability can bring about abrupt depreciation of the króna, which induces inflation pressures. Mitigating financial imbalances is an important task in order for small and open economies to be resilient to external shocks.

Kazakhstan

Kazakhstan, a booming transition economy, has had an eclectic monetary policy framework. Price stability has been the primary objective of the National Bank of Kazakhstan (NBK) since the change of policy framework in 2003, but the NBK also pays attention to exchange rate developments. Kazakhstan has sustained a very strong macroeconomic perfor-

mance since the start of the decade, with an average real GDP growth exceeding 10 percent. Oil-related inflows and improved confidence in the economy led banks to increase their external borrowing and extend loans domestically. Strong output and credit growth, coupled with resistance to allowing rapid appreciation, resulted in inflation pressures. In recent years, until mid-2007, the main challenge for the NBK was to strike a balance between inflation pressures and appreciation.

The Monetary Policy Framework

The law governing the NBK states that its main goal is to ensure stability of prices in the Republic of Kazakhstan. This goal, which was introduced to the law by amendments in 2003, supported the adoption by the NBK of a new monetary policy framework, with price stability as its primary objective. In practice, the current policy framework of the NBK can be considered eclectic, using different indicators in conducting monetary policy to control inflation and rapid credit growth as well as giving attention to the exchange rate. Looking forward, the NBK announced plans to introduce an inflation-targeting regime. Preparations for full-fledged adoption of inflation targeting are under way. The NBK and the National Statistics Agency developed a set of core inflation indices, and the NBK stepped up its efforts to model and monitor macroeconomic developments.

The operational framework reflects a very low level of government debt and large oil-related foreign exchange reserves. The NBK has a limited stock of government securities to conduct monetary operations, and therefore had to issue central bank securities (NBK notes) to manage liquidity.

Economic Background

Kazakhstan has sustained a very strong macroeconomic performance since 2000. Between 2000 and 2006, annual real GDP growth has averaged over 10 percent, and per capita income reached about five times the 1999 level in dollar terms. However, growth slowed to 5½ percent in the fourth quarter of 2007. Employment has expanded steadily since 2000, and social indicators have improved. The fiscal position has remained very strong, permitting substantial increases in public expenditures, especially social and infrastructure spending, as well as an accumulation of large savings in the National Fund (NFRK) for future generations (Box 9.1). High prices for oil and gas, rapid growth of domestic consumption, and a rebound in investment were among the factors that contributed to the strong economic performance.

Nevertheless, monetary policy faces a number of challenges. Sharply rising oil revenues and capital

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[75]In early 2008, the króna depreciated sharply, with credit spreads widening for the sovereign and the banking sectors. The currency depreciation fueled inflation pressures, pushing the CPI to a double-digit increase. In response, the CBI hiked the policy rate by 175 basis points in March and April, to clarify its determination to battle inflation.

[76]At the same time, the CBI allowed inflation to deviate beyond the tolerance limit for more than a year. This strikes a delicate balance between maintaining the inflation target and providing some flexibility in the face of an external shock.

> ### Box 9.1. The National Fund of the Republic of Kazakhstan
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> Faced with a surge in foreign exchange earnings from higher oil production and prices, the authorities established the National Fund of the Republic of Kazakhstan (NFRK) in 2001 to reduce the impact of volatile market prices for natural resources on the economy and to smooth the distribution of oil wealth over multiple generations. The NFRK is domiciled in the National Bank of Kazakhstan (NBK), which has the responsibility of managing its assets on behalf of the government. All NFRK assets are invested exclusively abroad. As of mid-March 2008, $22.8 billion had accumulated in the fund.
>
> The NFRK is a special account of the Ministry of Finance of Kazakhstan with the NBK. The NBK advises the Ministry of Finance on managing the assets of NFRK. A significant portion of the fund's reserves are under management by the world's leading private financial institutions, to ensure the transparency and accountability of the process.

inflows fueled inflation pressures and vulnerabilities in the banking sector. A major concern is external debt, which increased rapidly in recent years, almost all of it owed by private banks that extended loans to households and firms, with limited hedging possibilities. The very rapid growth in bank credit poses the risk of a sharp deterioration in loan quality. Containing inflation has also been a challenge for the NBK in an environment of rapid output and credit growth and large foreign exchange inflows. Inflation has been on an increasing trend since 2003, reaching 18.1 percent in March 2008. The challenge in this environment is to set appropriate monetary and exchange rate policy stances to slow the pace of bank credit growth and external borrowing and to contain inflation.

Another challenge throughout the period has been to assess the impact of money growth on the economy. As a transition economy with strong growth and macroeconomic stability, there was a steady buildup of confidence in the banking system after the late 1990s, which was reflected in strong money demand and monetization. Relying on monetary aggregates for monetary policy in such an environment is challenging. On the other hand, the lack of some of the preconditions to do this, including the lack of effective interest rate channels, made it difficult to adopt this regime in the short term. The NBK's eclectic approach reflects these challenges.

The 2003 monetary policy framework included inflation and exchange rate objectives. The NBK treated price stability as the key monetary policy objective, but continued to closely monitor the real exchange rate of the tenge against a basket of 24 currencies of key trading partners. The NBK intervened in the foreign exchange market, mainly through purchases aimed at preventing a rapid appreciation of the tenge. In an effort to stem upward pressure on the tenge while containing money growth, the NBK supplemented its exchange market intervention with continued large-scale sterilization operations. However, as sterilization costs mounted, the increase in the NBK's reserves was not fully sterilized. As a result,

reserve and broad money growth rose beginning in 2003. Moreover, although NBK policy rates were raised in 2005, 2006, and 2007, the increases were well short of the rise in international short-term rates, and interest rates were often negative in real terms.

Policy Response to the Boom until Mid-2007

The authorities' main concerns during the period were rapid appreciation, mounting vulnerabilities in the banking system, and inflation pressures. The authorities recognized that appreciation of the tenge was unavoidable amid high oil prices and increases in domestic production. Yet they believed that large and rapid nominal appreciation could prove disruptive. Resistance to rapid appreciation, however, brought about continued inflation pressures. Another major concern was banks' external borrowing and rapid credit growth. A sudden stop or a reversal of flows posed the risk of funding problems for the banking system.

The NBK used a variety of tools to respond to the economic boom and rapid credit growth. Interest rates were increased by 100 basis points in 2006 and a further 100 basis points during the first half of 2007. Despite these measures, banks' lending rates declined markedly in real terms, further fueling credit demand. During the first half of 2007, the NBK allowed a more rapid appreciation of the tenge by scaling back its interventions in the foreign exchange market.

Reserve requirements were another tool used to slow credit growth. To enhance its ability to absorb liquidity, in October 2005 the NBK broadened the coverage of required reserves to include net foreign liabilities. Reserve requirements were raised in mid-2006. Changes to the requirements were implemented in a phased manner to allow banks to adjust their balance sheets without undue disruption.

The financial position of the NBK was strengthened in 2005 to better cope with capital inflows. An amendment to the budget code enacted in mid-2005 envisaged

capital injections to the NBK to cover losses related to monetary operations, including interest expenses for sterilization operations and revaluation losses resulting from tenge appreciation.

Prudential measures were implemented in response to rapid credit growth. These included bank-capital-related limits on borrowing, tighter asset-classification rules and risk weights, and stronger collateral requirements. Banks' open foreign currency limits were reduced in early 2005, and capital adequacy requirements for market and operational risks were introduced. The risk weight for high-value property loans was raised, and the scoring system used by banks for loan classification was toughened. But the new regulations proved ineffective, partly because they appeared to be lax and were implemented too slowly.

Supervision was also strengthened. On-site inspections were intensified. Off-site supervision was strengthened and, since early 2006, banks have been required to submit additional information on their assets, contingent liabilities, and related party and holding operations. Banks are required to regularly submit stress test results—covering liquidity, credit, interest rate, exchange rate, oil, and real estate price shocks—and currency gap analyses to the financial supervisory authority.

Although these measures likely have had some impact, they have not fully addressed the authorities' concerns. Rapid appreciation may have been avoided to some extent, but inflation has continued to rise. Despite measures to tighten liquidity, money and credit aggregates surged. External debt and credit continued to grow at a fast pace.

Recent Developments

The volatility and liquidity problems that started after the subprime mortgage crisis in August 2007 hit the Kazakhstan banking sector hard. The banking system faced difficulties in external funding, and bond spreads in international markets jumped by 150–350 basis points during July–August. Liquidity conditions in the domestic money market tightened correspondingly, with interbank rates rising by 250 basis points despite large-scale redemption of NBK notes by banks as well as nonresidents. The tenge came under pressure, but NBK intervention helped limit its depreciation against the dollar to 3½ percent from end-June to end-August. The NBK responded by providing large-scale liquidity to the banks during August–October through repurchase agreements, foreign exchange swaps, the early redemption of NBK notes, and the easing of reserve requirements. It also intervened in the foreign exchange market, with 25 percent of reserves used to cool down the market and an effective peg of the tenge to the U.S. dollar after October 2007. After rising sharply, interbank rates have eased.

Implications

Concerns about rapid appreciation cause tension with the price stability objective. Resisting appreciation through intervention fuels liquidity growth, leading to inflation pressures. In a rapid-growth environment supported by a positive terms-of-trade shock, appreciation is unavoidable. The challenge for the NBK is to assess the equilibrium rate of the real exchange rate and keep the tenge around that level, no matter how rapid the appreciation may be. Otherwise, the risk remains that adjustment of the real exchange rate will take place through inflation, instead of nominal appreciation.

Regulatory measures are not sufficient to address vulnerabilities without a complementary monetary policy. Although the regulations themselves need to be strengthened, the fact that interest rates remained low or negative in real terms in Kazakhstan throughout the period has muted the overall policy impact.

Peru

Given high financial dollarization, the Central Reserve Bank of Peru (BCRP) takes the exchange rate into account in its framework. The BCRP has tried to prevent excess exchange rate volatility to avoid the risks associated with dollarization, as long as such a policy is consistent with the inflation objective. Strong depreciation pressure on the nuevo sol and its subsequent appreciation trend during 2005–06 highlighted the interaction and potential tension with exchange rate management.

Monetary and Exchange Rate Policy Framework

To achieve its constitutional objective—preservation of monetary stability—the BCRP adopted inflation targeting in 2002. This replaced monetary targeting, because there was no longer a systematic association between inflation and the growth of the monetary base. The key aspects of the inflation-targeting regime are as follows:

- The 2007 target was an annual inflation rate of 2 percent in terms of the CPI (for Metropolitan Lima), with a tolerance margin of ±1 percent. The central rate was reduced by 0.5 percent in February 2007, from 2.5 percent, the rate set when inflation targeting was introduced. The new target, closer to the inflation rates in Peru's major trading partners, is expected to reinforce the BCRP's commitment to maintain the purchasing power of the domestic currency in the long run and to help reduce financial dollarization.

- The board of the BCRP decides on a reference rate for the interbank lending market on a previously

announced date, usually at the beginning of each month. The decisions are based on forecast studies and macroeconomic simulations. To keep the interbank rates close to the reference rate, the BCRP conducts open market operations to inject liquidity into or withdraw it from the system. In addition, the BCRP provides lending and deposit facilities, which form a corridor of interbank rates.

- The board's decisions are immediately announced to the public along with the main reasons underlying the decisions. The BCRP also publishes an inflation report every four months, which analyzes recent inflation developments, outlines policy actions adopted by the BCRP, and presents the inflation forecast with the balance of risks. Exchange rate movements and their implications for inflation are also analyzed.

The first five years of inflation targeting were associated with good inflation control. The average annual inflation rate was 2 percent for 2002–06, indicating that inflation was within the target range. This outstanding performance apparently led to the reduction of the target rate (mentioned above).

Peru's inflation-targeting regime and its exchange rate policy are also aimed at preventing the risks associated with financial dollarization and smoothing the way to dedollarization. Peru's economy remains highly dollarized, although much less so in recent years, from more than 70 percent of deposits as of end-2000 to less than 40 percent as of March 2008. Financial dollarization poses risks stemming both from currency and maturity mismatches, which makes the economy more vulnerable to abrupt exchange variations, in particular an unexpected depreciation of the local currency. Inflation targeting contributes to a reduction in financial dollarization by reinstating confidence in the domestic currency. At the same time, a flexible exchange regime[77] is pursued to help stabilize the real return on domestic assets and avoid abrupt exchange rate fluctuations, which facilitates the dedollarization process.[78]

The BCRP intervenes in the exchange market to prevent excessive volatility. In addition, purchasing foreign currencies can strengthen the BCRP's foreign reserve position, which also enhances its ability to deal with strong depreciation pressures.[79] In its interventions, the BCRP does not strive for any particular exchange rate level; it emphasizes that the elimina-

tion of volatility in the exchange rate might prevent economic agents from promoting risk management in foreign currencies. Importantly, exchange interventions are conducted in line with the inflation-targeting regime, given the priority of achieving the target.

Policy and Exchange Rate Developments in 2005–06

Strong depreciation pressures and the subsequent appreciation trend during 2005–06 highlighted the interaction between inflation targeting and exchange rate management. The BCRP addressed these market developments, taking account of risks under high financial dollarization.

Depreciation pressures during late 2005 and early 2006

Beginning in August 2005, the exchange market was subjected to depreciation pressures accompanied by an increase in the sovereign risk premium. Following an appreciation trend beginning in 2003, the nuevo sol once again weakened in August 2005, as a result of growing uncertainty about the results of the presidential election and shifts in institutional investors' portfolios. Election-related uncertainty fueled the country risk premium increase as well. These downward currency movements ended in mid-January 2006, but volatility continued until the first round of elections in April 2006. Forward currency transactions also indicated rising expectations that the nuevo sol would deteriorate during the first several months of 2006.

To prevent the sol's depreciation and excess exchange rate volatility, the BCRP raised the reference rates by 150 bps, to 4.5 percent, and conducted foreign exchange market interventions. The policy rate was raised six times from December 2005 to May 2006 (25 bps each month). Although the inflation rate was below the targeted level (2.5 percent) during the period, strong economic growth, together with a depreciating exchange rate, made it advisable to reduce monetary stimulation to avoid creating inflation pressures that could affect the ability to meet the inflation target in the future. The BCRP also countered the market until January 2006 through the sale of dollars (purchase of nuevos soles) and the placement of U.S. dollar-indexed certificates called readjustable certificates of deposit. These policy actions and operations were meant to check the negative impact of the excessively volatile exchange rate on economic activity in the context of heavy financial dollarization.

Appreciation trend after mid-2006

As election-related uncertainty dissipated, the appreciation of the sol resumed in mid-2006, prompting the

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[77]Peru's exchange rate regime is currently classified as a managed float.

[78]In addition, the BCRP points out that a high level of foreign reserves, a banking system with liquid foreign currency assets, appropriate banking supervision, and a strong fiscal position help reduce the risks involved in financial dollarization.

[79]A portion of these purchases of dollars have served to meet the treasury's demand for foreign currency to repay the external debt.

BCRP to intervene in the opposite direction. The upward pressure was supported by the continuous favorable evolution of the external account and increasing remittances from Peruvian citizens abroad. In order to offset these pressures, the BCRP intervened in the exchange market and stepped up dollar purchase operations. This contributed to the restoration and subsequent strengthening of the BCRP's foreign reserve position. As a result, the dollarized economy was in a better position to deal with associated risks. Meanwhile, the BCRP maintained the monetary policy reference rate at 4.5 percent until July 2007, when it began to express concern about the possibility of inflation because of the increase in domestic demand. In line with this policy stance, the BCRP sterilized excess liquidity through placements of nuevo sol-denominated certificates of deposit.[80]

Implications

A high degree of financial dollarization increases the role of the exchange rate in the monetary policy framework. To prevent risks associated with dollarization, the authorities sought to avoid excess exchange rate volatility, particularly strong exchange rate swings, which could seriously affect the economy's balance sheet, given still significant dollarization. Peru has effectively succeeded in achieving this objective in line with its inflation-targeting regime, while increasing the economy's reliance on the local currency; the level of financial dollarization in Peru has decreased significantly in recent years.

As long as depreciation pressures are accompanied by inflation risks, there is little conflict between inflation targeting and exchange rate considerations, as seen between late 2005 and early 2006. However, appreciation with inflation complicates the implementation of monetary policy, because dollar purchase interventions may cause excess liquidity. To mitigate the tension, the BCRP must sterilize the monetary impact of its intervention.

Supplemental measures to promote dedollarization help prevent potential conflicts between the inflation objective and concern about a volatile exchange rate. As pointed out by the BCRP, robust financial systems and sound fiscal positions help reduce risks associated with financial dollarization.

Philippines

The strong appreciation of the peso in 2006 revealed potential tension between foreign exchange interven-

tions and the need to contain inflation pressures, complicating inflation targeting of the Bangko Sentral ng Pilipinas (BSP). Expanding sterilization operations and liberalizing capital controls have helped ease the problem to some extent.

Monetary and Exchange Rate Policy Framework

The BSP adopted an inflation target in January 2002, after abandoning monetary targeting. The primary objective of the BSP's monetary policy is "to promote price stability conducive to a balanced and sustainable growth of the economy," which the inflation target aims to achieve. Core elements of the framework are as follows:

- The BSP aims for an average year-over-year change in the headline CPI. The target for a given year is announced two years in advance (a two-year target horizon) and is set by the government in consultation with the BSP. The target for 2008 was 4 percent, with a tolerance of ±1 percentage point (or 3–5 percent). For 2009, the target is 3.5 percent ±1 percentage point (or 2.5–4.5 percent).[81]

- If the BSP fails to meet the inflation target, the BSP governor issues an open letter to the president to explain to the public why the target was missed, along with measures to be adopted to bring inflation toward the target. Open letters were issued January 16, 2004; January 18, 2005; January 25, 2006; January 19, 2007; and January 14, 2008.[82] This suggests that the target has been missed during most of the period.

- Acceptable circumstances under which the BSP is allowed to fail to achieve its inflation target include price pressures arising from (1) volatility in the prices of agricultural products; (2) natural calamities or events that affect a major part of the economy; (3) volatility in the price of oil products; and (4) significant government policy changes that directly affect prices—for example, changes in the tax structure, incentives, and subsidies.

- The BSP publishes a quarterly inflation report with inflation forecasts and the highlights of the meeting of the monetary board to help the public better understand monetary policy developments.

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[80]The BCRP explains that the sterilization operations have not led to negative effects on the BCRP financial outcome, because the interest rates on certificates of deposit have not been higher than the yield obtained on foreign reserves.

[81]Until 2007, the target formula was a range target, for example, "4–5 percent," but it was changed to a point target with a tolerance beginning in 2008, effectively widening the target band. This provides more flexibility to the BSP in steering inflation.

[82]These letters outline price developments and adopted measures in the previous year and the outlook for the coming year.

Monetary policy is decided by the monetary board, which meets every six weeks on pre-announced dates. To strengthen the decision-making process, an advisory committee was established to make recommendations to the monetary board. This committee, consisting of the BSP governor and representatives of several government agencies, meets a few days before each monetary policy meeting.

The primary instruments used to achieve the inflation target are overnight repos and reverse repos, whose interest rates form the BSP's policy rates. Other regular monetary instruments include short-term repos, outright purchases and sales of securities, rediscounting, and reserve requirements. In addition, the BSP sometimes adopts a "tiering scheme" for banks' aggregate placements at the BSP to encourage bank lending.[83] Moreover, the BSP implemented new liquidity management measures to improve capacity to absorb liquidity.[84]

The BSP's foreign exchange intervention is officially limited to countering disorderly market conditions.[85] The authorities took advantage of favorable market conditions to strategically build up reserves, thereby reducing vulnerability to external shocks. Over 2005–07, absolute monthly intervention averaged 38 percent of daily foreign exchange market turnover (Edison and others, 2007).

The BSP takes the exchange rate into account when carrying out monetary policy. Although the BSP does not attempt to keep the exchange rate at any particular level, it examines the impact of exchange rate movements on price developments in its overall inflation forecasts. The BSP also assesses external competitiveness through analysis of the real effective exchange rate.[86]

Recent Policy Responses to Exchange Rate Developments

After hovering around a historically low level in 2004–05, the peso strengthened markedly, which complicated the BSP's monetary policy. During this period, the BSP continued to be vigilant against risks of inflation higher than the target, which revealed potential tensions between the inflation target and exchange rate considerations.

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[83]Under the most recent tiering scheme (lifted in July 2007), the banks' liquid funds placed at the BSP were given progressively lower interest rates: the policy rate for the first 5 billion Philippine pesos (PHLP), 200 basis points less for the next PHLP 5 billion, and 400 basis points less for amounts in excess of PHLP 10 billion.

[84]Under the measure, government-owned and government-controlled corporations and trust entities are allowed to deposit with the BSP at a relatively high rate in a special deposit account.

[85]The central bank law stipulates that the monetary board shall determine the exchange rate policy of the country.

[86]The quarterly inflation reports of the BSP often discuss competitiveness based on real effective exchange rate developments.

The BSP's policy responses in 2005

In the face of inflation pressures, the BSP tightened its policy stance. Higher inflation in 2005 was attributed to price increases in food, energy-related products, and transportation, which are outside the control of monetary policy. Nevertheless, aware of increased risks for inflation, the BSP raised its policy rates in April, September, and October 2005 by a cumulative 75 basis points. In addition to supply shocks from high oil prices and their second-round effects, the BSP pointed out risks of exchange market pressure on inflation expectations, given the likelihood of declining differentials between domestic and foreign interest rates and a possible adverse shift in investors' sentiment. The BSP also increased reserve requirement ratios by 100 basis points in July 2005 in order to mop up excess peso liquidity.

In addition, the BSP implemented other administrative and regulatory measures to stem peso depreciation pressures. In July 2005, the Currency Risk Protection Program was revised, with the addition of a more competitive pricing mechanism. This enabled eligible corporate and other foreign exchange users to purchase foreign exchange from banks at a predetermined rate in the future, which was expected to remove a significant amount of demand from the spot market. The BSP also tightened its foreign exchange regulations in January 2006 to require any person whose transactions are in foreign currency or foreign-exchange-denominated monetary instruments to furnish information on the source and purpose of these transactions.

The BSP's policy responses in 2006–07

Despite the BSP's concern about depreciation, the peso appreciated significantly during 2006 and 2007. Strong dollar inflows from remittances by Filipino workers abroad as well as from portfolio and foreign direct investment were the main sources of the peso's appreciation. The latter reflected renewed investor confidence because of a positive economic outlook in the wake of fiscal reforms and stable macroeconomic performance.

Strong foreign exchange flows presented challenges for the BSP's monetary and exchange policy. During 2006, a series of adverse supply shocks, including from food prices, international oil prices, and reforms to the value-added tax, failed to feed into underlying inflation. The retreat of inflation to within the target band and stable interest rates contributed to continued foreign exchange inflows, leading to further appreciation pressures. Although the BSP recognized that the stronger peso helped keep the prices of imported goods down, the appreciating peso adversely affected exporters and Filipino workers abroad. Against this background, the BSP intervened in the foreign exchange market

to smooth out exchange rate fluctuations and build up reserves. However, the absence of full sterilization of interventions led to peso liquidity.

To curtail potential inflation pressures, the BSP implemented measures in 2007 to strengthen sterilization and increase demand for foreign exchange. As stated above, access to the special deposit account (SDA) window was expanded to more financial institutions in May 2007 to help withdraw liquidity from the system. The SDA grew quickly and helped contain the growth of liquidity. To increase demand for foreign exchange, the authorities accelerated prepayment of external debt in December 2006.[87] In addition, relaxation of foreign exchange controls on capital outflows began in April 2007, which included raising limits on banks' foreign currency transactions to pre-Asian-crisis levels (before 1997). In late December 2007, a second round of liberalization was implemented.

Implications

The large scale of foreign exchange intervention can cause tension with the inflation target. Although appreciation can contain inflation pressures, the concerns of the BSP about excessive peso fluctuations and its goal of building up foreign reserves led to intervention and rapid growth of liquidity, which has the potential to conflict with the inflation objective.

Sterilization can alleviate the tension but may not be sustainable. Although recent sterilization efforts were successful, such operations carry quasi-fiscal costs, which are ultimately borne by the government. Thus, sterilization cannot be seen as a panacea for dealing with conflict between inflation and foreign exchange objectives.

Relaxation of capital controls on outflows can also ease the problem to some extent. However, its effects on exchange rate developments have not been verified. Moreover, this is not a direct solution when seeking to achieve balance between monetary policy objectives and exchange rate considerations.

Singapore

Singapore's monetary policy has been centered since 1981 on management of the exchange rate. The Monetary Authority of Singapore (MAS) adopts the exchange rate as an operational target by guiding a trade-weighted Singapore dollar within a policy band. This framework reflects the fact that the exchange rate is the most effective tool for maintaining price stability in the small and open Singapore economy, and indeed it has performed very well to date. However, grow-

ing capital flows have posed new challenges to this exchange-rate-centered framework.

Monetary and Exchange Rate Policy Framework

In Singapore, monetary policy is centered on the management of the exchange rate, rather than monetary aggregates or interest rates. The primary objective of monetary policy in Singapore is to promote price stability[88] as a sound basis for sustainable economic growth.[89] To achieve this ultimate purpose, the MAS has used the exchange rate as the operational target since 1981, as outlined below.

- The MAS manages the Singapore dollar vis-à-vis a trade-weighted basket of currencies of Singapore's major trading partners and competitors (S$NEER). The composition of this basket is reviewed and revised periodically to take account of changes in trade patterns, but details concerning the index are not disclosed.

- The trade-weighted exchange rate fluctuates within a policy band. The general direction of the band is announced semiannually, but details on the slope and width are not disclosed.

- When the trade-weighted exchange rate breaches the policy band on either side, or when there is undue Singapore dollar volatility or speculation, the MAS intervenes in the foreign exchange market by using spot or forward transactions.[90] Intervention operations take the form of purchase or sale of Singapore dollars against U.S. dollars.

- The exchange rate policy band is reviewed semiannually to ensure that it remains consistent with the economic fundamentals and market conditions, results of which are published in the *Monetary Policy Statement*. The MAS may change the slope of the band or shift it in response to changes in inflation pressures. Sometimes, for example, during periods of heightened volatility, the band may be widened to accommodate more volatile fluctuations in the exchange rate.[91]

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[87]In December 2006, the BSP prepaid its outstanding obligations to the IMF in the amount of US$220 million, marking its exit from the postprogram monitoring arrangement with the IMF.

[88]The authorities do not provide any numerical target or definition of price stability.

[89]According to the central bank law, one of the MAS's objectives is to promote, within the context of the general economic policy of the government, monetary stability and credit and exchange conditions conducive to the growth of the economy.

[90]The MAS explains that it will refrain from intervention as much as possible and allow market forces to determine the level of the Singapore dollar exchange rate within the policy band (Monetary Authority of Singapore, 2007).

[91]For example, the policy band was widened during the Asian crisis of 1997–98 and after the terrorist attacks in the United States in September 2001.

Table 9.2. Monetary Authority of Singapore: Policy Developments since 1981

Period	Policy Stance	Description
1981–85	appreciation	Oil price shocks and high capital flows intensified inflation pressures. Appreciating the trade-weighted exchange rate by 30 percent during 1981–85 prevented the emergence of inflation.
1985–88	depreciation	Singapore experienced a recession, caused largely by a deterioration in export competitiveness, a cyclical downturn in electronics, and the collapse of the construction boom. The depreciation of the exchange rate by 16 percent during 1985–88 restored competitiveness.
1988–97	appreciation	After economic recovery from the recession, fear of renewed inflation prompted the MAS to guide a decade-long trend appreciation of the exchange rate.
1997–2000	zero-appreciation	During the Asian crisis, inflation eased and GDP growth stalled. The MAS eased policy by guiding the exchange rate to fluctuate within a zero-appreciation band.
2000–01	appreciation	Against the backdrop of a favorable external environment and a strong rebound of the economy, the MAS tightened policy by inducing a gradual appreciation of the exchange rate.
2001–04	zero-appreciation	Given weak external demand, a protracted global electronics downturn, and subsiding inflation pressures, the MAS eased its policy stance to a neutral setting in July 2001. The policy band was centered on a zero-percent appreciation.
2004–08	appreciation	Against a more favorable growth outlook for the economy, and the risk of rising inflation pressures, the MAS shifted to a policy of modest and gradual appreciation of the exchange rate in April 2004. In October 2007, the MAS increased the slope of the policy band slightly. Further, in April 2008, the MAS shifted the policy band upward by recentering it at the prevailing level of the S$NEER.

Source: IMF staff.

This framework reflects the fact that the exchange rate is the most effective tool in maintaining price stability in the small and open Singapore economy. Indeed, total exports and imports are each well in excess of 200 percent of GDP. Empirical research suggests that changes in the trade-weighted Singapore dollar have a greater influence on domestic inflation and the output gap than changes in interest rates.[92]

Under the exchange-rate-centered framework with an open capital account, the MAS cedes control over domestic interest rates. The MAS's money market operations are aimed at ensuring sufficient liquidity in the banking system to meet banks' demand for reserve and settlement balances. To this end, in addition to daily market operations such as repos, foreign exchange swaps, and lending, the MAS provides an end-of-day liquidity facility, an intraday liquidity facility, and a standing facility. These facilities have helped contain interest rate volatility. In conduct-

ing its money market operations, the MAS takes into account the net liquidity impact of foreign exchange interventions in conjunction with various autonomous and other market factors. In this respect, the MAS's foreign exchange interventions can be said to be sterilized in the broader sense that the liquidity in the system is always restored to a level sufficient to meet banks' demand for reserves.

The MAS has made efforts to increase disclosure and enhance transparency on the policy stance and the rationale behind that stance. Recent initiatives include the publication of the *Monetary Policy Statement* soon after each semiannual review of monetary and exchange rate policy. This is supplemented by the release of the *Macroeconomic Review*, which provides the MAS's background analysis and outlook for GDP growth and inflation for Singapore.

Policy Developments under the Exchange-Rate-Centered Framework

Policy developments since 1981

It is generally observed that Singapore's monetary policy has stabilized inflation pressures at a low level by guiding the exchange rate flexibly along an appre-

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[92]Parrado (2004a) found that the trade-weighted nominal exchange rate has relatively little impact on CPI inflation initially, but becomes more influential in the medium term. Khor, Robinson, and Lee (2004) also contend that the impact of an exchange rate appreciation on GDP, exports, and CPI is considerably greater than a corresponding increase in the interest rate.

ciation path. This has led to low and stable inflation with prolonged economic growth. Policy developments since 1981 are summarized in Table 9.2

Singapore's monetary policy framework has proven flexible in the face of heightened market volatility and uncertainty. The flexibility is brought about by widening the policy band, which could facilitate greater exchange rate adjustments, thereby preventing adverse volatility in the real economy. One example of this flexibility was after the uncertainty caused by the Asian financial crisis. Another was soon after the September 11 terrorist attacks in the United States. In both cases, the MAS widened the policy band to allow more volatile fluctuations in the Singapore dollar.

Recent policy challenges

Strong capital flows have posed policy challenges for Singapore. As noted, the MAS has maintained a policy of modest and gradual appreciation of the Singapore dollar policy band since April 2004. Though this has contributed to the low and stable inflation environment amid robust economic growth, carrying out the policy has been complicated by appreciation pressures stemming from strong investment inflows into the region, weak U.S. dollar sentiment, and a relatively buoyant Singapore economy.

Since 2006, the trade-weighted Singapore dollar has stayed in the upper half of the policy band, and more recently it has fluctuated near its upper end. The appreciation pressures have forced the MAS to intervene in the foreign exchange market to keep the exchange rate within the policy band, as evident in the accumulation of foreign exchange reserves (to US$163 billion at end-2007 from US$116 billion at end-2005).[93] In April 2008, the MAS recentered the policy band at the prevailing level of the S$NEER to mitigate inflation pressures.

Heavy intervention has built up domestic liquidity and lowered domestic interest rates. Under the MAS's money market operation framework, as explained, the extent to which the impact of foreign exchange interventions is sterilized depends on banks' demand for reserve and settlement balances, which in the end affects money market rates. Against expectations that the U.S. dollar will appreciate and expectations about liquidity conditions in the market, the (three-month) interbank interest rate had come down to 2.9 percent by March 2007, from 3.4 percent in September 2006. The interest rate fell further to 1.3 percent at the end of March 2008. Although the interest rate in Singapore is neither a policy instrument nor an intermediary target, the decline of interest

rates has partly offset tightening monetary conditions envisaged by the strong exchange rate.

Implications

Singapore's exchange-rate-centered monetary framework has performed very well to date. It should be noted that the framework is supported by the small size and high degree of openness of Singapore's economy. A key condition for the framework to be viable is that the exchange rate plays a significant role in the inflation dynamics in Singapore. Under the framework, there is relatively limited tension between the inflation objective and exchange rate management.

Increased capital flows pose challenges for the exchange-rate-centered framework. Growing gross capital flows highlight the importance of the MAS's ability to keep the exchange rate within the policy band. There have been few problems so far, but future concern cannot be ruled out. At the same time, maintaining the equilibrium value of the exchange rate within the framework might be another important issue.

South Africa

The South African Reserve Bank (SARB) allows the exchange rate to be determined in the market, but it takes into account the rate's impact on prices in the context of inflation targeting. This strategy has worked well, with little tension between the inflation objective and exchange rate policy. However, the rand remains vulnerable to the nation's large current account deficit, causing higher fluctuations of the exchange rate, and this calls for relatively swift and sizable policy responses, as seen in recent episodes. Furthermore, large capital flows pose new challenges to the SARB's monetary policy.

Monetary and Exchange Rate Policy Framework

In February 2000, South Africa announced the adoption of formal inflation targeting as the monetary policy framework. The monetary policy of the SARB was already aimed at price stability, which is stipulated as its primary goal in the constitution and in the central bank law. But the SARB has relied mainly on monetary aggregates in the past, causing uncertainty among the public about the policy stance. To make monetary policy more transparent and accountable and improve coordination between monetary policy and other macroeconomic policies, inflation targeting was introduced in a more formal way.

- The inflation target in terms of the CPIX (the overall consumer price index, excluding mortgage interest

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[93]The MAS sterilized in part the net liquidity impact of its foreign exchange intervention mainly through foreign exchange swaps, leading to rapid growth of the MAS's forward position (to US$63 billion at end-2007).

costs) is determined by the government in consultation with the SARB. Until 2003, the authorities specified the target in the form of the annual average rate of the CPIX for every calendar year.[94] But in November 2003, this was replaced by a continuous CPIX target of 3–6 percent on an annual basis for the period beyond 2006. This change aimed to prevent excessive interest rate volatility and ineffective management of inflation expectations.

- The Monetary Policy Committee (MPC) decides the policy stance by changing the repo rate, the policy rate applied to the SARB's refinancing operations, to achieve the inflation target. Currently, a meeting is held every two months. The result of the meeting is immediately made public at a press conference and broadcast live on national television. At the MPC meetings, a large number of indicators that could affect inflation as well as other exogenous factors are monitored.

- To fully inform the public about monetary policy implementation, the SARB publishes a number of reports, including the *Monetary Policy Review* twice a year, which provides its core forecast of inflation in the form of a fan chart. In addition, a Monetary Policy Forum is convened by the SARB twice a year in the major cities, at which representatives of labor organizations, business, government, and academic institutions exchange views on monetary policy and economic development.

The SARB adheres to a floating exchange regime in the context of inflation targeting. Although the exchange rate is perceived as an important transmission mechanism for monetary policy that could affect inflation and economic growth, the SARB is of the view that too much concern about exchange rate stability can induce the wrong policy response. Wide fluctuations in the exchange rate of the rand could complicate monetary policy decision making; nevertheless, South Africa opted for a flexible exchange rate regime to maintain monetary policy flexibility. The MPC therefore monitors the exchange rate from the perspective of whether and how it influences the inflation rate and inflation forecast. Indeed, most policy statements mention the exchange rate as one of the factors affecting inflation.

The SARB intervenes in the foreign exchange market only to bolster its reserve position through purchases of dollars. While allowing the exchange rate to be determined by the market, the SARB aims at creating underlying economic conditions that are conducive to exchange rate stability. For this purpose, the SARB attempted to reduce its oversold forward book (net open position in foreign currency), which caused concern and contributed to a volatile exchange rate. After achieving this goal in May 2003, the objective of the exchange operations was shifted to increase foreign reserve holdings whenever circumstances permitted.

Policy and Exchange Rate Developments in 2003 and 2006

Large fluctuations in the exchange rate of the rand have affected inflation, leading to relatively sizable monetary policy responses.

Recovery of the rand and monetary easing in 2003

After considerable depreciation until the beginning of 2002, the rand appreciated throughout 2003. The increased risk aversion of international investors created downward pressures on the rand, accelerating inflation well above the inflation target during most of 2002. The restored risk appetite toward emerging market economies, together with sound macroeconomic policy in South Africa and its improved credit ratings, changed the direction of the exchange rate and brought it back to the recovery trend. By mid-2003, the nominal effective exchange rate returned close to its end-2000 level—just before the start of the depreciation. This, in addition to other factors such as a slowdown in food price increases, contributed to lower inflation forecasts.

The SARB reduced its policy rate significantly as the inflation outlook improved. Favorable inflation projections enabled the SARB to ease its monetary policy beginnning in June 2003. The SARB cut the repo rate five times, to 8 percent by the end of the year, including at an unscheduled meeting in September, with a total reduction of the rate amounting to 550 bps. The inflation rate declined eventually within range of the inflation target in October 2003. Although the appreciation of the exchange rate somewhat affected the profitability and competitiveness of exporters, the recovery of the rand assisted materially in containing inflation, which was the basis for the SARB's monetary easing.

Depreciation of the rand and monetary tightening

After remaining relatively stable, the exchange rate encountered depreciation pressures in 2006. In 2005, the rand was supported by high commodity prices, foreign direct investment flows, and positive economic data for

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[94]This formula entailed revision of the targets, which complicated the implementation of inflation targeting and caused uncertainty among the public. For example, the initial CPIX targets of 3–5 percent for 2004 and 2005 were revised to 3–6 percent when it became clearer that they would be missed for a fairly protracted period.

South Africa, despite the growing current account deficit. However, the currency depreciated in mid-2006 amid volatility in global financial markets and uncertainty regarding the direction of U.S. interest rates. The SARB noted that a further widening of the current account deficit could trigger market concerns about its sustainability, which could have adverse impacts on the exchange rate. Along with higher oil prices and robust domestic demand, particularly strong household consumption, the rand's depreciation led to inflation pressures through some pass-through effects on domestic prices.

In the face of upside risks to inflation, the SARB tightened monetary policy beginning in mid-2006. As inflation projections deteriorated, the SARB raised the repo rate by 50 bps at its June 2006 meeting, which was followed by a subsequent series of 50 bps increases at the August, October, and December meetings. In addition, the policy rate was increased by a total of 2 percentage points on four occasions in 2007 and by a total of 1 percentage point on another two occasions in the first half of 2008, taking it to 12 percent. These policy responses are intended to ensure that inflation, which breached the target in April 2007 for the first time since August 2003, returns to within the target range.

Implications

The SARB allows the exchange rate to be determined in the market while taking account of its impact on prices in the context of inflation targeting. In this respect, attainment of the inflation objective has not been naturally limited by the exchange rate consideration. The SARB simply accepts the currency movements without leaning against them. Consistently, interventions in the foreign exchange market are aimed primarily at strengthening the reserve positions, which is expected to be conducive to exchange rate stability.

However, the rand remains vulnerable to the country's large current account deficit and exposure to commodity price movements. This causes concern about greater fluctuations in the exchange rate. Indeed, the rand was among the most volatile emerging currencies during the market turbulence of May–June 2006. In addition, the above episodes indicate that a large swing of the rand, at least in part, triggered relatively swift and sizable policy responses.

Large capital flows pose new challenges for the SARB's monetary policy. The growing current account deficit has been adequately financed by capital inflows. At the same time, the large inflows are accompanied by rapid credit growth, particularly in the household sector, as well as increases in asset prices, which contribute to the risk of inflation. Therefore, monetary tightening by the SARB interacting with the exchange rate and capital flows could support sustainability of the current account deficit but bring about unexpected outcomes in domestic monetary conditions, thereby potentially complicating achievement of the inflation target.

X Foreign Exchange Intervention Practices: Selected Cases

This section chronicles the foreign exchange market intervention practices of selected inflation-targeting emerging economies and emerging economies with other anchors. The first subsection offers detailed case studies of the foreign exchange market intervention practices of nine countries chosen to represent the analytical country groupings:

- Inflation-targeting emerging economies—Brazil, Chile, Colombia, Turkey;
- emerging economies with other anchors—Azerbaijan, Romania, Serbia;
- inflation-targeting advanced economies—New Zealand, Sweden.

This selection was based also on their experiences with the role of the exchange rate in the monetary and exchange rate policy framework. The case studies focus on the most relevant foreign exchange intervention episodes in recent years and thus are not meant to provide up-to-date descriptions.

The second subsection comprises summary tables of the intervention practices and foreign exchange markets of all the inflation-targeting emerging economies and emerging economies with other anchors, as well as six of the inflation-targeting advanced economies. The tables are for the most part based on information available as of mid-2007.

Azerbaijan

Azerbaijan is transitioning from a monetary policy framework anchored on the exchange rate to an inflation-targeting strategy. Nevertheless, the policy framework remains strongly focused on the exchange rate, implying that foreign exchange interventions are frequent. The heavy management of the exchange rate is also a result of the lack of financial market development, in particular a shallow foreign exchange market. The focus on exchange rate stability is negatively affecting the incentive to develop foreign exchange hedging instruments; at the same time, the lack of foreign exchange market development, in particular the absence of foreign exchange hedging instruments, is complicating the transition toward a more flexible exchange rate, because interventions become an important "market management" tool.

Foreign Exchange Market Development

The foreign exchange market consists mainly of spot market operations, and the interbank money market is thin. The foreign exchange market is largely U.S. dollar based, and most transactions take place in the spot market. The foreign exchange swap market is less developed; it is mostly bank-customer oriented, with only a limited number of interbank transactions. Moreover, foreign exchange swaps are typically built up through the interbank deposit market (by entering into a deposit-and-lending transaction in local and foreign currency), owing to the absence of an active interbank market for forward/swap transactions.

Market concentration is high, and imbalances in foreign exchange market flows lead to active participation by the central bank. Two large players have emerged as the dominant forces in supplying the bulk of foreign exchange: the oil company, SOCAR, and its transfers to the budget; and the oil fund, SOFAZ. The International Bank of Azerbaijan (IBA) is the dominant player in the wholesale market, because the IBA is SOCAR's exclusive bank and thus the main transmitter to the interbank market of the considerable oil-related foreign exchange inflows.

Trading is supported by a developed electronic trading infrastructure with transparent reporting of daily market turnover. The foreign exchange market is organized around the Baku Interbank Currency Exchange (BICEX) and the over-the-counter interbank market. BICEX runs the electronic matching system (BEST), where banks' buy and sell orders are matched in two daily trading sessions.

Institutional Framework

Azerbaijan implements an eclectic monetary framework, including a de facto conventional fixed peg arrangement.[95] The National Bank of Azerbaijan (ANB) intends to allow greater exchange rate flexibility, with the objective of moving to full-fledged inflation target-

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[95]The 2007 issue of the IMF's Annual Report on Exchange Arrangements and Exchange Restriction notes that the de facto regime is different from the de jure regime. In March 2008, the ANB reportedly adopted the two-currency basket (U.S. dollar and euro) under the pegged arrangement.

ing over the medium term. In its monetary policy statement for 2007, the ANB affirms that it "will apply a money-currency policy directed to hold basis inflation at the one-digit level and to defend financial stability for 2007." Central bank autonomy is limited both with respect to policy and instrument independence.

The ANB publishes information about intervention amounts, but there is limited overall transparency regarding the framework for foreign exchange interventions. Other than referring to the need to regulate supply and demand, the ANB reveals little about the role of foreign exchange interventions in the monetary policy framework, how these interact with the overall policy regime, and the modalities for their implementation. The fact that intervention activity has taken place, together with the accumulated intervention amount, is recorded in regular reports on monetary policy.

Objectives and Modalities of Foreign Exchange Intervention

Foreign exchange interventions aim to stabilize demand-supply pressures and to maintain economic competitiveness.[96] The 2007 monetary policy statement notes that the ANB will "apply active sterilization strategy in the currency market to neutralize the negative effect that may occur with the exchange rate of Azerbaijan and foreign strategic trade conditions of the country." The ANB intervenes frequently by supplying domestic currency to manage the exchange rate impact of the high amount of oil-related foreign exchange inflows, which has put upward pressure on the domestic currency.

An intervention framework to fully support a transition toward inflation targeting has not yet been developed. Interventions are not based on clear and transparent rules for their role and implementation. Instead, the strong focus on exchange rate stability, coupled with a lack of foreign exchange market development, seems to trigger an ad hoc intervention style. Interventions are mainly determined by end-of-day clearing operations to manage imbalances in demand and supply, rather than by a focus on price stability over the medium to long term.

The ANB conducts spot interventions through an electronic matching system. The ANB frequently intervenes through the electronic trading system to manage end-of-day imbalances between supply and demand. Because of the high amount of foreign exchange inflows, interbank market trading typically results in a shortage of domestic currency, which the ANB sup-

plies by purchasing the necessary foreign exchange. Transactions are conducted for spot value and with the relevant counterparty forming the interbank market in the electronic trading system.

Interaction between Foreign Exchange Intervention and the Policy Regime

Exchange rate management plays a prominent role in the overall monetary policy strategy. Although the de facto pegged exchange rate implies that foreign exchange interventions play a more central role than in an inflation-targeting framework, the strong focus on the exchange rate presents challenges for monetary policy management. This is illustrated in the IMF 2007 Article IV report (IMF, 2007a), which notes, "If fiscal restraint is not considered in 2007, it is all the more important to tighten monetary policy to facilitate the real exchange rate adjustment through nominal appreciation rather than through higher inflation."

Concerns about financial system stability and competitiveness are obstacles in the transition to greater exchange rate flexibility (IMF, 2007a). Despite improved prudential regulations, vulnerabilities in the banking sector create concerns about the impact of greater exchange rate variability. Further, concerns about the impact on competitiveness from an appreciating exchange rate seem to have spurred foreign exchange interventions. At the same time, active management of the exchange rate presents challenges for further development of the foreign exchange market, because this creates a disincentive for the development of risk-management instruments.

The balance between greater exchange rate flexibility and inflation-targeting objectives is being challenged by the shallow foreign exchange market. Greater orientation toward inflation objectives implies a gradual reduction of the prominent role of the exchange rate in monetary policy. At the same time, the lack of instruments for managing exchange rate risk leaves foreign exchange market participants and the market structure vulnerable to greater exchange rate movements. Furthermore, the concentrated market structure implies that a few market participants control the bulk of foreign exchange market transactions, which complicates further market development, because this makes them dominant in the overall foreign exchange distribution process and results in a thin market structure that is prone to greater volatility. In the absence of risk-management instruments, this is hard to accommodate.

Consequences of Foreign Exchange Intervention

The bilateral exchange rate against the U.S. dollar remained stable despite the formal exit from the pegged exchange rate regime in early 2006. The rise in foreign

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[96]The IMF 2007 Article IV report notes that "[. . .] in line with the Fund's advice, the authorities exited the fixed peg in early 2006, but they did not allow the exchange rate to appreciate sufficiently to contain inflation due to concerns regarding financial system stability and competitiveness."

exchange reserves, negligible exchange rate volatility, and limited day-to-day variability in the exchange rate suggest that the high degree of exchange rate stability reflects primarily the dominant role of the ANB in the foreign exchange market. The relatively underdeveloped foreign exchange market structure, with large oil-related foreign exchange inflows, little ability for foreign exchange hedging, and high market concentration, creates a market structure in which undue pressures could potentially emerge.

Brazil

The monetary policy framework is founded on an inflation-targeting regime, but foreign exchange market interventions are more frequent than normally prescribed in an independently floating regime. Interventions are not clearly set out in the inflation-targeting framework, reducing transparency about their role. The foreign exchange market is well developed, with ample instruments for economic agents to manage excess volatility. Nonetheless, central bank activity is heavily focused on managing excess volatility. Combined with the goal of accumulating international reserves, central bank participation in the foreign exchange market is frequent.

Foreign Exchange Market Development

The foreign exchange market in Brazil is well developed, with particularly heavy activity in foreign exchange derivatives. Spot and forward foreign exchange can be carried out only onshore, and is characterized as liquid by market participants active in this market. The 2007 Bank for International Settlements (BIS) Triennial Survey on foreign exchange reported an average daily turnover of US$5 billion, which is an increase from US$3 billion in the 2004 survey. In the offshore market, the real trades only on a nondeliverable basis. The nondeliverable forward market is available up to two years out, but liquidity is reported to be highest in maturities up to one year. Nondeliverable options are available in the offshore market, where exotic options are also primarily traded. Plain vanilla options are traded both on- and off-shore. Price discovery is reportedly highest in the foreign exchange swap and futures market, which might explain why the central bank intervenes primarily through the derivatives market (see HSBC, 2008).

Institutional Framework for Foreign Exchange Interventions

The Central Bank of Brazil (BCB) has set as its primary objective promoting the stability of the purchasing power of the currency and the soundness of the financial system. Since June 1999, monetary policy has been based on a formal inflation-targeting regime with an independently floating exchange rate (established in Decree 3.088 of 1999). The National Monetary Council (CMN), which is the government's economic decision-making body, is responsible for deciding general monetary policy, including setting the inflation target as well as foreign exchange and credit policies.[97] The monetary policy committee of the BCB is responsible for setting short-term interest rates in line with the inflation target defined by the CMN.

The exchange rate regime is formulated as independently floating, but the central bank reserves the right to intervene in periods of excess volatility. The role of the exchange rate is not explicitly described in the inflation targeting framework. However, the central bank has stated that it retains the right to intervene to manage excess volatility. In addition, it conducts a program of accumulating international reserves.

Objectives and Modalities of Foreign Exchange Intervention

The exchange rate regime is independently floating, but interventions are conducted more frequently than in the typical regime. Intervention objectives include managing the level of foreign exchange reserves and excess exchange rate volatility. In achieving these two objectives, the BCB is an active participant in the foreign exchange market, with interventions taking place weekly or more.

The BCB uses a combination of direct purchases, auctions, and issuance of foreign-exchange-linked debt denominated in domestic currency when operating in the foreign exchange market. The use of foreign-exchange-linked debt denominated in domestic currency dates to the mid-1990s, when it was used to safeguard the administered foreign exchange regime. It was also used to smooth the transition to the floating regime in 1999. The introduction of these instruments was based in particular on the need for the public sector to provide a foreign exchange hedge. The BCB is a consistent seller of debt-related dollar-linked "reverse swaps," with the purpose of reducing the exposure that the central bank and the government have to dollar-linked debt. At the same time, however, the BCB is accumulating reserves through direct purchases in the market.

Interaction between Foreign Exchange Intervention and the Policy Regime

Foreign exchange interventions appear to be driven by exchange rate management considerations rather than the inflation target. The BCB actively participates

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[97]The CMN comprises the minister of finance (chair), the minister of planning and budget, and the BCB governor.

in the foreign exchange market both through reverse swaps and direct purchases to accumulate reserves. The primary purpose of its activities seems to be to reduce the exposure to dollar-linked debt, emanating from the historical issuance of such debt, and reserves/ exchange rate management. The high-frequency foreign exchange activity is unusual in a typical inflation-targeting economy.

Consequences of Foreign Exchange Intervention

Daily nominal exchange rate volatility and exchange rate developments indicate a closely managed exchange rate. The frequent participation to reverse the exposure to dollar-linked debt and to accumulate reserves appears to have a dampening impact on exchange rate movements. This is consistent with the BCB's expressed intent to manage excess volatility. The well-developed and liquid market for hedging instruments suggests, however, that market participants are well placed to manage exchange rate volatility more independently. As such, interventions to manage excess volatility do not seem to be driven by the lack of market development.

Chile

Chile made the transition to an inflation-targeting floating exchange rate regime in 1999. Since then, foreign exchange interventions have been a rare event. The Central Bank of Chile (CBC) enjoys policy and instrument autonomy, reporting regularly to the president and the parliament to ensure accountability. Chile differs from other countries with respect to the high degree of transparency surrounding its intervention framework. Working through the information and signaling channel, it announces its preparedness to intervene and follows up with actual transactions to ensure the credibility of its announcements. The clear rules for the role of intervention and its high transparency are referred to as the very pillars safeguarding them from being overused as a tool. Chile is also unusual in an international context—although not from a Latin American perspective—in that it may issue foreign-currency-denominated debt as a tool for foreign exchange intervention.

Foreign Exchange Market Development

The foreign exchange market offers a developed market for hedging through foreign exchange forwards. The floating of the Chilean peso in 1999 contributed to the development of a derivatives market, which is seen as an important factor in having strengthened the flexible exchange rate regime, because market participants can use hedging instruments to protect against exchange rate volatility. The 2007 BIS Triennial Survey

reported that activity in overall foreign exchange market turnover increased from a daily average of US$2 billion in 2004 to US$4 billion in 2007. Measured in GDP, annual foreign exchange market turnover is significantly higher than in other economies in the region and at comparable levels to actively traded emerging economies such as South Africa. The Chilean peso is actively traded in the onshore spot and forward markets but trades on a nondeliverable basis in the offshore market. The onshore forward market is available only to residents, but there is also an offshore nondeliverable forward market that offers hedging up to three years' maturity (HSBC, 2008).

Institutional Framework for Foreign Exchange Interventions

Chile has an inflation-targeting framework with an independently floating exchange rate regime. The exchange rate was allowed to float freely in September 1999 to enhance the credibility of the inflation target. The Basic Constitutional Law sets out as the main objective of the CBC "safeguarding the stability of the currency and the normal functioning of the internal and external payment systems." The CBC interprets the "stability of the currency" as maintaining price stability, which it defines as maintaining an average annual inflation rate around 3 percent, with a tolerance range of ±1 percent. The CBC has full autonomy in policy decisions to meet its objectives and reports to the president of Chile and the Senate.

Foreign exchange interventions are characterized by a high degree of transparency. Chile is exceptional in that it communicates its interventions and modalities in advance, as well as at the beginning and the end of the intervention period. The daily intervention amount is the only variable that is not communicated in advance, although this is published with a two-week lag. The unusually high degree of transparency is associated with the authorities' intention to work through the information channel when intervening. Specifically, the aim is to signal that it considers a development related to the exchange rate to be unjustified on the basis of fundamentals. Because the purpose of foreign exchange interventions is to provide liquidity and stabilize markets, transparency is also deemed necessary so as not to create, or add to, volatility.

Objectives and Modalities of Foreign Exchange Intervention

The inflation-targeting framework enables the central bank to intervene under exceptional circumstances, but in practice interventions are rare. Intervention can take place in response to excessive depreciation or appreciation of the Chilean peso that may have a negative impact on economic developments. Consistent with the infla-

tion-targeting regime, interventions are not pursued to defend a certain level of the exchange rate; rather they aim to avoid excessive depreciation or appreciation of the exchange rate. Motivated by volatility in international financial markets and excessive depreciation of the Chilean peso to levels regarded as misaligned with fundamentals, the central bank intervened in 2001 and 2002, with a view to providing liquidity and foreign currency coverage. In Chile, the credibility and effectiveness of foreign exchange interventions are attributable to the fact that these interventions are rare and carried out only in extreme circumstances. The CBC argues that the principles of clear rules and transparency help ensure that this intervention is used only on occasion as a policy tool (Gregorio and Tokman, 2005).

Chile intervenes in the foreign exchange market through a combination of spot foreign exchange interventions and issuance of dollar-denominated central bank bills. The intervention framework states that in addition to intervening through foreign exchange operations, the CBC may intervene by providing hedging instruments. In 2002, the central bank used dollar-denominated debt as its sole instrument to influence the exchange rate. The principle behind these interventions was to meet the private sector's desire to hedge foreign exchange risk in an environment of Chilean peso depreciation pressure. Not only was this consistent with the aim of providing foreign currency coverage, it also made it possible to intervene without using foreign exchange reserves. The active use of currency-denominated debt instruments for intervention purposes is more common in Latin America than elsewhere. In addition to Chile, Brazil, Mexico, and Peru make use of such transactions as an intervention instrument (Archer, 2005).

Interaction between Foreign Exchange Intervention and the Policy Regime

The authorities turn to foreign exchange interventions when the domestic economic environment does not warrant a change in interest rates. In 2001 and 2002 the Chilean peso experienced a rapid depreciation in response to the Argentine financial market turmoil in 2001 and a capital account reversal in Brazil in 2002. Because domestic economic fundamentals did not show signs of deterioration, worsening financial market conditions in Chile were seen as a direct result of contagion from across the region. Domestic inflation and growth developments did not warrant an interest rate increase to safeguard the inflation target, in particular in 2001, when deflation pressures and the positive output gap suggested downward-moving interest rates. In this case, interventions were regarded as a first line of defense to protect against inflation pressures from excessive and prolonged exchange rate depreciation (Gregorio and Tokman, 2005).

Consequences of Foreign Exchange Intervention

Foreign exchange intervention appears to have succeeded in bringing stability to foreign exchange markets. Exchange rate developments stabilized during the two intervention periods in 2001 and 2002, suggesting that the intervention strategy of the central bank made a successful impact on financial market conditions. The intervention strategy included announcements about the interventions, and proof of the commitment to follow up was the direct intervention that followed. The credibility of intervention announcements is viewed by the authorities as critically linked with the commitment to follow up with actual intervention. Research by Tapia and Tokman (2004) suggests that, in addition to the actual interventions, exchange rate developments were also affected by public announcements.

Colombia

The Central Bank of Colombia (CBC) operates under an inflation-targeting regime but also pays close attention to exchange rate developments. Under the law, exchange rate policy is determined by the CBC, but according to the objectives set by Congress. Intervention objectives and rules are transparent and stress the importance of consistency with monetary policy.

Foreign Exchange Market Development

The spot foreign exchange market is relatively liquid, and foreign exchange hedging instruments have grown significantly in recent years. The 2007 BIS Triennial Survey reports an average daily turnover of US$2 billion (spot, outright forward, and swap transactions), which is an increase from US$1 billion in the 2004 survey. Offshore, the Colombian peso trades strictly on a nondeliverable basis. The market consists of on- and off-shore forward markets, nondeliverable forwards, foreign-exchange-linked notes with maturities ranging from one month to two years, foreign exchange options, and cross-currency swaps. Despite significant growth in the past few years, Colombia's derivatives market is still not fully developed by international standards. An IMF paper (IMF, 2004) noted that Colombia's forward market is still considerably smaller when measured as a percentage of GDP or total trade than those of other economies in the region that have a flexible exchange rate system.

Institutional Framework

The central bank has a constitutional mandate to reach and maintain low and stable inflation and achieve

long-term GDP growth. The CBC is responsible for setting the quantitative inflation target. The inflation target range for 2008 was 3.5–4.5 percent, and the long-term inflation target range is 2–4 percent. The bank law stipulates that the CBC must present a report to Congress twice a year on economic developments and monetary and exchange rate policy.

Monetary policy is implemented with a managed floating exchange rate regime. The CBC law assigns the CBC the task of formulating exchange rate policy within the framework of the criteria and objectives laid down by Congress, with the aim of regulating foreign trade and the international exchange rate regime. To manage the effects of the external situation on monetary conditions, the CBC states that one of its functions is to "organize and regulate the foreign exchange market and intervene with the purpose of defending the exchange rate, in order to regulate the conditions of the country's borrowing abroad." The CBC also administers the country's foreign exchange reserves as part of its responsibility for foreign exchange interventions.

Objectives and Modalities of Foreign Exchange Intervention

The implementation of the managed floating regime is guided by stability objectives. The intervention rules set the following objectives: (1) an adequate level of international reserves to protect the economy from external shocks, in both the current and the capital accounts, (2) control of excess volatility of the exchange rate in the short term, and (3) control of excessive appreciation or depreciation of the nominal exchange rate, which could jeopardize the achievement of future inflation targets and the economy's external stability.

Colombia makes use of both cash and derivative instruments for foreign exchange interventions. Options play an important role in the intervention framework. To limit excessive volatility, there is an automatic auction of options that gives the holder the right to sell or buy foreign exchange to or from the central bank every time the nominal exchange rate deviates by an average of 2 percent over the preceding 20 working days. Further, the CBC, at its discretion, can call for a new option auction if (1) the options issued in the previous auction have not expired (regardless of whether the previous options have been exercised), and (2) the exchange rate moves more than 2 percent above the 20-day moving average. In practice, the automatic interventions to limit volatility have been quite small. Discretionary option auctions may also be initiated to buy or sell foreign exchange for the purpose of accumulating or reducing foreign exchange reserves. In addition, the central bank may conduct spot operations directly in the foreign exchange market. Currently, the CBC is targeting an increase in reserves implemented through previously announced monthly options auctions.

Interaction between Foreign Exchange Intervention and the Policy Regime

When conducting foreign exchange interventions, the central bank aims for consistency with the direction of monetary policy. A set of intervention criteria have been established to ensure that interventions are consistent with the inflation-targeting framework. Specifically, the purchase of foreign exchange does not occur when the policy rate is being raised, and the sale of foreign exchange does not take place when the policy rate is being lowered. On the contrary, if projected inflation is below target, the central bank considers the purchase of foreign exchange to reduce the appreciation of the domestic currency to be consistent with the inflation-targeting framework. During 2004–06, the CBC applied these principles when it intervened actively to counter domestic currency appreciation. In early 2007, it appears these criteria were not applied; a high level of sterilized discretionary intervention occurred in the face of rising inflation and interest rates. Since mid-2007, however, the CBC has refrained from this form of intervention and has focused on the inflation objective (Kamil, 2008).

The foreign exchange intervention framework is transparent. The central bank argues that a high degree of transparency in foreign exchange intervention is necessary to be consistent with the inflation-targeting framework. This is clearly the case for the automatic intervention to limit volatility. Moreover, the CBC has stated that it will refrain from discretionary interventions (which has been the case since mid-2007) and is currently using previously announced interventions to accumulate reserves.

Consistency with monetary policy is ensured primarily by sterilizing the impact of foreign exchange operations. Because of the automatic characteristics of the options program, the direction of foreign exchange intervention may not always be consistent with the cycle of the policy rate. On such occasions, the central bank compensates the liquidity impact of the foreign exchange intervention in its monetary operations. This suggests that, even though as a rule the CBC views consistency in terms of the direction of sales and purchases of foreign exchange and interest rate moves, it concludes that consistency is ultimately ensured through monetary sterilization.

The management of intervention indicates that it is currently designed to influence the exchange rate while maintaining consistency with the monetary policy stance. Intervention objectives and rules stress the importance of consistency with the monetary policy objective of low and stable inflation, and the high degree of transparency makes intervention and its aims highly visible.

Consequences of Foreign Exchange Intervention and Sources of Exchange Rate Vulnerability

The effectiveness of intervention appears to have been mixed. Inflation targeting does not make it easy to identify whether automatic intervention has been effective. Automatic intervention has been limited, and the Colombian peso has been very volatile. Kamil (2008) concludes that discretionary intervention has not always worked, even on a large scale. The results indicate that exchange rate intervention was effective during 2004–06, during a period of monetary easing. In contrast, intervention was less effective in reversing or slowing down domestic currency appreciation during 2007, as large-scale intervention became incompatible with meeting the inflation target in an overheating economy.

New Zealand

New Zealand adheres to inflation targeting in a floating-exchange-rate environment with rare foreign exchange interventions. Foreign exchange interventions take place in accordance with the principles of the Policy Targets Agreement (PTA), and the Reserve Bank of New Zealand (RBNZ) has the operational independence to decide when and whether to intervene. The parameters according to which intervention decisions are made are transparent, which helps ensure accountability. Interventions are not used as a signaling tool for future monetary policy direction; rather, they are a tool to signal exchange rate misalignment and manage the extremes of the exchange rate cycle. The authorities recently introduced changes to the intervention process, including allowing the RBNZ to hold foreign exchange reserves on a partly unhedged basis.

Foreign Exchange Market Development

The foreign exchange market in New Zealand is well developed. The spot and over-the-counter derivative instruments are similar in structure to the global foreign exchange market. According to the 2007 BIS Triennial Survey, average daily turnover in New Zealand rose from about US$4 billion to US$12 billion between 2001 and 2007. Although activity and liquidity are regarded as high, average daily turnover is small in comparison with countries such as Australia (US$170 billion), Canada (US$60 billion), Norway (US$32 billion), and Sweden (US$42 billion). Foreign exchange derivatives turnover (cross-currency swaps and foreign exchange options) increased by 330 percent compared with the turnover reported in the 2004 RBNZ survey. Foreign exchange swaps made up about 74 percent of total foreign exchange turnover in 2007, which is com-

parable with the global foreign exchange market, where foreign exchange swaps constitute the major share of foreign exchange market trading. Trading in foreign exchange forwards was largely unchanged at 6 percent of total turnover.

Institutional Framework for Foreign Exchange Interventions

New Zealand pursues an inflation-targeting strategy with an independently floating exchange rate regime. Price stability as a monetary policy objective was introduced in 1989 and strengthened further when legislation went into effect in 1998, making the achievement and maintenance of price stability the single focus of monetary policy. The legislation also gave the RBNZ operational independence to achieve its primary objective. The RBNZ Act of 1989 gives the RBNZ the authority to intervene in the foreign exchange market, requires it to hold foreign exchange reserves to meet its capacity to intervene, and provides it with operational independence to decide on foreign exchange interventions. The inflation target is formulated and approved by the minister of finance and the governor of the RBNZ and is stated in the PTA.[98]

The PTA includes a provision that, while implementing monetary policy, the RBNZ shall "seek to avoid unnecessary instability in output, interest rates and the exchange rate." Although interventions are not a frequent tool in New Zealand, this provision enables the RBNZ to include foreign exchange interventions as a tool within the inflation-targeting strategy. The provision was introduced in the 1999 PTA on the initiative of the government, with the explanation that it reflects a "concern not to repeat the experience of the mid-1990s, when the export sector was placed under immense pressure by a sharp increase in the value of the dollar."

Foreign exchange market intervention policy is further detailed in a letter sent from the governor of the RBNZ to the minister of finance in March 2004.[99] The letter states that "Foreign exchange intervention under section 16 of the [RBNZ] Act is for the purpose of influencing the level of the exchange rate to reduce exchange rate variability when the exchange rate is exceptionally and unjustifiably high or low" and

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[98]Section 12 of the Reserve Bank Act gives government the power to override the PTA. Inflation targeting can do so by directing the RBNZ to use monetary policy for a different economic objective altogether for a 12-month period. Such an instruction by the government must be made public. (The override section has so far never been used.)

[99]See www.rbnz.govt.nz/finmarkets/foreignreserves/intervention/0148214.html. Foreign exchange intervention under section 17 of the RBNZ Act, for the purpose of restoring liquidity in a period of foreign exchange market dysfunction, is treated separately in a standing directive from the minister of finance.

"when, in the Bank's assessment, that level is clearly unjustified by economic fundamentals."

The objectives and mechanics of intervention are transparent, but the RBNZ regards intervention as an ongoing process and does not comment on specific activities. The financial accounts provide information about specific intervention activities on a monthly basis, announced with a one-month lag. At the time of its most recent intervention in June 2007, the RBNZ published a press release confirming that it had intervened in the foreign exchange market.

Objectives and Modalities of Foreign Exchange Intervention

Foreign exchange intervention is rare, but the capacity of the RBNZ to intervene was broadened in July 2007. Intervention that aims at reducing the cyclical variability in the exchange rate is included as an additional intervention objective.[100] Including the new approach, foreign exchange intervention may occur in the following three cases: (1) for the purpose of influencing the level of the exchange rate to reduce volatility when the exchange rate is exceptionally high or low, (2) to restore liquidity in a period of foreign exchange market dysfunction, or (3) to reduce extreme highs and lows in the exchange rate when these are well above economic fundamentals.

The broader intervention objective is combined with a strategy of moving from fully hedged to partly unhedged foreign exchange reserves.[101] Contrary to the previous practice of fully hedging foreign exchange reserves with foreign currency liabilities, reserves are now held on a partly unhedged basis; that is, a portion of reserves are funded with liabilities in New Zealand dollars. This provides more flexibility in managing the "growth and maintenance of the intervention capacity," because foreign exchange intervention is no longer restricted by the need to finance it with foreign exchange liabilities. The need for increased flexibility in using foreign exchange reserves suggests a move toward a more active intervention policy than in the past.

Under the new approach, intervention modalities include using the balance sheet position to send indirect signals about the appropriateness of the exchange rate level. This involves the actual sale or purchase of foreign exchange in the spot foreign exchange market for the purpose of creating an open foreign exchange position. Strictly speaking, this is a foreign exchange intervention, but it is not the foreign exchange transac-

tions themselves but the open foreign exchange position that is the intended signal. By showing its willingness to assume foreign exchange exposure, the RBNZ seeks to influence the attitude of private sector investors, possibly triggering a reassessment of their exposure in the desired direction.[102, 103]

Interaction between Foreign Exchange Intervention and the Policy Regime

Decision-making parameters dictate that foreign exchange intervention must "always" be consistent with the PTA. Consistency with inflation targeting suggests that foreign exchange intervention should be supportive of the direction of monetary policy in order not to contradict the primary objective of price stability. Intervention purchases of New Zealand dollars in an interest rate tightening cycle would typically support the direction of monetary policy. Such a strategy would be consistent with the generally accepted view that intervention in the opposite direction of monetary policy may send conflicting signals, which could reduce the effectiveness of the intervention.

Intervention in June 2007 aimed at depreciating the New Zealand dollar was executed in an environment of rising policy interest rates. When intervening to sell New Zealand dollars, the RBNZ referred to exchange rate developments as exceptional and unjustified in terms of economic fundamentals, declaring that the action did not "prejudge the future direction of monetary policy."[104] Rather than signaling the future stance of monetary policy, further clarifications reveal that intervention serves the purpose of signaling that the exchange rate is misaligned with fundamentals, moderating trends in the exchange rate, and rebalancing monetary policy pressures (Spencer, 2007).

Intervention is supportive of medium- to long-term external stability objectives. In addition to the primary objective of inflation targeting, the PTA requires monetary policy to prevent unnecessary instability in the exchange rate. Concerns about exchange rate stability are especially germane to New Zealand, because it is a small and open economy. In this particular case, instability in the exchange rate could potentially emerge as

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[100]See the RBNZ press release on "Reserve Bank announces changes to FX management," July 13, 2007.

[101]Foreign exchange reserves were fully financed by borrowing the required foreign currency from the New Zealand Debt Management Office, as opposed to using the RBNZ's own pool of liabilities to fund reserves.

[102]Movement away from the benchmark position, which is the fully hedged position, thus constitutes the key signal in the new intervention approach. By increasing the level of unhedged foreign reserves when the exchange rate is at the high end of the exchange rate cycle, the RBNZ sends a signal that the New Zealand dollar is overvalued compared with its long-run fundamental value. Reducing the level of unhedged reserves signals that the New Zealand dollar is undervalued with respect to the long-run fundamental value.

[103]The new approach to reserves management and foreign exchange intervention has much in common with that used by the Reserve Bank of Australia.

[104]Indeed, the RBNZ followed the intervention sales of New Zealand dollars with an interest rate hike on July 26, 2007.

a result of the New Zealand dollar's association with carry trading, which allows investors to take advantage of the positive interest rate spread by entering into long positions in New Zealand dollars financed by borrowing in low-interest-rate currencies such as the Japanese yen. Because the strong appreciation of the New Zealand dollar is believed to be attributable largely to these types of capital inflows, intervention to signal exchange rate misalignment could be viewed as consistent with management of potential future vulnerabilities associated with sudden stops in capital inflows.

Consequences of Foreign Exchange Intervention

Intervention purchases of foreign currency in June 2007 resulted in an open position on the RBNZ balance sheet.[105] More recent intervention resulted in a net long exposure to foreign currencies of just over $NZ 2.2 billion in July 2007. Consistent with its recent announcement regarding reserves management procedures, the RBNZ is now using a combination of direct foreign exchange intervention and its balance sheet position to signal an overvaluation of the New Zealand dollar.

The intervention purchases of foreign currency in June 2007 did not immediately halt the appreciation pressure on the New Zealand dollar. Market impact may have been complicated by the prevailing interest rate tightening cycle, in which expectations for further rate increases were strong and later materialized, when the RBNZ hiked rates further in July. The experience of New Zealand points to the difficulties in conducting effective foreign exchange intervention when these are not consistent with the direction of monetary policy, in particular in an environment where the appreciation pressure on the New Zealand dollar is, among other things, a result of investors taking advantage of the significantly positive interest rate differential (carry trading).

Nevertheless, the New Zealand dollar later depreciated when carry trades were unwound in response to a general decline in global investor risk appetite in the summer of 2007. Because the attractiveness of carry trades is based on a low-volatility environment, the increase in foreign exchange market volatility in association with the crisis in the U.S. subprime mortgage market led to a strong reversal in carry trade positions and a subsequent correction in the currencies associated with these trades. These events provided a supportive environment for New Zealand dollar depreciation, illustrating the important contribution of overall financial market sentiment to the success of intervention.

Romania[106]

Romania has adopted inflation targeting with a managed floating exchange rate regime, but implementation of interest rate and foreign exchange policy seems to be influenced by the exchange rate. The exchange rate's influential role can be attributed to concern about the possible impact of external imbalances on foreign investor sentiment—that is, the risk of sudden stops. Although the foreign exchange market is still in the early stages of development, activity has increased significantly since 2004.

Foreign Exchange Market Development

Foreign exchange market activity is typical of the early stages of market development, with most activity concentrated in the spot foreign exchange market. Interbank market activity started to take off in association with increased exchange rate flexibility in 2004, progress in macrostabilization, and a more open economy. In 2004, overall foreign exchange market turnover surpassed GDP for the first time (to just under 109 percent). The 2007 BIS Triennial Survey reports an average daily turnover of US$3 billion. The spot market remains the most liquid market segment, with volume in the forward market increasing but still accounting for only a small portion of overall activity.

Institutional Framework for Foreign Exchange Interventions

The primary objective of the National Bank of Romania (NBR) is to ensure and maintain price stability, in accordance with the central bank law, which also authorizes the NBR to define and implement monetary and exchange rate policy. Without prejudice to the price stability objective, the law establishes that monetary policy should also support the general economic policies of the government, as is the case in the European System of Central Banks.

In August 2005, the NBR introduced an inflation-targeting regime and a managed exchange rate arrangement. The implementation of this regime relies on anchoring inflation expectations around the announced inflation target, which was set at 4 percent for end-2007 and 3.8 percent for end-2008, with an accepted deviation band of ±1 percentage point around the central target. The role of intervention and the rules and procedures for its implementation are not explicit. This may be because foreign exchange intervention has not played an important role in the framework in recent years (there has been no intervention since October

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[105]Prior to this, net open foreign currency positions were relatively small and related to interest income on foreign reserves.

[106]This case study draws on information in IMF Country Reports (2007b and 2007c).

2005).[107] However, although foreign exchange intervention is not frequent, the 2007 IMF Article IV report indicates that the exchange rate plays an important role in setting the policy interest rate (IMF, 2007b).

Objectives and Modalities of Foreign Exchange Intervention

Intervention does not aim at a specific level or range for the exchange rate, but the NBR appears sensitive to the pace of appreciation. Concern about sudden stops is an important focus in exchange rate management. The size of the current account deficit and the emphasis on consumption create concern about excessive short-term appreciation because of the vulnerability to changes in foreign investor sentiment and to a sudden reversal in capital flows (see Box 3 in IMF, 2007b).

Foreign exchange intervention is not highly transparent. More specific modalities of foreign exchange intervention are not disclosed, the publication of explicit intervention data was discontinued in early 2005, and information on possible intervention activity can only be inferred from the publication of changes in foreign reserves.

Interaction between Foreign Exchange Intervention and the Policy Regime

Intervention is rare, but the role of the exchange rate is more prominent than usual in an inflation-targeting regime. Since October 2005, upward pressure on the exchange rate appears to have been managed through changes in the policy interest rate rather than foreign exchange intervention. The 2007 Article IV report (IMF, 2007b) states that "upward exchange rate pressures has prompted it [NBR] to reduce interest rates. On current policies, the end-2007 inflation target will likely be missed, unless sizeable appreciation occurs, and the current account deficit will widen further." The report also states that reductions in the official policy rate have been interpreted by market participants as a sign that the NBR prefers to "focus on recent appreciation, rather than future inflation."

Consequences of Foreign Exchange Intervention and Sources of Exchange Rate Vulnerability

Concern about sudden stops in capital inflows might explain the focus on the exchange rate. There is considerable concern that excessive short-tem appreciation could leave the economy vulnerable to changes in financial market sentiment and sudden reversals in capital flows. In particular, this is seen as potentially negative for the pace of disinflation and for the financial sector (IMF, 2007b).

Serbia

During 2007, monetary policy focused on maintaining price stability, defined as a core inflation objective of 4–8 percent by the end of the year. Intervention remained a supporting tool in the monetary framework, and its more prominent role reflects primarily the early stages of market development. As a result, the National Bank of Serbia (NBS) retains the right to intervene for a broad set of purposes, including in the event of excessive daily exchange rate fluctuations, without resisting cumulative longer-term pressure on the exchange rate. Foreign exchange market development will facilitate the move toward inflation targeting. NBS transactions have gradually decreased over the past few years, and the NBS has discontinued daily fixing sessions, allowing the interbank market to function more independently.

Foreign Exchange Market Development

Activity in the interbank spot foreign exchange market increased significantly after 2003, but there is no forward foreign exchange market. Interbank foreign exchange activity reached about €3.2 billion in July 2007, an increase of about €1.4 billion since June 2007. In the first seven months of 2007, the volume of interbank trading stood at nearly €10.9 billion, compared with €5.9 billion for all of 2006. Despite increasing volume in the spot foreign exchange market, foreign exchange forwards remain underdeveloped, mainly because of the lack of a reliable money market curve for pricing forwards. Small-scale forward transactions have been recorded, but these are mainly bank-customer driven, and an active and liquid interbank market has yet to develop.

Institutional Framework

The Law on the National Bank of Serbia states that price stability is the bank's primary objective. Until the adoption of an inflation-targeting regime, monetary policy is formulated in a separate "Memorandum of the National Bank of Serbia on the Principles of the New Monetary Policy Framework Aiming at Low Inflation Objectives." For 2008, the core inflation objective was set at 3–6 percent by year-end. The NBS achieves the inflation objective by using the two-week repo interest rate, with foreign exchange instruments playing a supportive role.

Exchange rate flexibility has gradually increased, and the NBS is implementing a managed floating regime with no predetermined path for the exchange

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[107]Statement by Age Bakker, IMF Executive Director for Romania, and Lucian Croitoru, senior adviser to the executive director, May 23, 2007.

rate. Because the interbank market is relatively new, participation of the NBS in the foreign exchange market is higher than under more developed floating exchange rate systems. To this end, the NBS describes its exchange rate regime as a soft managed floating regime in which it retains the right to intervene for a broader set of purposes, reflecting its position as a country in transition (see below).

Objectives and Modalities of Foreign Exchange Intervention

The main objective of the managed exchange rate regime is to ensure a balanced foreign exchange market. Daily fixing sessions were discontinued in early June 2007 and are organized only when the NBS considers that its participation is required in order to stabilize the foreign exchange market. The reduced role of the NBS in bringing together demand and supply has helped increase the interbank market's role in exchange rate determination and supported the growth of interbank transactions.

The NBS interacts with (nonbank) foreign exchange offices in the foreign exchange market. The NBS on a daily basis sells foreign exchange purchased from licensed foreign exchange dealers to commercial banks. The main purpose of these transactions is to rechannel foreign exchange to the interbank market, and when conducting these transactions, the NBS aims to deal in the prevailing and most favorable interbank exchange rate without affecting the exchange rate.

Foreign exchange intervention practices are shaped by Serbia's macroeconomic vulnerabilities and still-undeveloped financial markets. The role of the NBS in the foreign exchange market remains important, and intervention objectives are focused on supporting the transition to a full-fledged interbank market. To this end, the NBS has defined three instances for intervention: (1) to limit daily volatility, but without resisting cumulative pressure over the long term; (2) to contain potential threats to financial and price stability (after the potential to influence inflation through changing the key policy rate has been exhausted) or to prevent inflation from dropping below the planned level; and (3) to safeguard an adequate level of international reserves.

Intervention is carried out primarily through fixing sessions, but the NBS also can intervene directly in the interbank market. Only one fixing session was held during the three months after June 2007, suggesting a qualitative reduction in the direct market role of the NBS.

Interaction between Foreign Exchange Intervention and the Policy Regime

The NBS is gradually moving toward a more flexible exchange rate regime, but foreign exchange market inter-vention remains an important part of the framework. Although the role of the NBS in the interbank market remains larger than that of the central bank in more developed inflation-targeting economies, it is in the process of gradually reducing its market role in light of the increased capacity and functioning of the interbank market. The frequency of intervention, which once played a significant role in moderating volatility in the exchange rate, has decreased significantly since 2006. This is evident from the significant decrease in purchases and sales of foreign exchange in the daily fixing sessions, a development that was further cemented by the discontinuation of daily fixing sessions in June 2007.

Consequences of Foreign Exchange Intervention and Sources of Exchange Rate Vulnerability

Prudential risks and vulnerabilities in the banking system present challenges in moving toward a flexible exchange rate regime. Rapid credit growth and the rising exposure of unhedged borrowers to exchange rate risk constitute the major risks in the planned transition to a flexible exchange rate. Moreover, the IMF staff identified structural characteristics of the economy that pose challenges regarding the choice of exchange rate regime, including high euroization, high exchange rate pass-through, a long history of high inflation, and limited financial intermediation (IMF, 2006a). A relatively high degree of trade openness, a concentrated trade pattern, a synchronized cycle with trade partners, and the prevalence of monetary over real shocks are additional factors.

Sweden

Sweden has pursued inflation targeting with a floating exchange rate regime since 1992, when it discontinued the pegged exchange rate. The central bank (Riksbank) is permitted to make autonomous decisions on the implementation of monetary policy, including foreign exchange intervention. The Riksbank views foreign exchange intervention as a tool to be used sparingly but argues that intervention may be necessary even under an inflation-targeting regime. The intervention framework is highly transparent, as a result of intervention over the years since exiting the peg, and intervention is seen by the Riksbank as working primarily through the signaling channel.

Foreign Exchange Market Development

The foreign exchange market is well developed and able to support active trading and risk management. This well-functioning foreign exchange market means that the central bank should not need to engage in "market

management" operations. Central bank foreign exchange operations not related to intervention are carefully planned to achieve a transaction strategy that minimizes market impact. This includes announcing the operational plan in advance, maintaining it independently of market conditions, and limiting such transactions to the opening hour of the markets. The 2007 BIS Triennial Survey shows average daily turnover of US$42 billion, an increase from US$31 billion in 2004.

Institutional Framework

Sweden pursues inflation targeting with an independently floating exchange rate. The Swedish Parliament has provided the Riksbank with a mandate to achieve price stability, which is set forth in the Riksbank Act. The Riksbank's defined objective is to keep inflation at about 2 percent a year, with a tolerance range of ±1 percent around this target. Policy and instrument independence is contained in the Riksbank Act. The implementation of the exchange rate system and intervention are handled by the Riksbank in accordance with the law, which states that "The Riksbank shall decide on the application of the foreign exchange system decided on by the Government."

In 2007, the Riksbank published a set of intervention procedures to clarify its procedures regarding preparation for, decisions about, and communications regarding foreign currency intervention. These reflect the Riksbank's aim to adhere to an intervention framework characterized by openness and clarity and to follow procedures that reflect those of other monetary policy measures. The framework for intervention is specifically designed to be consistent with the policy regime of a floating exchange rate and inflation targeting. At the same time, the rules allows for some flexibility to respond to situations not foreseen by the rules regarding the procedures.[108]

Objectives and Modalities of Foreign Exchange Intervention

The Riksbank views intervention as working mainly through the signaling channel. Intervention is primarily a means of signaling changes in monetary policy motivated by the goal of achieving price stability. In accordance with its floating exchange rate regime, intervention is not conducted with an exchange rate target in mind, and as long as inflation is in line with the target, foreign exchange intervention is not used to influence the exchange rate. In addition, to maintain flexibility in case of unforeseen events, the Riksbank

reserves the right to make use of intervention under exceptional circumstances. Without impairing the primary objective, intervention could, under exceptional circumstances, be carried out in support of the general objectives of economic policy.

Another reason for intervention would be for the purpose of addressing exchange rate misalignments, but the Riksbank recognizes that decisions to intervene in such cases could be problematic. Intervention may, in the long run, support the objectives of the general economic policy, which is the secondary objective of monetary policy—for example, when the exchange rate is seen as significantly misaligned with what is considered to be the equilibrium exchange rate. However, several issues may complicate an intervention decision in this situation. First, the decision to intervene should be based on the possibility of achieving the desired exchange rate effect. Second, it is difficult to determine the equilibrium rate, and third, aiming to achieve a particular exchange rate or stabilize exchange rate developments could conflict with the inflation target.

Nevertheless, the Riksbank is of the view that even inflation-targeting countries need to maintain intervention as a tool in their monetary policy framework. In particular, intervention may be warranted when the interest rate instrument is no longer effective, for example, when deflation precludes negative real interest rates. Intervention could in this situation be used as a measure to achieve more expansionary monetary conditions through a weakening of the exchange rate.

The framework for intervention is highly transparent, but the degree to which detailed information is released is balanced between efficiency and openness. Foreign exchange intervention and monetary policy operations differ because of the different position of the central bank in these two markets. In the money market, the central bank can determine the level of the short-term rate through its position in the daily overnight interbank market. In foreign exchange interventions, the central bank is only one operator among many. This may argue for a different degree of transparency with respect to the readiness to intervene, length of operations, time of decision, and currencies involved. Thus, the Riksbank is transparent about the process for intervention and its role in the monetary policy framework, but reserves the right to keep some information to itself should it be deemed necessary to ensure the efficiency of intervention.

Interaction between Foreign Exchange Intervention and the Policy Regime

To secure a clear link with the overall monetary policy regime, intervention decisions are usually handled like other monetary policy decisions. The release of a public notice of the intention to intervene further contributes to thorough preparation, which strengthens the

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[108]Should a situation arise that is not foreseen by the procedures, the rules allows the Riksbank to take measures it deems appropriate to fulfill its objectives.

link to overall monetary policy. Furthermore, minutes of the deliberations on the reason for intervention are released quite a while after the intervention mandate has run out.

Although there have been no interventions under the new framework, the most recent episode prior to the new framework shows close interaction between foreign exchange interventions and the policy regime. The new rules were modeled on the intervention experiences of 2001. At that time, intervention was performed with a view to strengthening the currency. The decision to intervene was made at a time when there was increased risk that inflation would exceed the target, in particular because of continued exchange rate depreciation.

The intervention in June 2001 was followed by a rate increase in July 2001. Intervention to strengthen the currency was in this way a signal of tighter monetary policy to come. The assessment that future inflation prospects were threatened by the weaker exchange rate developments was signaled first with foreign exchange intervention.

Consequences of Foreign Exchange Intervention

The combination of foreign exchange interventions and interest rate hikes was initially successful in causing the exchange rate to appreciate, but the effects did not last long. Events in the global financial markets, in particular the terrorist attacks in the United States, led to a significant interest rate cut in September 2001. At this time, the currency markets reacted with a depreciation of the exchange rate.

Outside events and continued weakening of economic activity make it difficult to assess the effectiveness of the 2001 intervention. The economic slowdown domestically as well as internationally led to a significantly different environment from the one that prevailed at the time of the foreign exchange intervention. In the short term, the consistent monetary policy action would appear to have supported the effectiveness of the foreign exchange intervention.

Turkey

Turkey pursues inflation targeting with a floating exchange rate regime. The exchange rate is independently floating, and the foreign exchange market for Turkish liras is well developed. The central bank has intervened occasionally through discretionary operations while conducting regular foreign exchange auctions to build up official reserves in a gradual and predictable manner. The design of the auctions suggests that there is little interference with the foreign exchange price discovery mechanism.

Foreign Exchange Market Development

The interbank market for Turkish liras (YTL) is well developed, including liquid and deep markets for foreign exchange forwards and options.[109] Lira foreign exchange forwards trade on a deliverable basis with unrestricted access for nonresidents in the local market. The options market is deep, and interbank quotes are available for maturities of up to three years. Exchange-traded US$/YTL futures are available from the Turkish Derivatives Exchange (TURKDEX), located in İzmir. Indicative trading volumes and spreads suggest a good degree of liquidity in both the spot and forward markets (HSBC, 2008). According to the 2007 BIS Triennial Survey, daily average turnover stood at US$3 billion in 2007, which was unchanged from the survey in 2004.

Institutional Framework

The Central Bank of Turkey (CBT) law sets forth price stability as the primary objective of monetary policy. The law establishes that the central bank has the power to determine, at its own discretion, the implementation of monetary policy and the use of instruments to achieve price stability. Without damaging price stability, CBT policies shall support the growth and employment policies of the government.

The CBT adopted formal inflation targeting in 2006. This followed a period of implicit inflation targeting with a floating exchange rate regime following the 2001 financial crisis. The inflation target is defined as the end-year rate of inflation based on the annual percentage change of the consumer price index. The target horizon is set for three years. Formerly the medium-term inflation target was set jointly with the government at 4 percent. As a result of supply shocks in 2007–08, the targets were revised to 7.5 percent for 2009, 6.5 percent for 2010, and 5.5 percent for 2011.

The CBT operates an independently floating exchange rate regime. Within this regime, it holds small daily foreign exchange purchase auctions with the purpose of accumulating reserves in a gradual and predictable manner. These are characterized by a high degree of transparency to avoid a price impact. In addition, the CBT maintains the right to intervene through discretionary operations, if necessary to curb volatility.

Objectives and Modalities of Foreign Exchange Intervention

Discretionary intervention may be undertaken to manage excessive volatility. The CBT emphasizes that exchange rate stability is important for price stability. For this purpose, it may enter the foreign exchange

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[109]As assessed by investment banks active in the Turkish lira market.

market to prevent actual and expected excessive volatility to ensure foreign exchange market stability.

The regular foreign exchange auctions are designed to allow the accumulation of reserves in a way that is consistent with the flexible exchange rate and inflation targeting. The auctions are announced in advance. They are held daily and the volume is kept low so as not to alter foreign exchange demand significantly. Auctions have typically been held in an environment of strong capital inflows, which makes it easier to accumulate reserves without interfering with the market; these auctions have been temporarily suspended when such conditions were not in place.

Interaction between Foreign Exchange Intervention and the Policy Regime

The CBT focuses on the interest rate as the main tool for monetary policy, but may conduct foreign exchange intervention to prevent excessive exchange rate volatility. Since formally adopting inflation targeting in 2006, the CBT has conducted only a limited number of discretionary interventions (four in 2006, and none since then) to curb excessive volatility, suggesting that the exchange rate is not tightly managed compared with other large emerging market countries. Intervention is generally sterilized. The well-developed foreign exchange market may contribute to the ability of the central bank to limit its participation to extraordinary circumstances, because the availability of risk-management instruments helps market participants manage exchange rate volatility in the interbank market.

Consequences of Foreign Exchange Intervention and Sources of Exchange Rate Vulnerability

Discretionary intervention occurred most recently in 2006, when a strong rise in global risk aversion led to a sudden reversal of capital inflows. The sell-off of Turkish assets in May–June 2006 was met with relatively limited foreign exchange intervention, but was combined with significant interest rate hikes. Foreign exchange intervention did not immediately halt a depreciation of the Turkish lira, which experienced high volatility and significant depreciation. Instead, portfolio inflows later resumed in response to the increase in interest rate differentials and an improvement in global risk sentiment (IMF, 2006b).

Economic and political strains exposed Turkey to a sudden shift in market sentiment. The IMF November 2006 staff report (IMF, 2006b) identified that Turkey was particularly vulnerable in an emerging market context because of "comparatively weak fundamentals, unfavorable investor base and positions, and high sensitivity to shifts in global market sentiment." Inflation targeting uncovered three factors explaining the sudden reversal of capital inflows in 2006: (1) a current account deficit, (2) real currency overvaluation, and (3) past credit growth. Low reserve cover, high public debt, an uncertain inflation outlook, and a high degree of dollarization were other "less favorable fundamentals." To help preserve market confidence and economic progress, the IMF staff recommended that the authorities implement a disciplined fiscal policy, a tight monetary policy, and effective communication with markets and strive for continued progress on structural reform.

Foreign exchange operations have since been aimed at accumulating foreign exchange reserves in a gradual and predictable manner. After temporary suspension in May 2006, reserve accumulation operations were resumed in November 2006, when capital inflows recommenced. These do not target the exchange rate and are consistent with prudential considerations. In particular, the IMF November 2006 staff report (IMF, 2006b) identified a need to raise the level of international reserves (which were still below 100 percent of short-term debt on a residual maturity basis) to reduce vulnerability. Furthermore, the accumulation of reserves is achieved through auctions in which the CBT does not directly influence the exchange rate, implying that operational features are consistent with a floating exchange rate regime. Still, reserve accumulation operations may have marginally contributed to slowing the trend toward appreciation.

Appendix I

Table A1.1. Intervention Practices of Inflation-Targeting Countries, Late 2007

Country	Exchange Rate Regime	Foreign Exchange Intervention	Frequency of Interventions[1]	Intervention Modalities	Level of Market Development[2]	Sterilize Intervention	Special Data Dissemination	Frequency Intervention Data Published	Sources
Brazil	Independently floating	– Level of foreign exchange reserves – Excess volatility	Weekly or more	– Foreign-exchange-linked debt instruments denominated in domestic currency – Auctions	Emerging; spot, onshore forwards (for onshore entities), swaps nondeliverable forwards, and options	Yes	Yes	– Monthly level of reserves – Information through auctions	– BIS Paper No. 24 – IMF Annual Report on Exchange Arrangements and Exchange Agreements (AREAER), 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Canada	Independently floating	– Market breakdown – Extreme currency volatility	Never	Discretionary interventions	Developed; spot, forwards, swaps, and options	Yes	Yes	Monthly	– Central bank website
Chile	Independently floating	– Signal exchange rate misalignment – Excess volatility	Never	– Discretionary interventions – Issuance of U.S. dollar-denominated debt	Emerging; spot, forwards (residents), swaps, nondeliverable forwards, and options *Note: The Chilean peso is nondeliverable offshore*	Yes	Yes	Two-week lag	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Colombia	Managed floating	– Excess volatility – Accumulate foreign exchange reserves	Monthly, to accumulate foreign exchange reserves. Rule based for excess volatility	Auctions of put or call options	Emerging; spot, forwards, nondeliverable forwards, and options *Note: The Colombian peso is nondeliverable offshore*	Not automatically	Yes	– Auction amount at time of operation – Monthly interventions through options	– BIS Paper No. 24 – AREAER, 2006 – HSBC's Guide to Emerging Market Currencies, 2008
Czech Republic	Managed floating	– Excess volatility (in an environment of exchange rate misalignment)	Occasionally	Discretionary interventions	Emerging; spot, forwards, swaps, and options	Yes	Yes	Monthly amount with a two-month lag	– BIS Paper No. 24 – AREAER, 2006 – HSBC's Guide to Emerging Market Currencies, 2008

Hungary	Pegged exchange rate within horizontal bands	– Maintain exchange rate peg – Excess volatility	Never	– Discretionary interventions – Auctions	Emerging; spot, forwards, swaps, and options	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Iceland	Independently floating	– Preserve inflation target – Preserve financial stability	Never	– Discretionary – Almost exclusively in the spot market	Developed; spot, forwards, swaps, and options	Design of repo operations implies sterilization on demand from banks	Yes	Monthly	– AREAER, 2006 – Central bank website
Indonesia	Managed floating	– Maintain exchange rate stability	N/A	– Mainly through the spot market – Directly in the market or via an agent bank (closed method) – Moral suasion	Emerging; spot, forwards, swaps, nondeliverable forwards, and options *Note: Certain documentation requirements apply*	N/A	Yes	Monthly level of foreign reserves	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – Asian Currency Handbook, 2006 – Deutsche Bank – HSBC's Guide to Emerging Market Currencies, 2008
Mexico	Independently floating	– Stabilize foreign exchange markets – Manage level of foreign exchange reserves	Monthly	– Auctions – Discretionary interventions (under extreme circumstances)	Emerging; spot, forwards, swaps, and options *Note: Mexico is the only Latin American country that operates a deliverable forward market open to nonresident investors*	Yes	Yes	– Transparency through auctions – Monthly level of foreign reserves	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
New Zealand	Independently floating	– Moderate extremes in the exchange rate cycle	Rarely[3]	Interbank spot market	Developed; spot, forwards, swaps, and options	Yes	No	Monthly financial accounts	– AREAER, 2006 – Central bank website
Norway	Independently floating	– Exchange rate misalignment	Never	Discretionary interventions	Developed; spot, forwards, swaps, and options	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website – BIS Paper No. 24
Peru	Managed floating	– Excess volatility	Weekly or more	Discretionary interventions	Emerging; spot, forwards, non-deliverable forwards, and options *Note: A main characteristic is dual currencies; local currency and U.S. dollars are both accepted currencies*	Yes	Yes	Daily	– AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008

Table A1.1 *(concluded)*

Country	Exchange Rate Regime	Foreign Exchange Intervention	Frequency of Interventions[1]	Intervention Modalities	Level of Market Development[2]	Sterilize Intervention	Special Data Dissemination	Frequency Intervention Data Published	Sources
Philippines	Independently floating	– Maintain orderly conditions in the foreign exchange market	Weekly or more	Discretionary interventions	Emerging; spot, forwards, swaps, nondeliverable forwards, and options *Note: Turnover in nondeliverable forwards is low compared with other Asian currencies*	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008 – Asian Currency Handbook, 2006 – Deutsche Bank
Poland	Independently floating	– Manage exchange rate developments that threaten the inflation target	N/A	Discretionary interventions	Emerging; spot, forwards, swaps, nondeliverable forwards, and options	Yes	Yes	Monthly level of foreign reserves	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2007
Singapore	Managed floating	– Exchange rate is an intermediate target (policy band set on a six-month basis)	Weekly or more	Discretionary interventions	Emerging; spot, forwards, swaps, and options	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website
Slovak Republic	Exchange rate peg; ±15% horizontal band (European exchange rate mechanism II)	– Maintain exchange rate peg	Rarely	Discretionary interventions	Emerging; spot, forwards, swaps, and options (on a case-by-case basis)	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Sweden	Independently floating	– Signal changes in monetary policy	Never	Discretionary interventions	Developed; spot, forwards, swaps, and options	Yes	Yes	Weekly, including forward position with a three-month lag	– AREAER, 2006 – Central bank website
South Africa	Independently floating	– Level of foreign exchange reserves	Rarely	Discretionary interventions	Emerging; spot, forwards, swaps, and options	Yes	Yes	Monthly level of foreign reserves, specification of changes, and forward position	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008

Thailand	Managed floating	– Excess volatility – Achieve economic policy targets	Weekly or more	Discretionary interventions	Emerging; spot, forwards, swaps, and options	Yes	Yes	Weekly data on foreign reserve position, including net forward position	– BIS Paper No. 24 – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Turkey	Independently floating	– Accumulate foreign exchange reserves – Excess volatility	Daily foreign exchange auctions and occasional discretionary interventions (most recent discretionary intervention was in June 2006)	– Preannounced foreign exchange auctions – Occasional discretionary interventions	Emerging; spot, forwards, swaps, and options	Yes	Yes	– Weekly data on international reserves – Daily data on foreign exchange auction amounts and interventions – Data on discretion-ary foreign exchange interventions avail-able with a three-month lag – Schedule of foreign exchange buying auctions/optional selling and any changes resulting from market conditions	– AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
United Kingdom	Independently floating	N/A	Never	Discretionary interventions	Developed; spot, forwards, and options	Yes	Yes	Monthly level of foreign reserves	– AREAER, 2006 – Central bank website

[1]Frequency refers to how often interventions have taken place in the past three years.

[2]Categorization as "developed," "emerging," or "shallow" is based on how a market is designated by financial market participants active in this market.

[3]In June 2007, New Zealand intervened for the first time since the dollar was floated in 1985.

Table A1.2. Intervention Practices of Emerging Economies with Other Anchors, Late 2007

Country	Exchange Rate Regime	Foreign Exchange Intervention Objective	Frequency of Interventions[1]	Intervention Modalities	Level of Market Development[2]	Sterilize Intervention	SDD Subscriber	Intervention Data	Sources
Algeria	Managed floating with no pre-determined path for the exchange rate	N/A	N/A	N/A	Central bank is the main buyer and seller in the foreign exchange market.	N/A	No	No	– 2006 IMF Staff Report
Angola	Managed floating with no pre-determined path	N/A	Weekly or more	N/A	Shallow; N/A	Not automatically	No	No	– AREAER, 2006
Argentina	Managed floating with no pre-determined path	– Excess volatility – Level of foreign reserves	Weekly or more	Discretionary interventions	Emerging; spot, non-deliverable forwards, and nondeliverable options (on a case-by-case basis) *Note: Most commonly traded offshore as a nondeliverable forward*	Monetization according to the monetary program	Yes	– Daily press release stating intervention and its size – Weekly Exchange Report	– AREAER, 2006 – BIS Paper No. 24 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Azerbaijan	Conventional fixed peg against a single currency	– Excess volatility – Competitiveness – Financial stability	Weekly or more	Through the interbank electronic trading system	Shallow; spot and (less liquid) forward market *Note: The central bank is an active participant in clearing supply-and-demand imbalances*	Central bank achieves only partial sterilization	No	– Accumulated intervention data released in reports "on the situation of monetary policy implementation…." at certain intervals during the year – Level of foreign exchange reserves – IMF Staff Visit Concluding Statement, September 6, 2006	– AREAER, 2006 – Central bank website
Costa Rica	Crawling peg	As necessary to maintain the crawling peg	N/A	Through the organized electronic foreign exchange market (MONED)	Shallow; spot	Central bank achieves only partial sterilization	Yes	Daily exchange rates of intervention sales and purchases (not volume)	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website

Croatia	Managed floating with no pre-determined path	Exchange rate stability	Occasionally	Foreign exchange auctions	Emerging; spot, forwards, and options	N/A	Yes	Daily; intervention volume and average exchange rate	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Dominican Republic	Managed floating with no pre-determined path	– Maintain price stability – Adequate level of foreign reserves	Gradually accumulating reserves	N/A	Shallow; spot (traded on electronic trading platform)	Yes	No	Monthly level of reserves	– 2007 IMF Program Letter of Intent – AREAER, 2006 – Central bank website
Guatemala	Managed floating with no pre-determined path	Moderate exchange rate volatility	N/A	N/A	Shallow; Bolsa de Valores Nacional, S.A., is responsible for the operation and administration of the forward exchange market	N/A	No	N/A	– AREAER, 2006 – Central bank website
Iran	Crawling peg	Maintain the value of the currency and equilibrium in the balance of payments, to facilitate trade transactions and assist economic growth	N/A	N/A	Shallow; no forward foreign exchange market	N/A	No	N/A	– AREAER, 2006 – Central bank website
Kazakhstan	Managed floating with no pre-determined path	Manage short-term and speculative exchange rate fluctuations	N/A	N/A	Shallow; spot, forwards, and futures *Note: Electronic trading on stock exchange (KASE) as well as over the counter. Foreign exchange futures are quoted on the KASE*	Partial sterilization	Yes	– Monthly data (forward and future positions in foreign currencies)	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website
Malaysia	Managed floating with no pre-determined path	Smooth excess volatility	N/A	N/A	Emerging; spot, forwards, swaps, and options *Note: The Malaysian ringgit is not convertible outside Malaysia*	N/A	Yes	Monthly data on reserves	– IMF Public Information Notice No. 07/34 – AREAER, 2006 – Central bank website – Deutsche Bank Asian Currency Handbook, 2006 – HSBC's Guide to Emerging Market Currencies, 2008

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Appendix I

Table A1.2 *(concluded)*

Country	Exchange Rate Regime	Foreign Exchange Intervention Objective	Frequency of Interventions[1]	Intervention Modalities	Level of Market Development[2]	Sterilize Intervention	SDD Subscriber	Intervention Data	Sources
Romania	Managed floating with no pre-determined path	Excess volatility	N/A	N/A	Shallow; spot *Note: Ongoing development of forward market*	Partial sterilization	Yes	Monthly data on reserves	– AREAER, 2006 – Central bank website
Russia	Managed floating with no pre-determined path	Prevent excessive ruble appreciation and avert sharp exchange rate fluctuations that are not a result of fundamental economic factors	Weekly	On the currency exchange or the over-the-counter interbank market	Emerging; spot, forwards, swaps, nondeliverable futures, futures, and options *Note: Options are mostly nondeliverable owing to a lack of Russian ruble money market liquidity. Ruble futures are traded on the Chicago Mercantile Exchange and the Moscow Interbank Currency Exchange*	Unsterilized	Yes	Weekly level of international reserves	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008
Serbia	Managed floating with no pre-determined path	Prevent excessive daily exchange rate fluctuations, threats to financial and price stability, and risk to the adequacy of the level of foreign exchange reserves	Weekly or more	– Ad hoc fixing sessions or discretionary interventions – Daily rechanneling of foreign exchange purchased from licensed exchange dealers to commercial banks	Shallow; spot, and (small-scale) forward market	N/A	No	– Monthly publication of foreign exchange reserves specifying the amount of foreign exchange transactions of the central bank – Technical assistance reports	– AREAER, 2006 – Central bank website
Sri Lanka	Managed floating with no pre-determined path	– Excess volatility – Meet targets for official international reserves	N/A	N/A	Spot, forwards permitted per regulations, options on a case-by-case basis *Note: The Sri Lanka rupee is nondeliverable and not fully convertible on the capital account*	The 2006 IMF Staff Report notes that authorities "intend to step up open market operations to reduce excess liquidity in the banking system."	No	No	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website

Tunisia	Managed floating with no pre-determined path	According to the "real effective exchange rate rule"	N/A	Discretionary interventions	Shallow; spot, forwards (highly regulated)	Partial sterilization	Yes	– Breakdown of its own transactions, annually and cumulative amount during the current year – Level of foreign exchange reserves on a monthly basis	– 2006 IMF Staff Report – AREAER, 2006 – Central bank website
Uruguay	Managed floating with no pre-determined path	– Build up reserves – Slow down peso appreciation	N/A	Discretionary interventions	Emerging; spot, forwards *Note: Offshore, the Uruguayan peso is generally traded on a nondeliverable basis, deliverable forwards on a case-by-case basis. Locally, nondeliverable forwards and forwards are usually traded on a case-by-case basis*	N/A	Yes	– Weekly publication of reserves – 2006 Staff Report	– AREAER 2006 – Central bank website – HSBC's Guide to Emerging Market Currencies, 2008

[1]Frequency refers to how often interventions have taken place in the past three years.

[2]Categorization as "developed," "emerging," or "shallow" is based on how the market is designated by financial market participants active in this market.

Appendix II   The Small Open-Economy Model

The first part of this appendix describes the structure and calibration of the Small Open-Economy Model used in the analysis of alternative monetary policy frameworks. The second part reviews existing model-based analyses of hybrid inflation-targeting rules, and the third part describes the simulation methodology.

Model Structure

The model used in this paper to analyze alternative monetary policy rules is a fairly conventional New Keynesian open-economy model. These models embody a synthesis of the modeling approach of the real business cycle literature and micro foundations for Keynesian concepts.[110] Such models have essentially neoclassical long-run characteristics—notably including monetary neutrality—but have Keynesian short-term characteristics which provide scope for monetary policy to affect the real economy over the short to medium term. However, such models are mostly founded on explicit micro foundations, making the underlying assumptions of the model more transparent and making them less vulnerable to the Lucas critique than more ad hoc reduced-form specifications.

The model used in this paper is deliberately conventional in the sense of drawing on standard micro foundations to derive the main behavioral equations. An important feature of the model is that it abstracts from the determination of the steady state of the economy as well as from permanent shocks that change the steady state. Inflation targeting focuses on the dynamics of the return to the steady state following macroeconomic disturbances.

The model includes several features that attempt to capture some characteristics of financially vulnerable emerging economies. These include:

- Credit constraints limiting the degree of intertemporal arbitrage in consumption (following Amato and Laubach, 2003; and Galí, López-Salido, and Vallés, 2007), to reflect the relatively undeveloped domestic financial systems in many emerging economies; this is a procyclical component of aggregate demand, which is insensitive to the interest rate and has the potential to increase the reaction required of the central bank, introducing more volatility to exchange rates.

- An endogenous risk premium (following Céspedes, Chang, and Velasco, 2004), increasing in external indebtedness and the exchange rate.

- Allowance for perverse exchange rate effects on income (following Morón and Winkelried, 2005) to reflect adverse balance-sheet effects.

- Allowance for different timing of exchange rate pass-through to costs and prices (Monacelli, 2004).

- Inclusion of an exported natural resource, providing scope for terms of trade shocks.

- Allowance to explicitly include movements in the exchange rate in the central bank policy reaction function (Cavoli and Rajan, 2006; and Kirsanova, Campbell, and Wren-Lewis, 2006).

- Allowance to reflect weak policy credibility in more backward-looking inflation expectations and price formation (Erceg, Henderson, and Levin, 2000; and Argov and others, 2007).

The log-linearized equations included in the model are as follows:[111]

Aggregate Spending

Aggregate spending on the domestically produced good, $\hat{y}_t^d$, is composed of domestic spending, $\hat{c}_t$, plus exports, $\hat{x}_t^d$:

$$\hat{y}_t^d = \frac{\overline{c}}{\overline{y}^d}\,\hat{c}_t + \frac{\overline{x}^d}{\overline{y}^d}\,\hat{x}_t^d \tag{1}$$

where:

$\overline{c}/\overline{y}^d$ and $\overline{x}/\overline{y}^d$ represent the respective shares of consumption and exports in domestic output in the steady state.

A fraction, λ, of domestic spending is by optimizing (Ricardian) consumers, $\hat{c}_t^o$, and the rest is by "rule-of-thumb" (non-Ricardian) consumers, $\hat{c}_t^r$:

$$\hat{c}_t = \lambda \hat{c}_t^r + (1 - \lambda) \hat{c}_t^o \tag{2}$$

Spending by optimizing Ricardian consumers is derived from a standard separable utility function on consumption, C_t, and labor, N_t:

$$U(C_t, N_t) = \frac{(C_t - \gamma C_{t-1})^{1-\sigma} - 1}{1 - \sigma} - N_t^v \tag{3}$$

where:

σ is the coefficient of relative risk aversion

γ is the degree of habit formation in consumption.

This introduces an element of inertia into consumption, and is a fairly standard feature of New Keynesian models.

The first-order conditions of utility maximization provide the Euler equation that guides consumption:

$$\hat{c}_t^o = \left(\frac{\gamma}{1+\gamma}\right)\hat{c}_{t-1}^o + \left(\frac{1}{1+\gamma}\right)\hat{c}_{t+1}^o - \left(\frac{1-\gamma}{1+\gamma}\right)\frac{1}{\sigma}[(\hat{i}_t)-\hat{\pi}_{t+1}] \tag{4}$$

where:

$\hat{i}_t$ is the current nominal interest rate

$\hat{\pi}_{t+1}$ is the inflation rate expected in period $t+1$.

Rule-of-thumb or non-Ricardian consumers do not smooth consumption through borrowing and lending. The lack of consumption smoothing may reflect limited access of some households to financial markets.[112] As a consequence, for these consumers, spending is based on current income:

$$\hat{c}_t^r = \hat{w}_t - \hat{p}_t + \hat{n}_t \tag{5}$$

where:

$\hat{w}_t$ is the nominal wage rate per unit of work a supplied

$\hat{p}_t$ is the price level

$\hat{n}_t$ is the number of units of work supplied.

In addition to domestic demand, there is also foreign demand for the domestically produced good, $\hat{x}_t^d$. Export demand depends on foreign real income and the real exchange rate:

$$\hat{x}_t^d = \rho_{x^d} \hat{y}_{t-1}^d + (1 - \rho)[\tau\hat{q}_t + \hat{y}_t^*] \tag{6}$$

where:

$\hat{y}_t^*$ is foreign real income

$\hat{q}_t$ is the real exchange rate (the real cost of foreign currency)

ρ_{x^d} is the degree of persistence in domestically-produced exports

τ is the exchange rate elasticity of demand for domestically-produced exports.

Aggregate Production

Output in the economy consists of two types of goods. One is a composite good produced by monopolistically competitive firms using labor and imported goods as inputs. This good is both consumed domestically and exported. The second is a natural endowment commodity which is exported.

The composite good is produced using a CES production technology with inputs of labor and an imported input. This production function is particularly convenient because of its generality, given that it embeds a Cobb-Douglas or even a Leontief technology, depending on the size of the elasticity of input substitution chosen:

$$y = A_t \left[\alpha I_t^{\frac{\sigma_{s-1}}{\sigma_s}} + (1 - \alpha)N_t^{\frac{\sigma_{s-1}}{\sigma_s}}\right]^{\frac{\sigma_s}{\sigma_{s-1}}} \tag{7}$$

where:

σ_s is the elasticity of substitution in production

I_t is the imported intermediate input

N_t is the labor input

α is the share of the imported good in production—the openness of the economy

A_t is total factor productivity.

Production costs reflect the costs of the labor and the imported inputs, as well as labor. The real cost of imported inputs is determined by the real exchange rate, $\hat{q}_t$, while the real wage, $(\hat{w}_t - \hat{p}_t)$, is determined by the equilibration of producers' demand for labor, $\hat{n}_t$, with the supply of labor by households. The supply of labor is derived from maximization of utility in Equation (3)[113] by both types of consumers. Aggregate supply depends positively on real wage and negatively on consumption. This is a typical result obtained from the first order condition with respect to labor of separable utility functions:

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[112]See, for example, Galí, López-Salido, and Vallés (2007).

[113]Note that although some households may be constrained to follow a rule of thumb in consumption, it is assumed that all households are free to optimize their supply of labor services.

$$\hat{n}_t = \frac{1}{(v-1)}\left\{(\hat{w}_t - \hat{p}_t) - \sigma\left[\left(\frac{1}{1-\gamma}\right)\hat{c}_t - \left(\frac{\gamma}{1-\gamma}\right)\hat{c}_{t-1}\right]\right\} \qquad (8)$$

where:

v is the coefficient of disutility of labor.

With the production technology specified in Equation (7), the real marginal cost of production, $\hat{mc}_r^R$, is given by:

$$\hat{mc}_r^R = (1-\alpha)^{\sigma_s}(\hat{w}_t - \hat{p}_t) + \alpha^{\sigma_s}\hat{q}_t - [(1-\alpha)^{\sigma_s} + \alpha^{\sigma_s}]\hat{\alpha}_t \qquad (9)$$

where:

$\hat{w}_t$ is the nominal wage rate per unit of work supplied

$\hat{p}_t$ is the price level $\hat{q}_t$ is the real exchange rate (the real cost of foreign currency)

$\hat{\alpha}_t$ is the (log) deviation of A_t from its steady state value.

Equation (9) shows that the more open the economy, the larger the impact of exchange rate movements on production costs and inflation. The elasticity of substitution in production also plays an important role: the lower the possibility of substituting domestic labor for imported inputs, the larger the impact of an exchange rate movement on costs.

Production of the second endowment type good, $\hat{x}_t^{CM}$, is essentially exogenous and is completely exported. The amount produced of this commodity does not react to its price, and the requirement of local inputs to its production is negligible. Its value depends on the real exchange rate and its price, $\bar{p}_t^{CM}$, abroad, which is given by international markets. Consequently, the value of production is determined as:

$$\hat{x}_t^{CM} = \hat{q}_t + \hat{p}_t^{CM} \qquad (10)$$

Firms set the price of output for the domestic market in one of two ways. One group of firms, accounting for a fraction, μ, of sales of the domestic good, follows a simple, backward-looking approach to adjusting their prices.[114] In effect, this leads to an element of indexation of prices, generating persistence in inflation. Another group of price-setters takes a forward-looking optimization approach to price setting but only adjust their prices periodically, à la Calvo. In any given period, it is assumed that only a fraction, $(1-\theta)$, of the optimizing firms adjust their prices. The backward-looking component of price setting can be motivated by uncertainty regarding the central bank's inflation objective (Erceg, Henderson, and Levin, 2000) or limited credibility of the policy framework (Argov and others, 2007). In both cases, agents will tend to place a greater weight on recent inflation outcomes in forming inflation expectations than otherwise.

Taking these considerations into account, the aggregate inflation rate in the economy will be summarized by a New Keynesian Phillips curve of the form:

$$\hat{\pi}_t = \left(\frac{\beta}{1+\beta\mu}\right)\hat{\pi}_{t-1} + \left(\frac{\mu}{1+\beta\mu}\right)\hat{\pi}_{t-1} + \left(\frac{\varphi}{1+\beta\mu}\right)\hat{mc}_r^R \qquad (11)$$

where:

β is the subjective rate of time preference

μ is the proportion of price adjustment based on a simple indexation formula, $\varphi = \frac{1-\theta}{\theta}(1-\beta\theta)$, where $(1-\theta)$ is the average frequency of price adjustment by optimizing firms

$\hat{mc}_r^R$ is the real marginal cost of production.

This Phillips curve has three elements. The first is an expected inflation component. This reflects the assumption that firms adjust their prices periodically rather than continuously, so that when prices are adjusted, firms take into account the expected evolution of inflation. The second term is a lagged inflation component reflecting the indexation applied to a fraction, μ, of prices. The third term reflects the incorporation of marginal costs into optimizing firms' prices. Exchange rate movements feed into inflation through their impact on marginal costs. The speed of pass-through into inflation depends both on the proportion of optimizing firms and on the average frequency of price adjustments.

Exchange Rate Determination

The real exchange rate is assumed to be determined by the real uncovered interest parity condition, together with a risk premium:

$$\hat{q}_t = \hat{q}_{t+1} + [\hat{i}_t^* - \hat{\pi}_{t+1}^*] - [\hat{i}_t - \hat{\pi}_{t+1}] + \hat{\phi}_t \qquad (12)$$

where:

$\hat{q}_t = \hat{s}_t + \hat{p}_t^* - \hat{p}_t$ is the real exchange rate ($\hat{s}_t$ is the spot price of foreign exchange and $\hat{p}_t^*$ is the foreign price level)

$\hat{i}_t^*$ is the foreign nominal interest rate

$\hat{\pi}_{t+1}^*$ is the expected foreign inflation rate

$\hat{\phi}_t$ is the risk premium.

Following Céspedes, Chang, and Velasco (2004), the risk premium, $\hat{\phi}_t$, depends on debt, the exchange rate, and GDP:[115]

$$\hat{\phi}_t = \phi_0(\hat{b}_{t+1}^* - \hat{y}_t) - \phi_1\left(\frac{\bar{x}^d}{\bar{x}^d + \bar{x}^{cm}}\bar{x}_t^d + \left(\frac{\bar{x}^{cm}}{\bar{x}^d + \bar{x}^{cm}} - 1\right)\hat{q}_t\right) \qquad (13)$$
$$+ \phi_2(\hat{I}_t) + \phi_3(\hat{q}_t)$$

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[114]See Smets and Wouters (2002).

[115]See also Morón and Winkelried (2005). Gertler, Gilchrist, and Natalucci (2003) develop a closely related alternative to modeling this risk premium.

where:

$(\hat{b}^*_{t+1}-\hat{y}_t)$ is the projected external debt-to-GDP ratio.

The risk premium consists of four elements:

• The first term in the equation, $\phi_0(\hat{b}^*_{t+1}-\hat{y}_t)$, says that the risk premium is an increasing function of the ratio of external debt to GDP. This friction in the international capital markets is required to ensure stationarity of the external debt-to-GDP ratio.[116]

• The second and third terms,

$$\phi_1\left(\frac{\overline{x}^d}{\overline{x}^d+\overline{x}^{cm}}\overline{x}^d_t + \left(\frac{\overline{x}^{cm}}{\overline{x}^d+\overline{x}^{cm}}-1\right)\hat{q}_t\right) + \phi_1(\hat{I}_t),$$

relate the risk premium negatively to exports and positively to imports, so that a weakening of the current account raises the risk premium.

• The last term, $\phi_3(\hat{q}_t)$, captures the adverse impact of currency depreciation on the domestic currency value of external debt—the balance sheet effect. As the debt service burden on borrowers rises, the risk premium increases. For a financially vulnerable economy, the adverse impact of depreciation through the balance sheet effect must outweigh the beneficial effects of depreciation on the current account so that depreciation has a net harmful effect on activity. This imposes restrictions on the values of the parameters in the risk premium equation.[117]

Monetary Policy

Monetary policy is described by the alternative reaction functions presented in the main text.

Equilibrium Identities

Total output of the economy is the sum of the domestic consumption and exports of the domestically produced good, together with the exports of the exported endowment commodity:

$$\hat{y}_t = \frac{\overline{c}}{\overline{y}}\,\hat{c}_t + \frac{\overline{x}^d}{\overline{y}}\,\hat{x}_t + \frac{\overline{x}^{CM}}{\overline{y}}\,\hat{x}^{CM}_t \tag{14}$$

where:

$\overline{c}/\overline{y}$, $\overline{x}^d/\overline{y}$, and $\overline{x}^{CM}/\overline{y}$ are shares of consumption, exports of domestically produced goods, and exports of the endowment commodity in total production.

The balance of payments or economy-wide constraint is built adding up the consumer, government, and firm resource constraints:

$$\frac{\overline{c}}{\overline{y}}\hat{c}_t = \hat{y}_t - \alpha_y\frac{\overline{y}^d}{\overline{y}}\,(\hat{I}_t + \hat{q}_t) \tag{15}$$

$$+ \frac{\overline{b}}{\overline{y}}\,\frac{1}{(1+\hat{i}^*)\phi}\,[\pi^*_{t+1} + \hat{b}^*_{t+1} - (\hat{q}_{t+1} - \hat{q}_t)$$

$$- (1+\hat{i}^*_t) - \phi_t] - \frac{\overline{b}^*}{\overline{y}}\,\hat{b}^*_t$$

The net change in foreign debt should be equal to the current account, which is composed of the trade balance and interest payments abroad.

Model Calibration

Differences in the calibration of the financially robust advanced and the financially vulnerable emerging economies are shown in Table A2.1 and reflect the following considerations:

• Domestic financial development. In the emerging economy, the share of "rule-of-thumb spending" based on current income is set at 30 percent, compared to 0 percent in the advanced economy, to reflect limited access of agents to borrowing opportunities and greater use of quantitative credit rationing rather than use of retail interest rates. Better access to borrowing and saving opportunities in advanced economies is also reflected in higher persistence in spending behavior, with the persistence coefficient set at 0.5 versus 0.3 in emerging economies.

• External financial constraints. More limited capital mobility and international asset substitutability in vulnerable emerging economies is reflected in: (1) a risk premium with a substantially higher coefficient related to the level of the external debt-to-GDP ratio (0.05 compared to 0.01 for the advanced economy (based on Schmidt-Grohé and Uribe, 2003)); and (2) a higher coefficient on the current account balance (0.3 compared to 0.2 for the advanced economy).[118] In addition, the balance sheet vulnerability of the emerging economy is reflected in a much higher elasticity of the risk premium with respect to exchange rate movements than in the advanced economy (0.5 compared to 0.05).

A crucial implication of these parameter configurations is that currency depreciation in the financially robust advanced economy will be expansionary as the stimulus to net exports will outweigh any adverse bal-

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[116]See Schmidt-Grohé and Uribe (2003).
[117]See Céspedes, Chang, and Velasco (2003) and Morón and Winkelried (2005).

[118]The risk premium elasticity with respect to imports and exports are assumed to be equal for each country type on the presumption that capital market participants do not distinguish between whether a movement in the current account balance reflects changes in imports or exports.

Table A2.1. Parameter Calibration of the Advanced and Emerging Economy Models

	Advanced Economy	Emerging Economy
Utility function		
Subjective Discount rate	$\beta = 0.988$	$\beta = 0.988$
Coefficient of relative risk aversion	$\sigma = 1$	$\sigma = 2$
Parameter of the labor supply (disutility)	$\nu = 2$	$\nu = 2$
Habit coefficient	$\gamma = 0.5$	$\gamma = 0.3$
Share of rule-of-thumb consumers	$\lambda = 0$	$\lambda = 0.3$
Production function		
Factor (input) elasticity of substitution in production function	$\sigma_s = 1$	$\sigma_s = 1$
Weight of imported factor (degree of openness)	$\alpha = 0.25$	$\alpha = 0.3$
Exports		
Elasticity of home exports to exchange rate	$\tau = 5$	$\tau = 5$
Elasticity of commodity exports to exchange rate	0	0
Price-setting		
Probability of not reoptimizing	$\theta = 0.75$	$\theta = 0.75$
Degree of indexation (for firms that are not reoptimizing)	$\mu = 0$	$\mu = 0.8$
Elasticity of demand	$\varepsilon = 6$	$\varepsilon = 6$
Mark-up	$[\varepsilon/(\varepsilon-1)] = 1.2$	$[\varepsilon/(\varepsilon-1)] = 1.2$
Wage-setting		
Rigid wages (Dummy_WR)	D_WR = 0	D_WR = 0
Parity condition and risk premium		
Elasticity of country risk premium to foreign debt	0.01	0.05
Elasticity of country risk premium to exports	0.20	0.3
Elasticity of country risk premium to imports	0.20	0.3
Elasticity of risk premium to real exchange rate (balance sheet)	0.05	0.5
Exchange rate smoothing	0.6	0.6
Monetary Policy		
Interest rate smoothing in Taylor rule	0.7	0.7
Parameter related to inflation gap	$0.25 \leq$ coeff. ≤ 3.11	$0.26 \leq$ coeff. ≤ 3.15
Parameter related to output gap	$-0.28 \leq$ coeff. ≤ 2.57	$-0.28 \leq$ coeff. ≤ 2.61
Parameter related to exchange rate	0.6	0.6
Aggressiveness	6.5	6.6
Shock Inertia		
Shock persistence	Rho_R=0.8	Rho_R=0.8

ance sheet effects. In contrast, currency depreciation has a net contractionary effect in the vulnerable emerging economy as the stimulus to net exports is more than offset by the adverse impact on balance sheets and, consequently, on consumption and investment.

- Openness. The share of imports in production rather than GDP (following McCallum, 2006) is set at 25 percent for the advanced economy and at 30 percent for the emerging economy, consistent with international evidence.

- Policy credibility. In the robust advanced economy, price formation is based on a purely forward-looking approach to formation inflation expectations ($\mu = 0$). Implicitly, this assumes that agents know and believe the central bank's policy rule. In the emerging economy, price formation is assumed to be much more backward looking ($\mu = 0.8$), reflecting limited credibility of the central bank's commitment to an inflation objective (following Rudebusch and Svensson, 1998; Erceg, Henderson, and Levin, 2000; and Argov and others, 2007).

Evidence on the Performance of Alternative Frameworks

This section reports the performance of alternative hybrid monetary policy rules in financially robust advanced and financially vulnerable emerging economies. It reviews existing model-based analyses of hybrid rules and then discusses the simulations and findings using the model described above.

Existing Studies of Hybrid Policy Rules

Taylor (2001) reviews the limited number of studies that had looked at the issue of whether it would be appropriate to take the exchange rate explicitly into account in monetary policy in an open economy.[119] He concludes there was little evidence that including a systematic response to exchange rate movements would improve macroeconomic performance, even in an open economy. He attributes this to two principal factors: (1) even in the plain vanilla framework, monetary policy already responds to the indirect impact of exchange rate movements on output and inflation, and (2) the appropriate response to exchange rate movements should depend on the cause of the movement. He suggests that adding a mechanistic response to exchange rate movements in the policy reaction function could worsen performance, depending on the typical array of shocks affecting the economy. Both Taylor (2000) and Mishkin (2000), however, recognize that more research is needed in this area before any strong conclusions can be drawn.

More recent research has begun to examine whether differences in economic and financial structure between emerging and more advanced economies may explain the "fear of floating" evident in many emerging and developing economies and may justify including systematic dampening of exchange rate movements in the central bank policy reaction function.[120] Below is a brief summary of some of the main findings for each of the hybrid inflation-targeting exchange rate frameworks.

Open-Economy Inflation Targeting

Model-based analyses generally find little benefit from including the exchange rate in the monetary policy reaction function. Indeed, several studies argue that including the exchange rate worsens macroeconomic performance. However, in some other studies, including the exchange rate in the reaction function is found to be beneficial if the economy is financially fragile or if the central bank is very uncertain of how the exchange rate is determined:

- Céspedes, Chang, and Velasco (2004) consider the impact of exchange rate movements in economies with a high degree of dollarization and constrained access to international borrowing opportunities. In such circumstances, exchange rate movements can give rise to strong balance sheet effects opposite to the normal competitiveness effects of exchange rate movements. Which effect dominates depends on each country's

situation. However, the authors find that exchange rate flexibility outperforms a fixed exchange rate regime.

- Morón and Winkelried (2005) compare optimal hybrid reaction functions in financially vulnerable and financially robust economies. In general, the optimized rules for a vulnerable economy place much less weight on smoothing output and more weight on dampening exchange rates than in a robust economy. The analysis does not directly compare the performance of such hybrid rules against otherwise similar rules excluding exchange rate terms. Nonetheless, the finding that some exchange rate smoothing is involved in the optimal rules appears to imply that rules excluding exchange rate smoothing perform less well in minimizing inflation or output volatility or both. It is not clear, however, why some exchange rate smoothing appears optimal for both the vulnerable and robust economies.

- Cavoli and Rajan (2006) compare variations on plain vanilla and hybrid Taylor rules for a financially vulnerable economy (calibrated to the Thai economy). Key results of interest are that: (1) in optimally weighted, open-economy Taylor rules (including an exchange rate term), the optimal weight on the exchange rate is low; (2) open-economy Taylor rules may well lead to greater macroeconomic volatility than plain vanilla Taylor rules; and (3) the emphasis put on the level of the real exchange rate versus changes in the exchange rate has important consequences for macroeconomic outcomes. It is not clear, however, whether these results would carry over to a model with more forward-looking behavior, including more forward-looking policy formulation.

- Batini, Levine, and Pearlman (2007), using a calibrated model of the Peruvian economy with dollarization and financial "frictions," compare fixed and flexible exchange rate regimes. They find that a fixed exchange rate delivers much poorer performance. They conclude that, because dollarization weakens the output gap channel of transmission relative to the exchange rate channel, nothing should be done to limit the flexibility of the exchange rate in order to achieve the inflation target.

- Ravenna and Natalucci (2008) use a model loosely calibrated to the transition economies of Eastern Europe to examine the implications of the Balassa-Samuelson effect. They find that when the economy is experiencing a prolonged period of more rapid productivity growth in the tradables than in the non-tradables sector, macroeconomic performance is much better with a flexible exchange rate than with a rule involving a high degree of exchange rate management.

- Leitemo and Söderstöm (2005) and Wollmershäuser (2006) both consider the performance of alternative

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[119]The main studies included Batini and others (2001), Ball (1999), and Svensson (2000).

[120]See, for example, Céspedes, Chang, Velasco (2003), Morón and Winkelried (2005), Cavoli and Rajan (2006), and Leiderman, Maino, and Parrado (2006).

Table A2.2. Reaction Function Coefficients

	Inflation	Output
1	0.25	2.57
2	0.57	2.26
3	0.89	1.94
4	1.20	1.62
5	1.52	1.31
6	1.84	0.99
7	2.15	0.67
8	2.47	0.36
9	2.79	0.04
10	3.11	−0.28

policy rules when there is uncertainty surrounding the determination of the exchange rate. Although not specifically an emerging economy issue, uncertainty about the determination of the exchange rate may be even greater in such economies than in more advanced economies. The authors of both papers find a small gain from including the exchange rate in the reaction function when there is no uncertainty about exchange rate determination. However, when uncertainties are introduced, Leitemo and Söderstöm find that a Taylor rule is slightly more robust than an open-economy rule, while Wollmershäuser finds that open-economy rules are more robust to a wider range of exchange rate uncertainties.

Inflation Targeting with an Exchange Rate Band

It is unclear how well this type of framework compares with a more conventional inflation-targeting framework in terms of macroeconomic performance:

- Lahiri and Végh (2001) suggest that an exchange rate band may be appropriate if nominal exchange rate movements and higher interest rates have output costs and if intervention is costly. In such circumstances, a fairly free float within an exchange rate band may be optimal, at least in response to some kinds of shocks.

- Morón and Winkelried (2005) examine such a policy in their model of a financially vulnerable economy and find that it tends to outperform a policy involving a more linear response to exchange rate movements. The authors note, however, that the analysis fails to take into account the impact that limiting exchange rate movements will have on the behavior of economic agents. In particular, if the central bank limits the range of exchange rate

movement, this could encourage agents to increase their foreign currency liabilities, accentuating the vulnerability of the economy. This would make the economy particularly vulnerable to real shocks shifting the equilibrium real exchange rate.

Exchange-Rate-Based Inflation Targeting

McCallum (2006) compares the performances of plain vanilla and exchange-rate-based approaches to inflation targeting in an economy with varying degrees of openness. The first key finding is that, as the degree of openness increases, an exchange-rate-based approach to inflation targeting does much better than the standard interest-rate-based approach in stabilizing output, with no adverse consequences for inflation variability. The second key finding is that, in the interest-rate-based approach, the variability of the interest rate is low while that of the exchange rate is high, whereas in the exchange rate-based approach, the opposite occurs. These results suggest, broadly, that in a very open economy, smoothing the exchange rate rather than interest rates may contribute to reducing output volatility.

Simulation Method

Construction of Volatility Tradeoff Frontiers

The volatility trade-off frontiers shown in the main text are constructed as follows:

- For each of the two types of country models, 10 variants of each alternative policy reaction function were constructed, each with a slightly different weighting on the inflation and output objectives, as shown in Table A2.2. The sum of the coefficients on the two objectives was held constant, as were the coefficients on the exchange rate objective and the lagged instrument term.

- Each country model, with each variation of the parameterization of the alternative policy rules, is then simulated in response to each of three kinds of shocks: demand, cost-push, and risk premium shocks.

- Each simulation involves a 200-period run. In each period, the model is subjected to a shock drawn from a normal distribution.[121] For each kind of shock, the 200-period simulation is replicated 50 times.[122]

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[121]The shocks have a mean of zero and a standard deviation of one. Thus, the shock could be interpreted as a 1 percent shock with the responses of the variables being percentage deviations from steady state (Galí and Monarelli, 2005).

[122]Each simulation run uses a different initial seed for the random number generation so that each run is genuinely different. The same

• These simulations provide 50 time series with 200 observations for each kind of shock, each policy rule variant, and each of the 29 endogenous variables. Of these, the variables of most interest are inflation, output, the interest rate, the exchange rate, and the current account balance. The standard deviation of the time series for each variable is then computed, between the 100th and 120th observation, and then averaged over each of the 50 replications to produce a representative standard deviation

for each variable in response to each kind of shock and policy variant.[123]

The same kind of simulation exercises could be carried out for variations of the weight of the exchange rate objective as opposed to the output, inflation, or instrument-smoothing objective. In this analysis, however, inflation and output smoothing are considered to be the ultimate objectives of monetary policy, whereas smoothing of the policy instrument or an exchange rate objective is to be evaluated in terms of their performance in achieving the foremost policy objectives.

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set of seeds, however, are used for each kind of shock to ensure that differences in results for the different kinds of shocks are not attributable to the particular random draws.

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[123]The selection of the 100th–120th observations is to ensure that the observations in the sample are dominated by cross-sectional rather than longitudinal variation and also that they are free from the influence of initial conditions.

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