Monetary Policy Functions and Transmission Mechanisms: An Overview

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Monetary policy comprises the rules and actions adopted by the central bank to achieve its objectives. In most countries the primary goal of monetary policy is price stability. However, the mandate of many central banks also encompasses other objectives, including attainment of full employment, domestic financial stability, and normal operation of foreign payments. The priority of price stability over other policy goals tends to be politically accepted in most countries, if not actually enshrined in the laws governing the central bank.

Changes in monetary policy are triggered by domestic and external shocks that can imperil the attainment of policy objectives. Central banks implement policy changes by resetting their policy instrument, usually a short-term interest rate or a monetary or bank credit aggregate. These instruments affect the economy through various mechanisms of transmission to the ultimate policy goals.

Hence a useful way to understand monetary policy is to focus separately on central bank policy actions and the transmission mechanisms through which those actions work their effect. The central bank's policy rule or reaction function embodies its response to deviations in macroeconomic variables in order to achieve its ultimate policy objectives. Beyond the simple description of these policy rules, it is important to assess their efficiency (in the sense of achieving the desired combination of goals, subject to the structure of the

We are grateful to Francisco Gallego for his valuable contribution to the preparation of this overview.

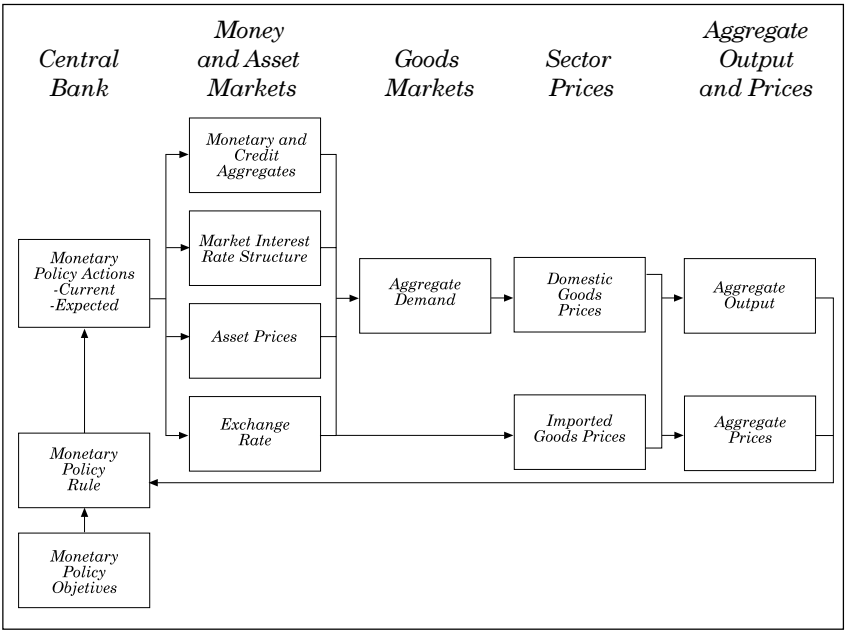
Monetary Policy: Rules and Transmission Mechanisms, edited by Norman Loayza and Klaus Schmidt-Hebbel, Santiago, Chile.

economy and prevailing economic conditions) and their optimality (in the sense of maximizing a given social welfare function).

The transmission mechanisms of monetary policy work through various channels, affecting different variables and different markets, and at various speeds and intensities. Identifying these transmission channels is important because they determine the most effective set of policy instruments, the timing of policy changes, and hence the main restrictions that central banks face in making their decisions.

Figure 1 depicts the relationship between monetary policy rules and transmission mechanisms. Policy actions (both current and expected) taken on the basis of the central bank's policy rules are directly transmitted to money and asset markets. Changes in these markets in turn affect goods and labor markets, and ultimately aggregate output and prices. Finally, changes in current and projected output and inflation feed back into the monetary policy rules. This reflects the central bank's aim and strategy to attain its policy

Figure 1. Monetary Policy Rule and Transmission Mechanisms



objectives, given policymakers' understanding of the economy's structure and its response to policy actions.[1]

The papers in this volume present and discuss some recent advances in theoretical and empirical research on monetary transmission mechanisms and monetary policy rules. Most are substantially revised versions of papers presented at the Third Annual Conference of the Central Bank of Chile, on "Monetary Policy: Rules and Transmission Mechanisms," held in Santiago in September 1999. Some of the papers analyze the properties of different types of central bank reaction functions. They link the objectives of the monetary authority to its reaction rules for different categories of shocks affecting the economy. These papers not only describe actual rules that central banks use or have used in the past, but also evaluate their efficiency and, in some cases, their optimality. Implicitly—and sometimes explicitly—these papers adopt a normative perspective, discussing how central banks *should* react to various shocks in order to achieve their goals, given the specific features of the economy in question. Other papers, mostly country studies, relate policy reaction functions to monetary transmission channels, emphasizing their interdependence in the actual conduct of monetary policy. These papers report on the transmission mechanisms in place in the various countries, allowing a comparison of their relative importance for economies that differ significantly in their structure.

1. Transmission Mechanisms

The literature identifies five channels of monetary policy transmission.[2] John Taylor, in his paper in this volume, provides a summary review of these channels, and the authors of the case studies analyze in depth the transmission mechanisms most relevant to their

1. The arrows in figure 1 depict causality as running from monetary policy to money and asset markets, labor and goods markets, and sectoral as well as aggregate prices and output. For simplicity, feedback effects from prices and output to goods markets and ultimately to asset and money markets are not depicted. Moreover, the sequence of causality does not suggest precedence in time.

2. Mishkin (1995) provides an exposition of the main channels of transmission and the role of each in the context of the U.S. experience. A recent Bank of England (2001) document provides a qualitative analysis of monetary transmission in the United Kingdom. A similar document by the Central Bank of Chile (2000) describes monetary transmission in Chile.

respective countries. The description of the monetary transmission channels that follows here assumes that the central bank pursues an expansionary monetary policy by resetting its policy instrument, either increasing a monetary aggregate under its control or reducing its policy interest rate.[3]

The first transmission channel is the interest rate channel, the traditional mechanism and the one often regarded as the main channel of monetary policy transmission.[4] An expansionary policy leads to a reduction in longer-term real interest rates, which in turn affects business investment, investment in residential housing, and consumer expenditure on durable goods. The corresponding shift in aggregate demand is eventually reflected in aggregate output and prices.

This transmission mechanism depends on several links, all of which are supported by various strands of the macroeconomic literature. Thus the relationship between nominal and real interest rates is explained by theories based on price and wage rigidities, the link between short- and long-term real rates follows from the expectational hypothesis of the term structure of interest rates, and the relationship between aggregate demand, on the one hand, and output and prices, on the other, is explained by combining a Phillips curve with temporary nominal price rigidities. The interest rate channel lies at the core of the current understanding of the "science of monetary policy [from] a new Keynesian perspective" (Clarida, Galí, and Gertler, 2000). This approach models the dynamic effects of monetary policy—temporary output effects and permanent price effects—in a framework based on optimizing dynamic behavior, rational expectations, and temporary price rigidities.[5]

3. The basic equivalence between an increase in money supply and a reduction in the policy interest rate—or the notion that the former leads to the latter (the liquidity effect)—has been empirically reconfirmed by Bernanke and Mihov (1998) for the United States. For welfare comparisons of money growth rules and interest rate rules, see Carlstrom and Fuerst (1995) and Végh (2002). Svensson (1999) compares inflation targeting with money growth targeting and nominal GDP targeting.

4. For example, this is the position taken by Taylor (1995), but strongly disputed by Bernanke and Gertler (1995).

5. The New Keynesian story as told by Clarida, Galí, and Gertler (2000) hinges on the existence of temporary price rigidities. Benhabib and Farmer (2000) provide an alternative model in which monetary policy also has temporary real effects but markets clear continuously. In their model, money enters the production function, and the possibility of multiple rational expectations equilibria arises.

In principle, there is no reason to focus on only one asset price—the interest rate—as a channel of monetary transmission. Monetary policy can also have important effects on the prices of equity, bonds, real estate, and foreign exchange. Considering these asset prices can lead to the identification of alternative channels of transmission. Given the special features of the transmission of monetary policy through the exchange rate, it is convenient to group equity, bonds, and real estate into a single, asset price channel and to consider the exchange rate mechanism separately.

According to the theory of the asset price channel, an expansionary monetary policy leads to higher equity prices, which make investment more attractive (through Tobin's q), thus raising aggregate demand. Higher equity prices also entail increased wealth, which raises consumption and thus also raises aggregate demand. The link between an increased money supply and higher equity prices can be argued from either a monetarist or a Keynesian perspective. In the former, an increase in money raises consumer wealth and asset prices, and hence spending on household and enterprise assets (as discussed by Meltzer, 1995), whereas in the latter, the increase in money lowers interest rates and makes equity markets more attractive.

The exchange rate channel works through both aggregate demand and aggregate supply effects. On the demand side, a monetary expansion lowers the domestic real interest rate, which, through the foreign interest parity condition, brings about a real depreciation of the domestic currency. This in turn leads to higher net exports and stronger aggregate demand.[6] On the supply side, the real depreciation that results from a monetary expansion raises the domestic prices of imported goods, raising inflation directly. Moreover, the higher price of imported inputs contracts aggregate supply, reducing output and increasing inflation.

A fourth channel of policy transmission focuses on monetary and credit aggregates. The classical monetarist view emphasizes the role of narrow or broad monetary aggregates in determining asset, goods, and factor prices; this is still a relevant theory for long-run inflation. A different approach, and one that has received considerable attention in recent years, emphasizes the credit channel (Bernanke and Gertler, 1995). Its basic notion is that monetary policy can have price and output effects through the credit

6. Obstfeld and Rogoff (1995) emphasize this form of the exchange rate channel.

rationing that arises from information asymmetries between financial institutions and the firms and consumers to which they lend. This occurs because monetary policy affects the extent of adverse selection and moral hazard that constrain credit provision. It is argued that a monetary expansion alleviates adverse selection and moral hazard by increasing firms' net worth (through higher equity prices), reducing perceived loan risks (through lower real interest rates), improving firms' cash flow (through lower nominal interest rates), and decreasing the burden of nominal debt contracts (by raising inflation). All these considerations tend to make banks willing to supply more credit—*pari passu* with the monetary expansion—thus financing a rise in aggregate demand.[7]

Up to now we have considered four main transmission mechanisms, all of which focus on money and asset markets (second column of figure 1). The literature identifies a separate, fifth channel, based on private sector expectations about the future stance of monetary policy and, more generally, about all future-related variables. According to this "expectations" channel, all variables that have intertemporal implications, and are therefore determined in a forward-looking way, are affected by agents' beliefs about future shocks to the economy and how the central bank will react to them. The specific mechanisms for the expectations channel are intertemporal versions of the static interest rate, asset price, exchange rate, and monetary and credit mechanisms. For example, consider an announcement of future central bank policy that is not supported by a change in current policy. Such an "open-mouth operation" exerts real effects by modifying market expectations, which in turn trigger current changes in money and asset markets and lead ultimately to changes in output and inflation. Announcements of future policies may have the desired effect, however, only if the monetary authorities are perceived as committed to

7. Much work has been done recently on the credit channel. Li (2000) uses a general-equilibrium model to show that a monetary expansion can generate a liquidity effect that increases credit to households and increases aggregate activity. Repullo and Suarez (2000) develop a model of heterogeneous firms and banks in which the latter engage in monitoring to alleviate the moral hazard problem. These authors show that monetary expansion increases bank lending and aggregate investment, narrows the spreads between rates charged to borrowers and the risk-free rate, and causes a shift in the extension of credit toward more risky firms. The credit channel is empirically confirmed for the United States by Kashyap and Stein (2000), who find that the impact of monetary expansion on bank lending is stronger for banks with less liquid balance sheets.

their policies. Hence, as the political economy literature emphasizes, the credibility of monetary policy becomes relevant.[8]

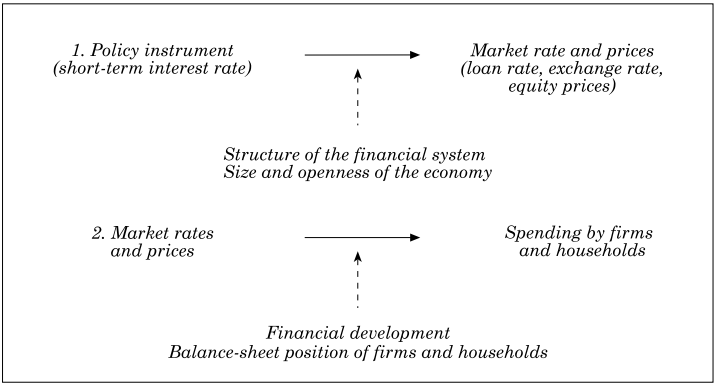
Various issues related to transmission mechanisms are worth discussing in more detail. For example, are different transmission channels functionally equivalent in terms of their effects on the economy? And what structural features of particular economies influence the relative importance of the various transmission mechanisms, and how do they do so?

(i) *Equivalence of transmission channels*. In the textbook example of a classical, fully flexible economy, a monetary shock translates into an equiproportionate and instantaneous increase in all nominal aggregates (including money and credit), asset prices, the exchange rate, factor prices, and goods prices. Hence aggregate demand expands but aggregate supply remains unchanged, precluding any real effects. Under such conditions it makes no sense to identify separate transmission mechanisms, much less attempt to measure their relative importance. All such mechanisms are observationally equivalent, reflecting the same transmission of money to prices in a fully flexible economy. Similar arguments can be made when moving away from a fully flexible economy, pointing out observational equivalence among transmission channels in a real-world economy characterized by temporary price rigidities. Discussing different transmission mechanisms makes sense only if it provides a better understanding of the relative dominance, speed, and intensity of the different channels, that is, if it helps to clarify how the dynamic response of output and prices is conditioned by the workings of specific asset, goods, and factor markets. But this requires an all-encompassing econometric model in order to engage in precise differentiation among competing transmission mechanisms, and such a model is not typically found in the empirical literature on transmission channels.

(ii) *Structural features and transmission mechanisms.* Not all economies react in the same way to changes in monetary policy. The choice of transmission mechanisms and their effectiveness in the conduct of monetary policy depend on the specific features of the economy in question. For purposes of illustration, we can divide monetary transmission into two steps (figure 2): first, the

8. See Persson and Tabellini (1997) for a survey of the credibility literature.

Figure 2. Factors that Influence the Transmission of Monetary Policy



policy instrument affects various asset markets and prices, and second, these changes affect spending decisions by firms and households. Each step is affected by the economy's specific features, and in particular its stage of financial development and openness to international trade and capital. The effect that changes in market prices can have on aggregate demand is also determined by the solvency and liquidity of firms and households.

(iii) *Depth and structure of the financial system.* Several characteristics of the financial system—whether it is based primarily on banks or comprises a variety of financial institutions, whether it is run publicly or privately, and whether it offers a large range of financial products—affect the effectiveness of monetary policy. First, monetary policy changes are more quickly and closely translated into changes in market interest rates and other financial prices if the financial system is well diversified in terms of its institutions and products. Conversely, when a few financial institutions have effective monopoly power and the supply of financial alternatives is poor, these institutions can to some extent determine market rates and prices independent of the actions of the central bank. Second, consumption and investment decisions by households and firms are more responsive to market rates and prices when those households and firms are not financially constrained

but can exercise their choices both intertemporally and across goods and services. The depth and structure of the financial system also determine which transmission mechanisms are the most relevant. When the financial system is shallow and poorly diversified (that is, dependent on a few banks), the asset price channel is of little importance (because of the low capitalization of the stock market) and the interest rate channel is weak (because of banks' monopoly power). The credit channel instead dominates, given the moral hazard and adverse selection problems that characterize shallow financial systems. The exchange rate channel is usually not very relevant in financially underdeveloped economies, because such economies tend to impose controls on foreign exchange transactions, whether related to international trade or capital flows. As the financial system develops and becomes deeper and more diversified, however, the asset price, interest rate, and exchange rate channels become more important.

(iv) *Size and openness of the economy*. The size of an economy and its openness to external transactions determine the importance of the exchange rate channel and the ability of monetary policy to determine domestic interest rates. The exchange rate channel receives much attention in this volume because the case studies focus on open and mostly small economies. In some of the studies, estimation of the pass-through from exchange rate changes to domestic inflation under different regimes takes center stage.

We turn now to a review of the findings on transmission mechanisms presented by the country case studies included in this volume. (Subsequent sections of this introduction discuss their findings on monetary reaction functions.) The economies studied—Australia, Canada, Chile, Israel, South Africa, and the United Kingdom—share several features: all are open, all except the United Kingdom are relatively small, and all follow a monetary regime based on inflation targeting with largely flexible exchange rates.

All the case studies develop models of varying complexity to analyze the interaction between the central bank and the economy. They apply various empirical techniques to identify the main transmission channels. Janine Aron and John Muellbauer (South Africa) and Leonardo Leiderman and Hadas Bar-Or (Israel) estimate simple structural equations. Alastair Cunningham and Andrew Haldane (United Kingdom) and Adam Cagliarini and Guy Debelle (Australia) rely on the calibration of simulated economies. Ángel Cabrera and Luis Felipe Lagos (Chile) estimate vector autoregression (VAR)

models. David Longworth and Brian O'Reilly (Canada) combine some of these techniques.

Table 1 summarizes the importance of each of the transmission channels in these six case studies.[9] Most relevant are the traditional interest rate and exchange rate channels. In Chile and Israel, where financial market imperfections are likely to be prevalent, the credit channel is also important. In Canada and the United Kingdom, two seasoned practitioners of inflation targeting, expectations about future monetary policy are found to be a relevant transmission mechanism. The asset price channel appears to be unimportant in the economies considered here. However, in some of the studies the conditions used to identify the transmission mechanisms were unable to differentiate among the interest rate, credit, and asset price mechanisms. Hence the variables used to estimate the interest rate channel may be proxying for the other two channels as well. This is a limitation shared not only by some of the other country studies in this volume but indeed by most papers on transmission mechanisms, as discussed above.

Some of the country studies pay special attention to the effect of nominal currency devaluations on inflation. This is only natural given the importance of the exchange rate mechanism in these economies. Table 2 shows that, in the United Kingdom and Israel, the pass-through from a depreciation to inflation is incomplete: the average pass-through is estimated at 70 percent and 40 percent, respectively. Both studies also find evidence that the pass-through effect

Table 1. Main Monetary Policy Transmission Mechanisms in Six Countries

Country	*Interest rate*	*Credit*	*Asset prices*	*Exchange rate*	*Expectations*
Australia	Yes	No	No	Yes	No
Canada	Yes	No	No	Yes	Yes
Chile	Yes	Yes	No	Yes	No
United Kingdom	Yes	No	No	Yes	Yes
Israel	Yes	Yes	No	Yes	No
South Africa	Yes	No	No	Yes	No

Source: Papers in this volume by Cagliarini and Debelle, Longworth and O'Reilly, Cabrera and Lagos, Cunningham and Haldane, Leiderman and Bar-Or, and Aron and Muellbauer.

9. For a review of the importance of different transmission mechanisms in a broader sample of emerging economies, see Bank for International Settlements (1998).

Table 2. Estimated Pass-Through of a One Percentage Point Nominal Depreciation to Inflation

Country	*Average impact on inflation (percentage points)*	*Cyclical adjustment*
United Kingdom	+0.7	If output is 1% below (above) potential, pass-through falls (rises) by 0.2 percentage points
Israel	+0.4	If unemployment is 1% above (below) its average, pass-through falls (rises) by 0.1 percentage points

Source: Cunningham and Haldane, and Leiderman and Bar-Or, this volume.

is influenced by the economy's cyclical position: it is smaller in recessions, and larger in a boom, than in normal times.

2. Monetary Policy Rules: Positive Analysis

Monetary policy rules or reaction functions describe the response of policy instruments to deviations in key macroeconomic variables from levels the monetary authorities deem optimal. The study of monetary policy rules made a qualitative leap with the path-breaking work of Taylor (1993); in fact, the policy rules by which interest rates respond to output and inflation gaps are now known as "Taylor rules." Actually, many central banks throughout the world use a short-term interest rate as their policy instrument, and this is also true in most of the cases considered in this volume. Some exceptions are noted in the papers by Laurence Ball (New Zealand uses a monetary conditions index) and by Longworth and O'Reilly (Canada uses the difference between short- and long-term rates as its instrument).

Central banks typically respond to deviations, or gaps, in inflation and output from desired levels—these gaps are the two standard arguments in monetary reaction functions. Some central banks also react to a key open-economy variable, such as the exchange rate or the current account deficit, in setting policy. Another argument often included in policy rules is the lagged value of the interest rate itself, reflecting some degree of inertia in central bank behavior.

The time dimension of the variables included in the reaction function varies from central bank to central bank. In some cases only the current values of the gaps are included; in others their

lags or future projected levels, or both, are also considered.[10] The variables included in the reaction function do not necessarily correspond to the ultimate policy objectives. Depending on its economic model, the central bank may react to changes in other variables that affect its objectives. For example, even when the authorities' only objective is price stability, they may have to respond not only to inflation gaps but also to output gaps.[11]

Table 3 summarizes the estimates from the studies included here of the reaction coefficients associated with inflation gaps. The paper by Vittorio Corbo in this volume describes the monetary reaction functions in five Latin American countries and arrives at several findings. First, the difference between actual inflation and its policy target is a significant variable in the policy rules of all five countries; output gaps are also important arguments in the policy rules of most. Second, only in Chile does the central bank react "aggressively" to inflation deviations; that is, in Chile the implied nominal interest rate is adjusted more than proportionately to a change in inflation, whereas in other countries nominal interest rates rise less than proportionately with inflation gaps.[12] Third, there is mixed evidence regarding whether structural changes occur in central banks' reaction functions when they become independent. Finally, Latin American central banks exhibit considerable inertia in their policy instruments.

Among the other papers in this volume, Leiderman and Bar-Or show that the Bank of Israel follows a rule by which the policy interest rate responds to inflation gap projections and the lag in

10. Clark, Laxton, and Rose (2001) compare an interest rate policy rule that responds to contemporaneous inflation with an alternative rule that responds to the forecast of future inflation. They show, in the context of an empirical model for the United States that allows for asymmetries, that the forward-looking rule yields lower output volatility and a higher equilibrium output.

11. Most models of monetary transmission and policy rules assume that economic agents have full information about the central bank's policy rules. Tetlow and von zur Muehlen (2001) develop an empirically plausible model in which agents must learn the policy rule, and show that the real costs of learning may be substantial.

12. Benhabib, Schmitt-Grohé, and Uribe (2001a) dispute the notion that policy rules that respond to increases in inflation with a more than one-for-one increase in the nominal interest rate are stabilizing. They show that once the zero bound on nominal interest rates is taken into account, "the peril of (a stabilizing) Taylor rule" is that there exist an infinite number of equilibrium trajectories that converge to a liquidity trap, that is, a steady state in which the nominal interest rate is close to zero and inflation is possibly negative. In a separate paper, Benhabib, Schmitt-Grohé, and Uribe (2001b) show that Taylor-type policy rules induce aggregate instability by generating multiple equilibria. Moreover, active monetary policy can give rise to multiple equilibria, whereas passive monetary policy renders the equilibrium unique.

Table 3. Estimates of the Inflation Coefficient in Nominal Interest Rate Reaction Functions, Selected Countries and Periods

Country	*Study*	*Estimation period*	*Estimated coefficient*
Canada	Longworth and O'Reilly	Calibrated model	1.65
Chile	Cabrera and Lagos	1986-96	1.10-1.14
	Corbo	1985-90	1.20
		1990-99	1.21
Colombia	Corbo	1985-90	0.41
		1991-98	0.50
Costa Rica	Corbo	1990-98	0.69
		1990-95	0.67
El Salvador	Corbo	1992-98	0.40
		1994-98	0.46
Israel	Leiderman and Bar-Or	1994-99	0.90
Peru	Corbo	1993-98	0.80
South Africa	Aron and Muellbauer	1986-97	0.20
United Kingdom	Cunningham and Haldane	Calibrated model	1.00
United States	Taylor (1993)	1987-92	1.50

Source: Papers in this volume; Taylor (1993).

output. The central bank appears to adjust to, rather than oppose, inflation increases; that is, the Bank of Israel raises the policy rate less than proportionately in reaction to inflation shocks. Aron and Muellbauer apply the framework of basic reaction functions to South Africa. They also control for elements of importance to open economies, including the world interest rate and a measure of international financial liberalization, and find that these factors are relevant to the South African central bank's reaction function.

The high degree of inertia in policy rules that characterizes most central banks' reaction functions is addressed in several of the papers. Ball suggests that policy inertia is the result of political economy considerations: central banks wish to maximize their credibility by keeping policies stable and systematic. Debelle and Cagliarini show that in Australia's case the inertia in the policy instrument is due to uncertainty about the economy's reaction to changes in the interest rate. When central banks are unsure of the impact of their policies, they tend to resist changes in their current policy stance. More generally, Juan Pablo Medina and Rodrigo Valdés, in the first of

their two papers in this volume, rationalize policy inertia in their theoretical model by including interest rate volatility as a negative argument in the central bank's objective function.

In their cross-country study in this volume, Stephen Cecchetti and Michael Ehrmann find that central banks that have adopted explicit inflation targets have evolved from being less averse to inflation before adopting the target to more averse than otherwise similar countries without inflation targets.[13] In fact, these authors estimate that eight of the nine inflation-targeting countries they study have become more hawkish: that is, their reaction functions feature significantly larger coefficients on the inflation gap.[14] Cecchetti and Ehrmann also conclude that countries that use this monetary policy framework have been able to reduce significantly both the level and the volatility of inflation compared with a control group of countries. On the other hand, these authors also find that output volatility is greater in countries with inflation targets than in countries without them. This raises the question as to whether policy actions can somehow soften the trade-off between output variability and inflation variability. Using Canada as an example, Longworth and O'Reilly make the case that credibility gained by the central bank in the pursuit of its objectives can result in a less pronounced sacrifice in terms of output volatility for a given reduction in inflation volatility.

According to Cecchetti and Ehrmann, Chile is one of the inflation-targeting countries with a stronger reaction to inflation surges, having become gradually more averse to inflation throughout the past decade. This finding for Chile is consistent with Corbo's results, which show that the relative coefficient on inflation variability in the monetary reaction function has become larger since the central bank became independent in 1990.

3. Monetary Policy Rules: Normative Analysis

The conceptual framework guiding the debate on normative aspects of monetary policy rules has been established by the "new

13. Increasing aversion toward inflation is not a unique feature of inflation-targeting central banks. For example, as Clarida, Galí, and Gertler (2000) show, U.S. interest rate policy in the Volcker-Greenspan period appears to have been much more sensitive to changes in expected inflation than in the pre-Volcker period.

14. The nine countries are Australia, Canada, Chile, Finland, Israel, New Zealand, Spain, Sweden, and the United Kingdom.

normative macroeconomics," as discussed in the paper by Taylor in this volume. According to this framework, policy rules are analyzed in reference to a process of objective optimization carried out by the monetary authorities. Following this approach, some of the papers included in this volume address, first, which monetary rules are most efficient at achieving the monetary authority's objectives and, second, what is the optimal policy response from a social welfare perspective.

Taylor compares the performance, in terms of macroeconomic stability, of model-specific optimal rules with that of simple rules under a variety of models and transmission mechanisms. He concludes that simple rules in which the policy instrument responds solely to deviations in output and inflation (Taylor rules) perform well under several *different* transmission mechanisms. For example, even when the transmission channel via the exchange rate is strong, simple rules perform very similarly to model-specific optimal rules that include reactions to deviations in the exchange rate. Taylor warns that, unlike simple rules, complex rules—those that include reactions to economic variables over and above inflation and output, or establish dynamic specifications within their reactions—can have disappointing results, depending on the economy's transmission channel. Since these optimal complex rules are model specific, a different characterization of the economy can render the complex rules far inferior to simple rules.

Using a theoretical model, the paper by Charles Carlstrom and Timothy Fuerst in this volume arrives at a conclusion similar to Taylor's. These authors also conclude that when central banks use rules based on future expectations of inflation, prices and monetary aggregates may become indeterminate (that is, the nominal anchor is lost); this does not occur when rules are based on current and past inflation gaps with respect to the target rate.

Another group of issues that can be analyzed from a normative viewpoint deals with rules for open economies. In their case study of the United Kingdom, Cunningham and Haldane quantify the optimal horizon for the central bank's future planning, that is, how far into the future inflation rates are noticeably affected by the monetary authorities' reaction. They argue that, in an economy where the pass-through from currency depreciation to domestic inflation is complete, the optimal planning horizon ranges between two and four quarters. In addition, in economies where the amount of pass-through varies with the business cycle, the optimal reaction should consider even shorter periods.

Working in a small, open economy setting, Medina and Valdés, in their paper described previously, derive optimal rules for various preferences on the part of the monetary authorities. They conclude that, if the current account balance is one of the objectives of monetary policy—as seems to have been the case for the Central Bank of Chile in the early 1990s—the optimal reaction function is similar even among central banks with varying degrees of inflation aversion. In addition, if the central bank is averse to current account deficits and not (or is averse to a lesser degree) to surpluses, it will respond more aggressively to inflation gaps than in the previous case.

Also focusing on open economies, Ball analyzes the case where the central bank prefers to fix its policy instrument for long periods. In particular, Ball compares rules that fix the interest rate with those that set a monetary conditions index (that is, a combination of the interest rate and exchange rate depreciation). His main conclusion is that setting the interest rate is optimal when the economy suffers mainly from real shocks to demand for its exports, whereas the monetary conditions index is superior when the economy is affected by international financial shocks.

In their second paper in this volume, Medina and Valdés study optimal monetary policy rules under inflation range targeting (sometimes called zone targeting). They compare the reaction rules that result when the central bank targets a single point, when it establishes a zone with "hard edges" (that is, when the central bank's loss function gives a large weight to inflation deviations beyond the range), and when the zone has "soft edges." They find that inflation range targeting produces a less aggressive optimal monetary policy than point targeting. However, optimal policy under range targeting is virtually never inactive and depends on how "hard" the edges are. Monetary policy behaves in a preemptive way: given that the probability of keeping inflation within the range is maximum when inflation is at the middle of the range, policy interest rates would always react when inflation is not at the center of the range.

Finally, this volume presents some findings regarding the relationship between fiscal and monetary policies. The paper by Herman Bennett and Norman Loayza argues that when monetary and fiscal authorities have different preferences for output and inflation gaps and conduct their policies without coordination, the policy reactions of each can become more radical. Combining a game-theoretical model with empirical evidence for industrialized countries, Bennett and Loayza find that if the central bank has a greater preference for inflation

control while the government cares more about unemployment reduction, public sector deficits (the government's instrument) and interest rates (the central bank's instrument) will both be biased upward. They conclude that, without prejudice to the gains associated with central bank independence, there are potential benefits to generating institutional incentives that permit coordination between monetary and fiscal authorities. They stress, however, that this process should not involve reducing the priority attached to inflation in the central bank's objective function.

4. Conclusions and Policy Implications

This volume presents original research on monetary policy rules and transmission mechanisms. The contributing authors take a variety of approaches in addressing these issues, from country studies to cross-country empirical analysis, and from theoretical models to historical narrative. Although the papers do not provide definitive answers to the questions of optimality and efficiency of monetary policy, they do produce relevant results that have policy implications.

Little is yet known about the empirical importance of different monetary policy transmission mechanisms. This is generally due to the lack of an all-encompassing macroeconomic model as well as to complexities derived from uncertainty, structural change, asymmetries, and nonlinearities in the response of an economy to changes in policy instruments. Nonetheless, this volume provides some evidence that the traditional mechanism, based on the direct impact of interest rates on aggregate demand, output, and inflation, remains the most relevant. The exchange rate channel is also found to be important—although not dominant—in open economies. Depreciations are not passed through fully to domestic inflation; rather, pass-through coefficients are found to range between 40 and 70 percent and are lower during recessions than during expansions. Finally, in countries with credible inflation targeting regimes, the expectations channel may be important in reinforcing the monetary authorities' intended policies, because economic agents know that the central bank's commitment to its target strongly influences the current and future policy stance.

Simple Taylor rules—rules consisting of the reaction of the monetary policy instrument to deviations from target inflation and potential

output—generally describe central bankers' behavior well. From a normative perspective, these rules perform robustly—and in many cases adequately—under different transmission mechanisms. That is, Taylor rules generate a similar level of macroeconomic stability under different monetary policy transmission scenarios. Moreover, simple rules seem to provide results similar to those of more model-specific complex rules, particularly when the exchange rate channel is important.

Finally, regarding the general framework of monetary policy, there is evidence that countries with explicit inflation targets have achieved inflation rates that are lower and less volatile than in countries without them; however, output in these inflation-targeting countries is somewhat more volatile than in nontargeting countries. In countries where the central bank becomes more credible in the pursuit of its objectives over time, a reduction in the volatility of inflation may be achieved at a lower cost in terms of output volatility.

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