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Scope of Development Macroeconomics

Developing and transition economies—including those, like South Korea, which are now classified as developed—now account for more than half of world output (evaluated at purchasing power parity exchange rates), and the great majority of the countries monitored by the International Monetary Fund belong to the developing world. Thus, not only does most of the world's production take place in developing countries, country-specific macroeconomic policy formulation is usually carried out in a developing-country context.

Despite this, much of modern macroeconomics has been developed to address circumstances and issues that arise in the context of industrial nations. The extent to which the analytical tools and models appropriate for the analysis of industrial-country macroeconomic problems are able to offer guidance for the formulation and conduct of macroeconomic policy in developing nations is thus an important issue for economists and policymakers alike.

The title of this book suggests that there is something intrinsically different about macroeconomics in developing nations. If the standard textbook treatment of macroeconomics developed for industrial countries were adequate to deal with macroeconomic phenomena in the developing world, there would be little justification for "development" macroeconomics. The title also suggests that macroeconomic phenomena in individual developing countries are sufficiently similar that it is meaningful to speak of a "development macroeconomics" rather than the macroeconomics of, say, Brazil, Cameroon, or Nepal. We are aware that both implications are problematic: many economists would subscribe to the notion that the standard tools and models of macroeconomics can be used in developing nations, and others would argue that Brazil, Cameroon, and Nepal have so little in common that the very notion of a "development" macroeconomics lacks meaning.

These views are sufficiently compelling that the burden of proof falls on us. The view that development macroeconomics is distinctive may sound suspiciously like an old and discredited claim from the 1960s that modern neoclassical (micro) economics is not relevant to developing countries, because these countries are somehow "different" in unspecified ways or because these "traditional" societies are populated by nonoptimizing—and nonrational—economic agents. The perspective adopted in this book should not be confused with that view. We do not believe that economic agents in developing countries behave differently from those in industrial economies in ways that are inconsistent with the rational optimizing principles of neoclassical microeconomics: rather, we believe that they behave similarly to their industrial-country counterparts, but operate in a different environment. Our perspective

is that the standard analytical tools of modern macroeconomics are indeed of as much relevance to developing countries as they are to industrial countries, but that different models are needed to analyze familiar issues.

This is so because "structural" differences between developing and industrial nations make many popular industrial-country macroeconomic phenomena. The word "structural" is in quotes because we do not want to suggest that the characteristics that we have in mind are unchanging and not amenable to reform. But they are given at a moment in time, and thus have to be taken into account by macroeconomists who focus on such countries. These differences in macroeconomic environment can be identified explicitly. Moreover, the structural features that distinguish developing from industrial economies are sufficiently widespread throughout the developing world that it is indeed meaningful to speak of a distinct family of "development" macroeconomic models. The task of development macroeconomics is to uncover the implications of these differences in macroeconomic structure for macroeconomic behavior and policy.

In addition to differences in structure, a number of specific macroeconomic issues that have concerned economists and policymakers in developing nations have not been of similar importance in the industrial world. Again, these issues have not been specific to single countries, but have come up in different developing nations at various times, and have therefore been of widespread interest in the developing world. In short, not only the nature of the models used, but also the purposes to which they have been applied, distinguish macroeconomics in developing countries from that in industrial countries.

Having said this, we would not wish to overstate our case. Good macroeconomics in any environment takes into account the institutional framework in which an economy operates. Economists who work mainly with industrial countries are familiar with the implications that different wage-setting mechanisms, budgetary institutions, exchange-rate and monetary policy regimes, as well as financial sector structures, can have for macroeconomic analysis. Our claim is simply that there are systematic differences in phenomena of these types between industrial and developing countries, and that there are enough similarities regarding such phenomena among developing countries themselves that it is useful to attempt to provide a unified treatment of macroeconomic issues in such countries.

In this chapter we shall attempt to lay the groundwork for the perspective to be adopted in this book by presenting an overview of important macroeconomic characteristics that are broadly shared among developing nations but that do not usually figure prominently in mainstream industrial-country macroeconomic models. We will then identify several issues that have been of particular interest in the developing-country context over the past two decades. Before doing so, however, we will describe some antecedents.

1 | Historical Background

The relevance of industrial-country macroeconomic analysis to developing nations has been the subject of debate for some time, particularly in Latin America, where the contending views have been dubbed "monetarist" or "orthodox" on the one hand and "structuralist" on the other. The former are associated with the perspective that mainstream macroeconomic orthodoxy is directly applicable to both long- and short-run macroeconomic issues in developing countries. In particular, the monetarist school takes the view that long-run growth in developing countries is hampered by dirigiste policies that distort the allocation of resources. The long-run policy prescription is that growth can be promoted by giving full scope to market mechanisms via free trade and noninterventionist domestic policies. In the short run, the high inflation and balance-of-payments deficits that have often afflicted developing countries reflect excessive money growth fueled by large fiscal deficits.¹ The cure is orthodox medicine—tight fiscal policy coupled with "getting prices right," usually by devaluing and raising domestic interest rates. The orthodox view is often associated with Harberger (1963) and Sjastad (1983). Its policy prescriptions lay behind the approach to macroeconomic adjustment followed by the "Chicago Boys" in Chile during the 1970s, as well as the Southern Cone stabilization programs of the late 1970s. More broadly, policies loosely based on this set of views have long been promoted by international financial institutions, both in Latin America and elsewhere in the developing world.

The inception of the structuralist school is associated with work done for the Economic Commission on Latin America by Raúl Prebisch early in the postwar period.² An important tenet of the early structuralist school was that, due to lower income elasticities of demand for raw materials than for industrial goods, the primary-exporting countries in the developing-world "periphery" would face secularly deteriorating terms of trade relative to the manufactured goods-exporting industrial-nation "center." The central policy recommendation for long-run growth that emerged from this prognosis was that production specialization along classical comparative advantage lines was to be avoided. Policy intervention was required to change the structure of production in the periphery. Industrialization should be promoted in developing nations by protecting indigenous "infant industry" against competition from the "center" through the use of trade barriers and foreign exchange controls, as well as by providing special advantages to the industrial sector in the form of cheap imported inputs (secured through an overvalued exchange rate), cheap credit, and cheap labor (promoted by turning the internal terms of trade against agriculture). This "import substitution" strategy was

¹ Actually, although high inflation has been more prevalent in developing nations than among industrial countries, it has been much more common in Latin America than in other parts of the developing world.

² See Kay (1989) for a discussion of the historical background of the structuralist school.

adopted widely in the immediate postwar period not only in Latin America, but elsewhere in the developing world (see Cardoso and Helwegge, 1992).

More recently, economists writing in the structuralist tradition have turned their attention to short-run macroeconomic stabilization. The best-known proponent of this "new structuralist" view of short-run development macroeconomics is Lance Taylor (1979, 1983, 1991). He identifies the "new structuralist" view with a number of general hypotheses about development macroeconomics. These include the recognition that

- many agents possess significant market power;
- macroeconomic causality in developing countries tends to run from "injections" such as investment, exports, and government spending, to "leakages" such as imports and saving;
- money is often endogenous;
- the structure of the financial system can affect macroeconomic outcomes in important ways; and
- imported intermediate and capital goods, as well as direct complementarity between public and private investment, are empirically important.³

New structuralists question the wisdom and efficacy of orthodox short-run macroeconomic policy prescriptions, particularly "shock treatment" in the form of fiscal austerity coupled with devaluation and tight monetary policy. Their diagnosis of the source of inflation attributes an accommodative, rather than a causal role to money growth. The source of inflation is slow relative productivity growth in agriculture (arising from poor land-tenure patterns) combined with administered prices (arising from noncompetitive market structures and implying downward price rigidity) in industry, together with wage indexation (see Chapter 12). Monetary policy is perceived to be passive in the face of these underlying inflationary forces.

Moreover, in part because of the roles of working capital and imported inputs, and in part because substitution possibilities are more limited than assumed by the proponents of orthodox macroeconomic management, a policy package combining devaluation with tight fiscal and monetary policies will result in stagflation in the short run, with little or no improvement in the external accounts. The alternative new structuralist policy prescription is not always clear, but it would in all likelihood contain a greater element of gradualism, direct intervention, and emphasis on the medium-term resolution of structural problems than is contained in traditional stabilization programs.

The perspective adopted here draws, in effect, from both monetarist and structuralist analyses. Both approaches yield useful insights, and we believe that macroeconomic reality in the developing world indeed combines features

³ A similar list of common characteristics of structuralist models is offered by Lusig (1992).

of both. Moreover, the central role of the fiscal deficit in fueling money creation and thus high steady-state inflation commands a wide consensus among contemporary macroeconomists. These are central tenets of "monetarist" orthodoxy. Nevertheless, agreement on these issues does not preclude accepting a number of points made by the new structuralists. For example, although inflation may be attributable to high fiscal deficits, the *persistence* of large public deficits itself needs to be explained, and the explanation may feature an important role for the continuing struggle over distributive shares emphasized by new structuralists.⁴

More important, perhaps, the preceding comments pertain to long-run properties of the economy. In the framing of short-run macroeconomic policy, which has been the bread and butter of industrial-country macroeconomics since Keynes, structural features of the economy, as well as of the policy environment, come into their own. As is well known, the dynamics of macroeconomic adjustment to changes in any given set of policies will invariably depend on structural features of the economy, on initial conditions, as well as on the nature of the other policies pursued contemporaneously. In this sense, it becomes important to identify the macroeconomic characteristics of developing countries that are likely to govern the response of their economies to macroeconomic shocks and that must therefore figure prominently in macroeconomic models designed to be applied in a developing-country setting.

2 | Economic Structure and Macroeconomics

What, then, are the macroeconomic features that tend to define development macroeconomics? The structural characteristics that differentiate a "representative" developing economy from the textbook industrial-country model cover a wide spectrum, spanning most of the standard components of a macroeconomic model. Many of these features are not shared by all developing countries, and some may be found among industrial countries too. Nevertheless, we will provide evidence in this section that the features described below—all of which can be readily recognized as affecting macroeconomic behavior—systematically differentiate developing countries as a *group* from the standard textbook representation of an industrial-country economy. They include the nature of openness to trade with the rest of the world in both commodities and assets, the nature of financial markets, the characteristics of fiscal institutions and the government budget, the properties of the economy's supply function, the degree of income inequality, the stability of policy regimes, and the degree of macroeconomic volatility.

⁴The role of distributional conflict in fostering macroeconomic instability has indeed been emphasized in the growth literature. See, for instance, Persson and Tabellini (1994).

2.1 | Openness to Trade in Goods and Assets

1. *Developing economies, like small industrial countries, tend to be much more open to trade in goods and services than are the major industrial countries.*

A standard measure of openness is the trade share, that is, the sum of the shares of exports and imports in GDP. By this measure, developing nations tend to be substantially more open than the major industrial countries.⁵ Openness to this extent, of course, limits at the outset the applicability of the closed-economy textbook industrial-country model to the developing-country context. Very few developing nations can even approximately be described as closed economies by this measure.

2. *Developing countries typically have little control over the prices of the goods they export and import—that is, they typically face exogenous terms-of-trade.*

This characteristic tends to distinguish developing countries even from small industrial countries. The exogeneity of the terms of trade for developing economies is suggested both by their small share in the world economy and by the composition of their exports.

Very few developing countries account for a significant portion of the world market even for the commodities in which their exports are heavily specialized. Moreover, various studies confirm that, with limited exceptions for particular goods, these countries continue to have limited individual influence over the prices at which they buy and sell. Exogenous terms of trade call into question the usefulness, for the analysis of many macroeconomic policy issues in developing nations, of the open-economy model that continues to be widely used in the industrial-country context, the Mundell-Fleming model. This model assumes endogenous terms-of-trade determination, with the domestic economy completely specialized in the production of a good over which it exerts significant market power. Instead, the production structure most suitable for the analysis of developing-country macroeconomic phenomena is likely to be the Salter-Swan "dependent economy" model or (given that terms-of-trade changes tend to be very important for such countries) a three-good model consisting of exportables, importables, and nontraded goods. Such a production structure permits a distinction to be drawn between the exogenous terms of trade and an endogenous real exchange rate, which is the central intratemporal macroeconomic relative price in these economies.

The importance for many developing nations of primary-commodity exports with exogenously determined prices accounts for an important source

⁵This group consists of the major industrial countries. Its members are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. It should be noted that the degree of openness of the smaller industrial countries (such as Belgium) is typically much higher.

of macroeconomic instability in these countries. Prices of primary commodities tend to fluctuate quite sharply. Consequently, developing countries have faced highly unstable terms of trade at various times over the past two decades, with large asymmetric effects; for instance, in a study of the behavior of the real prices of thirty-six world commodities over the period 1957-1999, Cashin, McDermott, and Scott (2002) found that price slumps typically last a lot longer than price booms.⁶ Episodes of drastic changes in the terms of trade for these countries have often been dominated by changes in oil prices, but at times nonfuel commodities also undergo sharp fluctuations in price. Coupled with the relatively large share of exports and imports in domestic economic activity, such fluctuations in export prices represent substantial exogenous changes in national income from one year to the next, and constitute an important source of macroeconomic volatility for such countries.

3. *The extent of external trade in assets has tended to be more limited in developing than in industrial countries, though this situation has recently begun to change in dramatic fashion for an important group of developing economies.*

Perfect capital mobility is often used as the standard textbook assumption for industrial countries. In developing countries, capital controls have long been the rule, and although their effectiveness is questioned, the degree of capital mobility that characterizes economies that frequently retain such restrictions remains far less than is assumed in textbook industrial-country models. Thus, unlike standard macroeconomic modeling for industrial countries, in the developing-country case the assumption of perfect capital mobility is generally inappropriate. Evidence on this issue is discussed in Chapter 14 and used in Chapters 7 and 12 to formulate appropriate models of the monetary transmission process and for the analysis of stabilization policies in developing countries.

At the same time, increased financial integration has occurred in the context of immature domestic financial systems, limited policy flexibility, and weak credibility. This situation has given rise to large capital flows, described in the next section and considered in Chapter 14.

4. *Greater integration with international financial markets exposes many middle-income countries to abrupt reversals in capital flows, which may exacerbate macroeconomic volatility.*

For many developing countries, a large stock of gross external debt presents important macroeconomic challenges, regarding most notably the

⁶There is, however, continuous debate on whether there has been a secular deterioration in primary-commodity prices relative to prices of manufactured goods—the so-called Prebisch-Singer thesis. For alternative views on this issue, see Bleaney and Greenaway (1993b), Cuddington (1992), and Reinhart and Wickham (1994).

allocation of public expenditure. Among highly indebted low-income countries, the problem emerged essentially because the domestic sector that held the external assets (generally the private sector) was not the same as the sector that held the external liabilities (the government). But among countries that have recently become integrated with international capital markets, on the other hand, external debt has tended to be incurred by the private sector. In this context, the policy challenges involve coping with potential macroeconomic overheating associated with a sudden inflow of capital, as well as with vulnerability to macroeconomic volatility induced by abrupt reversals in capital flows. As suggested by Caballero (2000), possible factors behind the high degree of volatility experienced by many middle-income developing countries are greater, but still weak, links with international financial markets (which limit the ability to borrow and lend to smooth shocks) and insufficiently developed domestic financial systems (which limit the speed of resource reallocation following an adverse shock and may magnify contractions in output).

2.2 | Exchange-Rate Management

In contrast to the major industrial countries, the vast majority of developing countries have neither adopted fully flexible exchange rates nor joined monetary unions.

Industrial countries are typically modeled either as operating flexible exchange rates or as members of a currency union, whereas in developing countries, officially determined rates, adjusted by a variety of alternative rules (loosely referred to as "managed" rates), predominate. A brief description of the nature of exchange-rate regimes in individual developing countries is presented in Chapter 9. Exchange-rate regimes in developing countries have evolved toward greater flexibility, since the collapse of the Bretton Woods system in 1973. However, in practice this has meant either more frequent adjustments of an officially determined parity or the adoption of market-determined exchange rates with extensive official intervention. The prevalence of intermediate exchange-rate regimes implies that issues relating to the macroeconomic consequences of pegging, of altering the peg (typically in the form of a devaluation), and of rules for moving the peg are of particular importance in developing countries. These issues are discussed in Chapters 9 and 10.

2.3 | Domestic Financial Markets

Financial systems in many developing nations have been the subject of extensive deregulation in recent years. However, they continue to be dominated by banks. They also remain fragile and often exacerbate macroeconomic and financial volatility.

Although several developing countries have recently developed very large equity markets, such markets (as well as secondary markets for securities)

continue to be small or nonexistent in many of them. Financial markets in the vast majority of developing economies continue to be dominated by a single type of institution—the commercial bank. Thus, the menu of assets available to private savers is limited. Moreover, even where equity markets have developed, they tend to be dominated by a few closely held firms and exhibit very low turnover ratios.

The commercial banking sector in developing countries has traditionally been heavily regulated; it has often been subjected to high reserve and liquidity ratios as well as legal ceilings on interest rates together with sectoral credit allocation quotas. In recent years, however, many countries have taken steps to deregulate their financial markets, resulting in enhanced competition, greater access to foreign banks, and improved efficiency. Rather than being legally imposed, as before, credit rationing in the developing world tends now to be endogenously generated by information asymmetries, as is commonly taken to be the case in industrial countries.

Nevertheless, the financial system remains, in many countries, poorly developed. In spite of the more limited range of financial assets available to savers in developing nations, monetization ratios (as measured by the ratio of a monetary aggregate to nominal GDP) are generally lower for such countries than for industrial countries. In large part because of the nature of the financial system, but also because of some of the other features mentioned previously, the specification of standard textbook macroeconomic behavioral relationships (decision rules) may need to be modified in the developing-country context. In particular, it becomes necessary to incorporate the implications of credit rationing in private decision rules when such rationing is present. This affects, for instance, private consumption, investment, and asset demand functions. The incorporation of these phenomena has been treated in different ways—by including, for instance, quantity constraints in consumption and investment equations. These issues are taken up in Chapter 3.

Another issue relates to the fact that the institutional prerequisites for successful liberalization—in the form of appropriate regulatory and supervisory mechanisms—have frequently not been in place, resulting in enhanced macroeconomic instability and severe crises involving interactions between the balance of payments and the financial system. As discussed in Chapters 15 and 16, the weakness of the institutional framework in many developing countries has made both the frequency and depth of such crises much more extensive in such countries than in industrial countries.

2.4 | The Government Budget

7. The composition of the government budget differs markedly between industrial and developing countries.

In many developing nations, the state plays a pervasive role in the economy. This role is exercised through the activities of not just the nonfinancial

public sector (consisting of the central government, local governments, specialized agencies), and nonfinancial public enterprises), but also of financial institutions owned by the government. Regarding the nonfinancial public sector itself, the government tends to play a more active role in production than is the case in most industrial nations, and the performance of public sector enterprises is often central in determining the fiscal stance.

Unfortunately, systematic data on the size and performance of the consolidated nonfinancial public sector are not available for a large number of developing countries. Published information tends to refer to the finances of the central government only. Even so, existing studies suggest that the central government absorbs a smaller fraction of output in developing than in industrial countries, and that the composition of spending differs between the two groups of countries. Developing nations devote a substantially larger fraction of expenditures to general public services, defense, education, and other economic services (reflecting the role of government in production) than do industrial nations, whereas the latter spend somewhat more on health and substantially more on social security.

As for revenue, the main source of central government revenue is taxation, but the share of nontax revenue in total revenue tends to be much higher in developing than in industrial countries. The collection of tax revenue and developing countries is often hindered by limited administrative capacity and political constraints (Bird and Zolt, 2005). One consequence of this is that direct taxation plays a much more limited role in developing than in industrial nations; as noted by Bird and Zolt (2005), the tax structure in most developing countries is dominated by taxes on consumption, whereas in industrial countries, income taxes account for the largest share and taxes on foreign trade are negligible. Of direct taxes, the share of tax revenue raised from individual incomes (which often amount to withholding taxes on labor income in the formal sector) tends to be much larger than that from corporations in the developing world, whereas the reverse is true in the industrial world. In part, this is the result of high collection costs on capital income. Trade taxes consist primarily of import rather than export duties in developing countries and are used more extensively in the poorest countries.

The political and administrative constraints on tax collection in developing nations, coupled with the limited scope for the issuance of domestic debt in many such countries, has led to greater reliance on seigniorage, and therefore to higher levels of inflation (on average), than in industrial countries. With few exceptions, industrial countries tend to raise fairly low amounts (less than 1 percent of GDP) of seigniorage revenue, whereas many developing countries have traditionally collected significant amounts in this fashion. As a result, inflation rates in developing countries tend to be higher than those that prevail in the industrial world.

The macroeconomic implications of budget institutions—the set of rules and procedures by which government budgets are prepared, revised, and

approved by the legislature—has attracted renewed interest, particularly in Latin America (see Grisanti, Stein, and Talvi, 1998; and Agénor and Yilmaz, 2006). Three dimensions, in particular, have been much discussed: (a) the nature (and credibility effects) of the constitutional rules that can be implemented to impose constraints on the size of the fiscal deficit, such as balanced-budget rules; (b) the procedural rules that guide the elaboration of the budget by the executive branch, its approval by the legislative branch, and its execution; (c) the type of rules (whether “collegial” or “hierarchical”) that may enhance the transparency of the budgetary process, and the implications of alternative fiscal rules for growth. It has been argued, for instance, that in a volatile environment asymmetric balanced-budget rules (which prevent borrowing in “bad” times but impose no saving in “good” ones) may be overly restrictive—possibly forcing a procyclical reaction to adverse economic shocks. By contrast, imposing an upper limit on the debt-to-output ratio may be desirable, especially as a means to ensure fiscal sustainability (see Chapter 4). It has also been suggested that, in Latin America, better budgetary institutions are associated with lower fiscal deficits and stocks of public debt, but that at the same time high inflation and the volatility of economic activity have tended to reduce the ability of the budgetary process to impose fiscal discipline (Aizenman and Hausmann, 1995).

2.5 | Aggregate Supply and the Labor Market

8. *The large direct role that the state has played in production in many developing countries implies that the size and efficiency of the public capital stock figures prominently in the aggregate (or sectoral, under the three-good classification suggested earlier) production function(s).*

Nonfinancial public enterprises have been important economic actors in most of the developing world. Public capital represents a much larger share of the aggregate capital stock in such countries than in developed nations. Although reliable capital stock data are not available for such countries, existing data do indeed show that in many countries the public sector accounts for a sizable share of total investment. Given the important role that the public sector has played in the development process, the medium-term supply-side effects of government spending often cannot be ignored.

In recent years, the traditional role of the public sector as producer in developing countries has received new scrutiny, and several developing countries have undertaken massive privatizations of nonfinancial public enterprises. Because of the relatively large weight of public sector production in developing countries relative to that in industrial countries, the macroeconomic implications of such measures have been particularly important in the developing country context. Nonetheless, as of the time of writing, the share of public

sector assets that have been privatized remains relatively small in many developing countries, leaving a large share of production in public hands.

9. *Imported intermediate goods play an important role in the aggregate (or, under the three-good structure, sectoral) production function(s) in developing countries.*

Imported intermediate goods play a prominent role in economic activity in the developing world. Such goods account for a sizable fraction of all developing-country imports. In some countries the share of energy and non-energy intermediate imports can even exceed 70 percent. As a result, the difference between the value of domestic production and domestic value added tends to be larger in developing than in industrial nations. Through the cost of imported intermediates, the exchange rate has an important influence on the position of the economy's short-run supply curve. The role of imported intermediate goods means not only that exchange-rate changes will have short-run supply effects, but also that, in the presence of foreign exchange rationing, the availability of foreign exchange may have a direct effect on the position of the economy's short-run supply curve.

10. *Short-run supply functions in developing economies may be significantly affected by working-capital considerations.*

Because of the underdeveloped nature of the financial system, firms in many developing countries tend to rely on bank credit to finance their working-capital needs (labor costs and imported intermediate goods) prior to the sale of output. The existence of these needs implies that shocks to official interest rates and credit availability may play an important supply-side role in the short run; they imply, for instance, that a contractionary monetary policy may have short-run stagflationary consequences. This issue is discussed further in Chapter 7.

11. *Although labor market institutions vary substantially across developing countries, the informal sector continues to play an important role in the determination of wages and employment in many of them.*

The nature of short-run wage-setting behavior represents one of the key differences between the major schools of modern macroeconomics, but most participants in these disputes acknowledge that country-specific institutional differences (such as the prevalence of staggered overlapping contracts in the United States) or synchronized wage bargaining in Scandinavia) are important in determining the economy's short-run supply behavior. In this context, the role of economy-wide backward indexation mechanisms in the context of disinflation programs has received much attention. Despite the importance of

labor market institutions in wage formation, however, the (limited) empirical evidence available on wage-setting behavior in developing countries suggests that many of them are characterized by a high degree of real wage flexibility (Horton et al., 1994; Agénor, 2006b).

There is also increasing recognition of the macroeconomic role played by the informal urban sector, which can account for a sizable proportion (50–60 percent, and in some cases even more) of economic activity and total employment in developing countries, particularly in some parts of Asia, the Middle East, and Sub-Saharan Africa. A consequence of the formal–informal dualism is the segmentation of the urban labor market, which plays a crucial role in explanations of urban poverty, unemployment, and underemployment in developing countries.

2.6 | Stability of Policy Regimes

Overall, developing countries have tended to exhibit higher fiscal deficits, higher rates of inflation, and higher average growth rates than the major industrial countries. During the period 1999–2006, for instance, in advanced economies real GDP growth was on average 2.6 percent per annum, and inflation 2.0 percent, according to the International Monetary Fund. In developing countries, the average output growth rate was 6.4 percent per annum and inflation 6.2 percent. In addition, average inflation rates in all regions in the developing world continue to exceed those of the major industrial countries.⁷

High inflation has been a symptom of policy instability and has frequently been associated with policy uncertainty. In large parts of the developing world—particularly in Latin America and Africa—policy instability has been endemic. In part, this has been the result of indigenous factors. Political instability has characterized many developing countries from the time of their independence, and multiparty democracies with free elections remain rare. Changes in government not infrequently signal changes in ruling ideologies and correspondingly in economic policy regimes.

Policy uncertainty has been an important factor in the macroeconomics of development, in many instances triggering currency substitution, capital flight, exchange-rate crises, and the collapse of private investment. Uncertainty regarding the policy environment—or the anticipation of future policy reversals—is a feature that frequently must be built into developing-country macroeconomic models and the design of macroeconomic reform programs.

⁷ At the same time, average inflation has fallen considerably since the 1990s in all developing countries. During 1999–2006, inflation averaged 10.5 percent in Africa, 6.7 percent in the Middle East, and 7.0 percent in Latin America, compared to 28.2 percent, 11.4 percent, and 134.2 percent, respectively, during 1989–1998.

2.7 | Macroeconomic Volatility and Fluctuations

12. As a result of many of the phenomena described previously, the macroeconomic environment in developing countries is often much more volatile than that in industrial countries.

A critical feature of the macroeconomic environment in many developing countries is instability of macroeconomic outcomes. The roots of this macroeconomic instability are both external and internal. Volatility in the terms of trade and in international financial conditions are directly transmitted to small developing countries that are price takers in international markets both for goods and services as well as for financial assets. Coupled with the inflexibility of domestic macroeconomic instruments and political instability resulting in frequent and discrete changes in policy regimes in weak institutional settings, the macroeconomic experience of many developing countries has tended to be punctuated by a series of crises. These have had implications for a broad range of macroeconomic phenomena. Components of the government's budget, for instance, tend to be much less stable in developing countries than is typically the case in industrial countries. Instability has also characterized macroeconomic relative prices such as the terms of trade and real exchange rate. Most important, macroeconomic instability has resulted in unstable growth rates of real output as well as of private consumption. There is also evidence that macroeconomic volatility in some countries (particularly in Latin America) may have been compounded by a procyclical fiscal policy response—a tendency for government expenditure and fiscal deficits to increase during periods of economic expansion and to fall during recessions (Gavin and Perotti, 1997). Overall, boom and bust phenomena tend to be much more common in developing than in industrial countries; the higher degree of macroeconomic volatility that results from such phenomena are correspondingly more costly in the former group of countries. Indeed, using small calibrated models of archetypal economies with a single representative consumer, Pallage and Robe (2003) found that macroeconomic volatility may entail large welfare losses and that even if consumers are only moderately risk averse, eliminating these fluctuations altogether may be preferable, from a welfare perspective, to a permanent increase in consumption growth.

13. In part as a result of greater exposure to volatility, features of macroeconomic fluctuations in developing countries differ significantly from those characterizing industrial countries. In particular, supply-side and external shocks play a more prominent role.

A related issue is that the sources of macroeconomic fluctuations differ significantly between industrial and developing countries. Developing countries not only experience shocks that differ in type and amplitude from those experienced in industrial countries, but also the domestic macroeconomic

environment in which these shocks play themselves out tends to be quite different in the developing-country setting from what is typically assumed in industrial-country macroeconomic analysis. Thus, both the sources of macroeconomic shocks and their propagation mechanisms are likely to differ in the developing world.

Agénor, McDermott, and Prasad (2000) provide a systematic attempt to document a wide range of regularities in macroeconomic fluctuations for a group of 12 developing countries with diverse experiences with structural change and for which quarterly data of reasonable quality could be assembled (Colombia, Chile, India, Korea, Malaysia, Mexico, Morocco, Nigeria, the Philippines, Tunisia, Turkey, and Uruguay). The data they use cover a wide range of macroeconomic variables and include industrial output, prices, wages, various monetary aggregates, domestic private sector credit, fiscal variables, exchange rates, and trade variables. The relationship between economic fluctuations in these countries and two key indicators that proxy for economic activity in industrial countries—an index of industrial country output and a measure of the world real interest rate—are also examined.

To examine economic fluctuations at business cycle frequencies, it is necessary to decompose all macroeconomic series into nonstationary (trend) and stationary (cyclical) components, because certain empirical characterizations of the data, including cross-correlations, are valid only if the data are stationary. Agénor, McDermott, and Prasad (2000) use three alternative filters, to examine the robustness of their results: a modified version of the Hodrick-Prescott filter (see Hodrick and Prescott, 1997); the band-pass filter, developed by Baxter and King (1999) and extended by Christiano and Fitzgerald (2003); and a nonparametric detrending method.

In line with much of the literature, Agénor, McDermott, and Prasad (2000) measure the degree of comovement of a series y_t with industrial output x_t by the magnitude of the correlation coefficient $\rho(j)$, $j \in \{0, \pm 1, \pm 2, \dots\}$. These correlations are between the stationary components of y_t and x_t , with both components derived using the same filter. A series y_t is said to be procyclical, acyclical, or countercyclical, depending on whether the contemporaneous correlation coefficient $\rho(0)$ is positive, zero, or negative. In addition, the series y_t is said to be strongly contemporaneously correlated if $0.26 \leq |\rho(0)| < 1$, weakly contemporaneously correlated if $0.13 \leq |\rho(0)| < 0.26$, and contemporaneously uncorrelated with the cycle if $0 \leq |\rho(0)| < 0.13$.⁸

The cross-correlation coefficients $\rho(j)$, $j \in \{0, \pm 1, \pm 2, \dots\}$ indicate the phase-shift of y_t relative to the cycle in industrial output. Again, in line with the existing literature, y_t is said to lead the cycle by j period(s) if $|\rho(j)|$ is

maximum for a positive j , to be synchronous if $|\rho(j)|$ is maximum for $j = 0$, and to lag the cycle if $|\rho(j)|$ is maximum for a negative j .⁹ To establish which correlations are significantly different from zero, they use the following result, established by Kendall and Stuart (1967, pp. 292-93): the statistic $\ln[(1+\rho)/(1-\rho)]/2$, where ρ is the bivariate correlation coefficient between detrended output and detrended x_t , has an asymptotically normal distribution with a variance equal to $1/(T-3)$, where T is the number of observations. With 27 observations, for instance, this implies that positive correlations of 0.32 or larger are significantly different from zero at the 10 percent level, and 0.48 or greater are significant at the 1 percent level. Their main findings can be summarized as follows:

- Output volatility, as measured by standard deviations of the filtered cyclical component of industrial production, varies substantially across developing countries, but is on average much higher than the levels typically observed in industrial countries. This is consistent with the results in Neumeyer and Perti (2005).¹⁰ There is also considerable persistence (as measured by autocorrelation coefficients) in output fluctuations in developing countries.
- Activity in industrial countries has a positive but relatively weak influence on output in developing countries. Real interest rates in industrial countries tend to be positively associated with output fluctuations in developing countries; these results are consistent with those of Ahmed (2003), Neumeyer and Perti (2005), and Uribe and Yue (2006), regarding the impact of U.S. interest rates.
- Government expenditure is countercyclical. Government revenues are acyclical in some countries, and significantly countercyclical in others, a phenomenon that appears difficult to explain. The fiscal impulse (defined as the ratio of government spending to government revenue) is negatively correlated with the business cycle.
- The cyclical behavior of nominal wages varies markedly across countries and is not robust across filters. By contrast, the evidence strongly supports the assumption of procyclical real wages.
- There is no consistent relationship between the stationary components of the levels of output and prices, or the levels of output and inflation. Variations in the price level and inflation are countercyclical in a number of countries and procyclical in a few.

⁹ The pattern of lead-lag correlations and, in particular, the lag at which the peak positive correlation occurs, could be interpreted as indicating the speed with which innovations in variable y_t are transmitted to real activity x_t .

¹⁰ Pallege et al. (2006) estimate that the percentage volatility of per capita consumption in developing countries (excluding countries affected by civil wars) has typically been two to six times greater than in industrialized countries over the past three decades.

⁸ The approximate standard error of these correlation coefficients, computed under the null hypothesis that the true correlation coefficient is zero, and given the average number of observations per country in the sample, is about 0.13.

- Contemporaneous correlations between money (measured through various monetary aggregates) and output are broadly positive, but not very strong—in contrast to the evidence for many industrial countries.
 - The contemporaneous correlations between the velocity of broad money and industrial output are strongly negative across all filters for almost all the countries in our sample. This result is in contrast to the weakly procyclical behavior of velocity observed in most advanced industrial countries.
 - Domestic credit and industrial output are positively associated for some countries. However, the strength of the relationship between credit and output is not always robust to the choice of detrending procedure. In some countries, there is a negative correlation between these two variables.
 - There is no robust correlation between merchandise trade movements (as measured by the ratio of exports to imports) and output. For some countries, the contemporaneous correlations are negative (irrespective of the filter used), whereas for others the contemporaneous correlations are strongly positive—the latter result possibly indicating that industrial output fluctuations are driven by export demand and that merchandise imports are not as sensitive to domestic demand fluctuations as in industrial countries.
 - Cyclical movements in the terms of trade are strongly and positively correlated with output fluctuations.
 - There are no systematic patterns in the contemporaneous correlations between nominal effective exchange rates and industrial output; in addition, for a majority of the countries under study, these correlations are not significantly different from zero. Similar results are obtained for real effective exchange rates.
- These results highlight the importance of supply-side shocks in driving business cycles in developing countries. Of course, using cross-correlation coefficients as indicators for evaluating the empirical relevance of demand-oriented, versus supply-oriented, macroeconomic theories can be problematic.¹¹ The results are also not uniform across countries. In particular, whereas negative price-output correlations in some countries provide support for “real” or supply-side interpretations of business cycles, countries where price-output correlations are positive would tend to support “nominal” or demand-side interpretations.
- The above results are in line with those for a number of industrial countries and those obtained by Hoffmaister and Roldós (1997) for Asia

¹¹ More generally, covariation among a set of variables may depend not only on the nature of the shocks that perturb the economy, but also (under rational expectations) on how long the lag is between perception (announcement) and realization (implementation) of the shock.

and Latin America, and Hoffmaister, Roldós, and Wickham (1998) for Sub-Saharan Africa, which suggest that in developing countries the main source of output fluctuations are supply shocks—even in the short run. In addition, Hoffmaister and Roldós (1997) found that in Latin America external shocks—in particular, world interest rate shocks—and demand shocks affect output fluctuations more than in Asia, whereas Hoffmaister et al. (1998) found that external shocks—including changes in the terms of trade—tend to have a greater impact on output in CFA franc countries, compared to the rest of Sub-Saharan Africa. Similarly, Kose and Riezman (2001) estimate that terms-of-trade shocks account for almost half of the volatility in aggregate output in Sub-Saharan Africa—partly because a significant fraction of exports of countries in that region consists of a narrow range of primary commodities. Kalumina and Nyankye (2000) also found that for Cameroon, terms-of-trade shocks are the most important source of business cycle fluctuations. Shocks to relative prices of both imported capital goods and intermediate inputs may be even more important to explain the volatility of output in developing countries (Kose, 2002).¹²

2.8 | Income Inequality

14. *The degree of income inequality tends to be much higher in developing than industrial countries: Income inequality has important implications not only for growth and development, but also for short-run macroeconomic fluctuations.*

The high degree of inequality that characterizes the distribution of income in developing countries is well documented (see, for instance, Todaro and Smith, 2006), and much research on the economic effects of income inequality focuses on its implications for growth and long-term development. However, a highly unequal distribution of income may also have short-run macroeconomic implications. Countries characterized by high levels of income inequality tend to have a small and volatile tax base; this may translate into high volatility of (public) expenditure and output.

Alternatively, as argued by Iyigun and Owen (2004), the degree of income inequality can affect private consumption variability when the ability to obtain credit depends on income. Essentially, when income plays a role in access to credit, the distribution of income contains information about the fraction of individuals who are credit-constrained and cannot smooth consumption. If credit is so abundant that only the lower class is shut out of credit markets and unable to smooth consumption through downturns, greater inequality (a smaller middle class) is likely to be associated with more volatility in

¹² To our knowledge, Raddatz (2007) is the only study that departs from the consensus on the quantitative importance of external shocks in explaining output volatility in low-income countries.

consumption. In contrast, if the availability of credit is limited to such an extent that both the lower and middle classes are credit-constrained, a more unequal distribution of income is likely to result in smoother aggregate consumption. Put differently, when credit-constrained and -unconstrained individuals have different consumption smoothing abilities, the distribution of wealth and income can affect aggregate fluctuations because it determines the fraction of individuals who are borrowing constrained.

Using cross-country panel data for the period 1969–1992, Iyigun and Owen found that greater income inequality is associated with less consumption variability when per capita income is low. By contrast, when per capita income is high, greater income inequality is associated with higher consumption variability. Thus, the distribution of income affects the short-run variability of consumption differently in high- and low-income countries—possibly because financial development and availability of credit are positively associated with higher levels of per capita income, as discussed in Chapter 18.

3 | Some Special Topics

As mentioned in the introduction, over the past two decades economists and policymakers in developing nations have been concerned with a number of issues that have not received similar attention in industrial countries. These issues have been of particular importance in the developing world precisely because they have arisen from features of these economies such as those mentioned in this chapter, and some of them have already been discussed above. Although all of these will be considered in some detail later in the book, they are listed here to complete our overview of development macroeconomics.

• Stabilization of High Inflation

As indicated previously, high inflation has been more common in the developing world than in the industrial world over the past two decades. The developing world has also witnessed several alternative approaches to price-level stabilization, ranging from orthodox money-based programs relying on tight fiscal and monetary policies and exchange-rate policy geared to external balance, to “heterodox” programs based on tight aggregate demand policies supplemented by an exchange-rate freeze as well as some form of wage and price controls. The evaluation of this experience and its lessons for future stabilization efforts in the developing world and elsewhere have been important topics of research.

• Fiscal Rules and the Procyclicality of Fiscal Policy

There has been much debate in recent years on whether explicit fiscal frameworks may help to achieve and maintain fiscal discipline. Fiscal rules,

in particular, have taken the form of maintaining fixed targets for the deficit (variously defined) and/or public debt ratios to GDP. Such rules have been used in industrial and developing countries alike. A common criticism of standard deficit rules (including balanced-budget rules) is that they are inflexible (to the extent that they are defined irrespective of the cyclical position of the economy) and tend to be procyclical. Another criticism of deficit rules is that they discourage public investment. Some economists have advocated a “golden rule” approach to budgetary policy, whereby the focus is on maintaining a balance or surplus on the current fiscal account (that is, current revenues less current expenditures), with net capital expenditure financed from government savings and borrowing. A key issue relates to the implications of the golden rule for growth.

• Inflation Targeting and Monetary Policy Regimes

To achieve the goal of price stability, monetary policy in many countries was for a long time conducted by relying on intermediate targets such as monetary aggregates or exchange rates. During the 1990s, however, several industrial and developing countries have begun to focus directly on inflation itself. This new approach to the problem of controlling inflation through monetary policy is known as inflation targeting. It essentially makes inflation—rather than output or unemployment—the primary goal of monetary policy. The design and implementation of an inflation targeting regime are at the forefront of the policy agenda in many countries.

• Exchange-Rate Management

The macroeconomic effects of devaluation have been rather controversial in the developing-country context, although this topic has ceased to preoccupy industrial-country macroeconomists over the past two decades. Long-standing issues are the desirability of alternative exchange-rate regimes, and the “new structuralist” critique of the role of the exchange rate in orthodox stabilization. More recently, the macroeconomic consequences of alternative nominal exchange-rate rules and the role of the exchange rate as a nominal anchor in an open economy, including the role of exchange-rate bands in mitigating the trade-off between credibility and flexibility, have also been important policy issues.

• Benefits and Costs of Currency Unions

In recent years, there has been growing interest in developing countries in forming currency unions.¹³ Research on both industrial and developing

¹³ Ishiyama (1975) provided an early review of the literature. For a more recent discussion, see De Grauwe (2000).

countries has identified various criteria for participating in these unions, including similarity of inflation rates, the degree of factor mobility, the openness and size of the economy, the degree of commodity diversification, the degree of price and wage flexibility, the extent of integration in goods markets, the correlation between economic shocks across countries, the degree of fiscal integration, and the political will to integrate. However, joining a currency union also entails some costs, and understanding the nature of these costs is important from the perspective of macroeconomic management.

- *Managing Capital Flows*

The magnitude of capital inflows has in some cases severely complicated macroeconomic management. The causes of such inflows, their welfare implications, and appropriate policy responses have been the subject of much recent attention. We will discuss, in particular, the phenomenon of "sudden stops" and their implications for macroeconomic policy.

- *Financial Crises*

Although currency crises have afflicted both industrial and developing countries as capital mobility has increased, these events have been both more frequent and more severe in the latter group of countries. This issue remains at the forefront of the research agenda in development macroeconomics. The roles of self-fulfilling expectations and policymakers' preferences, the links between banking and currency crises, and the predictive content of various economic indicators, in particular, have generated a sizable literature in the past few years.

- *Financial-Sector Reforms*

In recent years, a large number of developing countries have undertaken wide-ranging reforms to their financial systems designed to enhance the role of financial intermediaries in channeling domestic saving, as well as to give the real economy a more outward orientation. The relationship between these reforms and macroeconomic stabilization has been a recurrent focus of attention.

- *The Functioning of Labor Markets*

The role of labor markets has received much attention in the development literature (particularly in the analysis of rural to urban migration) and more recently in the literature on trade and structural reform. Macroeconomists have also begun to appreciate the role that the various types of labor market structures observed in developing nations may play in the analysis of the transmission mechanism of policy shocks. Particularly important phenomena are the incidence of labor market segmentation, the role of government regulations

(in setting, for instance, the minimum wages for different categories of workers or in designing unemployment benefit schemes), and the low degree of labor mobility across sectors in the short run. In Chapter 5 we will examine the effects of macroeconomic policies on output, wages, and unemployment in a dynamic, general equilibrium model of a small, open developing economy with a large informal sector and segmented labor markets.

- *Public Capital and Growth*

The impact of public investment and public capital on growth has been the subject of much attention in recent academic research and policy debates. Much academic research (both empirical and analytical) has focused, in particular, on the effects of public infrastructure (see Agénor and Moreno-Bodson, 2007). It is now increasingly recognized that infrastructure generates externalities that go much beyond those typically emphasized in the early literature—notably with respect to education and health outcomes. We will examine some of these effects in the context of a new class of endogenous growth models.

- *Political Aspects of the Macroeconomy*

In all countries, political factors play a pervasive role in economic life. The recent literature in macroeconomics has recognized the need to take these factors into account in attempting to understand many macroeconomic phenomena, such as inflation inertia, the setting of policy instruments, and the sustainability of reform programs. The interactions between the political objectives of policymakers and the design of economic policy is critically important in developing countries undergoing macroeconomic reform and remains a major area of investigation.

The view that will be advocated in this book, then, is as follows: although economic agents in developing countries are no less likely to behave in neoclassical optimizing fashion than their industrial-country counterparts, and although the long-run determinants of growth and inflation are likely to be very similar in developing and in industrial economies (as emphasized by Latin American monetarists), structure matters, and it matters particularly for the issues of short-run stabilization that have long preoccupied macroeconomists. Developing economies share a number of features not often found in industrial-country macroeconomic models, so a somewhat different family of models is required for developing-country macroeconomic analysis. In addition, these features have given rise to a set of macroeconomic problems that are specific to developing countries and that have been of broad interest in the developing world. Both of these facts call for a specifically "development" macroeconomics.

under these circumstances, as demonstrated by both Israel and Mexico. The danger is that the program's short-run success will tempt policymakers to slide into populism by relaxing fiscal discipline while relying on wage and price controls for inflation abatement, as in Argentina and Brazil's heterodox programs. This path will quickly run into domestic capacity and foreign financing constraints, and is likely to leave the country in worse condition than before the attempted stabilization. Whether well-implemented heterodox adjustment can permanently avoid the output costs of stabilization is less obvious, and remains an issue under debate. Kiguel and Liviatan (1992a) and Végh (1992), for instance, have argued that exchange-rate-based stabilization programs, whether orthodox or heterodox, tend to avoid real output costs on impact (triggering instead a boom in private consumption), only to undergo a recession later.⁴⁰ While Kiguel and Liviatan base their view on observations of twelve exchange-rate-based stabilizations over three decades, they specifically cite two of the cases examined in this chapter—that of Chile during the Southern Cone stabilization of the late 1970s and the recent heterodox experience of Israel. This issue, which has become known as the “boom-recession” cycle associated with exchange-rate-based stabilization, is explored analytically in Chapter 13.

⁴⁰ Easterly (1995) has argued that money-based stabilization programs are also characterized by an early resumption of output. He uses, however, a different (and broader) definition of inflation stabilization—a movement from a situation in which annual rates of inflation are above 40 percent for two years or more, to one in which annual inflation rates drop below 40 percent for two years or more—which makes his results not strictly comparable with those of Kiguel and Liviatan (1992a) and Végh (1992). For a further discussion (and dissenting view) see Hamann (2001).

12 |

Inflation and Short-Run Dynamics

Since the monetarist-structuralist controversy of the early 1960s, the nature of the mechanisms underlying the dynamics of inflation has been the subject of a voluminous theoretical and empirical literature in developing countries. Key aspects of the debate in recent years have been the interactions—and the lack of consistency—between fiscal, monetary, and exchange-rate policies; structural factors (such as the degree of capital mobility and the existence of wage and price inertia); credibility problems; and the stance of expectations regarding future policies.

This chapter examines alternative models of the inflationary process and studies the short-run macroeconomic dynamics associated with monetary and exchange-rate policies. The first part begins by contrasting two models of inflation: the “orthodox” or “monetarist” model, which focuses on the interactions between fiscal deficits, money creation, and inflation; and the “new structuralist” model, which emphasizes the links between food bottlenecks, income distribution, and social conflicts over the determination of real wages. We then point out that although these models are traditionally viewed as competing explanations of the inflationary process, they can in fact be combined in a way that casts doubt on the policy prescriptions that would emerge from simple structuralist models. The second part of the chapter focuses on the short- and long-run effects of monetary and exchange-rate policy rules. It begins with a presentation of an optimizing one-good model with imperfect capital mobility, which is then extended to a two-sector, three-good framework. In addition to imperfect capital mobility, the extended model captures a number of structural features that have been shown in previous chapters to play an important macroeconomic role in the developing world (such as nominal wage rigidity and price-setting behavior) and thus provides a useful conceptual framework for the analysis of stabilization policies in developing countries.

1 | Models of the Inflationary Process

The “orthodox” view of the inflationary process holds that the primary cause of inflation in developing countries is the recourse to money creation by governments faced with limited borrowing options (both domestically and internationally) for financing large fiscal deficits. By contrast, new structuralists in the tradition of Cardoso (1981) and Taylor (1983, 1991) view inflation as resulting essentially from the worker-capitalist conflict over the distribution of income between real wages and profits.

We begin by presenting the orthodox view, highlighting the role of inflationary expectations and the potentially destabilizing role of fiscal rigidities. We follow by discussing the new structuralist approach to inflation. We then show how the two models can be merged, by introducing the government budget constraint in the new structuralist model. An analysis of the effect of food subsidies on the behavior of inflation in the integrated model highlights the potentially misleading predictions that may result from the omission of financing constraints in simple new structuralist models.¹

1.1 | Inflation, Money, and Fiscal Deficits

Consider a closed economy with exogenous output. Suppose that the demand for money function takes the Cagan semi-logarithmic form used in analyzing inflationary finance in Chapter 4:

$$m = \exp(-\alpha\pi^a), \quad \alpha > 0, \tag{1}$$

where $m \equiv M/P$, with M representing the base money stock and P the price level. The expected inflation rate is π^a . The government cannot issue bonds to the public and finances its primary budget deficit d entirely through seigniorage:

$$d = \dot{M}/P = \mu m, \tag{2}$$

where $\mu \equiv \dot{M}/M$. Combining (1) and (2) implies

$$d = \mu \exp(-\alpha\pi^a). \tag{3}$$

Equation (3) specifies how the primary fiscal deficit affects the equilibrium rate of growth of the money stock, and hence the equilibrium inflation rate. However, to the extent that the demand for real money balances is inversely related to the expected rate of inflation, the possibility of multiple solutions to (3) arises. As shown later, and in line with our discussion in Chapter 4, the existence of a "seigniorage Laffer curve" implies that there are two steady-state rates of inflation that generate any given amount of seigniorage.

Equation (3) is plotted in Figure 12.1, which is adapted from Bruno and Fischer (1990). Curve D depicts the combinations of μ and π^a for which the primary deficit is constant. Because Equation (3) indicates that $d = \mu$ when the expected inflation rate is zero, the deficit is measured by the distance between the origin and the intercept of the D curve on the μ -axis. Because the government budget constraint is binding at any given moment in time, the economy is always located on the D curve.

¹To simplify the presentation, we consider throughout this section a closed economy. Extending the results to an open economy, although not a trivial matter, would not affect qualitatively the most salient conclusions derived here.

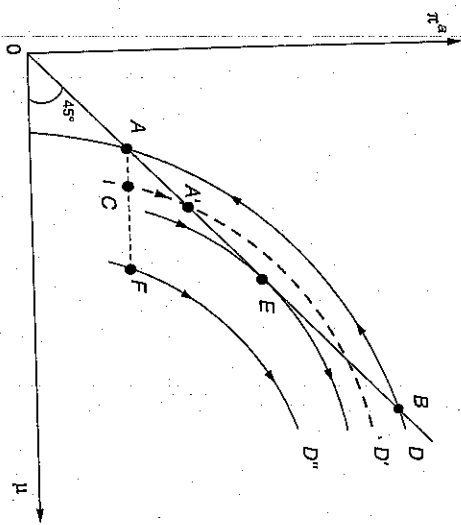


Figure 12.1
Seigniorage and Dual Inflation Equilibria.
Source: Adapted from Bruno and Fischer (1990, p. 355).

Differentiating Equation (1) with respect to time yields, since $\dot{m} \equiv$

$$\dot{M}/P - \pi m, \tag{4}$$

so that in the steady state, with $\dot{\pi}^a = 0$,

$$\pi = \pi^a = \mu. \tag{5}$$

Equation (5) is represented by the 45° line in Figure 12.1. As depicted in the figure, the D curve and the 45° line intersect twice. There are therefore two potential steady-state positions, that is, two inflation rates at which the primary fiscal deficit is financed through revenue from the inflation tax: a low-inflation equilibrium (point A) and a high-inflation equilibrium (point B). At point A the elasticity of the demand for real money balances is less than unity, whereas at point B it is greater than unity.

Suppose for a moment that the size of the primary deficit is constrained by the amount of revenue that can be generated through money creation. As shown in Chapter 4, the inflation rate that maximizes steady-state seigniorage revenue is equal to $\pi^s = 1/\alpha$, and the corresponding level of revenue is given by

$$d^s = \exp(-1)/\alpha.$$

Assume now that the primary deficit the government wishes to finance is fixed at an arbitrary level \bar{d} . Depending on the size of the deficit target,

there may be zero, one, or two equilibria. Because the government cannot obtain more than d^s in the long-run equilibrium, there is no steady state if $d > d^s$. For $\bar{d} = d^s$ or $\bar{d} < 0$, there is a unique steady state. For $0 < \bar{d} < d^s$, there are two steady states, and the economy may be "stuck" at the high-inflation equilibrium (point B). To see under what conditions these long-run outcomes obtain, we consider two alternative assumptions about the formation of inflation expectations.

1.1.1 | Adaptive Expectations

Consider first the case where inflation expectations are characterized by a first-order adaptive process:

$$\pi^e = \beta(\pi - \pi^e), \quad \beta > 0. \quad (6)$$

Combining Equations (4), (3), and (6) determines—together with an appropriate initial condition—the time path of actual and expected inflation, for a given primary fiscal deficit. From (4) and (6), changes in expected inflation are determined by

$$\dot{\pi}^e = \beta(\mu - \pi^e)/(1 - \alpha\beta),$$

whereas the actual inflation rate is

$$\pi = (\mu - \alpha\beta\pi^e)/(1 - \alpha\beta),$$

which implies again that in the steady state (which involves $\dot{\pi}^e = 0$), $\pi = \pi^e = \mu$.

If the speed of adjustment β is low enough (that is, $\beta < 1/\alpha$), $\dot{\pi}^e > 0$ for all points located below the 45° line, whereas $\dot{\pi}^e < 0$ for all points located above that line (see figure). This implies that point A is a stable equilibrium, whereas B is unstable. Thus, starting from any point to the left of B , the economy will converge to point A , whereas if it starts from any point to the right of B it will tend to diverge from it—ending up in hyperinflation.² The government prints money at an ever-increasing rate, preventing the expected inflation rate from ever coinciding with the actual rate of increase in prices. Although real money balances (the inflation tax base) are reduced at an increasing rate, the pace at which the government is printing money is so rapid that it is still able to finance its deficit.³

Suppose that the economy is initially at the stable low-inflation equilibrium (point A), and consider the effect of an increase in the fiscal deficit.

² As shown by Evans and Yarrow (1981), similar results continue to hold if the adaptive mechanism is a second-order error-learning process of the type $\dot{\pi} = \beta_1(\pi - \pi^e) + \beta_2(\pi - \pi^e)^2$, where $\beta_1, \beta_2 > 0$.

³ When the speed of adjustment of expectations is very high, the low-inflation equilibrium becomes unstable while the high-inflation equilibrium becomes stable. As noted by Bruno and Fischer (1990), if the speed of adjustment of expectations rises with the rate of inflation, both equilibria may be stable.

Suppose first that the increase is "small," so that curve D shifts to the right to D' but continues to intersect the 45° line twice. The increase in the fiscal deficit thus leads to an instantaneous jump in the rate of money growth—as well as the actual inflation rate—from point A to C , and from then on to a gradual increase in both the actual and the expected inflation rate from point C to A' . The horizontal shift from A to C at the moment the deficit increases occurs because the adaptive expectations hypothesis implies that the expected inflation rate cannot jump in response to shocks.

Once expectations begin to adjust, the demand for real money balances—which depends, as shown in (1), only on π^e —starts falling. To compensate for the reduction in the inflation tax base, the government must print money at an accelerated pace, until the new equilibrium is reached. A similar result obtains if the shift in the D curve is such that there exists only one point of intersection with the 45° line (point E). By contrast, if the increase in the fiscal deficit is large, curve D may not intersect the 45° line at all (curve D''). There is thus no steady state, and inflation will keep increasing continually. The economy jumps from point A to point F and follows a hyperinflationary path, moving jumps from point A to point F and follows a hyperinflationary path, moving to the northeast along the curve D'' .

If bonds can be used as an additional source of financing of the fiscal deficit, dual equilibria will still obtain if the government fixes the interest rate, but a unique steady-state inflation rate is attained when the government sets a nominal anchor for the economy—for instance, by fixing the rate of growth of the nominal money stock.⁴ The existence of dual equilibria is thus a consequence of the government's choice of monetary and fiscal policy rules, given the process through which inflationary expectations are formed. This result has implications for the choice of a nominal anchor in disinflation programs, which is discussed in the next chapter.

1.1.2 | Perfect Foresight

Consider now the case where inflation expectations are rational, an assumption that can be implemented here by setting $\beta \rightarrow \infty$ in (6) and allowing expected and actual prices to jump on impact. In this case, it can be shown that point B is now a stable equilibrium, whereas A is unstable. Stability requires the elasticity of the demand for real balances to exceed unity at point B . Moreover, because the initial expected rate of inflation can now jump on impact, all points located on curve D are potential short-run equilibria. An increase in the fiscal deficit leads in this setting to an instantaneous jump to a new equilibrium, but there is no guarantee that the economy will be at any particular position on the curve D' (at, say, point A'). Inflation, without displaying any sign of instability, may thus be unnecessarily high under perfect foresight.

⁴ See Bruno and Fischer (1990). As shown by Lee and Ratti (1993), dual equilibria may still emerge with regard to other variables of the economy, such as the levels of real money balances, real bond holdings, and real interest rates.

The above discussion seems to suggest that large budget deficits may lead to hyperinflation only when private agents have adaptive expectations, that is, when they make systematic errors in predicting future inflation. Because the assumption of adaptive expectations is difficult to defend in situations where inflation is high or tends to follow an unstable path, this would seem to make hyperinflation unlikely in the orthodox model. Bruno and Fischer (1990) and Kiguel (1989), however, have shown that large budget deficits may lead to hyperinflation even under perfect foresight, if there is sluggish adjustment toward equilibrium in the money market.

Following Kiguel, assume that the money market adjusts gradually according to

$$\dot{m}/m = \kappa(\ln m^d - \ln m), \quad \kappa > 0, \tag{7}$$

where m^d denotes desired real balances, given by Equation (1), and κ the speed of adjustment. Equation (7) can equivalently be written as

$$\dot{m} = \mu - \kappa(\ln m^d - \ln m), \tag{8}$$

which indicates that the inflation rate adjusts one-for-one with the rate of growth of the nominal money stock, but adjusts only partially in response to differences between the desired and actual levels of real money balances. The inflation rate is therefore sticky (but not predetermined), whereas real balances are predetermined at any point in time.

Solving for the logarithm of money demand from Equation (1) and using the identity $\dot{m} \equiv M/P - \pi m$ in Equation (8) yields

$$\dot{m} = \frac{\kappa}{\alpha\kappa - 1}(\alpha d + m \ln m). \tag{9}$$

Equation (9) is plotted in Figure 12.2 for a value of the deficit equal to d_0 and $\kappa < 1/\alpha$. There are two equilibria, one unstable (point A) and one stable (point B). When the speed of adjustment is very high ($\kappa \rightarrow \infty$), Equation (9) becomes

$$\dot{m} \simeq d + \alpha^{-1}m \ln m,$$

which, for $\dot{m} \simeq 0$, gives a curve similar to D in Figure 12.1.

Consider now what happens when the policymaker increases the primary deficit to $d_1 > d_0$. The schedule $[\dot{m} = 0]$ moves down, so much so that it may no longer intersect the horizontal axis. Put differently, there may be no stationary value of the inflation rate that ensures adequate revenue from the inflation tax to finance a deficit equal to d_1 . In such conditions the behavior of the system will be unstable, characterized by decreasing real money balances and rising rates of inflation. Too large a deficit can therefore lead to a hyperinflationary path, as argued above in the case of adaptive expectations. Under perfect foresight, the potential instability in the inflation process depends crucially on the assumption of sluggish adjustment in the

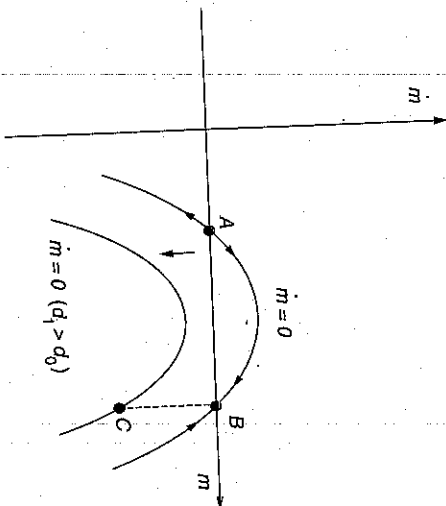


Figure 12.2
Fiscal Deficits and Inflation with Gradual Adjustment of the Money Market.
Source: Kiguel (1989, p. 152).

money market. The increase in money growth required to finance a higher deficit creates a temporary excess supply in the money market, which leads to an increase in inflation. The higher inflation rate exerts two conflicting effects on the equilibrium of the money market. On the one hand, it reduces the supply of real money balances, which tends to reequilibrate the market. On the other, it leads to a fall in the demand for real money balances, which tends to amplify the initial disequilibrium. When the system does not possess a stable long-run equilibrium, the latter effect dominates the former, and the resulting outcome is accelerating inflation, with a continuous increase in the rate of expansion of the nominal money stock.⁵ As shown by Kiguel (1989), the possibility that the economy may follow an unstable inflationary path becomes even more likely if, as a result of the Olvera-Tanzi effect, discussed in Chapter 5, the erosion in tax revenue results in a positive relation between the primary fiscal deficit and the inflation rate. The importance of the Tanzi-Olivera effect in hyperinflation episodes has been emphasized also by Dornbusch (1993).

To summarize, money financing of fiscal deficits may lead, depending on the mechanism through which expectations are formed and the speed of adjustment of the money market, to multiple steady-state equilibria. Governments can therefore find themselves operating at an unnecessarily high inflation rate. The key message of the analysis, however, is that hyperinflation is an unstable process that emerges as a result of large, unsustainable fiscal deficits

⁵ Because $\dot{m} = d - \pi m$, seigniorage is constant along the unstable path. At the stationary equilibrium where $\dot{m} = 0$, seigniorage equals the inflation tax.

financed by money creation. Consequently, an essential feature of stabilization programs in countries undergoing hyperinflation must be a significant fiscal adjustment.

In small, open developing countries, an additional factor that may affect inflation directly in the short run is the exchange rate. A nominal depreciation affects directly the domestic-currency price of import-competing goods and exportables. An indirect effect may also result, as indicated in Chapter 10, if the cost of imported inputs (such as oil and semifinished goods) affects pricing decisions directly (see below). In addition, a depreciation of the exchange rate may also affect inflation by raising nominal wages, through implicit or explicit indexation mechanisms.⁶ In such conditions, a real exchange-rate depreciation is likely to lead to inflationary pressures. The evidence provided by Darat and Arize (1990), Dornbusch et al. (1990), Jorgensen and Paldam (1986), and Montiel (1989) supports the view that the exchange rate plays an important role in the short-run behavior of inflation in some chronic-inflation countries of Latin America. However, it is worth emphasizing that such evidence is not inconsistent with the presumption that fiscal deficits play a key role in the long run, as argued by the orthodox "fiscal view."

The model developed by Rodriguez (1978) provides a theoretical framework for explaining this type of result. If the fiscal deficit is financed through credit creation by the central bank, as is often the case in developing countries, the monetary expansion will lead to an increase in prices and a progressive erosion of foreign reserves, which will eventually trigger a devaluation if the central bank has limited access to borrowing in international capital markets (see Chapter 15). A devaluation-inflation spiral may develop, in the absence of corrective measures aimed at reducing the deficit. Thus, while the "proximate" cause of inflation may appear to be exchange-rate adjustment, the "ultimate" factor responsible for both inflation and exchange-rate depreciation may stem from fiscal rigidities.

1.2 | Food Supply and the Wage-Price Cycle

By contrast with the orthodox focus on the fiscal deficit, the link between inflation, food supply, and competing claims for the distribution of income is at the heart of the new structuralist approach to inflation. This section presents a modified version of a model developed by Cardoso (1981), which provides a particularly clear formalization of the new structuralist view.

Consider a closed economy producing two goods: an agricultural good, whose production level is denoted y_A , and a manufactured good, whose

⁶ In turn, the initial depreciation of the exchange rate may result from an external shock, such as a deterioration in the terms of trade or a sudden increase in external debt payments. Dornbusch (1993) has argued that in Argentina in the early 1980s, for instance, deteriorating terms of trade aggravated the external debt shock and forced a depreciation of the real exchange rate.

production level is y_I . Food supply in the agricultural sector is given in the short run at \bar{y}_A , while output is demand determined in the industrial sector. The equilibrium conditions in both markets are given by

$$\bar{y}_A = c_A^d(\bar{y}, \bar{\theta}), \quad \theta \equiv P_A/P_I,$$

$$y_I = c_I^d(\bar{y}, \bar{\theta}) + g,$$

where $c_A^d(\cdot)$ denotes food demand, which in general depends positively on real factor income y and negatively on the relative price of agricultural goods, θ ; $c_I^d(\cdot)$ represents private expenditure on manufactured goods, which depends positively on income and the relative price; g measures autonomous government expenditure on industrial goods. Real factor income, measured in terms of industrial goods, is defined as

$$y = \theta \bar{y}_A + y_I.$$

Assume, without loss of generality, that the direct effect of changes in θ on demand is zero and let $0 < \alpha < 1$ denote the marginal propensity to consume. Measuring the proportion of consumption spent on agricultural goods by $0 < \delta < 1$, the equilibrium condition of the food market can be written as

$$\theta \bar{y}_A = \delta \alpha y = \delta \alpha (\theta \bar{y}_A + y_I), \tag{10}$$

while the market-clearing condition for industrial goods is

$$y_I = (1 - \delta) \alpha (\theta \bar{y}_A + y_I) + g. \tag{11}$$

To examine the dynamic adjustment process and the behavior of inflation, assume for the moment that prices of industrial goods remain constant and that output in the industrial sector responds gradually to excess demand for manufactured goods:

$$y_I = v_I [\alpha (1 - \delta) (\theta \bar{y}_A + y_I) + g - y_I], \quad v_I > 0. \tag{12}$$

Similarly, agricultural prices respond gradually to the excess demand for food:

$$P_A/P_I = v_A [\delta \alpha (\theta \bar{y}_A + y_I) - \theta \bar{y}_A], \quad v_A > 0. \tag{13}$$

The rate of change in agricultural prices is thus equal to the rate of change in the relative price, θ/β , since prices of industrial goods remain constant. Equations (12) and (13) constitute a system that determines the dynamic behavior over time of production in the industrial sector and agricultural prices:

$$\begin{bmatrix} \dot{P}_A \\ \dot{y}_I \end{bmatrix} = \begin{bmatrix} -v_A \alpha (1 - \alpha \delta) & v_A \alpha \delta \\ v_I \alpha (1 - \delta) & -v_I (1 - \alpha (1 - \delta)) \end{bmatrix} \begin{bmatrix} P_A \\ y_I \end{bmatrix}.$$

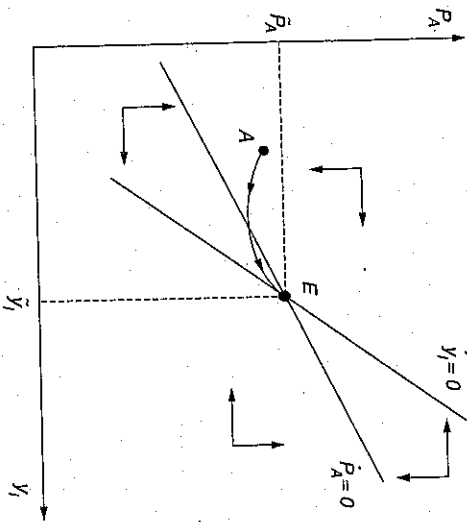


Figure 12.3
Equilibrium in the New Structuralist Model.

where, for simplicity, $g = 0$, and industrial prices are normalized to unity. For stability, the trace of the coefficient matrix must be negative and its determinant positive.

The equilibrium of the economy is shown in Figure 12.3. The curve [$P_A = 0$], which determines the combinations of industrial output and relative price that maintain equilibrium in the food market, has a positive slope. Points located to the left of this curve are associated with excess supply of food and falling prices, while points located to the right of it indicate excess demand and rising food prices. The curve [$y_I = 0$] represents the equilibrium condition for rising food prices. This curve also has a positive slope, which must be steeper than the slope of the [$P_A = 0$] curve to ensure stability.⁷ Points situated to the left of [$y_I = 0$] indicate excess demand for industrial goods and rising output, while points located to the right of [$y_I = 0$] indicate an excess supply of manufactured goods and falling output. The steady-state equilibrium of the economy obtains at point E .

Suppose, for instance, that the initial position of the economy is at point A in Figure 12.3, which represents an excess supply of food and an excess

⁷Formally, the slopes of the [$P_A = 0$] and [$y_I = 0$] curves are given by, respectively,

$$\left. \frac{dP_A}{dy_I} \right|_{P_A=0} = \frac{\alpha\delta}{1-\alpha\delta} \quad \left. \frac{dP_A}{dy_I} \right|_{y_I=0} = \frac{1-\alpha(1-\delta)}{\alpha(1-\delta)}$$

Calculating the determinant of the coefficient matrix given previously establishes that the relationship between the slopes indicated in the text is sufficient for stability, because the condition on the trace of the coefficient matrix always holds.

demand for manufactured goods. The increase in output in the industrial sector dampens excess demand for manufactured goods while increasing income and the demand for agricultural products—reducing excess supply in that sector. The stability condition ensures that the income effect generated by the increase in industrial output does not exacerbate the initial excess demand in the market for industrial goods. Thus, in this basic framework, food prices fall at first and then rise, while industrial output rises continuously over time until the long-run equilibrium is reached. There is no tendency toward instability—because we assumed that industrial prices remain constant and we abstracted from workers' behavior.

Suppose now that firms in the industrial sector set prices as a fixed markup γ over labor costs. Assuming for simplicity that the unit labor requirement for industrial output is normalized to unity, industrial prices are given by

$$P_I = (1 + \gamma)w, \quad \gamma > 0. \tag{14}$$

Suppose also that workers have a constant real wage target ω^* , which implies that nominal wages are determined by

$$w = \tilde{\omega}P, \tag{15}$$

where P denotes the consumer price index, defined as

$$P = P_A^\delta P_I^{1-\delta}, \quad 0 < \delta < 1 \tag{16}$$

Using Equations (14), (15), and (16) yields the "required" relative price, consistent with workers' real wage target:

$$\theta^* = [(1 + \gamma)\omega^*]^{1/\delta} \tag{17}$$

The rate of change of nominal wages is assumed to be determined by the difference between the required price ratio θ^* and the actual ratio θ so that, using Equation (14), the rate of change of industrial prices π_I is equal to

$$\pi_I = \dot{w}/w = \kappa(\theta - \theta^*), \quad \kappa > 0, \tag{18}$$

where κ measures the speed of wage adjustment. θ^* is thus the relative price at which wage inflation is zero and industrial prices remain constant. Using Equations (13) and (18) in the definition of θ yields

$$\dot{\theta} = \nu_A[\alpha\delta\theta\dot{y}_A + \gamma\dot{y}_I] - \theta\dot{y}_A - \kappa(\theta - \theta^*), \tag{19}$$

Figure 12.4 presents a diagrammatic solution of the system consisting of Equations (12), (13), and (19). Curve AA is identical to curve [$P_A = 0$] defined previously, and gives combinations of the relative price and industrial output that ensure continuous equilibrium in the food market. The curves [$\dot{y}_I = 0$] and [$\dot{\theta} = 0$] are both upward sloping, with the former having a steeper slope to ensure stability. The slope of the AA curve is by construction also steeper than the slope of the [$\dot{\theta} = 0$] curve. The two curves intersect at point B , where

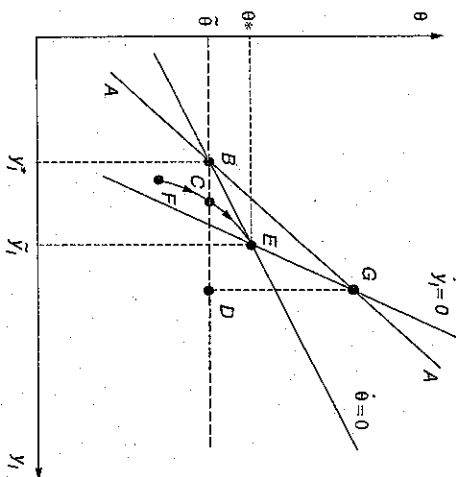


Figure 12.4
The Wage-Price Cycle in the New Structuralist Model.
Source: Adapted from Cardoso (1981, p. 275).

the actual relative price ratio is equal to the required relative price θ and the food market is in equilibrium. Curves $[y_f = 0]$ and $[\theta = 0]$ intersect at point E , which determines a value of the relative price $\bar{\theta} > \theta^*$. Finally, curves $[y_f = 0]$ and A intersect at point G .

None of the points B , E , nor G represent a long-run equilibrium in this economy. Suppose that the economy is initially at point G , where the food and industrial goods markets are both in equilibrium but real wages are lower than the desired level—or, equivalently, the actual relative price is higher than the required level. Nominal wages therefore increase, raising industrial prices and lowering the relative price of agricultural goods. The negative income effect reduces output in the industrial sector. At point B , real wages are at their desired level and the market for food is in equilibrium, but the economy is characterized by excess demand for manufactured goods. Industrial production begins rising, but as the economy moves away from point B (toward, say, point C), the increase in income exerts upward pressure on the relative price of food products.

If the economy is initially in a position such as point F , corresponding to a situation of excess demand in the food market, the upward pressure on agricultural prices is accompanied by a rise in nominal wages, which, in turn, leads to an increase in industrial prices and higher output in that sector. But as long as the excess demand for food remains large relative to the difference between the actual and the desired real wage, nominal wages and thus industrial prices will continue to increase less rapidly than agricultural

prices, so that the relative price θ will rise over time. The upward pressure on the relative price leads to excess demand for manufactured goods, and industrial output rises. The economy therefore moves toward point E , where the curves $[y_f = 0]$ and $[\theta = 0]$ intersect, and both industrial output and the relative price remain constant.

But at that point, excess demand for agricultural products—resulting from the increase in income linked to output expansion in the industrial goods sector—maintains upward pressure on their price. Moreover, since the real wage is lower than desired, both nominal wages and industrial prices will continue to rise. Thus, there is no stable long-run equilibrium in this model because it is overdetermined. The relative price that corresponds to equilibrium in goods markets is inconsistent with the relative price that satisfies workers' claims on income. The outcome may be a self-perpetuating inflationary process, which may be exacerbated if the speed of adjustment of wages to changes in the price ratio increases over time.⁸

A stable, long-run equilibrium can be achieved in the above setting by various government policies. A reduction, for instance, in government spending g that is large enough to shift the $[y_f = 0]$ curve to the left—until it intersects the A and $[\theta = 0]$ curves at point B —would halt the inflationary spiral, at the cost of lower industrial output. An incomes policy that would bring a reduction in the markup coefficient γ could also increase the target relative price θ^* toward $\bar{\theta}$ and eliminate the inflationary cycle. Price controls could also prevent capitalists in the industrial sector from raising their profits and maintain the relative share of profits in national income, without necessarily leading to a reduction in output (see the Appendix to Chapter 13). Nevertheless, the general implication of the analysis remains that when workers' desired real wage is high relative to the level compatible with long-run equilibrium, inflation stabilization is impossible to achieve without a shift in income distribution.

1.3 | A Structuralist-Monetarist Model

A crucial and generally implicit assumption in new structuralist models of inflation, including the modified version of Cardoso's model developed above, is that monetary policy fully accommodates changes in the price level. We now present an integrated framework that accounts explicitly for money supply dynamics in the new structuralist model developed above. This extension provides a link with the orthodox approach described earlier and allows us to qualify some of the policy prescriptions commonly advocated by new structuralist economists. The link between prices, money, and fiscal deficits

⁸ In an extension of her analysis to an open economy, Cardoso (1981) argues that a devaluation of the real exchange rate has only a temporary effect on the trade balance but may generate a wage-price cycle similar to the one described here.

is captured by introducing food subsidies in the model and accounting for the government budget constraint.⁹

In the presence of a subsidy at the rate $0 < s < 1$, the consumer price index is defined as

$$P = [(1 - s)P_A]^{1-\delta} P_I^{1-\delta} \quad (20)$$

Suppose that the government levies a uniform tax on factor income at the rate $0 < t < 1$. Its expenditures consist of demand for industrial goods (in quantity g) and food subsidies. The government budget constraint can be written as

$$\dot{M} = P_I g + s P_A \bar{y}_A - t(P_A \bar{y}_A + P_I y_I),$$

which, in real terms, is equivalent to

$$\dot{m} = g + (s - t)\theta \bar{y}_A - t y_I - \pi m, \quad (21)$$

where m denotes real money balances measured in terms of industrial prices. Assuming that the demand for food products is a positive function of real money balances yields the equilibrium condition of the food market in the presence of food subsidies:

$$(1 - s)\theta \bar{y}_A = \alpha \delta (1 - t)(\theta \bar{y}_A + y_I) + \lambda \delta m, \quad (22)$$

where α is now the propensity to consume out of disposable income, and $0 < \lambda < 1$. The left-hand side of this expression denotes the post-subsidy value of the supply of food, measured in terms of industrial goods.¹⁰ The last term on the right-hand side measures a real balance effect.

The dynamics of output adjustment in the market for manufactures is now given by

$$\dot{y}_I = \nu_I [\alpha (1 - \delta)(\theta \bar{y}_A + y_I) + \lambda (1 - \delta)m + g - y_I]. \quad (23)$$

Assuming that workers pursue a real wage target as before, the required relative price is now given by

$$\theta^* = (1 - t)^{-1} [(1 + \gamma)\omega^*]^{-1/\delta}. \quad (24)$$

After appropriate substitutions, the behavior of the relative price is determined by

$$\dot{\theta}/\theta = \nu_A \left[\frac{\alpha \delta}{1 - s} (\theta \bar{y}_A + y_I) + \frac{\lambda}{1 - s} m - \theta \bar{y}_A \right] - \kappa (\theta - \theta^*). \quad (25)$$

⁹ The analysis follows Parkin (1991) and Srinivasan et al. (1989). For an analysis of food subsidies and inflation in a conventional new structuralist framework, see Taylor (1979, pp. 73–83).

¹⁰ We assume in the following analysis that $s < 1 - \alpha \delta (1 - t)$, to ensure that for a given level of industrial output, a rise in the relative price of food reduces excess demand for agricultural goods.

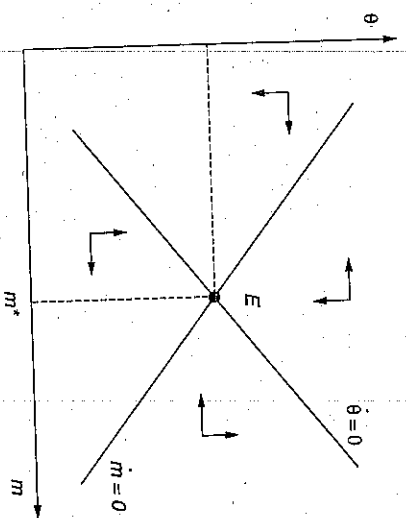


Figure 12.5
Equilibrium with Money and Food Subsidies in the New Structuralist Model.
Source: Srinivasan et al. (1989).

Using (18), Equation (21) can be approximated in the vicinity of the initial position (at $t = 0$) by

$$\dot{m} \simeq g + [(s - t)\bar{y}_A - \kappa m_0] \theta - t y_I + \kappa (\theta_0 - \theta^*) m. \quad (26)$$

Equations (23), (25), and (26) constitute a dynamic system in y_I , θ , and m . Instead of analyzing the complete system, let us assume that output adjustment in the market for industrial goods is instantaneous—that is, $\nu_I \rightarrow \infty$. Solving (23) for y_I with $\dot{y}_I = 0$ and substituting the result in (25) and (26) thus yields a system of two differential equations in θ and m .

A graphical presentation of the equilibrium is shown in Figure 12.5. The locus $[\dot{\theta} = 0]$ is positively sloped, since an increase in money holdings raises demand for agricultural and manufactured goods, requiring an increase in the relative price of food to maintain equilibrium. Under the assumption that $(s - t)\bar{y}_A > \kappa m_0$, the locus $[\dot{m} = 0]$ is negatively sloped. In this case, stability is ensured.¹¹ In this setup, it can be shown that the long-run effect of an increase in the subsidy rate on inflation is ambiguous (see Parkin, 1991; Srinivasan et al., 1989). On the one hand, the increase in subsidy payments increases government spending and reduces the wedge between the actual price ratio and its required level—thus slowing down wage inflation—which tends to raise real money balances. On the other hand, higher activity in the industrial sector raises income tax revenue and reduces the fiscal deficit, exerting a downward pressure on money growth. It can be shown, nevertheless, that if

¹¹ If $(s - t)\bar{y}_A < \kappa m_0$, stability requires that the slope of the $[\dot{m} = 0]$ curve be steeper than that of the $[\dot{\theta} = 0]$ curve.

the subsidy rate is high enough initially, then raising it further leads to higher money growth and inflation. Moreover, if wages are fully flexible, increasing subsidies on food is always inflationary.

The thrust of the preceding analysis is thus that once the link between subsidies, fiscal deficits, and monetary policy is properly taken into account, predictions of new structuralist models that ignore asset accumulation and the government budget constraint may require qualifications. In particular, an increase in subsidies may be inflationary, regardless of the specific assumption made regarding wage formation. More generally, the foregoing discussion suggests that combining orthodox and new structuralist models of inflation may provide new insights into the inflationary process. The emphasis on social conflict and income distribution may be important in understanding the chronic effects of deficit financing is essential to understanding in most cases the transmission mechanism of policy shocks to inflation.

2 | Dynamics of Alternative Policy Rules

A key aspect of the debate on the choice between money-based and exchange-rate-based stabilization programs is the dynamic path that different policy choices imply for inflation, output, and the current account. We present in this section two optimizing models that allow a rigorous analysis of the dynamics of stabilization policies in developing countries. The usefulness of these models results from their ability to capture some of the salient structural features of developing economies emphasized in previous chapters—particularly the role of imperfect asset substitutability, and nominal wage inertia—and their explicit microeconomic foundations. We begin by considering a one-good framework and then extend the analysis to a two-sector, three-good setting in which we endogenously determine the behavior of inflation and the real exchange rate.

2.1 | A One-Good Framework

The evidence discussed in Chapter 6 suggests that neither extreme of zero or perfect capital mobility appears to characterize the vast majority of developing countries. More relevant is an intermediate case in which domestic and foreign assets are imperfectly substitutable in private agents' portfolios. In what follows we present an analytical framework that captures this important feature of financial behavior in developing countries.¹²

¹² The model developed here is adapted from Agénor (1997) and represents an extension of the model with zero capital mobility developed in Chapter 4 to analyze the relationship between fiscal deficits, policy expectations, and real interest rates. Agénor (2006a) introduces commercial banks in a similar setting.

Consider a small, open economy in which there are four types of agents: producers, households, the government, and the central bank. All firms and households are identical, and their number is, for simplicity, normalized to unity. Domestic output consists of a tradable good produced using only labor, which is supplied in fixed quantity n^* . Wages are perfectly flexible, so that domestic production is fixed during the time frame of the analysis. Purchasing power parity holds continuously. Under a regime of predetermined exchange rates, the domestic currency is depreciated at a constant rate by the central bank, whose stock of foreign assets adjusts to equilibrate supply and demand for foreign exchange. Under a regime of flexible exchange rates, foreign reserves of the central bank are constant and the rate of credit growth is predetermined.

Households hold two categories of assets in their portfolios: domestic money and domestic government bonds. As in the model with zero capital mobility developed in Chapter 5, domestic money bears no interest. The household borrows on world capital markets subject to a rising risk premium, as discussed below. Foreigners do not hold domestic assets. The domestic interest rate adjusts to maintain equilibrium in the money market, while (as a result of the small-country assumption) the real rate of return on foreign bonds is determined on world capital markets. The government consumes goods and services, collects lump-sum taxes, and pays interest on its domestic debt. It finances its budget deficit either by issuing domestic bonds or by borrowing from the central bank.¹³

2.1.1 | Households

The household's discounted lifetime utility is given as

$$\int_0^{\infty} \left\{ \frac{c^{1-\eta}}{1-\eta} + \chi \ln m \right\} e^{-\rho t} dt, \quad \rho, \chi > 0, \quad (27)$$

where ρ again denotes the constant rate of time preference, and c consumption. The instantaneous utility function takes the same form as in Chapter 4.

Nominal wealth of the representative household A is given by

$$A = M + B - EL^*,$$

where M denotes the nominal money stock, B the stock of government bonds, and EL^* the domestic-currency value of the stock of foreign bonds, with E denoting the nominal exchange rate and L^* the foreign-currency value of foreign borrowing by the household. Letting $m \equiv M/E$ denote real money balances and $b \equiv B/E$ the real stock of government bonds, real wealth can

¹³ The assumption that the government may finance its fiscal deficit in part by issuing bonds may not be appropriate for all developing countries. If it is, however, relevant for several upper-middle-income countries of Latin American and Asia. In any case, we do not focus on bond financing here.

be defined as

$$a = m + b - L^* \tag{28}$$

The flow budget constraint is given by

$$a = y + ib - c - \tau - (i^* + \theta)L^* - (m + b)\varepsilon,$$

where y denotes domestic output (which is constant at $y(r^*)$), τ the real value of lump-sum taxes, i the domestic nominal interest rate, and $\varepsilon \equiv E/E$ the predetermined rate of depreciation of the exchange rate. The term $-(m + b)\varepsilon$ accounts for capital losses on the stocks of money and domestic bonds resulting from changes in the exchange rate.

The term $i^* + \theta$ measures the cost of borrowing on world capital markets, and consists of an exogenous, risk-free interest rate i^* and a risk premium θ , which is defined as

$$\theta = \theta(L^*, \cdot), \quad \theta_{L^*} > 0 \tag{29}$$

where the premium is assumed to be positively related to L^* .¹⁴ Thus, domestic households are able to borrow more on world capital markets only at a higher rate of interest. This assumption captures the existence of individual default risk: the domestic agent's borrowing options are restricted by his or her capacity to repay.¹⁵ Of course, the premium may also depend on various household characteristics other than the level of borrowing (such as the composition of the household), or factors such as market sentiment toward the country in question—in effect, a country-specific risk factor that reflects foreign lenders' idiosyncratic perceptions of the country's creditworthiness. It could also be related to macroeconomic variables, as for instance in Razin and Sadka (2004), where the risk premium on world capital markets is taken to depend on the fiscal stance (as measured by the primary surplus). For simplicity, we will abstract from these other factors at this stage.

Using (28), the flow budget constraint can be rewritten as

$$a = y + \gamma a - c - \tau - (i^* + \theta - r)L^* - im, \tag{30}$$

where $r = i - \varepsilon$ denotes the domestic real rate of interest.

Households treat y , ε , i^* , i , and τ as given and maximize (27) subject to (29) and (30) by choosing a sequence $\{c, m, b, L\}_{t=0}^\infty$. The required optimality

¹⁴ It is also plausible to assume that the premium is convex in L^* (so that $\theta_{L^*L^*} > 0$), and that for L^* sufficiently high a binding borrowing constraint is eventually reached. In what follows it is assumed that the economy operates on the upward-sloping portion of the supply curve of funds, rather than at any absolute borrowing ceiling, and that θ is continuously differentiable in that range.

¹⁵ See Agénor (1997) for a more detailed discussion. The assumption that the (household-specific) premium depends positively on the agent's level of debt—rather than the economy's total debt—leads naturally to the assumption that agents internalize the effect of their borrowing decisions on θ , as discussed below.

conditions are given by

$$m^d = \chi c^{\rho} / i \tag{31}$$

$$i = (i^* + \theta + \varepsilon) + L^* \theta_{L^*}, \tag{32}$$

$$c/c = \sigma(r - \rho), \tag{33}$$

together with the transversality condition $\lim_{t \rightarrow \infty} (e^{-\rho t} a) = 0$.

Equation (31) is the money demand function, and is obtained from the condition that the marginal rate of substitution between money balances and consumption be equal to the opportunity cost of holding money—the nominal interest rate on domestic government bonds. Equation (33) is the conventional Euler Equation, which shows that consumption rises or falls depending on whether the domestic real interest rate exceeds or falls below the rate of time preference.

Equation (32) is an arbitrage condition that determines implicitly the demand for loans. To understand its derivation, consider first the case where households face no risk premium on world capital markets ($\theta = 0$). In that case, clearly, optimality requires $i = i^* + \varepsilon$. Suppose, for instance, that $i > i^* + \varepsilon$; agents would then borrow unlimited amounts of funds on world capital markets and reap a net profit by buying government bonds. On the contrary, with $i < i^* + \varepsilon$, a corner solution would obtain, with households not borrowing at all from foreign lenders. Equilibrium (with a positive level of foreign debt) therefore requires equality between the marginal return i and the marginal cost of funds (measured in domestic-currency terms), $i^* + \varepsilon$.

Suppose now, as assumed above, that the premium rises with the level of private debt. Optimality requires, as before, that households borrow up to the point where the marginal return and the marginal cost of borrowing are equalized. Here, however, although the marginal return is again equal to the rate of return on domestic bonds, the marginal cost of borrowing is given by $i^* + \theta + \varepsilon$ plus the increase in the cost of servicing the existing stock of loans induced by the marginal increase in the risk premium (itself resulting from the marginal increase in borrowing), $L^* \theta_{L^*}$.

Since θ is a function of L^* , the optimal level of borrowing can be obtained from Equation (32) by taking a linear approximation to θ , so that

$$L^* = (i - i^* - \varepsilon) / \gamma, \tag{34}$$

where $\gamma = 2\theta_{L^*} > 0$. Equation (34) indicates that foreign borrowing is positively related to the difference between the domestic interest rate and the sum of the safe world interest rate and the devaluation rate. Moreover, the demand for foreign loans is proportional to the differential $i - i^* - \varepsilon$, with a proportionality factor that depends on the sensitivity of the risk premium to the level of private debt.

2.1.2 | Government and the Central Bank

There are no commercial banks in the economy, and the central bank lends only to the government. The nominal money stock is therefore equal to

$$M = D + ER^* \tag{35}$$

where D denotes the stock of domestic credit allocated by the central bank to the government, and R^* the stock of net foreign assets, measured in foreign-currency terms. Changes in the real credit stock $d \equiv D/E$ are given by

$$\dot{d} = (\mu - \varepsilon)d, \tag{36}$$

where μ denotes the rate of growth of the nominal credit stock.

The central bank receives interest on its holdings of foreign assets and its loans to the government. For simplicity, we assume that the interest rate paid by the government on central bank loans is equal to the market rate of interest on domestic bonds. Real profits of the central bank are therefore equal to

$$\Pi^{cb} = (i^* + \varepsilon)R^* + id, \tag{37}$$

where εR^* measures real capital gains on reserves.

The government's revenue sources consist of lump-sum taxes on households and transfers from the central bank. It consumes goods and services and pays interest on its domestic debt. It finances its budget deficit by borrowing from the central bank or issuing bonds.¹⁶ In nominal terms, the flow budget constraint of the government can be written as

$$\dot{B} + D = E(g - \tau - \Pi^{cb}) + i(B + D),$$

where g denotes noninterest government spending, assumed exogenous. In real terms, and using Equation (37), we have

$$\dot{d} + \dot{b} - \varepsilon m = g + r\dot{b} - i^*R^* - \tau. \tag{38}$$

Equation (38) indicates that government spending plus net interest payments on the domestic debt, minus lump-sum taxes, and interest income on reserves, must be financed by issuance of bonds, an increase in real domestic credit, or seigniorage revenue. Solving Equation (38) yields the government's intertemporal budget constraint, which equalizes the present value of government purchases of goods and services to initial holdings of net assets plus the present value of lump-sum taxes subject to the solvency requirement

$$\lim_{t \rightarrow \infty} b e^{-rt} = 0.$$

As discussed in Chapter 5, the solvency constraint rules out indefinite Ponzi games by the government.

¹⁶ We thus exclude the possibility that the government may borrow abroad.

2.1.3 | Money Market Equilibrium

To close the model requires specifying the equilibrium condition of the money market:

$$m^s = m^d.$$

Given (31), the above equation can be solved for the market-clearing domestic interest rate:

$$i = i(\bar{c}, \bar{m}). \tag{39}$$

which shows, as noted in Chapter 5, that the equilibrium nominal interest rate depends positively on private consumption and negatively on the stock of real cash balances.

2.1.4 | Dynamic Form

Substituting (30), (35), and (38) in the household's flow budget constraint (28) give the economy's consolidated budget constraint:

$$\dot{L}^* - \dot{R}^* = i^*(L^* - R^*) + \theta L^* + c + g - y, \tag{40}$$

which determines the behavior over time of the total stock of foreign debt. Specifically, Equation (40) indicates that the counterpart to the current account deficit, which is given as the sum of the trade deficit $c + g - y$ and net interest payments on the outstanding foreign debt $i^*(L^* - R^*) + \theta L^*$, is the change in net external liabilities. Integrating Equation (40) yields (under the assumption that the safe world interest rate remains constant over time) the economy's intertemporal budget constraint

$$L_0^* - R_0^* = \int_0^\infty e^{-it} (y - c - g - \theta L^*) dt + \lim_{t \rightarrow \infty} e^{-it} (L^* - R^*),$$

To satisfy the economy-wide intertemporal budget constraint, the second term on the right-hand side in the above expression must be zero. Thus, this constraint can be written, with i^* constant over time, as:

$$L_0^* - R_0^* = \int_0^\infty e^{-it} (y - c - g - \theta L^*) dt,$$

which indicates that the current level of foreign debt must be equal to the discounted stream of the excess of future output over domestic absorption ($c + g$), adjusted for the loss in resources induced by capital market imperfections.

Equations (33), (34), (36), (38), (39), and (40) describe the evolution of the economy along any perfect foresight equilibrium path. The system can be

rewritten as:

$$\begin{aligned}
 L^* &= [i(c, m) - i^* - \varepsilon] / \gamma, & (41) \\
 \dot{c}/c &= \sigma [i(c, m) - \varepsilon - \rho], & (42) \\
 \dot{L}^* - \dot{R}^* &= i^*(L^* - R^*) + \theta(L^*)L^* + c + g - y, & (43) \\
 \dot{d} + b + \varepsilon m &= g + r b - i^* R^* - \tau, & (44) \\
 \dot{d} &= (\mu - \varepsilon) d, & (45) \\
 m &= d + R^*. & (46)
 \end{aligned}$$

Equations (41)-(46) represent a differential equation system with six endogenous variables, $c, b, L^*, R^*, d,$ and m . It is worth noting that the capital account and the overall balance of payments are defined in terms of changes in the level of private foreign debt and official reserves that occur over time. These definitions do not capture transactions that occur discretely under a regime of predetermined exchange rates, such as those that may reflect an instantaneous conversion of foreign currency loans for domestic cash balances. Specifically, although the economy's overall stock of foreign debt $L^* - R^*$ is predetermined, official reserves and private foreign borrowing may jump in response to sudden movements in domestic interest rates. An instantaneous shift in private indebtedness on world capital markets is thus associated, under a regime of predetermined exchange rates, with an offsetting movement in the level of official foreign reserves held by the central bank.

In what follows, we will assume that the government foregoes the issuance of bonds to finance its deficit ($\dot{b} = 0$), and instead either borrows from the central bank or varies lump-sum taxes to balance its budget. Given this assumption, the model can be operated in different modes, depending on the "closure rule" chosen: the rate of devaluation can be treated as predetermined, or the rate of growth of the nominal credit stock can be viewed as predetermined. Regardless of the particular mode chosen, the steady-state solution is obtained by setting $\dot{c} = \dot{L}^* = \dot{R}^* = \dot{d} = 0$ in the above system. As can readily be shown from Equations (42) and (45), in the long-run equilibrium the real domestic interest rate must be equal to the rate of time preference:

$$r = i - \varepsilon = \rho, \tag{47}$$

and the rate of domestic credit growth must be equal to the devaluation rate:

$$\mu = \varepsilon. \tag{48}$$

Real money balances are thus equal to

$$\bar{m} = \bar{m}(c, \rho + \varepsilon). \tag{49}$$

However, alternative closure rules lead to different transitory dynamic paths, as we now show.

2.1.5 | Devaluation Rule

Under a constant rate of devaluation ($\varepsilon = \varepsilon^h$), the rate of growth of the credit stock must be endogenous if taxes cannot be adjusted to finance the fiscal deficit ($\tau = \tau_0$). Setting, for simplicity, the constant stock of government bonds equal to zero, Equation (44) implies that the evolution of the real stock of credit over time is given by

$$\dot{d} = g - i^* R^* - \tau_0 - \varepsilon^h m. \tag{50}$$

The path of \dot{d} given by (50) can be substituted in Equation (45) to determine μ :

$$\mu = \varepsilon^h + d/d.$$

From (46), $m = d + R^*$. Substituting (50) in this expression yields

$$\dot{m} = \dot{L}^* + y - c - \tau_0 - (i^* + \theta)L^* - \varepsilon^h m.$$

or, using (43):

$$\dot{m} = \dot{L}^* + y - c - \tau_0 - (i^* + \theta)L^* - \varepsilon^h m. \tag{51}$$

Because the stock of government bonds is normalized to zero, Equation (28) implies that

$$m = a + L^*, \tag{52}$$

which can be substituted in (41) to give

$$L^* = [i(c, a + L^*) - i^* - \varepsilon^h] / \gamma.$$

Taking a linear approximation to the function $i(\cdot)$ yields

$$L^* = (i_c c + i_m a - i^* - \varepsilon^h) / (\gamma - i_m),$$

or equivalently

$$L^* = \Phi(c, a; \varepsilon^h), \tag{53}$$

where, setting $\beta \equiv 1/(\gamma - i_m) > 0$:

$$\Phi_c = \beta i_c, \quad \Phi_a = \beta i_m, \quad \Phi_{\varepsilon} = -\beta.$$

Substituting Equation (53) in (52) implies that

$$m = a + L^* = h(c, a; \varepsilon^h), \tag{54}$$

where

$$h_c = \Phi_c, \quad h_a = 1 + \Phi_a < 1, \quad h_{\varepsilon} = \Phi_{\varepsilon}.$$

Substituting (54) in Equation (42) yields

$$\dot{c} = \sigma \alpha [i_c h(c, a, \varepsilon^h) - \varepsilon^h - \rho] = G(c, a; \varepsilon^h), \tag{55}$$

where

$$G_c = \sigma \bar{c} \beta \gamma i_c, \quad G_a = \sigma \bar{a} i_m h_a, \quad G_e = -\sigma \bar{c} \beta \gamma.$$

Finally, substituting (53) and (54) in (51) and rearranging yields

$$\dot{a} = \bar{m} - \bar{l}^* = y - c - \tau_0 - [\bar{l}^* + \theta(\Phi(c, a; e^h))] \Phi(c, a; e^h) - e^h h(c, a; e^h),$$

or equivalently

$$\dot{a} = \Psi(c, \bar{a}; e^h), \tag{56}$$

where, with a '+' denoting initial steady-state values:

$$\Psi_c = -1 - (\bar{\theta} + \bar{l}^* \theta_{L^*}) \Phi_c, \quad \Psi_a = -(\bar{\theta} + \bar{l}^* \theta_{L^*}) \Phi_a - e^h h_a,$$

$$\Psi_e = -(\bar{\theta} + \bar{l}^* \theta_{L^*}) \Phi_{e^h} - \bar{m},$$

where we assume that e^h and \bar{m} are sufficiently small.

Taking a linear approximation of Equations (55) and (56) around the initial steady state yields the following system in c and a :

$$\begin{bmatrix} \dot{c} \\ \dot{a} \end{bmatrix} = \begin{bmatrix} G_c & G_a \\ \Psi_c & \Psi_a \end{bmatrix} \begin{bmatrix} c - \bar{c} \\ a - \bar{a} \end{bmatrix}. \tag{57}$$

Consumption is a forward-looking variable, whereas financial wealth is predetermined at each moment in time, with an initial value a_0 . The determinant of the system (57) is given by $G_c \Psi_a - G_a \Psi_c$, which must be negative for the system to be saddlepoint stable.

A diagrammatic solution of the model is presented in Figure 12.6. The locus CC (along which $\dot{c} = 0$) is upward sloping and so is the locus AA , along which $\dot{a} = 0$. Saddlepoint stability requires CC to be steeper than AA . The saddlepath SS , which also has a positive slope, is the unique path leading to the steady-state equilibrium (point E).

Suppose that the economy is initially in a long-run equilibrium position. Consider the effect of a permanent, unanticipated reduction in the devaluation rate from e^h to $e^s < e^h$, with no discrete change in the level of the exchange rate. Using the steady-state solutions, it is readily established that a reduction in the devaluation rate raises \bar{a} and lowers \bar{c} . From Equations (41) and (47), the steady-state level of private foreign borrowing is given by

$$\bar{l}^* = (\rho - i^*)/\gamma, \tag{58}$$

which is independent of the devaluation rate. But because \bar{a} rises, it must be the case that \bar{m} rises. The reason is that from (47) the nominal interest rate must be equal in the steady state to the rate of time preference plus the devaluation rate; it therefore falls in the same proportion as the devaluation rate—thereby reducing the opportunity cost of holding money and raising the demand for cash balances.

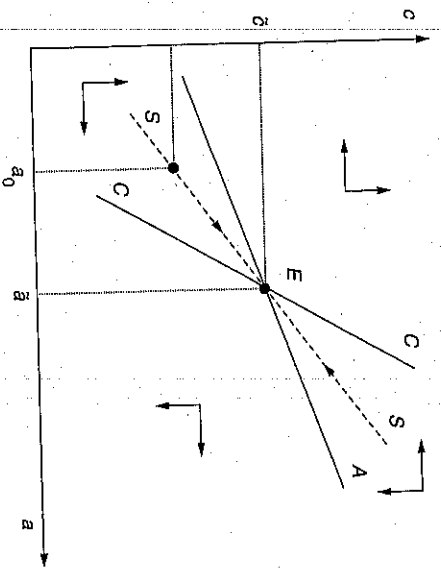


Figure 12.6
Equilibrium in the One-Good Model.

On impact, the reduction in the devaluation rate raises private foreign borrowing at the initial level of domestic interest rates. Because private financial wealth cannot change on impact, this portfolio shift must be offset by a rise in real money balances. This instantaneous adjustment takes place through purchases of foreign currency assets by the central bank (the counterpart to the inflow of capital associated with foreign borrowing) accompanied by a discrete increase in the domestic money stock. Consumption falls to place the economy on the convergent trajectory toward the new steady state. Because the real money stock rises and consumption falls, the domestic nominal interest rate falls—but by less than the devaluation rate, implying a rise in domestic real interest rates. The increase in foreign borrowing raises the risk premium faced by private agents on world capital markets. As a result, the services account of the balance of payments deteriorates. At the same time, however, the reduction in private consumption leads to an improvement in the trade balance. The net effect on changes in private financial wealth, as can be inferred from Equation (56), is positive ($\dot{a}_0 > 0$). The rate of growth of the nominal credit stock falls on impact.

Because the shock is permanent, the adjustment path to the new steady state is monotonic. The transitional dynamics are illustrated in Figure 12.7. The economy is initially at point E ; the reduction in the rate of devaluation shifts both CC and AA to the right. Because private wealth is predetermined, consumption jumps downward from point E to point B , located on the new saddlepath $S'S'$, and begins rising afterward. The nominal interest rate must rise over time to allow the real interest rate to return to its initial steady-state value. This increase leads to a reduction in private foreign borrowing (capital

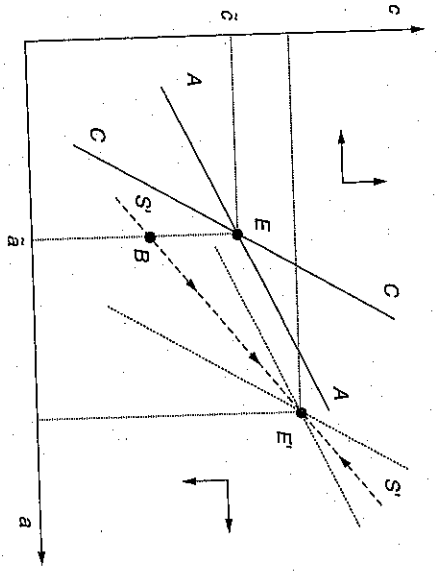


Figure 12.7 Reduction in the Devaluation Rate in the One-Good Model.

outflows), which returns to its initial value. During the transition the current account remains in surplus (in part because the reduction in foreign borrowing lowers the risk premium and improves the services account), which is large enough to compensate for the capital account deficit. Over time, therefore, the central bank's holdings of foreign assets and the real money stock increase. As a result of both the increase in real money balances and the reduction in the foreign borrowing, private financial wealth rises over time. Assuming that the risk-free rate is not too large, the rate of nominal credit growth falls gradually over time toward the lower devaluation rate. The new steady state is reached at point E' .

2.1.6 | Credit Growth Rule

Under a constant nominal-credit rule ($\mu = \mu^h$), foreign reserves of the central bank remain constant ($\dot{R}^* = 0$), and the devaluation/inflation rate is determined endogenously. Setting, for simplicity, the constant level of official reserves equal to zero (so that $m = d$), Equation (41) yields

$$\varepsilon = i(c, d) - i^* - \gamma L^* = \varepsilon(\bar{c}, \bar{d}, L^*),$$

which can be substituted out in Equation (45) to give¹⁷

$$\dot{d} = [\mu^h - \varepsilon(c, d, L^*)]d. \tag{59}$$

¹⁷ Given that the nominal credit stock grows at a predetermined rate, the solution for the level of the nominal exchange rate obtains once the path of the real credit stock is known.

Equation (59) determines changes in the real credit stock. Because $\dot{R}^* = 0$, Equation (43) can be written as

$$\dot{L}^* = [i^* + \theta(L^*)]L^* + c + g - \gamma, \tag{60}$$

which determines changes in private external borrowing over time. In contrast to the previous case, therefore, private foreign borrowing is predetermined at any point in time. To ensure solvency of the public sector, we assume that jump-sum transfers are continually adjusted to maintain fiscal equilibrium—so that, from Equations (44) and (45), and with $b = b = 0$, $\tau = g - \mu^h d$. From

The dynamic system now therefore consists of (42), (59), and (60). From (41), $i - \varepsilon = \gamma L^* + i^*$; substituting this result in (42) yields

$$\dot{\varepsilon}/c = \sigma(i - \varepsilon - \rho) = \sigma(\gamma L^* + i^* - \rho) = \Gamma(L^*).$$

The dynamic system is thus

$$\begin{bmatrix} \dot{\varepsilon} \\ \dot{d} \\ \dot{L}^* \end{bmatrix} = \begin{bmatrix} 0 & 0 & \Gamma' \\ -\varepsilon_d \bar{d} & -\varepsilon_d \bar{d} & -\varepsilon_{L^*} \bar{d} \\ 1 & 0 & \Theta \end{bmatrix} \begin{bmatrix} c - \bar{c} \\ d - \bar{d} \\ L^* - \bar{L}^* \end{bmatrix}, \tag{61}$$

where $\Theta = i^* + \bar{\theta} + \bar{L}^* \theta_{L^*}$.

Consumption and the real stock of credit are both jump variables, so to ensure saddlepath stability, system (61) must possess two positive roots and one negative root. In turn, sufficient conditions for this result are that the determinant of the matrix of coefficients in (61) be negative (which ensures either one or three negative roots) and that its trace be positive (which ensures at least one positive root). Both conditions always hold, because the trace is equal to $\Theta - \varepsilon_d \bar{d} > 0$ and the determinant is equal to $\varepsilon_d \bar{d} \Theta' < 0$.

Consider now a reduction in the rate of expansion of the nominal credit stock, from μ^h to $\mu^s < \mu^h$. In the long run, as shown earlier, private foreign borrowing is determined only by the difference between the rate of time borrowing and the risk-free world interest rate, and thus does not change preference and the risk-free world interest rate, and thus does not change [Equation (58)]. Because output is constant, this result implies, using (60), that consumption also does not change. And from (59), the devaluation rate must fall in the same proportion as the nominal credit growth rate, to ensure that the real credit stock is constant in the steady state. As a result, the domestic nominal interest rate also falls in the same proportion as the nominal credit growth rate.

But because consumption does not change, the reduction in the opportunity cost of holding money is unambiguously associated with an increase in real money balances—or, equivalently, given that official reserves are constant, an increase in the real credit stock. And because the stock of nominal credit does not change, the nominal exchange rate must undergo a step appreciation (a discrete fall in prices). There are, therefore, *no transitional dynamics*. The economy jumps immediately to a new steady state, with no effect on consumption, the current account, private foreign borrowing, or the domestic

real interest rate. The rate of depreciation falls instantaneously to the lower level of the credit growth rate. The nominal interest rate falls also in the same proportion as the credit growth rate, and is associated with a steady-state increase in real money balances, resulting from an appreciation of the nominal exchange rate.¹⁸

The thrust of the foregoing discussion, then, is that exchange rate and monetary rules may lead to very different adjustment paths for the main variables under imperfect capital mobility. Models based on the monetary approach to the balance of payments—such as the one developed by Calvo and Rodriguez (1977)—typically possess a “dynamic equivalence” property, in the sense that the steady-state solutions and the adjustment paths associated with a monetary rule or an exchange-rate rule are identical. In the model developed here, although either rule can be used to attain a long-run inflation rate target—given the solvency constraint of the public sector—the behavior of the economy during the transition period is completely different.¹⁹ Under a credit growth rule, there is no transitional adjustment as such; the economy jumps immediately to the new steady state. Under an exchange-rate rule, by contrast, there are two types of adjustments: those that occur through time and those that occur instantaneously, in order to maintain portfolio balance. Depending on the constraints that policymakers face in the short run, the nature of the transitional dynamics may determine the adoption of one rule as opposed to the other; the implication of this result for the choice of a nominal anchor in disinflation programs will be examined in the next chapter.

2.1.7 | Dynamics with Alternative Fiscal Policy Rules

The adjustment path induced by monetary and exchange-rate policy shocks depends, among other factors, on the financing rules that policymakers adopt to close the fiscal deficit. Consider, for instance, a situation in which the government (as before) does not issue bonds, and the central bank sets the rate of growth of nominal credit so as to compensate the government for the loss in value of the real outstanding stock of credit due to inflation ($\mu = \epsilon$). The government then adjusts lump-sum taxes endogenously to close the fiscal deficit. In this setting, monetary policy and exchange-rate policy cannot be distinguished. This financing rule nevertheless satisfies the transversality condition of the public sector given above and is therefore sustainable. Because the credit rule implies that $\dot{d} = 0$, Equation (44), with $b = b = 0$, can be solved

¹⁸ Turnovsky (1985) obtains qualitatively similar results.

¹⁹ Auerhainer (1987), Kiguel (1987), and Velasco (1993) also develop models in which the adjustment path depends on the prevailing policy rule. In particular, Kiguel develops a model with an endogenous real sector and imperfect capital mobility and shows how the path of the real exchange rate varies under alternative policy rules. Velasco (who assumes zero capital mobility) argues that the rise in real interest rates during the transition to the steady state determines the sustainable size of the primary (noninterest) fiscal deficit, leading to nonequivalence also in the long run.

for the endogenous level of lump-sum taxes:

$$\tau + \epsilon m = g - i^* R^* \quad (62)$$

where ϵm represents again inflation tax revenue. As a result of this rule, $m = R^*$; that is, changes in the real money stock reflect only changes in the central bank's net foreign assets.

An analysis of the above model under the financing rule (62) is provided by Agénor (1997). In particular, Agénor shows that the short- and long-run dynamics associated with a permanent, unanticipated reduction in the rate of devaluation-credit growth rate are qualitatively similar to those described earlier in our discussion of a reduction in the devaluation rate with credit financing of the budget deficit.

Yet another fiscal rule would be to assume that following an initial policy adjustment, the central bank finances its deficit during a transitory period through bond or money financing, with the promise to switch at a future date to either a lower level of government expenditure or tax financing. This type of rule was examined in Chapter 4 in the context of a closed economy, in our discussion of the “monetarist arithmetic.”

2.2 | A Three-Good Model with Flexible Prices

We now extend the analysis to consider the case where the economy produces two goods: a nontradable good that is used only for final domestic consumption, and an exportable good whose output is entirely exported.²⁰ The capital stock in each sector is fixed, while labor is homogeneous and perfectly mobile. Households and the government consume home goods and an imperfectly substitutable importable good, which is not produced domestically. Prices in the home goods sector and nominal wages are perfectly flexible.

2.2.1 | Households

The consumption decision of households follows a two-stage process. They first determine the optimal level of total consumption given their budget constraint, and then allocate the optimal amount between consumption of home and importable goods.²¹

Under the assumption that labor is supplied inelastically, the representative household's discounted lifetime utility remains as given in Equation (27), where c is now an index of total consumption expenditure and real money balances m are measured in terms of the price of the consumption basket, P .

²⁰ All other assumptions of the one-good model—particularly regarding the structure of private portfolios—are maintained in the present framework, which follows Agénor (1997). For simplicity and clarity, we abstract from the existence of an import-competing sector. Such an extension would, however, be useful for analyzing terms-of-trade shocks, as discussed in Chapter 2.

²¹ Precise conditions for the two-stage budgeting process of the type considered here to be well defined are given in Deaton and Muellbauer (1980).

Real financial wealth of the representative household is also defined as in (28):

$$a = m + b - l^* \quad (63)$$

with a and b measured in terms of the price of the consumption basket, and real foreign indebtedness l^* now defined as $l^* \equiv EL^*/P$. The flow budget constraint is now given by

$$\dot{a} = y + ib - c - \tau - (i^* + \theta)l^* - \varepsilon l^* - \pi a, \quad (64)$$

where net factor income y is derived below, and $\pi \equiv \dot{P}/P$ is the overall inflation rate. The term $-\pi a$ accounts for capital losses on total wealth resulting from inflation, whereas the term εl^* represents the increase in the domestic-currency value of external liabilities resulting from exchange-rate devaluation.

Using (63), Equation (64) can be written as

$$\dot{a} = ra + y - c - \tau - (i^* + \theta + \varepsilon - i)l^* - im, \quad (65)$$

where $r = i - \pi$ denotes the domestic real rate of interest.

In the first stage of the consumption decision process, the household treats π , ε , y , i , i^* , and τ as given, internalizes again the effect of his or her borrowing decisions on θ , and maximizes (27) subject to (29) and (65) by choosing a sequence $\{c, m, b, L^*\}_{t=0}^{\infty}$.²² The optimality conditions are similar to those derived before:

$$m^d = \chi c^n / i = m(c, i) \quad (66)$$

$$i = (i^* + \theta + \varepsilon) + L^* \theta_L^* \quad (67)$$

$$c/c = \sigma(r - \rho), \quad (68)$$

together with the transversality condition $\lim_{t \rightarrow \infty} (e^{-\rho t} a) = 0$. Using again a linear approximation to θ , Equation (67) yields a demand function for foreign loans similar to (34):

$$L^* = (i - i^* - \varepsilon) / \gamma. \quad (69)$$

The properties of Equations (66) and (69) are essentially the same as those described in the previous section. An important new element in the present setting, however, is that the intertemporal Euler Equation (68) implies that overall expenditure growth depends on the real rate of interest measured in

²² The assumption that the household chooses the foreign-currency value of foreign loans is adopted for simplicity. Note, however, that it is natural to retain the assumption that the risk premium depends on the foreign-currency value of private foreign borrowing, given that it reflects the behavior of foreign lenders.

terms of the price of the consumption basket. Thus, as emphasized notably by Dornbusch (1983), even in the absence of capital market imperfections ($\gamma \rightarrow 0$), the presence of nontradable goods prevents equalization of domestic and foreign real interest rates. Put differently, differential changes in the relative price of nontradable goods across countries imply different real rates of return even when nominal rates of return are equal.

In the second stage of the consumption decision process, the representative household maximizes a homothetic sub-utility function $V(c_N, c_I)$, subject to the static budget constraint

$$P_N c_N + E c_I = P c,$$

where P_N denotes the price of the home good, and c_I (c_N) expenditure on the importable (nontradable) good. Because the foreign-currency price of the importable good is normalized to unity, the domestic-currency price is simply the nominal exchange rate.

Let z be the relative price of the importable good in terms of the home good, that is $z \equiv E/P_N$. Because the representative household's intratemporal preferences are homothetic, the desired ratio between home and importable goods depends only on their relative price, and not on overall expenditure. Thus:

$$V_{c_N} / V_{c_I} = z^{-1}.$$

Suppose that the sub-utility function is Cobb-Douglas, so that

$$V(c_N, c_I) = \delta^{\delta} c_N^{1-\delta} c_I^{\delta},$$

where $0 < \delta < 1$ denotes the share of total spending falling on home goods.

The desired composition of spending is thus

$$c_N / c_I = \delta z / (1 - \delta),$$

which can be substituted in the intratemporal budget constraint, $c = z^{\delta} (c_I + c_N / z)$, to give

$$c_N = \delta z^{1-\delta} c, \quad c_I = (1 - \delta) z^{-\delta} c. \quad (70)$$

From the indirect sub-utility function, the appropriate definition of the consumer price index P is thus (Samuelson and Swamy, 1974):²³

$$P = P_N^{\delta} E^{1-\delta} = E z^{-\delta}, \quad (71)$$

so that the inflation rate is

$$\pi = \varepsilon - \delta \dot{z} / z. \quad (72)$$

²³ Strictly speaking, the cost-of-living index should also include the opportunity cost of holding real money balances, that is, the domestic nominal interest rate. For simplicity, this component is ignored.

2.2.2 | Output and the Labor Market

Technology for the production of tradable and nontradable goods is characterized by decreasing returns to labor:

$$y_h = y(n_h), \quad y_h' > 0, \quad y_h'' < 0 \quad h = N, X \quad (73)$$

where y_h denotes output of good h , and n_h the quantity of labor employed in sector h . From the first-order conditions for profit maximization, the sectoral labor demand functions can be derived as

$$n_X^d = n_X^d(w_X), \quad n_N^d = n_N^d(zw_X), \quad n_X^d, n_N^d < 0, \quad (74)$$

where w_X is the product wage in the exportable goods sector. Nominal wages are perfectly flexible, so that w_X can be solved for from the equilibrium condition of the labor market:

$$n_X^d(w_X) + n_N^d(zw_X) = n^s,$$

where n^s denotes the supply of labor, which is again taken to be constant. This equation implies that the equilibrium product wage is negatively related to the real exchange rate:

$$w_X = w_X(z), \quad w_X' < 0, \quad |w_X'| < 1. \quad (75)$$

Substituting this result in Equations (74), and noting that $d(zw_X)/dz = 1 + w_X' > 0$, yields the sectoral supply equations:

$$y_h^s = y_h^s(z), \quad y_X^s > 0, \quad y_N^s < 0. \quad (76)$$

2.2.3 | Central Bank and the Government

As before, there are no commercial banks in the economy, and the central bank does not provide credit to domestic agents. The real money supply is thus equal to

$$m^s = z^\delta R^*. \quad (77)$$

Real profits of the central bank, $(i^* + \varepsilon)z^\delta R^*$, are fully transferred to the government. With lump-sum financing, and setting the constant real stock of government bonds to zero, the government budget constraint can be written as

$$\tau = z^\delta (g_I + g_N/z) - z^\delta (i^* + \varepsilon)R^*, \quad (78)$$

where g_I and g_N denote government spending on importable and nontradable goods, respectively.

2.2.4 | Market-Clearing Conditions

To close the model requires specifying the equilibrium conditions for the home goods market and the money market, the latter being solved for the market-clearing interest rate. The former condition is given by

$$y_N^s = \delta z^{1-\delta} c + g_N, \quad (79)$$

and, from (66) and (77), the market-clearing interest rate is given as before by (39).

2.2.5 | Dynamic Form

Real factor income y (measured in terms of cost-of-living units) is given by

$$y = z^\delta (y_X^s + y_N^s/z). \quad (80)$$

Equations (63) and (77) yield

$$a = z^\delta (R^* - i^*).$$

Although $R^* - i^*$ is predetermined, the real exchange rate can change in discrete fashion: net financial wealth a (or, equivalently, the domestic-currency value of the economy's stock of foreign assets) can therefore also jump on impact. Using the above definition of a and Equation (72) yields:

$$\dot{a} = z^\delta (\dot{R}^* - \dot{i}^*) + (\varepsilon - \pi)a.$$

Substituting the above results, together with Equations (70), (78), (79), and (80) in (64) yields

$$\dot{L}^* - \dot{R}^* = i^*(L^* - R^*) + \theta(L^*, \cdot)L^* + (1 - \delta)z^{-\delta}c + g_I - y_X^s, \quad (81)$$

which represents the consolidated budget constraint of the economy. As before, integrating Equation (81) yields, subject to the transversality condition $\lim_{t \rightarrow \infty} (L^* - R^*)e^{-rt}$, the economy's intertemporal budget constraint.

From Equations (70) and (79), the short-run equilibrium real exchange rate is obtained as

$$z = z(c; g_N), \quad (82)$$

where

$$z_c = \delta / [y_N^s - \delta(1 - \delta)z], \quad z_{g_N} = 1 / [y_N^s - \delta(1 - \delta)z].$$

Equations (39), (68), (69), (72), (77), (81), and (82) describe the behavior of the economy over time. These equations can be summarized as follows:

$$L^* = [i(c, m) - i^* - \varepsilon] / \gamma, \quad (83)$$

$$\dot{c} / c = \sigma [i(c, m) - \varepsilon + \delta z / z - \rho], \quad (84)$$

$$z = z(c; g_N), \quad (85)$$

$$\dot{D} = i^* D + \theta(L^*)L^* + (1 - \delta)z^{-\delta}c + g_I - y_X^s(z), \quad (86)$$

$$m = z^\delta R^*, \quad (87)$$

with Equation (78) determining residually lump-sum taxes and $D = L^* - R^*$ denoting again net external debt.

To condense the dynamic form into a system involving only c and D , note that from Equation (87):

$$m = z^{\delta}(L^* - D), \tag{88}$$

or, using Equation (83):

$$m = z^{\delta} \{ [i(c, m) - (i^* + \varepsilon) - \gamma D] / \gamma \}. \tag{89}$$

Substituting (85) in (89) yields

$$m = z(c; g^N)^{\delta} \beta \{ i_c c - (i^* + \varepsilon) - \gamma D \}, \quad \beta \equiv 1 / (\gamma - i_m), \tag{90}$$

so that

$$m = \varphi(c, \bar{D}; i^* + \varepsilon, \bar{g}^N), \tag{91}$$

where

$$\varphi_c = \beta \{ i_c + \delta \gamma z_c \bar{R}^* \}, \quad \varphi_D = -\beta \gamma, \quad \varphi_{i^* + \varepsilon} = -\beta, \quad \varphi_{\bar{g}^N} = \beta \delta \gamma z_{g^N} \bar{R}^*.$$

Substituting (91) in (84) yields

$$\dot{c} / c = \sigma \{ [i(c, \varphi(c, D; i^* + \varepsilon, g^N)) - \varepsilon + \delta z / z - \rho] \}. \tag{92}$$

Suppose that changes in g^N occur only in discrete fashion. Equation (85) therefore implies that $z = z_c c$, with $z_c < 0$. Substituting this result in (92) yields a dynamic equation which can be written as

$$\dot{c} = G(c, D; i^*, \varepsilon, \bar{g}^N), \tag{93}$$

where, with $\Delta \equiv \sigma \bar{c} / (1 - \sigma \bar{c} \delta z_c) > 0$:²⁴

$$G_c = (i_c + i_m \varphi_c) \Delta, \quad G_D = i_m \varphi_D \Delta,$$

$$G_{i^* + \varepsilon} = i_m \varphi_{i^* + \varepsilon} \Delta, \quad G_{\bar{g}^N} = i_m \varphi_{\bar{g}^N} \Delta.$$

Substituting Equation (91) into (83) yields

$$L^* = \lambda(c, D; i^* + \varepsilon, \bar{g}^N), \tag{94}$$

where

$$\lambda_D = i_m \varphi_D / \gamma = -i_m \beta, \quad \lambda_{i^* + \varepsilon} = -\beta,$$

$$\lambda_c = (i_c + i_m \varphi_c) / \gamma = \beta (i_c + i_m \delta z_c \bar{R}^*), \quad \lambda_{\bar{g}^N} = i_m \varphi_{\bar{g}^N} / \gamma.$$

Finally, using Equation (94), Equation (86) can be written as

$$\dot{D} = \Psi(c, D; i^*, \varepsilon, \bar{g}^N) - g_I, \tag{95}$$

²⁴ Note that $i_c + i_m \varphi_c = \gamma \beta (i_c + i_m \delta z_c \bar{R}^*) > 0$; thus, G_c is positive regardless of whether m_c is positive or negative. Note also that $i_m \varphi_{i^* + \varepsilon} - 1 = -\beta \gamma < 0$.

where

$$\Psi_c = -z_c [y_X^c + \delta(1 - \delta)z] + (1 - \delta) + (\bar{\theta} + \bar{L}^* \theta_L) \lambda_c,$$

$$\Psi_D = i^* + (\bar{\theta} + \bar{L}^* \theta_L) \lambda_D, \quad \Psi_{\varepsilon} = (\bar{\theta} + \bar{L}^* \theta_L) \lambda_{i^* + \varepsilon},$$

$$\Psi_{\bar{g}^N} = -z_{g^N} [y_X^c + \delta(1 - \delta)z] + (\bar{\theta} + \bar{L}^* \theta_L) \lambda_{\bar{g}^N},$$

$$\Psi_{i^*} = \bar{D} + (\bar{\theta} + \bar{L}^* \theta_L) \lambda_{i^* + \varepsilon}.$$

In general, the partial derivative Ψ_{i^*} is ambiguous. On the one hand, an increase in the risk-free rate raises debt-service payments in proportion to the initial stock of foreign debt; on the other, the premium-related component of external debt service also falls along with the demand for foreign loans by private agents. The net effect on the current account (and thus the rate of accumulation of foreign debt) cannot be ascertained a priori. In the discussion that follows, and in order to focus the discussion on the case of a highly indebted economy, it will be assumed that the net effect is positive ($\Psi_{i^*} > 0$); that is, a rise in the risk-free world interest rate (at given levels of debt and consumption) increases the current-account deficit.

Equations (93) and (95) form again a dynamic system in c and D , which can be linearized around the steady state and written as

$$\begin{bmatrix} \dot{c} \\ \dot{D} \end{bmatrix} = \begin{bmatrix} G_c & G_D \\ \Psi_c & \Psi_D \end{bmatrix} \begin{bmatrix} c - \bar{c} \\ D - \bar{D} \end{bmatrix}. \tag{96}$$

Saddlepath stability requires $G_c \Psi_D - G_D \Psi_c < 0$. The steady-state solution is obtained by setting $\dot{c} = \dot{D} = 0$ in Equations (93) and (95). From Equation (72), the steady-state inflation rate and the rate of inflation in nontradable prices are thus equal to the devaluation rate:

$$\bar{\pi} = \bar{\pi}^N = \varepsilon. \tag{97}$$

As before, in the steady state the current account must be in equilibrium:

$$y_X^c(z) - (1 - \delta)z^{-\delta} \bar{c} - g_I = i^* \bar{D} + \theta(\bar{L}^*, \cdot) \bar{L}^*. \tag{98}$$

The real (consumption-based) interest rate is again equal to the rate of time preference [Equation (47)], and the household's steady-state level of foreign borrowing is given by (58).

The steady-state equilibrium is depicted in Figure 12.8. The NN curve in the northwest quadrant depicts combinations of private consumption c and in the real exchange rate z that are consistent with equilibrium in the market for nontradable goods [Equation (82)], whereas the LL curve in the southwest quadrant depicts combinations of the product wage in the exportable goods sector w_X and the real exchange rate that are consistent with labor market equilibrium [Equation (75)]. The interpretation of the CC and DD curves in the northeast quadrant is similar to the description provided in the previous subsection. In particular, points located to the right of CC represent situations

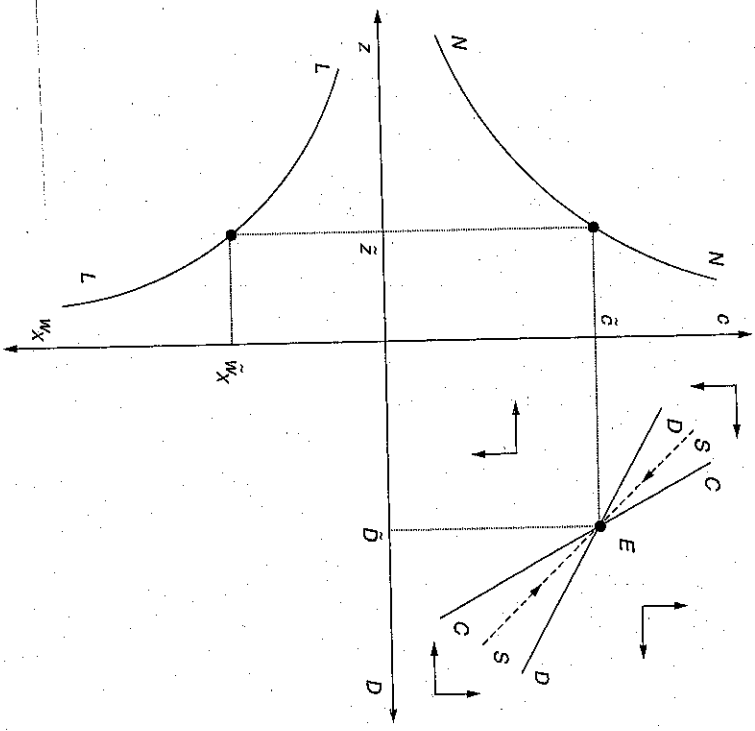


Figure 12.8
Equilibrium in the Three-Good Model.
Source: Agénor (1997, p. 31).

where the domestic real interest rate is higher than the rate of time preference, consumption is increasing, and the real exchange rate is appreciating to eliminate excess supply of nontradable goods. Conversely, points located to the left of CC represent situations of falling consumption, excess supply of home goods, and a depreciating real exchange rate. Saddlepath stability requires again that the CC curve be steeper than the DD curve.

2.2.6 | Policy Experiments

To illustrate the functioning of the model, consider first a tax-financed, permanent increase in g_N . Such a shock has no long-term effect on the domestic nominal interest rate, which remains equal to the rate of time preference plus the devaluation rate [see Equation (47)]. It also has no effect on foreign borrowing by the private sector, which depends, as indicated by

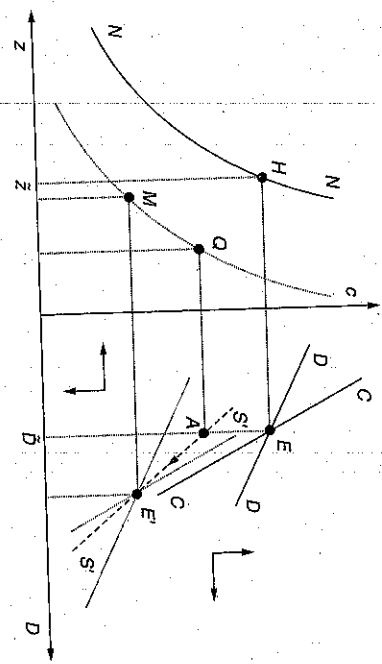


Figure 12.9
Increase in Government Spending on Home Goods.
Source: Agénor (1997, p. 40).

Equation (58), only on the difference between the world risk-free interest rate and the rate of time preference. At the initial level of the real exchange rate, private consumption must fall to maintain equilibrium of the market for nontradable goods. Real money balances must therefore fall, as shown by (49), because domestic interest rates do not change. The reduction in private consumption is proportionally less than the increase in government expenditure, so that total domestic spending on home goods rises and the real exchange rate appreciates to maintain equilibrium in the home goods market. Although the real appreciation tends to reduce output of tradable goods, the trade-balance surplus (which, again, matches the initial deficit of the services account) must rise to maintain external balance, because the economy's stock of debt D increases, and the services account deteriorates. This increase in debt results from a reduction in net foreign assets held by the central bank, R^* (since holdings of foreign assets by the private sector, L^* , do not change), which accommodates the fall in the demand for real money balances.

On impact, private consumption falls—to an extent that depends on the degree of intertemporal substitution—because the increase in government spending raises households' lifetime tax liabilities and thus reduces their lifetime wealth. But the real exchange rate may now either appreciate or depreciate, depending on whether total spending on nontradable goods rises sufficiently low, private consumption will change relatively little on impact, and total spending will increase, thereby leading to an appreciation of the real exchange rate on impact.

Figure 12.9 illustrates the adjustment path to a permanent increase in g_N in the case where the degree of intertemporal substitution is indeed low

enough to ensure that the real exchange rate appreciates on impact. Curves CC and DD both shift to the left in the northeast panel.²⁵ The NN curve in the northeast panel shifts inward. Private consumption jumps downward from point E to point A located on the new saddlepath $S'S'$, and the real exchange rate jumps from point H to point Q located on the new NN curve. At the initial level of interest rates and official reserves, the real money stock falls on impact; the reduction in money demand induced by the fall in consumption is matched by a reduction in supply, resulting from the valuation effects on the domestic-currency value of official reserves associated with the appreciation of the real exchange rate. If valuation effects are not too large, the fall in private consumption leads to a reduction in the domestic nominal interest rate, despite the upward pressure induced by the reduction in money supply. Private foreign indebtedness therefore falls, and the economy registers an outflow of capital. Because the stock of foreign debt cannot change on impact, official reserves must fall concomitantly. The current account moves into deficit ($\dot{D}_0 > 0$) and—as a consequence of the steady-state increase in the stock of debt and the monotonicity of the adjustment path to the new equilibrium—remains in deficit throughout the transition process.²⁶ Private consumption continues to fall over time, and the real exchange rate depreciates. Because the domestic nominal interest rate falls on impact, it must be rising during the transition to the new long-run equilibrium in order to restore the equality between the real interest rate and the rate of time preference. Thus, private foreign indebtedness increases over time and the economy experiences net capital inflows, which continue until private borrowing on world capital markets returns to its initial value.

Consider now an unanticipated reduction in the devaluation rate, ε .²⁷ Suppose first that the shock is permanent. As formally shown in the Appendix to this chapter, the reduction in ε in this case has no long-run effects on the real interest rate or private foreign borrowing. But, although the real interest rate

²⁵ As noted by Agénor (1997), the movement of the CC locus shown in the figure is drawn under the empirically plausible assumption that valuation effects (which account for the indirect effect of government spending on changes in private consumption, through its impact on the real exchange rate) are not too large.

²⁶ The services account unambiguously improves, because the premium-related component of external debt service falls—as a result of both the reduction in private foreign borrowing and the reduction in the risk premium itself. For the current account to move into deficit on impact therefore requires the trade balance to deteriorate sufficiently to outweigh the improvement in the services account. And because private consumption falls, the reduction in output of tradable goods (resulting from the appreciation of the real exchange rate) must exceed the drop in consumption.

²⁷ Of course, because the initial steady state is in the present setting characterized by full employment (wages are fully flexible), it is not clear what the costs of inflation (and thus the benefits of disinflation) are. Given the illustrative nature of the exercise, however, it is sufficient to assume the existence of implicit distortions associated with the initial inflation-devaluation rate.

remains equal to the rate of time preference in the new steady state, the nominal interest rate falls in the same proportion as the devaluation rate. The reduction in the opportunity cost of holding money raises the demand for domestic cash balances. The official stock of net foreign assets must therefore increase; and because private foreign borrowing does not change, the economy's external debt must be lower in the new steady state, implying that the initial deficit in the services account is also lower. To maintain external balance, the initial trade surplus must fall—or equivalently private consumption must rise. The increase in private expenditure leads to a real exchange-rate appreciation and raises further the demand for domestic cash balances.

On impact, consumption falls because the immediate effect of the reduction in ε is to increase the real interest rate, thereby creating an incentive for the household to shift consumption toward the future. The reduction in ε also leads to a discrete increase in private demand for foreign loans, thereby requiring an offsetting increase in official reserves (and thus a rise in the real money stock) which is such that the economy's stock of debt remains constant on impact. Because consumption falls and the real money stock rises, the net impact effect on the nominal interest rate is unambiguously negative.²⁸

The fall in consumption requires a depreciation of the real exchange rate to maintain equilibrium between supply and demand for home goods. As a result of the reduction in private spending and the expansion of output of tradables induced by the depreciation of the real exchange rate, the trade balance surplus increases. At the same time, the negative income effect associated with the increase in the premium-related component of interest payments (itself resulting from the increase in private foreign borrowing) raises the initial deficit of the services account. The current account nevertheless improves, and external debt falls ($\dot{D}_0 < 0$). Because the shock is permanent, the current account remains in surplus throughout the adjustment process. Consumption begins increasing, and the real exchange rate appreciates. The real interest rate rises toward its initial steady-state level, given by the rate of time preference. The upper panel of Figure 12.10 illustrates the dynamics of this shock. Both CC and DD shift to the left. Consumption jumps downward from point E to point A on impact, and begins rising afterward. The economy's stock of foreign debt falls continuously during the transition to the new steady state, which is reached at point E' .

The case where the reduction in ε is temporary is illustrated in the lower panel of Figure 12.10. Again, because the shock is temporary, the optimal smoothing response for the representative household is to reduce consumption by less than he or she would if the shock was permanent. Depending on the length of the interval $(0, T)$, two adjustment paths are possible. If the duration of the shock is short, private consumption will jump downward from point E

²⁸ If the degree of capital mobility (as measured by γ) is sufficiently high, the nominal interest rate will fall approximately by the same amount as the devaluation rate.

2.3 | Extensions

The two-sector model developed above can be further extended to account for other features deemed relevant for developing countries. We consider here the existence of imported intermediate inputs and price stickiness in the nontraded goods sector.

2.3.1 | Imported Intermediate Inputs

Suppose, for instance, that output of nontraded goods is produced using labor n_N and imported intermediate materials O_N according to a fixed-coefficients technology. The production function is thus given by³⁰

$$y_N = \min(n_N, \alpha O_N),$$

where the parameter $1/\alpha$ measures the amount of intermediate materials that must be combined with a unit of labor to produce a unit of the domestic good. Constant returns to scale prevail in the nontraded goods sector according to this formulation. Factor demand functions are given by

$$n_N^d = y_N, \quad O_N^d = \alpha^{-1} y_N.$$

Assuming that the world price of imported inputs is equal to unity, in equilibrium the price of home goods would be given by the zero-profit condition:

$$p_N = w + \alpha^{-1} E,$$

which implies that $w/E = z - \alpha^{-1}$. If intermediate imports are treated as final tradable goods, modifications of the current account equation are straightforward.

2.3.2 | Sticky Prices

In the basic three-good model presented earlier, we assumed that prices of nontraded goods were perfectly flexible. Although this assumption is convenient as a benchmark case, it is not necessarily well-supported by the evidence; in fact, a number of economists would adopt the view that the degree of price inertia can be substantial in the short run. We now discuss briefly how the three-good model developed previously can be modified to introduce sticky prices.

Of course, because prices of exportables are given on world capital markets, we only need to focus on price formation in the home goods sector. Accordingly, suppose now that the price of the nontraded good P_N is predetermined and adjusts only gradually in response to disequilibrium in the market for these goods. Specifically, consider the price adjustment equation:

$$\dot{P}_N \equiv \dot{P}_N/P_N = \beta[\delta z^{-1-\delta} c + g_N - y_N^s] + \varepsilon, \quad \beta > 0, \tag{99}$$

³⁰ A similar formulation is adopted by Obstfeld (1986b).

where β denotes the speed of adjustment. In the limiting case of $\beta = 0$ the model operates in a "Keynesian" mode with fixed prices, whereas the case of perfect price flexibility considered earlier corresponds to $\beta \rightarrow \infty$. In general, the assumption of sticky prices carries with it some underlying rationing mechanism and the possibility of various rationed equilibria.³¹ However, this issue will not be pursued here.

Because by definition $\dot{z}/z = \varepsilon - \pi_N$, using Equation (99) yields

$$\dot{z}/z = \varepsilon - \beta[\delta z^{-1-\delta} c + g_N - y_N^s] - \varepsilon = \Phi(\bar{c}, \bar{z}, \bar{\varepsilon}, \bar{g}_N^s), \tag{100}$$

where, in particular, $\Phi_c = -\beta\delta$. Thus, in contrast to the case of perfect price flexibility, the relationship is not between the rates of change of the real exchange rate and consumption, but between the rate of change of z and the level of c .

In addition to (100), the other equations of the dynamic system are, as derived earlier:

$$L^* = [f(c, m) - i^* - e]/\gamma, \tag{101}$$

$$\dot{c}/c = \sigma[f(c, m) - \varepsilon + \delta z/z - \rho], \tag{102}$$

$$\dot{D} = i^* D + \theta(L^*)L^* + (1 - \delta)z^{-\delta} c + g_I - y_X^s(z), \tag{103}$$

$$m = z^\delta R^*, \tag{104}$$

$$L^* = \Lambda(c, D; i^* + \varepsilon), \tag{105}$$

where, as shown previously, $\Delta_c, \Delta_D > 0$, and $\Delta_{i^*+\varepsilon} < 0$. Eliminating L^* as before using (101) and (104) yields

$$m = z^\delta \{ [f(c, m) - (i^* + \varepsilon) - \gamma D] / \gamma \},$$

which can be written as

$$m = \varphi(\bar{c}, \bar{z}, \bar{D}; i^* + \varepsilon),$$

where as before $\varphi_D = -\beta\gamma$ and $\varphi_{i^*+\varepsilon} = -\beta$, and now

$$\varphi_c = \beta i_c, \quad \varphi_z = \delta \bar{R}^*, \quad \varphi_{g_N} = 0.$$

Substituting this result in Equation (102) yields

$$\dot{c}/c = \sigma \{ [f(c, z, D, i^* + \varepsilon)] - \varepsilon + \delta z/z - \rho \},$$

so that, using (100):

$$\dot{c} = G(\bar{c}, \bar{z}, \bar{D}, i^* + \varepsilon, \bar{g}_N^s), \tag{106}$$

³¹ Firms, for instance, will typically increase output only as long as the marginal cost (the going real wage) does not exceed the prevailing product price.

with now $\Delta = \sigma \bar{c} > 0$.³²

$$G_c = (i_c + i_m \phi_c + \delta \Phi_c) \Delta, \quad G_z = (i_m \phi_z + \delta \Phi_z) \Delta, \quad G_D = i_m \phi_D \Delta, \\ G_{i^*} = i_m \phi_{i^* + \varepsilon} \Delta, \quad G_\varepsilon = (i_m \phi_{i^* + \varepsilon} - 1) \Delta, \quad G_{g^*} = \delta \Phi_{g^*} \Delta.$$

Although $i_c + i_m \phi_c > 0$, the sign of G_c is in general ambiguous. G_z is also ambiguous. If the speed of adjustment β is sufficiently high (as will be assumed below), $G_\varepsilon, G_z < 0$.

Equations (103) and (105) yield

$$\bar{D} = \Psi(c, z, \bar{D}; i^*, \bar{\varepsilon}) - g_i, \tag{107}$$

where Ψ_D, Ψ_{i^*} , and Ψ_ε are as given earlier:

$$\Psi_D = i^* + (\bar{\theta} + \bar{I}^* \theta_{L^*}) \Delta_D, \quad \Psi_\varepsilon = (\bar{\theta} + \bar{I}^* \theta_{L^*}) \Delta_{i^* + \varepsilon}, \\ \Psi_{i^*} = \bar{D} + (\bar{\theta} + \bar{I}^* \theta_{L^*}) \Delta_{i^* + \varepsilon};$$

and now

$$\Psi_c = (1 - \delta) + (\bar{\theta} + \bar{I}^* \theta_{L^*}) \Delta_c, \quad \Psi_z = -\gamma \bar{x}' - \delta(1 - \delta) \bar{c},$$

with $\Psi_{i^*} > 0$ assumed positive as before.³³

Equations (100), (106), and (107) represent a dynamic system in c, z , and D . As before, linearizing the model around the steady state gives

$$\begin{bmatrix} \dot{c} \\ \dot{z} \\ \dot{D} \end{bmatrix} = \begin{bmatrix} G_c & G_z & G_D \\ \Phi_c & \Phi_z & 0 \\ \Psi_c & \Psi_z & \Psi_D \end{bmatrix} \begin{bmatrix} c - \bar{c} \\ z - \bar{z} \\ D - \bar{D} \end{bmatrix} \tag{108}$$

To examine the local stability properties of the linearized system, note that the determinant of the system's matrix of coefficients Λ may be written as

$$|\Lambda| = -\Phi_c (\Psi_D G_z - \Psi_z G_D) + \Phi_z (\Psi_D G_c - \Psi_c G_D),$$

from which it can be established, assuming that Ψ_D is initially close to zero, that $|\Lambda| > 0$. Because $|\Lambda|$ is equal to the product of the system's characteristic roots, there are either two roots with negative real parts or no negative root. Suppose that the speed of adjustment β is sufficiently high to ensure that the trace of the system's matrix of coefficients $\text{tr} \Lambda$, given by

$$\text{tr} \Lambda = G_c + \Phi_z + \Psi_D,$$

is negative. Because $\text{tr} \Lambda$ is equal to the sum of the system's characteristic roots, there must be at least one root with a negative real part. It can therefore be concluded that there are exactly two roots with negative real parts. Thus, because z and D are predetermined state variables, the system is saddlepath stable.

³² Note again that $i_m \phi_{i^* + \varepsilon} - 1 = -\gamma \beta < 0$, and that in the case where β^* is small, $G_{g^*} \rightarrow 0$.
³³ Note that now $\Psi_{g^*} = 0$.

With two predetermined variables and one jump variable, it is not straightforward to apply standard phase diagram techniques, although the solution technique proposed by Dixit (1980) can be useful in this case to assess impact effects on consumption (see, for instance, Agénor, 1998a). One can also solve the model numerically to examine the short- and long-run effects of the type of shocks that we considered previously. Cook and Devereux (2006a), for instance, study the quantitative impact of an exogenous rise in the country risk premium in an open-economy model with sticky prices, imported intermediate goods, and flexible exchange rates.

Various other extensions are possible, depending on the issue at hand. These include the introduction of sticky wages, a positive supply effect of government expenditure (as in Kimbrough, 1985, and Chapter 17), private investment and capital accumulation (in line with our discussion in Chapter 3), or a banking system (as discussed in Chapter 7).³⁴ The analysis could also be extended to account for habit formation and durable goods, as in Ikeda and Gombi (1999), Karayalcin (2003), Mohsin (2006), and Mansoorian and Neaime (2003). The first three studies focus on the current-account effects of fiscal policy; whereas the third discusses (as in this chapter) the dynamic effects of a change in the devaluation rate. But some of these extensions could come at the cost of making the model overly complex and difficult to solve analytically. Again, a numerical solution becomes the only recourse.

APPENDIX: Impact and Steady-State Effects

This Appendix establishes the impact and steady-state effects of a reduction in ε in the three-good model with flexible prices.

Consider first a permanent shock. The equation of the saddlepath, SS , of the dynamic system (108) is given by

$$c - \bar{c} = \kappa(D - \bar{D}), \tag{A-1}$$

where $\kappa \equiv (\nu - \Psi_D) \Psi_c = G_D / (\nu - G_c) < 0$ and ν denotes the negative root of (96). κ is the slope of the saddlepath SS .

From Equations (93) and (95), it can be established that

$$d\bar{c}/d\varepsilon = (\Psi_c G_D - \Psi_D G_c) / \Omega, \tag{A-2}$$

$$d\bar{D}/d\varepsilon = (\Psi_c G_c - \Psi_D G_c) / \Omega, \tag{A-3}$$

where $\Omega \equiv G_c \Psi_D - G_D \Psi_c < 0$ to ensure saddlepath stability, and (as discussed in the text) $G_\varepsilon, \Psi_\varepsilon < 0$. To show that $d\bar{c}/d\varepsilon > 0$ requires showing that

³⁴ Dixon and Kara (2006) provide a general framework that accounts for various sources of wage stickiness and for understanding its relation with inflation persistence. Ascari (2003) focuses on the relation between wage stickiness and output persistence. He also discusses differences between wage and price stickiness.

$\Psi_e G_D - \Psi_D G_e < 0$ or that

$$\Psi_e / \Psi_D < G_e / G_D = (i_m \psi^{i^*+e} - 1) / i_m \psi^D = 1 / i_m^*$$

or equivalently

$$(\bar{\theta} + \bar{I}^* \theta_{L^*}) \lambda_{i^*+e} < i_m^{-1} [i^* + (\bar{\theta} + \bar{I}^* \theta_{L^*}) \lambda_D]$$

With $\lambda_D = -i_m^* \beta$ and $\lambda_{i^*+e} = -\beta$ (with $\beta \equiv 1 / (\gamma - i_m^*)$):

$$-\beta(\bar{\theta} + \bar{I}^* \theta_{L^*}) < i_m^{-1} [i^* - i_m^* \beta(\bar{\theta} + \bar{I}^* \theta_{L^*})],$$

or $i^* > 0$, which always holds. From the equilibrium condition of the home goods market:

$$d\bar{z}/de = z_e d\bar{z}/de < 0. \tag{A.4}$$

From the steady-state condition (47), $d\bar{r}/de = 1$. From (49):

$$d\bar{m}/de = m_e d\bar{r}/de + m_i < 0,$$

and from (A.4), with $\bar{z} = 1$:

$$d\bar{R}^*/de = d\bar{m}/de + \delta \bar{m}(d\bar{z}/de) < 0.$$

This result implies, because $d\bar{r}^*/de = 0$, that

$$d\bar{D}/de = -d\bar{R}^*/de > 0.$$

To determine the impact effects of a reduction in ε , note that from Equation (A.1) and because $dD_0/de = 0$:

$$dc_0/de = d\bar{c}/de - \kappa(d\bar{D}/de),$$

which implies that, using (A.2), (A.3), and the definition of κ :

$$dc_0/de = [\Psi_e(G_D + \kappa G_e) - v G_e] / \Omega,$$

or equivalently, because $G_D + \kappa G_e = \kappa v$:

$$dc_0/de = -v(G_e - \kappa \Psi_e) / \Omega > 0. \tag{A.5}$$

Thus, from the equilibrium condition of the market for nontradable goods,

$$dz_0/de = z_e dc_0/de < 0, \tag{A.6}$$

and from Equations (76), output of nontradable (exportable) goods falls (rises) on impact.

From the equilibrium condition of the money market

$$di_0/de = (i_e + i_m \psi_e)(dc_0/de) + i_m \psi^{i^*+e} > 0, \tag{A.7}$$

because $i_e + i_m \psi_e$ and $i_m \psi^{i^*+e}$ are both positive. It can be established that $di_0/de \rightarrow 1$ when $\gamma \rightarrow 0$, and that $di_0/de < 1$ for $\gamma > 0$.

Finally, from Equation (83), and given that $di_0/de < 1$:

$$d\pi_0^*/de = \gamma^{-1} \{ (di_0/de) - 1 \} < 0,$$

because $dD_0/de = 0$, $dR_0^*/de = dL_0^*/de < 0$. Thus, using (A.7), and with $\bar{z} = 1$:

$$d\pi_0^*/de = d(c_0^2 R_0^*)/de = \delta \bar{R}^*(dz_0/de) + dR_0^*/de < 0.$$

Consider now a temporary reduction in ε . The general solution of system (96) can be written:

for $0 \leq t \leq T$,

$$D = \bar{D}_{t \leq T} + C_1 e^{v_1 t} + C_2 e^{v_2 t}, \tag{A.8}$$

$$c = \bar{c}_{t \leq T} + \kappa_1 C_1 e^{v_1 t} + \kappa_2 C_2 e^{v_2 t}, \tag{A.9}$$

and for $t \geq T$,

$$D = \bar{D}_0 + C_1' e^{v_1 t} + C_2' e^{v_2 t}, \tag{A.10}$$

$$c_t = \bar{c}_0 + \kappa_1 C_1' e^{v_1 t} + \kappa_2 C_2' e^{v_2 t}, \tag{A.11}$$

where $v_1 (=v)$ denotes the negative root and v_2 the positive root of the system, and $\kappa_h = G_D / (v_h - G_e)$, $h = 1, 2$. The four arbitrary constants $C_1, C_2, C_1',$ and C_2' are determined under the assumptions that (a) $C_2' = 0$ (for the transversality condition to hold); (b) D evolves continuously from its initial given value $\bar{D}_0 = D_0$, so that $D_0 = \bar{D}_{t \leq T} + C_1 + C_2$; and (c) the time paths for c and D are continuous for $t > 0$. In particular, at time $t = T$, the solutions for (A.8) and (A.10); and (A.9) and (A.11) must coincide, yielding two more equations which, together with the above condition on D_0 , uniquely determine the solution for $C_1, C_2,$ and C_1' . The solutions are given by:

for $0 \leq t \leq T$

$$D = \bar{D}_{t \leq T} - X \Delta (D_0 - D_{t \leq T}) e^{v_1 t} + X v_1 (v_2 - G_e) (D_0 - \bar{D}_{t \leq T}) e^{v_2 (t-T)},$$

$$c = \bar{c}_{t \leq T} - X \Delta \kappa_1 (D_0 - \bar{D}_{t \leq T}) e^{v_1 t} + X v_1 G_e (D_0 - \bar{D}_{t \leq T}) e^{v_2 (t-T)},$$

and

for $t \geq T$

$$D = D_0 - X (D_0 - \bar{D}_{t \leq T}) e^{v_1 t} \{ \Delta - v_2 [v_1 - G_e] e^{-v_1 T} \},$$

$$c = \bar{c}_0 + \kappa_1 (D - D_0),$$

where

$$X = 1 / G_e (v_2 - v_1), \quad \Delta = -X + v_1 (v_2 - G_e) e^{-v_1 T}.$$

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Analytical Issues in Disinflation Programs

The repeated failure of disinflation attempts in developing countries, particularly in Latin America, has given rise to a voluminous literature aimed at explaining the mechanisms through which program collapse may occur. While the early literature focused on the role of policy inconsistencies and inertial mechanisms (such as backward-looking implicit or explicit wage indexation, and adaptive inflationary expectations), more recent developments have highlighted the role of credibility and its interactions with expectations regarding the sustainability and political feasibility of government stabilization policies.

This chapter focuses on a selected, but representative, set of issues that have been considered in the recent literature. Section 1 focuses on two issues that have drawn much attention in recent discussions on exchange-rate-based stabilization programs: the boom-recession pattern of output (which was discussed in Chapter 11) and the behavior of real interest rates at the inception of such programs. We discuss the various interpretations of these phenomena that have been advanced in the literature, particularly the role of expectations about future government policies, and provide an assessment of alternative views. Section 2 examines the role of credibility factors in the formulation and design of stabilization programs. We review alternative mechanisms that have been suggested to enhance the credibility of such programs, including the adoption of a shock therapy approach for "signaling" purposes, the use of multiple nominal anchors, increased central bank independence, and recourse to foreign assistance.

1 | Topics in Exchange-Rate-Based Programs

The empirical evidence on stabilization programs reviewed in Chapter 10 indicated that although the use of the exchange rate as a key nominal anchor brought hyperinflation to a halt with a relatively small output cost, success in using the exchange rate has been more limited in chronic-inflation countries. The Southern Cone tablita experiments of the late 1970s, in particular, were associated with a slow reduction in the inflation rate and an appreciation of the real exchange rate.

In addition, such programs have often been accompanied by an initial expansion in economic activity, followed by a significant contraction. In the exchange-rate-based stabilization program implemented in Morocco in 1990, for instance, an initial expansion followed by a significant slowdown was also

discernible. Output grew at an annual rate of more than 10 percent in 1990 (compared with 1.5 percent in 1989) but dropped to -2.4 percent in 1991, -4.1 percent in 1992, and -0.2 percent in 1993. The boom-recession cycle seems to have been observed in both successful and eventually unsuccessful stabilization attempts, and has attracted much interest from development macroeconomists.

The behavior of real interest rates in exchange-rate-based stabilization programs has also been the subject of some scrutiny. While real interest rates declined at the inception of the program in the Southern Cone tablita experiments of the late 1970s, they rose sharply in the heterodox programs of the 1980s implemented in Argentina, Brazil, Israel, and Mexico (Végh, 1992; Rebelo and Végh, 1997). In addition, while real interest rates showed a tendency to increase gradually over time in the early experiments, no discernible pattern seems to have emerged in the more recent programs.

This section discusses a variety of analytical models that have attempted to explain the behavior of output and real interest rates in exchange-rate-based stabilization programs. A key aspect of some of these models is the emphasis on the dynamic effects associated with imperfectly credible policy announcements, or more generally the effect of varying expectations about present and future government policies. We begin by examining alternative interpretations of the boom-recession puzzle and then focus on explanations of the behavior of real interest rates.

1.1 | The Boom-Recession Cycle

The first attempt at explaining the expansion-recession cycle that appears to characterize exchange-rate-based disinflation programs (in particular the tablita experiments) was proposed by Rodríguez (1982). More recently, an alternative explanation was developed by Calvo and Végh (1993a, 1993b). A key feature of the latter approach is its emphasis on the interactions between the lack of credibility (modeled as a temporary policy) and intertemporal substitution effects in the transmission of policy shocks to the real sphere of the economy.¹ We first present the Rodríguez model and then provide a detailed account of the Calvo-Végh "temporariness" model, before evaluating the key features of both models.

1.1.1 | Expectations, Real Interest Rates, and Output

The model developed by Rodríguez (1982) explains the behavior of output in exchange-rate-based programs implemented in a small open economy where the exchange-rate path is preannounced, the money supply is endogenous,

¹The role of intertemporal substitution in consumption—simply put, that agents are sensitive to changes in the relative price of consuming now rather than later—was also emphasized by Obstfeld (1985), whose contribution is discussed later.

Financial Integration, Capital Inflows, and Sudden Stops

The degree of integration of financial markets around the world increased significantly during the late 1980s and 1990s. A key factor underlying this process has been the increased globalization of investments seeking higher rates of return and the opportunity to diversify risk internationally. At the same time, many countries have encouraged inflows of capital by dismantling restrictions and controls on capital outflows, deregulating domestic financial markets, liberalizing restrictions on foreign direct investment, and improving their economic environment and prospects through the introduction of market-oriented reforms. Indeed, many developing and transition economies in East Asia, Latin America, and Eastern Europe removed restrictions on international financial transactions, at the same time that they relaxed regulations on the operation of domestic financial markets and moved away from regimes of financial repression.

The increase in the degree of integration of world capital markets has been accompanied by a significant rise in private capital flows to developing countries. Foreign direct investment to these countries started growing in the 1980s and expanded at an accelerated rate after 1990, whereas portfolio flows have fluctuated significantly. Short-term, cross-border capital flows have also become more responsive to changes in relative rates of return, as a result of technological advances and increased linkages among capital markets.

Financial openness is often regarded as providing important potential benefits. Access to world capital markets, as noted earlier, expands investors' opportunities for portfolio diversification and provides a potential for achieving higher risk-adjusted rates of return. From the point of view of the recipient country, there are potentially large benefits as well. It has been argued that access to world capital markets allows countries to borrow to smooth consumption in the face of adverse shocks, and that the potential growth and welfare gains resulting from such international risk sharing can be large and permanent (Obstfeld, 1994). At the same time, however, it has been recognized that the risk of volatility and abrupt reversals in capital flows in the context of a highly open capital account may represent a significant cost. Concerns associated with such reversals were heightened by a series of recent financial crises (see Chapter 15). Although misaligned fundamentals usually played a very important role in all of the above crises (in the form of either overvalued exchange rates, excessive short-term foreign borrowing, or growing fiscal and current-account imbalances), they have called attention to the inherent instability of international financial markets and the risks that cross-border financial transactions can pose for countries with relatively fragile

financial systems and weak regulatory and supervision structures. From that perspective, a key issue has been to identify the policy prerequisites that may allow countries to exploit the gains, while minimizing the risks, associated with financial openness.

This chapter begins with a selective review of the recent analytical and empirical literature on the benefits and costs of international financial integration.¹ Section 2 discusses alternative ways to measure the degree of financial integration, or more specifically, the degree of capital mobility. Section 3 discusses explanations that are often offered to explain episodes of capital inflows into developing countries. Section 4 discusses the characteristics of sudden reversals in capital inflows, namely, sudden stops. Section 5 examines the policy challenges posed by these inflows and the policy options available to the recipient countries.

1 | Benefits and Costs of Financial Integration

This section provides a selective review of the recent analytical and empirical literature on the benefits and costs of international financial integration, to identify some key policy lessons for small open economies. The first part reviews analytical arguments related to the benefits and costs of integration, with particular attention paid to the determinants of capital flows to small countries and the role of foreign bank penetration.² The second part provides an assessment of the empirical evidence on the benefits and costs of financial integration, highlighting in the process areas in which this evidence appears to lack robustness.

1.1 | Potential Benefits

Analytical arguments supporting financial openness (or, equivalently, an open capital account) revolve around four main considerations: the benefits of international risk sharing for consumption smoothing; the positive impact of capital flows on domestic investment and growth; enhanced macroeconomic discipline; and increased efficiency, as well as greater stability, of the domestic financial system associated with foreign bank penetration.

1.1.1 | Consumption Smoothing

Access to world capital markets may allow a country to engage in risk sharing and consumption smoothing, by allowing the country to borrow in “bad” times

¹ Section 1 draws largely from Agénor (2003).

² The benefits and costs of financial integration can be viewed either from the point of view of individual investors (such as, for instance, the opportunity for international risk diversification, as indicated earlier) or from the point of view of the countries initiating the process of integration. This chapter focuses solely on the second perspective, ignoring in the process issues such as the “home-bias puzzle” often observed in the behavior of private capital flows.

(say, during a recession or a sharp deterioration in the country’s terms of trade) and lend in “good” times (say, in an expansion or following an improvement in the country’s terms of trade). By enabling domestic households to smooth their consumption path over time, capital flows can therefore increase welfare. This countercyclical role of world capital markets is particularly important if shocks are temporary in nature. Bekaert et al. (2006) found that financial liberalization (in the form of equity market liberalization and capital account openness) is indeed associated with lower consumption growth volatility. Countries that have more open capital accounts experience a greater reduction in consumption growth volatility after equity market openings. They also find that financial liberalizations are associated with declines in the ratio of consumption growth volatility to GDP growth volatility, suggesting improved risk sharing.

1.1.2 | Domestic Investment and Growth

The ability to draw upon the international pool of resources that financial openness gives access to may also affect domestic investment and growth. In many developing countries, the capacity to save is constrained by a low level of income. As long as the marginal return from investment is at least equal to the cost of (borrowed) capital, net foreign resource inflows can supplement domestic saving, increase levels of physical capital per worker, and help the recipient country raise its rate of economic growth and improve living standards. These potential benefits can be particularly large for some types of capital inflows, most notably foreign direct investment (FDI).

In addition to this direct effect on growth, FDI may also have significant indirect long-run effects. FDI may facilitate the transfer or diffusion of managerial and technological know-how—particularly in the form of new varieties of capital inputs, as in Grossman and Helpman (1991)—and improve the skills composition of the labor force as a result of “learning by doing” effects, investment in formal education, and on-the-job training. In addition, as suggested by Markusen and Venables (1999), although the increased degree of competition in the product and factor markets induced by FDI may tend to reduce profits of local firms, spillover effects through linkages to supplier industries may reduce input costs, raise profits, and stimulate domestic investment.

FDI also has a risk-sharing advantage over other capital flows. As argued by Albuquerque (2003), this advantage results from the fact that although imperfect enforcement of financial contracts and expropriation risk lead to endogenous financing constraints and the emergence of a default premium on all types of capital flows, FDI is harder to expropriate than other flows, (as it involves the use of intangible assets of the multinational company, such as human and organization capital, and technological advances). This translates into a lower default premium on FDI and lower sensitivity to changes in a country’s financing constraint. The important point is that countries

(particularly those that are financially constrained) should indeed borrow more through FDI—but not because it is more productive or less volatile.

To highlight the complementarity (through productivity effects) between FDI and skilled human capital in the growth process, consider, following Borenzstein et al. (1998), an economy in which the source of technological progress is an increase in the number of varieties of capital goods available to producers, which consist of local and foreign firms. Suppose also that the economy produces a single final consumption good using the following technology:

$$Y = S^\alpha K^{1-\alpha} \tag{1}$$

where $\alpha \in (0, 1)$, S is the economy's endowment of skilled labor (assumed given), and K is the stock of physical capital, which is itself a composite of a continuum of different varieties of capital goods, each one denoted by $x(j)$:

$$K = \left[\int_0^N [x(j)]^{1-\alpha} dj \right]^{1/(1-\alpha)} \tag{2}$$

with N denoting the total number of varieties. Physical capital accumulation therefore takes place through an increase in the number of varieties of capital goods produced domestically.

Suppose that there are two types of firms producing capital goods: foreign firms, which produce $n^* < N$ varieties, and domestic firms, which produce the other $N - n^*$ varieties. Specialized firms produce each variety j of capital goods and rent it out to producers of final goods at a rate $m(j)$. The optimal demand for each variety j is thus determined by equating the rental rate and the marginal productivity of j in the production of the final good:

$$m(j) = (1 - \alpha) S^\alpha x(j)^{-\alpha} \tag{3}$$

An increase in the number of varieties of capital goods available to producers is assumed to require the adaptation of technology available in more advanced countries. This adaptation to local needs requires a fixed setup cost, F , which is assumed to depend negatively on the ratio of foreign firms operating domestically to the total number of firms, n^*/N . Thus, $F = F(n^*/N)$, with $F' < 0$.³ This assumption captures the idea that foreign firms make it easier to adopt the more advanced technology required to produce new varieties of capital, by bringing in the "knowledge" already available elsewhere.

³ Borenzstein et al. (1998) also discuss a second possible effect on F , namely, the possibility of a "catch-up" effect in technological progress reflecting the fact that it may be cheaper to imitate products already in existence than to create new ones at the cutting edge of innovation. This notion is implemented in their model by assuming that setup costs depend positively on the number of capital varieties produced domestically, compared to those produced abroad.

In addition to this fixed cost, once a capital good is introduced, its owner must spend a constant maintenance cost per period of time. This is equivalent to assuming that production of $x(j)$ involves a constant marginal cost equal to unity and that capital goods depreciate fully. Assuming that the interest rate r that firms face is constant, profits for the producer of a variety j , denoted $\Pi(j)$, are given by

$$\Pi(j) = -F + \int_0^\infty [m(j)x(j) - x(j)] \exp(-rs) ds \tag{4}$$

Maximization of (4) subject to (3) yields the equilibrium level of production of each capital good:

$$x(j) = S(1 - \alpha)^{2/\alpha}$$

which shows that, given the assumption of symmetry among producers, the level of production of the different varieties of capital is the same.⁴ Assuming free entry, it can be shown that the zero-profit condition implies that

$$r = \phi S/F \tag{5}$$

where $\phi \equiv \alpha(1 - \alpha)^{(2-\alpha)/\alpha} > 0$.

To close the model requires specifying savings decisions, which determine the process of capital accumulation. Suppose that households face a rate of return also equal to r and that they maximize a standard intertemporal utility function given by the discounted present value of consumption, C . It can be shown (see, for instance, Chapter 5, Section 3) that the optimal solution for the rate of growth of consumption, g_C , is:

$$g_C = \sigma(r - \rho) \tag{6}$$

where ρ is the rate of time preference and σ measures the intertemporal elasticity of substitution. In a stationary state, the rate of growth of consumption must be equal to the rate of growth of output, g . Substituting (5) in (6) yields therefore the economy's growth rate:

$$g = \sigma[\phi S/F(n^*/N) - \rho] \tag{7}$$

Equation (7) shows that FDI, as measured by the fraction of capital goods produced locally by foreign firms in the total number of these goods, n^*/N , has a positive effect on the economy's long-term growth rate. The reason is that FDI reduces the cost of introducing new varieties of capital, thereby increasing the rate at which these goods are introduced. Moreover, the effect of FDI on the economy's growth rate is positively related to the existing stock of skilled labor employed in production—this is the complementarity effect mentioned earlier.

⁴ Substituting the optimal level of production into Equation (3) yields the constant equilibrium rental rate, $m(j) = 1/(1 - \alpha)$, as a markup over maintenance costs.

1.1.3 | Enhanced Macroeconomic Discipline

It has also been argued that by increasing the rewards of good policies and the penalties for bad policies, the free flow of capital across borders may induce countries to follow more disciplined macroeconomic policies and thus reduce the frequency of policy mistakes. To the extent that greater policy discipline translates into greater macroeconomic stability, it may also lead to higher rates of economic growth, as emphasized in the recent literature on endogenous growth. A related argument is that external financial liberalization can act as a “signal” that a country is willing (or ready) to adopt “sound” macroeconomic policies, for instance by reducing budget deficits and foregoing the use of the inflation tax (Bartolini and Drazen, 1997). From that perspective, an open capital account may also encourage macroeconomic and financial stability, ensuring a more efficient allocation of resources and higher rates of economic growth.

1.1.4 | Banking System Efficiency and Financial Stability

An increasingly common argument in favor of financial openness is that it may increase the depth and breadth of domestic financial intermediation processes, an increase in the degree of efficiency of the financial intermediation process, by lowering costs and “excessive” profits associated with monopolistic or cartelized markets. In turn, improved efficiency may lead to lower markup rates in banking, a lower cost of investment, and higher growth rates (see Baldwin and Forslid 2000). More generally, Levine (1996) has argued that foreign bank penetration may

- improve the quality and availability of financial services in the domestic market, by increasing the degree of bank competition and enabling the application of more sophisticated banking techniques and technology (such as more advanced risk management systems), which may improve efficiency by reducing the cost of acquiring and processing information on potential borrowers;
- serve to stimulate the development of the domestic bank supervisory and legal framework, if the local foreign banks are supervised on a consolidated basis with their parent;
- enhance a country’s access to international capital, either directly or indirectly through parent banks;
- contribute to the stability of the domestic financial system (and reduced volatility in capital flows) if, in periods of financial instability, depositors may shift their funds to foreign institutions that are perceived to be more sound than domestically owned banks, rather than transferring assets abroad through capital flight.

In addition, foreign banks may also contribute to an improvement in the overall quality of the loan portfolios of domestic banks if they are less

susceptible to government pressure to lend to “preferred” borrowers—as may be the case with domestic financial institutions, particularly those in which the state is involved.

1.2 | Potential Costs

The experience of the past two decades has led economists and policymakers to recognize that, in addition to the potential benefits just discussed, open financial markets may also generate significant costs. These costs include a high degree of concentration of capital flows and lack of access to financing for small countries, either permanently or when they need it most; an inadequate domestic allocation of these flows, which may hamper their growth effects and exacerbate pre-existing domestic distortions; the loss of macroeconomic stability; procyclical movements in short-term capital flows; a high degree of volatility of capital flows, which relates in part to herding and contagion effects; and risks associated with foreign bank penetration.

1.2.1 | Concentration of Capital Flows and Lack of Access

There is ample historical evidence to suggest that periods of “surge” in cross-border capital flows tend to be highly concentrated to a small number of recipient countries. The dramatic increase in capital inflows in the early 1990s, for instance, was directed to only a small number of large, middle-income countries of Latin America and Asia (see Fernández-Arias and Montiel, 1996). The share of total private capital flows going to low-income countries actually fell during the 1990s (from levels that were already quite low), whereas the share going to the top ten recipients increased significantly. Little foreign capital is directed to Sub-Saharan African countries, and most of what flows to the region continues to be limited to a few countries with significant natural resources (see Basu and Srinivasan, 2002). The capital inflow episode that started in 2003, and gathered pace in 2006–2007, displays the same features, with a considerable share of total flows going to just two countries (China and India).⁵ Thus, a number of developing countries (particularly the small ones) may simply be “rationed out” of world capital markets—regardless of how open their capital account is.⁵

1.2.2 | Domestic Misallocation of Capital Flows

Although the inflows of capital associated with an open capital account may raise domestic investment, their impact on long-run growth may be limited (if not negligible) if such inflows are used to finance speculative or low-quality

⁵ Imhoroğlu and Kumar (2004) develop a model in which financial intermediation costs helps to explain why capital tends to flow from rich countries to middle-income countries, rather than capital-scarce, poor countries (where apparent rates of return may be higher).

domestic investments—such as investments in the real estate sector. Low-productivity investments in the nontradables sector may reduce over time the economy's capacity to export and lead to growing external imbalances.

The misallocation of capital inflows may in part be the result of pre-existing distortions in the domestic financial system. In countries with weak banks (that is, banks with low or negative net worth and a low ratio of capital to risk-adjusted assets) and poor supervision of the financial system, the direct or indirect intermediation of large amounts of funds by the banking system may exacerbate the moral hazard problems associated with (explicit or implicit) deposit insurance. That is, lenders may engage in riskier and more concentrated (or outright speculative) loan operations.

An example of how asymmetric information problems can affect the benefits of capital inflows is provided by Razin et al. (2000), who focus on the impact of FDI flows. They argue that through FDI and the transfer of control that it entails, foreign investors may gain inside information about the productivity of the firm(s) that they are investing in. This gives them an informational advantage over less informed domestic investors (whose holdings of shares may be insufficient to give them corporate control)—an advantage that they may be tempted to exploit by retaining the high-productivity firms and selling the low-productivity ones to partially informed domestic savers. This type of adverse selection problem can lead to overinvestment by foreign direct investors.

1.2.3 | Loss of Macroeconomic Stability

The large capital inflows induced by financial openness can have undesirable macroeconomic effects, including rapid monetary expansion (due to the difficulty and cost of pursuing sterilization policies), inflationary pressures (resulting from the effect of capital inflows on domestic spending), real exchange rate appreciation, and widening current account deficits. Under a flexible exchange rate, growing external deficits tend to bring about a currency depreciation, which may eventually lead to a realignment of relative prices and induce self-correcting movements in trade flows. By contrast, under a fixed exchange-rate regime, losses in competitiveness and growing external imbalances can erode confidence in the viability and sustainability of the peg, thereby precipitating a currency crisis and increasing financial instability.

As formally established by Aghion et al. (2004b), capital account liberalization (and the capital inflows that it leads to) may be particularly destabilizing in economies at an intermediate level of financial development—as opposed to countries that are either very developed financially or underdeveloped. The reason essentially is that at high levels of financial development borrowing constraints on firms' investment become less binding, whereas at low levels of financial development firms cannot borrow much to begin with.

1.2.4 | Procyclicality of Short-Term Flows

As noted earlier, small developing economies are often rationed out of world capital markets. Moreover, among those countries with a greater potential to access these markets (such as oil producers), the availability of resources may be asymmetric. These countries may indeed be able to borrow only in "good" times, whereas in "bad" times they tend to face credit constraints. Access may thus be procyclical. Clearly, in such conditions, one of the alleged benefits of accessing world capital markets, the ability to borrow to smooth consumption in the face of temporary adverse shocks, is simply a fiction. Procyclicality may, in fact, have a perverse effect and increase macroeconomic instability: favorable shocks may attract large capital inflows and encourage consumption and spending at levels that are unsustainable in the longer term, forcing countries to over-adjust when an adverse shock hits.

There are essentially two reasons that may explain the procyclical behavior of short-term capital flows. First, economic shocks tend to be larger and more frequent in developing countries, reflecting these countries' relatively narrow production base and greater dependence on primary commodity exports. A common adverse shock to a group of countries may cause a deterioration in some countries' creditworthiness, as a result of abrupt changes in risk perception. This can lead borrowers who are only marginally creditworthy to be "squeezed out" of world capital markets. Second, asymmetric information problems may trigger herding behavior (as further discussed later) because partially informed investors may rush to withdraw "en masse" their capital in response to an adverse shock whose economic consequences for the country are not fully understood.

1.2.5 | Herding, Contagion, and Volatility of Capital Flows

A high degree of financial openness may be conducive to a high degree of volatility in capital movements, a specific manifestation of which being large reversals in short-term flows associated with speculative pressures on the domestic currency. The possibility of large reversals of short-term capital flows raises the risk that borrowers may face costly "liquidity runs" or "sudden stops," as discussed later. The higher the level of short-term debt is relative to the borrowing country's international reserves, the greater the risk of liquidity runs will be. High levels of short-term liabilities intermediated by the financial system also create risks of bank runs and systemic financial crises.

In general, the degree of volatility of capital flows is related to both actual and perceived movements in domestic economic fundamentals, as well as external factors, such as movements in world interest rates. The volatility of capital flows can have sizable real effects. Suppose, for instance, that foreign investors seek high-return investment projects in a developing country. As in Gopinath (2004), suppose also that these investors are constrained in their investment decisions by the need to determine the idiosyncratic

type of each potential project through a time-consuming evaluation process and face an endogenously determined adjustment hazard, that is, a nonzero probability that the investment will not be successful. Thus, each investor has an incentive to search for a project with high idiosyncratic returns and investment decisions will incorporate the option value to waiting (see Chapter 3). By implication, at any point in time, both "project creation" (when new projects get activated by foreign investors) and "project destruction" (when foreign investors withdraw from projects) may be observed. But in response to a deterioration in fundamentals (resulting for instance from an adverse productivity shock), previously good matches may now provide inadequate returns and one may observe a sudden rise in "project destruction," which in turn may generate an asymmetrically sharp contraction in output. Search frictions in entry and exit decisions of investors may therefore magnify the impact of abrupt reversals in capital flows on output.

More generally, the fact that investor sentiment (particularly that of highly leveraged, speculative trading institutions, such as hedge funds) is constantly changing in response to new information creates the potential for markets to overshoot on a scale that can generate financial crises with very large economic and social costs. Short-term portfolio flows, in particular, tend to be very sensitive to herding among investors and contagious factors.⁶ Although investor herding is seen by some as evidence of irrationality, some recent literature suggests differently. Herding can be a "rational" response in the presence of several effects (Devenow and Welch, 1996):

- *payoff externalities*, which are related to the fact that the payoff to an agent (investor) adopting a specific action may be positively related to the number of other agents adopting the same action;
- *principal-agent considerations*, which result from the fact that a portfolio manager, in order to maintain or improve his or her reputation when markets are imperfectly informed, may prefer either to "hide in the herd" to avoid evaluation and criticism, or to "ride the herd" to generate reputational gains;
- *information cascades*, which are due to the fact that (small) agents that are only beginning to invest in a country may find it optimal to ignore their own information and follow the behavior of larger and more established investors.

In any case, whether rational or irrational, herding behavior often translates into large movements into and out of certain types of assets and exacerbates fluctuations in asset prices and capital movements.

Volatility of capital flows can also result from contagion effects.⁷ Financial contagion may occur when a country suffers massive capital outflows triggered

⁶ See Chan and Kohoe (2004) for a model of herding behavior.

⁷ For an overview of the literature on contagion and a comparison of alternative definitions, see Pericoli and Stracca (2003).

by a perceived increase in the vulnerability of a country's currency by international investors, or, more generally, a loss of confidence in the country's economic prospects, as a result of developments elsewhere (see Masson, 2000). It may also occur through two other channels, with indirect effects on the volatility of capital flows: terms-of-trade shocks or competitiveness effects. An example of the former effect is provided by the events that followed the Asia crisis, which led to a sharp reduction in the demand for imports by crisis-stricken countries and a sharp drop in world commodity prices. By increasing the degree of uncertainty regarding the short-term economic prospects of a country, terms-of-trade shocks may translate into financial contagion—as appeared to have happened in the case of Chile in late 1997 and early 1998. Changes in the terms of trade may also create contagion through collateral-based credit constraints (see Paasche, 2001). As an example of the latter effect, the sharp depreciation of the Thai baht that began in July 1997 put pressure on the currencies of neighboring countries that maintained a pegged exchange rate, in part because it implied a large loss of competitiveness for these countries (see Chapter 15).

Chang and Majumoti (2002) develop a model in which both fundamentals and self-fulfilling beliefs may cause contagion. In their model, the probability of a financial crisis in any given country depends on foreign investors' beliefs about the distribution of its fundamentals, and also on "animal spirits" or sunspots—which are independent across countries. In this setting, contagion occurs if a crisis in one country leads investors to rationally and adversely update their beliefs about fundamentals in other countries. However, purely expectational crises may still be contagious; this is the case if investors cannot determine whether the originating crisis has been caused by weak fundamentals or animal spirits. Their analysis carries some important lessons. First, it implies that a country is more vulnerable to contagion if its fundamentals (in particular its financial position) are weak. Second, how contagious a crisis is depends on the amount of information the crisis-stricken country releases. If information is sufficient for investors, then they can discern whether the crisis is caused by fundamentals or beliefs; a fundamentals-driven crisis will tend to be more contagious than a beliefs-driven crisis and will be more contagious than when information is less complete. The policy implication is that better information would not eliminate contagion. Instead, more transparency would make some kinds of crises more contagious and some others less so.

1.2.6 | Risk of Entry by Foreign Banks

Although foreign bank penetration can yield several types of benefits (as discussed earlier), it has some potential drawbacks as well. First, foreign banks may ration credit to small firms (which tend to operate in the nontradables sector) to a larger extent than domestic banks, and concentrate instead on larger and stronger ones (which are often involved in the production of tradables). If foreign banks do indeed follow a strategy of concentrating their lending

operations only to the most creditworthy corporate (and, to a lesser extent, household) borrowers, their presence will be less likely to contribute to an overall increase in efficiency in the financial sector. More important, by leading to a higher degree of credit rationing to small firms, they may have an adverse effect on output, employment, and income distribution.

Second, entry of foreign banks, which tend to have lower operational costs, can create pressures on local banks to merge in order to remain competitive. The process of concentration (which could also arise as foreign banks acquire local banks) could create banks that are "too big to fail" or "too political to fail"—as monetary authorities may fear that the failure of a single large bank could seriously disrupt financial markets and lead to social disruptions. Although these potential problems could be mitigated through enhanced prudential supervision or an outright ban on mergers that are perceived to increase systemic risks sharply, they may lead to an undesirable extension of the scope and cost of the official safety net. A too-big-to-fail problem may, in turn, increase moral hazard problems: knowing the existence of an (implicit) safety net, domestic banks (particularly those in which the state is involved) may be less careful in allocating credit and screening potential borrowers. Concentration could also create monopoly power that would reduce the overall efficiency of the banking system and the availability of credit. In particular, a high degree of banking system concentration may adversely affect output and growth by yielding both higher interest rate spreads (with higher loan rates and lower deposit rates relative to competitive credit and deposit markets) and a lower amount of loans than in a less concentrated, more competitive system.

Third, entry of foreign banks may not lead to enhanced stability of the domestic banking system, because their presence per se does not make systemic banking crises less likely to occur—as may happen if the economy undergoes a severe and persistent recession, leading to a large increase in default rates and a rise in nonperforming loans, and because they may have a tendency to "cut and run" during a crisis. To some extent, the latter effect could again be mitigated by strengthening prudential supervision in domestic markets and improving information sharing between supervisors in industrial and receiving countries. In practice, however, countries have very few options to prevent foreign banks from, say, cutting lines of credit to domestic borrowers in a crisis.

1.3 | Assessing the Evidence

The foregoing discussion suggests that, from a purely analytical point of view, it cannot be established a priori whether the benefits of financial openness are likely to outweigh its potential costs. One must therefore resort to the empirical evidence to determine if, on balance, unambiguous conclusions can be drawn. At the outset, it is important to note that the task is far from

being straightforward, although some of the historical evidence for smaller industrial countries appears to suggest substantial net benefits. The reason is that to quantify the gains countries can reap from international financial integration would require, to be rigorous, a fully articulated model in which the counterfactual of financial autarky could be simulated. So far there has been no such ambitious attempt.

Agénor (2003) provided a selective review of the evidence, both formal (econometric) and informal (country experiences), focusing on the determinants of the volatility and procyclicality of capital flows, the impact of the degree of financial openness and capital flows on domestic investment and growth, the macroeconomic effects of large capital inflows (dwelling mostly on the experience of the early 1990s), and the effect of foreign bank entry on the performance and stability of the domestic financial system. On balance, several conclusions can be drawn from this review.

First, there is evidence that international financial integration during the 1980s and 1990s has been accompanied in many developing countries by an increase in consumption volatility relative to output volatility—in contrast to what risk-sharing arguments would have predicted. A possible explanation for this result is provided by Lewchenko (2005), who develops a model of a country with poorly developed financial markets (which therefore precludes efficient risk sharing domestically). The analysis shows that when risks are purely idiosyncratic, that is, perfectly insurable within the domestic economy, opening up to international markets reduces the amount of risk sharing attained at home and raises the volatility of consumption. When risk is purely aggregate in nature, the underdeveloped financial system prevents the pooling of aggregate risk across agents for the purposes of insurance in the international markets. Put differently, all agents do not have equal access to international markets. Thus, while the volatility of consumption decreases with opening in this case, it does so by much less than in a model with no capital market frictions.

Second, several studies suggest that short-term capital flows tend to be more unstable than longer-term flows (such as FDI), and thus more conducive to financial crises. Albuquerque (2003), for instance, provides evidence showing that FDI flows tend to be less volatile (or more persistent) than other types of capital flows. There is also evidence that short-term capital flows to developing countries tend to be procyclical, whereas medium and long-term capital flows appear to be weakly countercyclical or acyclical. By itself, procyclical behavior may not be a cause for concern if it results from changes in demand in the developing countries themselves. In practice, however, it often arises from external, supply-side factors, such as a sudden change in the country's terms of trade, which raises the risk perceptions of lenders; it tends therefore to magnify the impact of a shock.

Third, studies examining the impact of international financial integration on domestic investment and growth—based either on a direct measure of the

impact of capital account liberalization, derived from qualitative information on restrictions on capital movements, or on the level of capital flows as a proxy measure for the degree of financial openness—provide mixed support. Artea et al. (2001), for instance, found some evidence of a positive link between the index of capital account openness and growth, but only when countries are already sufficiently open commercially and face limited macroeconomic imbalances. This is an important result because it brings to the fore the issue of sequencing of reforms. The evidence also suggests that the relationship between financial integration (as proxied by the size of FDI flows) and growth may be bidirectional: capital inflows may have a positive effect on growth, but growth in turn may tend to stimulate the inflow of FDI. This is an important result because it highlights the possibility of a “virtuous circle” between capital flows and growth-enhancing policies. It also implies, as emphasized by Edison et al. (2004), that studies of the impact of FDI on growth that do not account for the endogenous nature of capital flows (that is, the fact that FDI can itself be influenced by the economy’s growth rate) are likely to produce estimated coefficients that are subject to significant bias. Edison et al. (2002) do account for endogeneity, as well as a host of other potential econometric problems. Using advanced panel data econometric techniques, these authors failed to find a robust, independent effect of FDI and various other measures of international financial openness on growth. By contrast, Edison et al. (2004), using various empirical measures to gauge the presence of controls on capital account transactions and the liberalization of equity markets, found a positive and significant effect of capital account openness and stock market liberalization on economic growth for middle-income countries but not for poor or rich countries. Along the same line, using panel data for 108 countries over the period 1980–2000, Chinn and Ito (2006) found that a higher level of capital account openness spurs equity market development only if a threshold level of legal development has been attained.⁸ Both of these results are consistent with the view that poorer countries do not have the legal, social, and political institutions necessary to fully reap the benefits of capital account liberalization. Fourth, it is important to account for microeconomic evidence on the effects of FDI. This evidence suggests that private capital flows may enhance productivity, particularly in countries with a relatively skilled labor force and a well-developed physical infrastructure. More generally, microeconomic evidence is important in judging the impact of capital flows on the quality of domestic investment. Indeed, one lesson from the Asia crisis is that high, aggregate ratios of capital formation to GDP can mask a sharp decline in the productivity of these investments.

Fifth, it should be noted that few existing econometric studies test for the existence of an adverse effect of the volatility of capital flows (as opposed

⁸ They also found banking system development to be a precondition for equity market development.

to their level) on investment and growth. As emphasized in the literature on uncertainty and irreversibility (see Chapter 3), uncertainty about the availability of external finance in the future may deter investment, particularly in projects that have long gestation periods. At the same time, it must be recognized that the volatility of capital flows is itself endogenous, because it may arise not only from external shocks but also from domestic factors. In such conditions, modeling the sources of volatility is essential.

Sixth, the experience of the early to mid-1990s (as discussed by Calvo et al., 1996, and Fernández-Arias and Montiel, 1996) reveals that several large recipients of capital inflows suffered from some, or a combination of some, of the potential problems identified earlier—namely, a rapid increase in liquidity, inflationary pressures, real exchange-rate appreciation, and growing external imbalances. That was particularly the case in the main recipient countries in Latin America (compared to those in Asia), as a result of various factors. The deterioration in competitiveness weakened the credibility of the fixed exchange rate in some of these countries and raised doubts about their sustainability. The domestic liquidity expansion that resulted from large inflows may also have been a factor behind the credit boom, and subsequent deterioration in banks’ balance sheets, that some of these countries experienced during the period.

Finally, entry by foreign banks (which increased dramatically in the 1990s, to the point where in some major Latin American countries more than half of total bank assets are now controlled by foreign institutions) continues to raise significant questions. From the point of view of international financial integration, two important questions that arise in this context are, as noted earlier, what impact has foreign entry had on the profitability and efficiency of domestic banks, and whether it has improved the financial system’s ability to respond to large domestic and external shocks. The evidence on these issues, and more generally on the net benefits of foreign bank penetration, remains ambiguous. In some countries, increased penetration of foreign domestic banking system (as measured by the relative importance of foreign banks in either the total number of banks, or total assets, of the banking system) appears to be associated with a reduction in both profitability and overhead costs for domestic banks. By contrast, the effect on net interest margins (that is, the ex post spread between lending and deposit rates), which can be viewed as a measure of the efficiency of financial intermediation, is not always significant. There is also evidence that foreign banks lend less to small- and medium-sized enterprises, possibly leading to credit rationing (particularly to small firms in the nontradables sector) and greater concentration in the allocation of credit. Finally, some recent episodes appear to indicate that foreign banks may indeed “cut and run” during crisis periods, thereby contributing to domestic financial instability and increased volatility in the availability of credit.

The foregoing discussion suggests therefore that it is difficult to make broad statements regarding the benefits and costs of international financial integration. Although in principle financial openness allows countries to use

international capital markets to diversify and hedge against idiosyncratic adverse shocks (particularly when those shocks are temporary), in practice, this alleged benefit is often a mirage for many developing countries—which often gain access to these markets (if at all) only in “good” times. Moreover, if international capital markets are prone to over-exuberance in good times and excess pessimism or herding (leading to sudden withdrawals of capital) in bad times, the benefits of capital inflows can be completely offset by large and sudden outflows that may put an already weak domestic financial system under stress. In such conditions, financial integration may increase the risks of costly financial crises, instead of reducing them. The empirical evidence suggests that international capital markets can be prone to sharp shifts in sentiment regarding a country’s short- and longer-term economic prospects. The discipline that they exercise over government policies, although beneficial in some respects, can be excessive.

Nevertheless, despite creating the possibility of costly crises, and despite the fact that the existing empirical evidence does not allow blanket generalizations, global financial integration and the increase in FDI flows that it may lead to, hold potentially significant benefits in terms of higher domestic investment and economic growth rates. These “dynamic gains” are likely to be magnified in economies where, to begin with, the stock of human capital is high enough to take advantage of complementarity effects between technology and skills. The key issue for both national and international policymakers is therefore not to choose between openness and autarky, but rather to design policies that help to minimize the short-term risks, and maximize the longer-run gains, of financial openness. From the point of view of domestic policymakers, there has been renewed emphasis on the importance of macroeconomic discipline, information disclosure, and enhanced banking sector supervision. Avoiding real exchange-rate misalignment, limiting fiscal imbalances and preventing an excessive buildup of domestic debt, maintaining a monetary policy consistent with low inflation, and ensuring that the ratio of unhedged short-term foreign-currency debt over official reserves remains sufficiently low, are all preventive measures that are likely to reduce the risk that sudden changes in market sentiment may turn into large capital outflows and precipitate a financial crisis. Strengthening supervision and prudential regulation, and fostering risk management capacities in banks and nonfinancial firms, are also important. The stronger economic fundamentals are, the longer the track record of macroeconomic discipline, the less susceptible the country will be to potentially volatile flows, and thus the lower will be the probability of a financial crisis.

2 | Determinants of Capital Inflows

Explanations of surges in capital inflows to developing countries typically bring to the fore two categories of factors, dubbed “push” and “pull” factors.

“Pull” factors are those that attract capital from abroad as a result of changes in regulation and improvements in the risk–return characteristics of assets issued by developing-country debtors, whereas “push” factors are those that operate by reducing the attractiveness of lending to industrial-country debtors. This section describes in more detail these two determinants capital inflows.

2.1 | “Pull” Factors

Domestic or pull factors (macroeconomic stabilization and structural reforms) may play an important role in driving capital flows. Capital account liberalization (an important component of structural adjustment programs in many developing countries) may provide a strong incentive to invest or repatriate capital. Fiscal adjustment (entailing large cuts in budget deficits, through reductions in public expenditure and tax reform) may lower inflationary expectations and act as an important signal about the commitment to achieving and maintaining macroeconomic stability and may be instrumental in attracting capital flows.⁹

The welfare implications of capital flows driven by “pull” factors depend on whether these reflect the removal of a previously existing distortion, an exogenous change in an undistorted environment, or the introduction of a new distortion. For instance, if social risk–return trade-offs in the domestic economy are improved by economic reform, the capital inflows attracted by higher domestic returns would be welfare-enhancing, because they reflect wealth-increasing borrowing for the financing of new high-yield domestic investment opportunities that were not previously available and/or welfare-enhancing financing for consumption smoothing motivated by reform-induced increases in national wealth. Similarly, the characteristics of claims on domestic agents acquired by external lenders may have improved as a result of the removal of distortions that created gaps between social and private rates of return. For instance, if debt-overhang problems created a gap between social and private rates of return in a heavily indebted country, then resolution of such problems may allow private rates of return to reflect social returns more accurately and thus help to create the incentive for a renewed flow of capital.

Even an exogenous change in domestic portfolio preferences may trigger welfare-enhancing capital inflows. A domestic money-demand shock, for example (in the form of an increase in money demand), could attract capital inflows by causing the prices of domestic interest-bearing assets to fall. In this case, the capital inflow makes it possible to accommodate the shift in domestic portfolio preferences and would again be welfare-enhancing.

⁹ It should also be noted, however, that there are instances where it is large fiscal imbalances themselves, coupled with a relatively tight monetary policy stance (and consequent upward pressures on domestic real interest rates), that have led to large inflows of (short-term) capital. A notable example is Turkey in the early 1990s (see Agénor, McDermott, and Ucer, 1997).

On the other hand, as argued by Doolley (1996), the adoption of fixed exchange rates and deposit guarantees in the context of a liberalized but poorly supervised financial sector may create an opportunity for foreign lenders to reap high and secure private rates of return that do not reflect social returns on the resources that they transfer to the borrowing economy. This is a case of a "pull" factor that is welfare-reducing.

2.2 | "Push" Factors

The most widely cited "push" factor driving capital inflows to developing countries is a deterioration in the risk-return characteristics of assets issued by industrial-country debtors. This could happen, for example, in response to cyclical factors that temporarily depress rates of return on assets in the lending country. The decrease in interest rates in the United States as a result of stimulative monetary policy adopted in response to the 1990-1991 recession indeed had the effect of driving capital abroad in search of higher short-run returns. From the perspective of the developing country, this represents an external financial shock, which may be welcome or not depending on the country's circumstances. For countries that had been credit-constrained and remain heavily indebted, the shock is a favorable one. However, its cyclical origin threatens to make it temporary. An important question for policy in borrowing countries raised by shocks of this type, therefore, is whether the domestic private response is likely to optimally take into account the possibility of reversal.

A different "push" factor with different implications for policy has to do with changes in financial structure in capital-exporting countries. The increased role of institutional lenders such as mutual and pension funds as financial intermediaries, as well as the increased importance of securitization, may represent a secular change that favors lending to emerging markets portfolio diversification reasons. If so, and given the fact that emerging markets continue to carry a relatively small share in the portfolios of institutional lenders, the sustainability implications would be very different from those associated with cyclical factors. To the extent that flows to developing countries since the early 1990s have been driven by structural "push" factors of this type, flows are likely to be sustained at high levels for an extended period of time.

The three-good model developed in Chapter 12 can be used to assess the effects of a reduction in world interest rates (or "push" factors, as discussed in the text) on capital flows, asset accumulation, and the real exchange rate (see Agénor, 1998c). Specifically, the model can be used to examine both permanent and temporary reductions in the world safe interest rate, i^* .

In the setting described earlier, the long-run effects of a permanent reduction in i^* are a reduction in consumption, a depreciation of the real exchange rate, and an increase in foreign debt. The initial effect of the reduction in the cost of borrowing in world capital markets is an increase in private foreign

indebtedness. At first sight, the net effect of the shock on external debt service—and thus the services account—would appear ambiguous, for two reasons. First, as noted in Chapter 12, a reduction in i^* has two types of partial effects: on the one hand, at the initial level of the economy's stock of foreign debt, it lowers interest payments; on the other, because the increase in private foreign borrowing raises the premium-related component $\theta \bar{L}^*$, it tends to increase interest payments to foreign creditors. As indicated earlier, the former effect is assumed to dominate the latter, so that the services account tends to improve. Second, because the economy's stock of debt also increases, debt service at the initial risk-free rate tends also to increase. The latter effect dominates the former, so that the net effect is a deterioration of the services account.

To maintain external balance in the long run, the initial trade surplus (which matches the initial deficit in the services account) must therefore increase. In turn, at the initial level of the real exchange rate (and thus output of tradables), consumption must fall. This leads to a depreciation of the real exchange rate, which stimulates output of tradable goods and further improves the trade balance. Because the nominal interest rate remains constant at $\rho + \varepsilon$ (as shown earlier), real money balances fall also, as do official reserves. With foreign borrowing by private agents increasing, and net foreign assets held by the central bank falling, the economy's external debt unambiguously rises.

On impact, a permanent reduction in the world interest rate raises private spending and leads to an appreciation of the real exchange rate. The reason is that the wealth and intertemporal effects associated with this shock operate in the same direction: the reduction in i^* not only encourages agents to save less and consume more today (the intertemporal effect), but it also lowers the debt burden and generates a positive wealth effect.¹⁰ The effect of a reduction in the risk-free world interest rate is in general ambiguous, because while it lowers interest payments on the economy's total foreign debt (which is given on impact), it also increases private foreign indebtedness, thereby raising directly and indirectly the premium-related component of external debt service. Again, from the discussion in Chapter 12, it is assumed that the net effect is an improvement in the services account on impact.

Although the trade balance and the services account move in opposite directions (the former deteriorates, whereas the latter improves), the net effect is a current-account deficit on impact—and thus an increase in external debt. The economy experiences an inflow of private capital matched by an increase in official reserves, which is such that the economy's stock of debt remains constant on impact. Because both consumption and the real money stock increase, the net effect on domestic interest rates is in general ambiguous. If

¹⁰ As discussed by Agénor (1998c), if the economy is initially a net creditor with respect to the rest of the world, the impact effect of a reduction in the risk-free rate on consumption is ambiguous, because wealth and intertemporal effects operate in opposite directions.

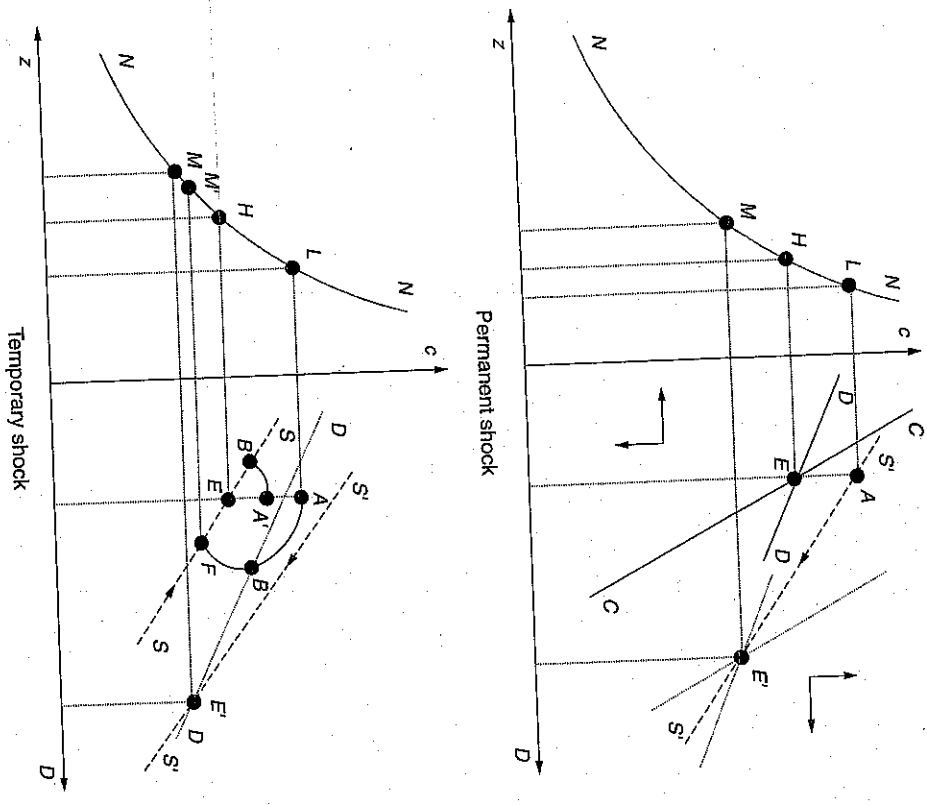


Figure 14.1
Reduction in the World Risk-Free Interest Rate.
Source: Agénor (1997, p. 30).

the degree of intertemporal substitution is sufficiently low (so that consumption increases relatively little), the domestic interest rate will rise on impact. The dynamic path of consumption, debt, and the real exchange rate are illustrated in the upper panel of Figure 14.1 (see the graphical description of the model in Chapter 12). Both CC and DD shift to the right, but the former shifts algebraically by more than the latter. Consumption jumps upward from point E to point A , and the real exchange rate appreciates from H to L . Because of

the permanent nature of the shock and the monotonic nature of the adjustment process, the current account remains in deficit (with the economy's external debt increasing) throughout the transition period; consumption falls toward its new, lower steady-state level, and the real exchange rate depreciates—both effects contributing to a gradual reversal of the initial deterioration in the trade deficit.

The lower panel of Figure 14.1 illustrates the dynamics of a temporary reduction in the world interest rate. Because the expected duration of the shock matters for the adjustment path, consider first the case where the period of time, T , during which r^* falls is sufficiently large. The economy follows the path labeled $EABF$, with consumption jumping upward on impact, and falling continuously afterward—until reaching point F at period T . Because the shock is known to be temporary, the optimal response for households is to increase consumption on impact by less than they would if the shock were permanent. The real exchange rate depreciates gradually (from L to M'), after an initial step appreciation. The current account moves into deficit during the first phase of the transition process; however, the real depreciation to a restoration of external balance (at point B , where $\dot{D} = 0$). Afterward, the economy generates a current-account surplus, and the stock of debt declines continuously over time, until the initial equilibrium (point E) is reached.

Suppose now that the length of time, T , during which the world interest rate falls is relatively short. In that case, the economy follows the path labeled EAB' , which is characterized (as before) by an initial upward jump in consumption and a real appreciation. Consumption then starts falling, reaching the original saddlepath at point B' at T . Throughout the period during which the risk-free interest rate falls, the economy registers a current-account surplus, that is, a reduction in external debt. After T , the economy remains on the original saddlepath (between B' and E), and the stock of debt rises over time. Intuitively, the reason that the adjustment path depends on the length of the period during which world interest rates fall is as follows. If the duration of the shock is sufficiently long, agents have an incentive to substitute intertemporally, and to increase consumption on impact by a relatively large amount; the negative effect on the trade balance in that case outweighs the positive effect on the services account, so that the current account moves into deficit and is expected to be short-lived, agents will not adjust their consumption path by much. The improvement in the services account will therefore outweigh the deterioration in the trade balance, and the current account will move into the surplus, with external debt falling throughout the period during which the shock is in place.

Finally, among “push” factors, one may also consider the fact that large inflows may reflect increased financial integration due to the removal or barriers impeding cross-border capital flows. Such barriers may arise either

as the result of policy choices or of technological conditions affecting, for instance, information costs. As mentioned before, capital account liberalization had been widely adopted as the outcome of explicit policy decisions in both industrial and developing countries at the onset of the capital-inflow episode of the 1990s. Although it may seem that the removal of such distortions is unambiguously welfare-enhancing, this may not be so if previously existing restrictions reflected a second-best response to other distortions in the economy—for instance, the financial market distortions mentioned above.

2.3 | Assessing the Evidence

In practice, determining the relative roles that various factors may have played during an episode of capital inflow is difficult. A key issue is whether the inflow episode originates in the creditor or debtor countries.

Fernández-Arias (1996) provides a useful analytical framework within which to consider this issue. Capital flows are assumed to potentially occur in the form of transactions in various classes of assets, indexed by s , where $s = 1, \dots, n$. The domestic return on an asset of type s is decomposed into a "project" expected return D_s and a "country creditworthiness" adjustment factor C_s , which is bounded between zero and one. The project return depends inversely on the vector F of net flows to projects of all types (based on a diminishing marginal productivity argument), while the creditworthiness factor is a negative function of the vector of the end-of-period stocks of liabilities of all types, denoted S . Voluntary capital flows (components of the vector F) are determined by the arbitrage condition:

$$D_s(d, F)C_s(c, S_{-1} + F) = R_s(R), \tag{8}$$

where R_s is the opportunity cost of funds of type s in the creditor country, taken to depend on creditor-country financial conditions (proxied by the long-term risk-free external interest rate R), while c and d are shift factors associated with country creditworthiness and with the domestic economic climate, respectively. The convention adopted is that the functions D_s , C_s , and R_s are increasing in these shift parameters. Notice that in this framework capital flows will be determined by c , d , and R —that is, by domestic factors that operate at the project and country levels, as well as by external financial factors. The assumptions made above imply that the components of the vector F are increasing in d and c , but decreasing in R and S_{-1} .

The country creditworthiness factor c is taken as reflecting the expected present value of resources available for external payments. If such resources grow at rate g from an initial value W , c is given by:

$$c = W / (R - g). \tag{9}$$

When creditworthiness is sufficiently low, the solution to Equation (8) above may entail extremely low capital inflows or capital outflows (negative

values of various components of F) of a magnitude that imply transfers of resources that the country is unwilling to undertake. In this case, voluntary capital flows of such types would cease, and the condition would become an inequality no longer determining the corresponding (involuntary) capital flows. This observation is important for explaining how inflows could be externally driven, yet not uniform across developing countries. In a world in which some countries are creditworthy and others are not, a reduction in R would generate increased capital flows only for those countries that met the creditworthiness requirement.

For the inflow episode of the early 1990s, studies such as Calvo, Leiderman, and Reinhart (1996), Fernández-Arias (1996), Dooley, Fernández-Arias, and Kletzer (1994), and Fliess (2003) provided strong support for the role of R in determining F , though more recent research has suggested that the country-specific factor d and the "mixed" factor c also played important roles. Similar results have been found for the 1990s as a whole; in a study of private portfolio investment to four Asian and five Latin American countries over the period 1989–2002, Baek (2006), for instance, found that in Asia these flows were predominantly "pushed" by investors' appetite for risk (measured on the basis of excess returns) and other external factors; favorable domestic economic conditions had a negligible role. By contrast, in Latin America portfolio flows were partly "pulled" by strong economic growth and partly "pushed" by foreign financial factors—but not by the market's attitude toward risk.

However, other studies, such as Schadtler et al. (1993), argued that while foreign phenomena may have been important, such influences cannot be regarded as dominant, essentially for two reasons. First, they noted that the timing, persistence, and intensity of inflows has varied considerably across countries that have received inflows, suggesting that investors have responded to changes in country-specific factors over time. Second, they pointed out that surges in capital inflows have not been universal within regions of developing countries, so that external creditors have clearly exercised some cross-country discrimination in the allocation of funds.

The analytical framework described above is helpful in sorting out these issues. The reduced-form solution for F from Equation (8) for country i takes the form

$$F_i = F(c_i, d_i, R, S_{-1}), \tag{10}$$

which implies

$$F_i = F_c dc_i + F_d dd_i + F_R dR + F_S dS_{-1} \tag{11}$$

The partial derivatives of F depend on the country-specific values of c , d , and S_{-1} , as well as on R . This means that cross-country differences in capital-inflow variations are perfectly compatible with a primary role for the "push" factor R . Differences in the timing and persistence of changes in capital

inflows, on the other hand, do indeed suggest a role for changes in "pull" factors. By estimating directly Equation (10), Hernández and Rudolf (1994) provided evidence supporting a role for domestic factors in attracting capital inflows. Similarly, the World Bank (1997) suggests that the factors driving inflows in the early 1990s changed over time, and in particular that domestic factors may have played a more prominent role during 1994–1995, compared to 1990–1993.

In sum, the formal evidence for the inflow episode of the early 1990s strongly supports the "push" view that falling U.S. interest rates played an important role in driving capital flows to developing countries, although at the same time there is evidence supporting the "pull" view during the early years of the episode. Of course, the apparent importance of "push" factors does not preclude the relevance of "pull" phenomena. For instance, a fall in interest rates in industrial countries, in addition to improving the relative rate of returns in favor of developing economies, may also improve the creditworthiness of some debtor countries and stimulate further inflows. More generally, while "push" factors may help to explain the timing and magnitude of a capital inflow episode, "pull" factors may be necessary to explain the geographic distribution of flows during this time. Differences in capital inflow levels across countries and within countries across time point to the importance of specific country (or period) characteristics for foreign capital absorption.

At the same time, it is important to recognize that at the individual country level, the identification of the factors underlying a surge in capital inflows matters considerably for policy formulation. It may be tempting to take the view that flows attracted to the recipient country by domestic "pull" factors do not present a policy problem, because they represent a restoration of creditworthiness, whereas flows "pushed" out of the source countries are an external shock that can easily be reversed and thus call for a policy response. This would be incorrect, however. Because both categories of factors can incorporate a wide variety of domestic and foreign phenomena, the policy implications associated with "push" and "pull" factors depend on the specific "pull" or "push" phenomena that are at work, rather than on whether the origin of the shock is domestic or external.

3 | Managing Capital Inflows: Policy Options

What can countries do to manage capital movements during large inflow episodes? This is a particularly challenging task for countries that maintain an officially determined nominal exchange rate at the inception of the inflow episode. The macroeconomic challenge relates to the fact that large inflows may result in overheating—that is, an excessive expansion of aggregate demand, resulting in an increase in domestic inflation and an appreciation of the real exchange rate. The mechanism through which inflows could have this effect is as follows: with a predetermined exchange rate, large capital inflows

are likely to generate an overall balance-of-payments surplus. To avoid an appreciation of the nominal exchange rate, the central bank would have to intervene in the foreign exchange market to buy the excess supply of foreign currency at the prevailing exchange rate. *Ceteris paribus*, this would result in an expansion of the monetary base. Base expansion would lead to growth in broader monetary aggregates, which would fuel an expansion of aggregate demand. This, in turn, would put upward pressure on the domestic price level. With the nominal exchange rate fixed, rising domestic prices would imply an appreciation of the real exchange rate.

This causal chain can be broken at various points by policy intervention. One useful way to organize the menu of policies available to the authorities to resist the emergence of overheating is thus according to where the intervention occurs along the chain of transmission described above. Accordingly, policy interventions can be classified as follows:

- Policies designed to restrict the *net inflow* of capital, either by restricting gross capital inflows or promoting gross capital outflows. Such policies include the imposition of administrative controls on capital inflows as well as the elimination of a variety of restrictions on capital outflows. They may also include the widening of exchange-rate bands with the intention of increasing uncertainty.
- Policies that seek to restrict the *net foreign exchange inflow* (reserve accumulation) by encouraging a current-account offset to a capital account surplus. Trade liberalization and nominal exchange-rate appreciation would have this effect. In the limit (flexible exchange rates), the latter could avoid any foreign exchange accumulation whatsoever.
- Policies that accept the reserve accumulation associated with a balance-of-payments surplus, but attempt to ameliorate its effects on the monetary base. These amount to sterilized intervention, as well as attempts to limit recourse to the central bank's discount window.
- Policies that accept an increase in the base, but attempt to restrain its effects on broader monetary aggregates. Increases in reserve requirements and quantitative credit restrictions are examples of such policies.
- Policies that accept a monetary expansion, but attempt to offset expansionary effects on aggregate demand that could result in inflation and/or real exchange rate appreciation. This refers essentially to fiscal contraction.

3.1 | Restrictions on Gross Inflows

Though the imposition of capital controls is controversial, a case for imposing them can be made on welfare grounds. The key requirement for controls to

improve welfare is the presence of a preexisting distortion that creates an excessive level of foreign borrowing. This could happen, for example, when the act of foreign borrowing itself creates externalities. If the costs of default on an international loan contract are shared by domestic agents other than the borrowing agent, then individual acts of foreign borrowing have negative external effects in the domestic economy. Because individual domestic agents do not internalize such effects, they will tend to overborrow (Aizenman, 1989). Capital controls, in the form of a tax on foreign borrowing, would effectively cause agents to internalize the costs that their external borrowing decisions impose on others. As such, they would represent a first-best policy intervention. A variety of second-best cases can also be made for capital controls (Dooley, 1996). These emerge when the negative welfare consequences of a preexisting domestic distortion that cannot be removed are magnified by external borrowing. Distortions in the domestic financial system, for example, may cause resources borrowed from abroad to be allocated in socially unproductive ways in the domestic economy. If the distortion causing the problem cannot be removed, a second-best option may be to limit foreign borrowing.

Beyond the issue of optimality, the use of capital controls faces the question of feasibility. Many economists have questioned the feasibility of direct intervention with capital flows, on the view that controls may be easily evaded (Ariyoshi et al., 2000). Testing this proposition is complicated by the fact that the efficacy of controls is likely to depend on a wide range of factors, including whether controls are imposed on inflows or outflows, whether controls have been imposed previously, whether their coverage is comprehensive or partial, and a host of other considerations. The upshot is that the effectiveness of controls is likely to differ both across countries as well as over time, making it difficult to draw general conclusions.¹¹

Dooley (1996) concluded his survey of the existing evidence on the efficacy of controls by arguing that controls can be effective in the sense of preserving some degree of domestic monetary autonomy (that is, influencing interest differentials). But he found little evidence that controls have helped governments meet policy objectives or improve economic welfare in the ways outlined above.

3.2 | Encouragement of Gross Outflows

The relevant issues are efficacy and optimality in the case of liberalizing restrictions on outflows, although these issues arise in a somewhat different

¹¹ The incentive to evade depends on differences between foreign and domestic rates of return, and thus on financial policies abroad and at home. The feasibility of evasion, in turn, depends on the structure of trade (which affects the scope for under- and over-invoicing), on that of the domestic financial system (which affects the possibility of evasion by altering the channels of financial intermediation), and the efficacy of policing mechanisms. Such factors explain why the efficacy of controls is likely to differ across countries and over time.

way. First, in parallel with the previous case, restrictions on *outflows* may not be effective. But even if outflow restrictions are effective, however, their removal may not have the desired effect of reducing net inflows, because the very act of removing such restrictions may attract additional inflows.

Two sets of arguments have been adduced to suggest how this could happen. Labán and Larrán (1997) have pointed out that the presence of effective controls on outflows renders inflows irreversible. If future policies affecting the return on loans to domestic agents are uncertain, the option to keep funds abroad while the uncertainty is resolved becomes valuable, and foreign creditors may thus refrain from lending in this situation. Removing the outflow restrictions eliminates the irreversibility, and thus increases the relative return on domestic lending by eliminating the value of the option to wait. Alternatively, Bartolini and Drazen (1997) have argued that, because controls on outflows are often maintained for fiscal reasons (to facilitate the collection of financial repression taxes), their removal is interpreted by foreign investors as a signal that future capital taxation is less likely, thereby inducing capital inflows.

3.3 | Trade Liberalization

From a macroeconomic perspective, trade liberalization lowers the domestic currency price of importables directly, and may lower the price on nontradables indirectly (through a substitution effect). As indicated previously, to the extent that it induces a trade deficit, it absorbs some of the foreign exchange generated by the capital inflow, easing monetary pressures as well. The most controversial issue that arises with respect to trade liberalization as a means to restrict the net inflow of foreign exchange concerns efficacy. Because the trade balance is the difference between domestic saving and investment, the effect of trade liberalization on the trade balance depends on how saving and investment are affected. Both theory and evidence suggest that the effects of trade liberalization on the trade balance are ambiguous, depending on a host of structural characteristics of the domestic economy as well as on the nature of the liberalization program. The former include the importance of nontraded goods, sectoral factor intensities, the nature of accompanying fiscal policies, and the extent of labor market rigidities. The latter include the incidence of tariffs (whether they fall on intermediate or final goods) and their projected future paths.

For example, Ostry (1991) shows that if temporary tariffs on intermediate and goods are reduced, and tradables are more intensive in both intermediate and capital goods than nontradables, then the effect of the liberalization program will be to increase saving and reduce investment, thereby unambiguously improving the trade balance. The reduction in tariffs on intermediates will result in a short-run real appreciation as the traded goods sector expands, absorbing resources from the nontraded sector. This real appreciation will cause agents to expect a larger real depreciation over time, because future

trade policy is left unaffected. Consequently, the real interest rate rises, and consumption tilts toward the future, increasing domestic saving. In turn, the increase in future consumption causes a future real appreciation which, relative to the undisturbed equilibrium, shifts capital from the traded to the nontraded sector in the future. Because the traded sector is relatively capital-intensive, the implication is a reduction in today's aggregate investment. With saving higher and investment lower, the trade balance unambiguously improves.

While this example may appear contrived, it merely illustrates the general principle that it is indeed quite possible in theory for a trade liberalization to improve the trade balance. The experience of liberalizing countries, as discussed in Chapter 18, suggests that this result is more than a theoretical curiosity.

3.4 | Exchange-Rate Flexibility

The alternative of inducing a current account offset to capital inflows through nominal exchange-rate flexibility, by contrast, raises issues that concern optimality, rather than efficacy. The potential inflationary implications of capital inflows can be completely avoided by refraining from intervention in the foreign exchange market. Permitting a (temporary) appreciation of the nominal exchange rate in response to a favorable external interest rate shock (by restricting the scale of foreign exchange intervention) will dampen and possibly reverse the expansionary effect of the foreign shock on domestic aggregate demand, by appreciating the real exchange rate. A capital inflow arising from a reduction in external interest rates becomes a *deflationary* shock under fully flexible exchange rates. This outcome will be desirable if domestic macroeconomic conditions are such that policymakers seek to avoid stimulating aggregate demand. Thus, to the extent that capital inflows are permitted to materialize, the desirability of foreign exchange intervention depends in part on the requirements for macroeconomic stability.

The trade-off, however, concerns the implications for domestic resource allocation. If the authorities allow the nominal exchange rate to appreciate in response to capital inflows, the profitability of the traded goods sector will obviously be affected adversely. Aside from possible political economy considerations, policymakers may have two reasons to be concerned with this outcome: first, if the capital inflow is believed to be temporary, an appreciation of the official exchange rate may tend to aggravate the effects of any previously existing domestic distortions biasing domestic resource allocation away from the traded goods sector (and causing the "shadow" value of foreign exchange to exceed its official value).¹² Second, with temporary

¹² If the inflow is permanent, the associated real appreciation may be matched by an appreciation of the equilibrium real exchange rate, and thus would not necessarily increase the wedge between the "shadow" exchange rate and its official value.

capital inflows, the associated real exchange-rate appreciation will also be temporary, and any costly resource reallocations induced by changes in relative sectoral profitability between the traded and nontraded goods sectors would later have to be reversed. Because such costs represent fixed costs from the perspective of private agents, the associated resource reallocations would not be undertaken unless the incentives for doing so were perceived to be long-lasting. Because private agents will find it in their best interest to avoid the costs of transitory resource reallocation, the noise introduced into relative price signals by allowing excessive nominal exchange-rate variability may reduce the efficiency of resource allocation.

The preceding discussion treats the exchange rate as an instrument of short-run stabilization policy. However, the exchange rate also plays another role in small open economies—that of nominal anchor (see Chapter 9). Indeed, this role is often prominent in stabilization programs, and institutional arrangements have often been devised to enhance the credibility of the anchor. Where the exchange rate plays such a role, the issues are whether institutional arrangements are sufficiently flexible to allow the rate to move and, if so, whether perceptions of the authorities' anti-inflationary commitment would indeed be jeopardized by an appreciation of the nominal rate (albeit one which may later need to be reversed, if the inflow is temporary). The concern would be that even an appreciation may convey the signal that the exchange rate is not immutable.

3.5 | Sterilization

The monetary authorities can seek to avoid aggregate demand stimulus with a fixed exchange rate through sterilized foreign exchange intervention. The use of this policy raises a number of feasibility issues. First, by keeping domestic interest rates higher than they otherwise would be, sterilization will tend to magnify the cumulative capital inflow. The higher the degree of capital mobility, the larger will be the accumulation of reserves associated with sterilized intervention. Second, sterilized intervention has quasi-fiscal costs, because the central bank exchanges high-yielding domestic assets for low-yielding reserves. The magnitude of these costs will be greater the higher the degree of capital mobility and the larger the gap between domestic and foreign rates of return. Thus, the fiscal feasibility of this policy is also at issue.¹³ Third, even if sterilization succeeds in limiting domestic monetary expansion, it may not insulate the economy from the effects of capital inflows. This would be

¹³ Kletzer and Spiegel (2004) develop a framework in which sterilization costs are explicitly accounted for in the intertemporal government budget constraint. Their analysis shows that increases in sterilization costs tend to lead to a greater degree of flexibility (or accommodation) in the nominal exchange rate, in response to capital inflows.

true under two sets of circumstances:

- If domestic interest-bearing assets are perfect substitutes among themselves, insulation would fail if the shock that triggers the inflows affects domestic money demand. In this case, with shifting money demand but fixed supply, domestic interest rates would change;
- if domestic interest-bearing assets are imperfect substitutes, then a capital inflow may be associated with a shift in the composition of demand for domestic interest-bearing assets, as well as with an increase in the total demand for such assets. In this case, unless the composition of domestic assets emitted in sterilization operations matches that demanded by creditors, the structure of domestic asset returns would be altered.

The empirical evidence discussed in the Appendix to this chapter suggests that most developing countries continue to be characterized by imperfect capital mobility implies that sterilized intervention remains a viable policy option for these countries. By and large, studies that have examined the effectiveness of sterilization directly have supported this conclusion. However, recent capital account liberalization in many developing countries may have changed this situation, increasing the effective degree of financial integration for the liberalizing countries. Thus, whether sterilization remains viable after liberalization is an open empirical question.

3.6 | Policies to Influence the Money Multiplier

If for fiscal or other reasons sterilization is incomplete, the implication of a foreign exchange inflow is an expansion in the monetary base. Monetary expansion can still be avoided by a commensurate reduction in the money multiplier achieved through an increase in reserve requirements or other restrictions on credit expansion by the banking system. Feasibility issues arise here in several forms: first, increases in reserve requirements may have little effect if banks are already holding excess reserves. Second, if reserve requirements are changed selectively for different components of banks' liability portfolios, then their effects could be evaded as bank creditors shift to assets not affected by changes in reserve requirements. Finally, even if changes in reserve requirements are applied broadly across bank liabilities, domestic credit expansion could materialize through nonbank institutions (disintermediation). The scope for doing so, and thus for avoiding an increase in domestic aggregate demand, depends on the sophistication of the domestic financial system.

With regard to optimality, measures directed at the money multiplier avoid quasi-fiscal costs, but do so through implicit taxation of the banking system. The economic implications of this tax will depend on how the tax burden is ultimately shared among bank shareholders, their depositors, and their loan

customers. Nonetheless, the likely effect of this policy is to shrink the domestic financial system, an outcome that runs counter to the trend toward financial liberalization in most reforming economies, and which may have adverse implications for economic growth.

3.7 | Fiscal Contraction

If domestic monetary expansion is not avoided, or if an expansionary financial stimulus is transmitted outside the banking system, the stabilization of aggregate demand will require a fiscal contraction. Feasibility and optimality issues arise in this context as well. Concerning feasibility, fiscal policy may simply prove too inflexible to be available as a tool to respond to fluctuations in capital movements. The budgetary process in most countries may not be able to respond sufficiently quickly, and lags in response may indeed aggravate the stabilization problems created by volatile capital movements. Second, even if fiscal policy can be changed, the desired effects on domestic demand (and thus on the real exchange rate) will be forthcoming—that is, the policy will be effective—only if expenditure cuts fall on nontraded goods.

From the perspective of optimality, similar issues arise in the case of fiscal adjustment as in that of exchange-rate changes—that is, should fiscal policy be designed to anchor long-run expectations of inflation and taxation, or should policy have countercyclical objectives? In principle these goals are not mutually exclusive, because short-run deviations from the medium-term fiscal stance can be designed to achieve stabilization objectives. The problem is, however, that if government credibility is lacking, adherence to the medium-term stance in the face of shocks may be the surest way to achieve it. In a nutshell, the issue is whether the achievement of fiscal credibility is compatible with the adoption of feedback rules for fiscal policy.¹⁴ Finally, if the stabilization objective is adopted, changes in marginal tax rates in response to temporary capital inflows should be avoided, because fluctuations in such rates would distort intertemporal choices.

4 | Sudden Stops

For developing countries, financial integration has been associated not just with surges of capital inflows, but also with large reversals in short-term capital flows. For instance, in the wake of the Asia crisis, although FDI remained remarkably stable, short-term capital inflows from BIS-reporting banks to developing countries fell from \$43.5 billion in 1997 to \$8.5 billion in 1998. Volatility in capital inflows has also tended to translate into exchange-rate

¹⁴ Note that, if such a rule were to be applied symmetrically, it would imply that capital outflows should elicit an *expansionary* fiscal response.

instability (under flexible exchange rates) or large fluctuations in official reserves (under a pegged exchange-rate regime), and greater volatility in domestic equity markets. Financial volatility may have led to adverse real effects as well—nominal exchange-rate volatility, in particular, may hamper the expansion of exports if hedging options available to domestic producers are limited.

While both first- and second-generation crisis models (as reviewed in the next chapter) predict a switch from domestic currency-denominated assets to foreign currency-denominated ones (or from foreign currency—to domestic currency-denominated liabilities), neither type of model predicts that the emergence of a crisis is necessarily associated with a sudden inability on the part of domestic agents to engage in external borrowing. However, Calvo (1998) noted that the currency crises in Mexico in 1994 and Asia in 1997–1998 were characterized by precisely such a loss of access to foreign funds, which he referred to as “sudden stops” of capital inflows. A sudden stop is a sharp, discontinuous fall in net capital flows (including foreign exchange reserve depletion) into a country. Because this phenomenon is not a necessary concomitant of either first- or second-generation currency crisis, it calls for a different modeling approach.

Models of sudden stops have sought to explain several empirical regularities associated with this phenomenon. First, among emerging market economies, sudden stops have tended to be accompanied by large real exchange-rate depreciations. By contrast, large real exchange-rate depreciations and capital flow reversals are not closely associated with each other among industrial countries. Second, sudden stops have tended to come in bunches, affecting simultaneously countries with very different characteristics. Third, sudden stops have generally been accompanied by severe output contractions, large reductions in current-account deficits, sharp increases in domestic interest rates, and substantial losses of foreign exchange reserves, often culminating in exchange regime transitions.¹⁵ Hutchinson and Noy (2006), for instance, using panel data for twenty-four developing countries over the period 1975–1997, found that sudden-stop crises have a large negative, but short-lived, impact on output growth over and above that found with currency crises: a currency crisis typically reduces output by about 2–3 percent, whereas a sudden stop reduces output by an additional 6–8 percent in the year of the crisis. The cumulative output loss of a sudden stop is even larger, around 13–15 percent over a three-year period. Edwards (2004) also found that current-account reversals generally have a large adverse impact on output, and that the effect is larger in countries that are relatively closed to trade and characterized by greater exchange-rate fixity. Finally, vulnerability to sudden stops seems to be reduced by “real” openness (measured as a large share of

output devoted to production of traded goods), as well as by the absence of domestic liability dollarization.¹⁶

From a modeling perspective, the discontinuity in capital flows associated with sudden stops can come about either as the result of a switch among multiple equilibria or as the outcome of a discontinuity in the relationship between capital flows and fundamentals in a model in which equilibrium is unique. In this section we briefly describe the structure of models with multiple equilibria, before examining in some detail a model in which the economy's equilibrium is unique, yet small changes in the fundamentals can nevertheless trigger discontinuous changes in capital flows that result in currency crises.

4.1 | Alternative Models

4.1.1 | Models with Multiple Equilibria

In the original paper calling attention to the sudden-stop phenomenon, Calvo (1998) argued that sudden stops can come about through a self-fulfilling mechanism, in which capital inflows cease because creditors fear that they will not be repaid, while the cessation of capital inflows itself creates the conditions that make repayment unlikely. In this formulation, causation from a sudden stop of capital inflows to debt repayment difficulties operates through the real exchange rate. To see how this works, note that the balance-of-payments identity implies that a sudden stop of capital inflows requires an exactly offsetting increase in the current-account surplus. In turn, the current account balance (CA) consists of the trade balance plus the sum of other factor and nonfactor payments (N), while the trade balance is the excess of domestic production of traded goods (Y^T) over domestic demand for such goods (D^T). Thus, the current-account balance can be written as:

$$CA = Y^T - D^T + N. \quad (12)$$

It follows that current-account adjustment in response to a sudden stop could in principle be achieved through a reduction in domestic demand for traded goods, leaving real output unchanged. However, as noted by Calvo, this is unlikely to happen in the real world, because in the absence of a change in the real exchange rate, a drop in domestic demand for traded goods would have to be brought about through a reduction in domestic absorption, which means that it is likely to be accompanied by a similar drop in demand for nontraded goods. The latter would require a real depreciation in order to maintain equilibrium in the nontraded goods market.

¹⁶ See Calvo et al. (2004). In the same vein, Mendoza and Smith (2002) define three key features of sudden stops: sharp reversals in capital inflows and current account deficits; large downward adjustments in domestic production and absorption; and collapses in asset prices and in the relative prices of nontradable goods relative to tradables.

¹⁵ See Guidotti et al. (2004).

To examine what determines the size of the required change in the real exchange rate, in a later paper Calvo et al. (2004) postulated the following relationship between the demand for nontraded goods and that for traded goods:

$$d^N = \alpha + \beta e + \gamma d^T, \quad (13)$$

where d^N is the log of the domestic demand for nontraded goods, e is the log of the real exchange rate (price of traded goods in terms of nontraded goods), and d^T is the log of the domestic demand for traded goods (i.e., $d^T = \log(D^T)$). α , β , and γ are positive parameters, where γ can be interpreted as the ratio of nontraded to traded goods in domestic absorption. If an initial current-account deficit has to be completely eliminated by a sudden stop in capital inflows, then holding Y^T and N constant, the proportionate size of the adjustment in domestic absorption of traded goods is given by: $\Delta D^T/D^T = CA/D^T < 0$, because $CA < 0$.

Taking first differences in Equation (13), and holding output of nontraded goods constant, this means that the change in the real exchange rate must satisfy $0 = \beta \Delta e + \gamma CA/D^T$, or

$$\Delta e = -\frac{\gamma CA}{\beta D^T}, \quad (14)$$

that is, the required real exchange-rate depreciation is larger the larger the initial current-account deficit, the smaller the elasticity of substitution in demand between traded and nontraded goods, and the larger the marginal propensity to absorb nontraded goods.

The intuition behind the last of these properties is that to achieve a given size of adjustment in the trade balance, the contraction in domestic absorption will have to be larger the smaller the share of this contraction falls on traded goods. The larger the contraction in domestic absorption, the larger the resulting excess supply of nontraded goods at the original real exchange rate, and therefore the larger the required change in the real exchange rate.¹⁷

To link the depreciation of the real exchange rate to debt-servicing difficulties, note that if the "sudden stop" was unanticipated, the real exchange-rate adjustment that accompanies it must have been so as well. In the presence of liability dollarization in the balance sheets of domestic agents (whether the government, banks, or firms), such an unanticipated change in the real exchange rate may create widespread reductions in net worth and potential insolvencies. Calvo claims that widespread bankruptcies in the domestic economy lower the marginal product of capital and thus make it unlikely that firms will be able to service their debt. They do so because they destroy specific

¹⁷ Using a calibrated model with costly labor adjustment for Mexico, Kehoe and Ruhl (2005) found that sudden stops are also associated with substantial resource reallocation between the tradable and nontradable sectors.

human capital, partly by interfering with the fulfillment of implicit contracts within firms (which undermine the incentive structure inside the firm), and partly by diverting human capital to financial transacting, as the result of a reduction in inter-enterprise credit that is likely to accompany widespread bankruptcies. Because specific human capital is complementary to physical capital, the marginal product of physical capital is reduced, making it harder for firms to service their debt and justifying the cutoff of credit. Although the details differ, a variety of other multiple-equilibrium models of the sudden-stop phenomenon follow similar lines. Specifically, these models tend to emphasize the interaction of real exchange-rate depreciation with liability dollarization in linking sudden stops to debt-servicing difficulties.

4.1.2 | A Sudden Stop as a Unique Equilibrium

An alternative modeling framework explains sudden stops as the outcome of a discontinuous transition between unique equilibria. In this section we will examine a simple model of this type due to Calvo (2003). An interesting feature of this model is that the sudden stop is both "real" (that is, it arises from goods-market rather than financial-market phenomena) and demand-driven, rather than supply-driven. In other words, it reflects a reduced supply of such funds on the part of domestic agents, rather than a reduced supply of such funds from external creditors. Nonetheless, the model is able to reproduce many of the features of the currency crises of the late 1990s, including steep output collapses, reduced growth rates, sharp real exchange-rate depreciations, and reserve depletion potentially associated with exchange-rate regime transitions. Consider a small open economy that uses traded capital K to produce a single traded good Y with a linear production technology:

$$Y_t = \alpha K_t, \quad (15)$$

where α is the marginal product of capital.¹⁸ The government taxes away a fraction τ of the economy's output, so that firms' cash flow S is equal to after-tax profits minus new investment \dot{K} :

$$S_t = \alpha(1 - \tau)K_t - \dot{K}_t = [\alpha(1 - \tau) - z_t]K_t, \quad (16)$$

where $z_t = \dot{K}/K$ is the rate of growth of the capital stock. If the international real interest rate is equal to r and the value of the initial capital stock K_0 is set equal to unity, the value of the firm is given by:

$$V = \int_0^\infty [\alpha(1 - \tau) - z_t]K_t e^{-rt} dt = \int_0^\infty [\alpha(1 - \tau) - z_t] e^{(r - z_t)t} dt. \quad (17)$$

The firm maximizes its value by choosing the time path of z_t . Because the optimal value of z_t can be shown to be constant over time, this is equivalent to

¹⁸ The specification used in (15) is the so-called "AK" technology; its implications for long-run growth are discussed in Chapter 17.

maximizing:

$$Y = \frac{\alpha(1-\tau)z}{r-z} \tag{18}$$

To ensure that the value of the firm is positive, and that the growth rate of the capital stock is positive but bounded from above, z is restricted to the range $0 \leq z \leq \bar{z} < r$. It is easy to show that the sign of the derivative of Y with respect to z is given by the sign of the expression $\alpha(1-\tau) - r$, that is, the excess of the after-tax marginal product of capital over the real interest rate. If this expression is positive, the firm will set z at its maximum value \bar{z} . Otherwise, it sets z at its minimum value $z = 0$.

The tax rate τ is determined so as to maintain the government's solvency. Specifically, suppose that the government has an outstanding debt D , and that to maintain its solvency it has to raise resources through distortionary taxation equal in present value to a share θ of its total debt (the remaining resources $(1-\theta)D$ are raised in a nondistortionary fashion). Then the government's intertemporal budget constraint implies:

$$\theta D = \alpha \tau \int_0^\infty K_t e^{-rt} dt = \alpha \tau \int_0^\infty z_t e^{(\alpha - r - z) t} dt = \frac{\alpha \tau}{r - z} \tag{19}$$

In turn, this means that the tax rate must be:

$$\tau = (r - z)\theta D / \alpha \tag{20}$$

Substituting this expression for τ in the firms' objective function, the critical expression governing the behavior of investment becomes:

$$\alpha(1-\tau) - r = \alpha[1 - (r - z)\theta D / \alpha] - r = \alpha - (r - z)\theta D - r \tag{21}$$

Note that the criterion determining the optimal amount of investment depends on the rate of investment itself. A zero-investment (and zero-growth) equilibrium (that is, one with $z = 0$) will be optimal if $\alpha - r(1 + \theta D) < 0$, that is, if $\theta D > (\alpha - r)/r$. The intuition is that a high stock of debt requires a high value of the distortionary tax rate, which discourages investment. An equilibrium with the maximum growth rate \bar{z} , by contrast, will be optimal if $\alpha - (r - \bar{z})\theta D - r > 0$, or if $\theta D < (\alpha - r)/(r - \bar{z})$. In principle, the growth rate is indeterminate if $(\alpha - r)/r < \theta D < (\alpha - r)/(r - \bar{z})$, because both conditions are satisfied in that range. However, Calvo assumes that in this case coordination among investors will cause the economy to settle on the high-growth equilibrium. Under this assumption the economy's growth rate and level of investment display a discontinuity with respect to the fundamental θD at $\theta D = (\alpha - r)/r$. For debt below this level, the economy is in the high-growth equilibrium $z = \bar{z}$, while if debt is above this level the economy is in the low-growth equilibrium $z = 0$. This has the important implication that for economies that are very close to the threshold $(\alpha - r)/r$, a small decrease in the productivity parameter α or a small increase in the world real interest rate

r could cause a discontinuous collapse in the level of investment and rate of growth.

To link this mechanism to sudden stops of capital flows, it is necessary to expand the model to describe the current account of the balance of payments. Suppose that the representative consumer in this economy has a time-separable utility function with a constant rate of time preference that is equal to the world real interest rate r , and let this consumer's instantaneous utility function be denoted as $u(c^T, c^N)$, where the function $u(\cdot)$ has the usual properties, and c^T and c^N are respectively the consumer's consumption of traded and nontraded goods. Output of nontraded goods, denoted Y^N , is determined by the concave production frontier $Y^N = f(x)$, where x is the portion of total tradables output Y that is used as an input into the production of nontradables. Under these conditions, the budget constraint is given by:

$$r[V - (1 - \theta)D] = c^T + x, \tag{22}$$

given that production and consumption of nontradables must be equal in equilibrium. The consumer's problem is to maximize:

$$u_1(c^T, f(r[V - (1 - \theta)D] - c^T)), \tag{23}$$

by choosing the level of c^T . This yields the first-order condition:

$$\frac{u_2(c^T, f(r[V - (1 - \theta)D] - c^T))}{u_1(c^T, f(r[V - (1 - \theta)D] - c^T))} = \frac{1}{f'(r[V - (1 - \theta)D] - c^T)} = e^{-1}, \tag{24}$$

where e is the real exchange rate (relative price of traded goods in terms of nontraded goods). Note that this equation implies that c^T and e are both functions of net wealth $V - (1 - \theta)D$. But using Equations (20) and (23), net wealth can be written as:

$$V - (1 - \theta)D = \frac{\alpha - z}{r - z} \tag{25}$$

By Equation (25), the condition for a high-growth equilibrium to exist requires that $\alpha - z > 0$. This implies that net wealth must be an increasing function of z . If the initial capital stock is equal to unity, as assumed above, gross output of traded goods in this economy is equal to α , and net output of traded goods is $\alpha - x$. Thus, the trade balance is $(\alpha - x) - (c^T + z)$, and the current account is given by:

$$CA = (\alpha - x) - (c^T + z) - rD = -\frac{\alpha - z}{r - z} \tag{26}$$

Because $\alpha - \bar{z} > 0$ and $r - \bar{z} > 0$, the current account must be in deficit in the "high growth" equilibrium—that is, when $\theta D < (\alpha - r)/(r - \bar{z})$ —and it will be zero when $z = 0$. Thus, a discontinuous elimination of a preexisting current-account deficit (a sudden stop) takes place at the transition from a high- to a low-growth equilibrium. Because the collapse in the economy's growth rate at the transition point implies a reduction in net wealth, the demand for

nontraded goods must fall. This has the joint implication that real output falls and the real exchange rate depreciates.

4.2 | The Role of Reserves and Policy Responses

The model described in the previous subsection is a nonmonetary one. As Calvo shows, however, it can easily be extended to a monetary economy by adding a cash-in-advance motive for holding money:

$$M = S(c^T + e^{-1}c^N), \quad (27)$$

where M is the money supply and S is the nominal exchange rate, assumed fixed initially. Because c^T and c^N both fall over the transition from a high- to a low-growth equilibrium, and the real exchange rate depreciates (e rises), the demand for money falls as well. Consequently, the stock of foreign exchange reserves must also fall. In other words, the sudden stop is accompanied by a speculative attack. If the stock of reserves is sufficiently low initially, this reserve loss could be accompanied by an abandonment of the fixed exchange rate and a transition to a floating rate, as in first-generation models.

However, the model has another interesting implication for policy. In first-generation models, if the factor driving domestic credit expansion is an ongoing fiscal deficit, a fixed exchange rate can be sustained by making a fiscal adjustment that permits the rate of credit expansion to be reduced. However, in Calvo's sudden-stop model, such a fiscal adjustment may actually trigger the sudden stop and the associated currency crisis if it takes the form of an increase in τ , because an increase in τ , which effectively represents an increase in the share θ of government debt that is serviced through distortionary taxation, may actually take the economy over the threshold from the high- to the low-growth equilibrium. Instead, what is required to avoid the crisis in the present model is a reduction in θD . This implies that what matters is not the fiscal deficit per se, but rather the distortions imposed on the economy by the need to finance the government's activities. Avoiding sudden stops requires either reducing the scale of such activities or adopting less distortionary ways of financing them.

In practice, countries that are susceptible to sudden stops have tended to accumulate sizable international reserves. A rationale for such a (generally expensive) self-insurance strategy is the desire to gain a measure of protection and avoid costly liquidation of investment projects and a drop in output. Aizenman and Lee (2005) develop a model of the precautionary (and thus, voluntary) demand for reserves along these lines. Their analysis suggests that, although hoarding international reserves entails an opportunity cost, a high degree of volatility in capital flows (coupled with limited access to global capital markets) makes the welfare gain from hoarding reserves of a first-order magnitude—even under risk neutrality. Put differently, optimal hoarding of reserves reduces the magnitude of the output cost associated with sudden stops from first to second order. Aizenman et al. (2007) provide empirical evidence

that supports the precautionary approach for the case of Korea, in the aftermath of the 1997 Asian crisis.

APPENDIX: Measuring the Degree of Financial Integration

Capital controls continue to prevail in many developing countries, but their effectiveness has often been questioned. At one extreme, if such controls are effective and the economy is completely closed, external financial intermediation is ruled out. Thus, domestic interest rates can be influenced by domestic monetary, fiscal, and other shocks.¹⁹ At the other extreme, if controls are completely ineffective and perfect capital mobility prevails (meaning that nonmonetary domestic financial assets are perfect substitutes for their foreign counterparts and that portfolio adjustment is instantaneous, possibly despite the presence of formal capital controls), the interest rate on domestic financial assets must be equal to the uncovered-parity foreign rate, that is, the exogenous foreign interest rate plus the expected rate of depreciation of the domestic currency. The marginal cost of funds in the economy would then be given by the uncovered parity rate and would be unaffected by domestic policies and shocks, except to the extent that these affect the expected rate of depreciation of the domestic currency.

In practice, of course, the degree of financial openness differs both across countries and over time. Drawing on Montiel (1994) and Willett et al. (2002), this Appendix reviews some of the evidence on measuring the degree of capital mobility, which takes the form of indications of the size of gross capital flows, tests of interest parity conditions, tests of the effectiveness of sterilization, and correlations between savings and investment.

A.1 | The Magnitude of Gross Flows

To the extent that the size of capital flows is indicative of the degree of financial integration, evidence on past episodes of substantial capital movements in and out of developing countries can be brought to bear on the issue. Specifically, one can measure the gross stocks of financial claims between developing countries and external financial markets to which capital flows have given rise. Some studies have found that private capital flight amounts to a large fraction of the external debt of a number of countries, with capital flight itself linked to portfolio considerations.²⁰ The gross-flow evidence indicates therefore that

¹⁹ When the intensity of capital controls is high, parallel markets for foreign exchange tend to emerge (see Agenor, 1992). The macroeconomic implications of these markets (together with informal credit markets) were discussed in previous editions of this book; this material is now summarized in Annexes, available upon request.

²⁰ Various methodologies can be used to measure capital flight (see Cuddington, 1986). The most common is the "residual" approach, which identifies capital flight with net inflows of capital and net outflows (current-account deficit plus the central bank's increase in reserves). An

some countries have exhibited a substantial amount of at least de facto financial openness.

A.2 | Tests of Interest Parity Conditions

Tests of interest parity conditions are the most common approach to the measurement of financial integration for industrial countries (see, for instance, Dooley and Isard, 1980, for an early study). In brief, if i denotes the domestic interest rate on an asset of a given type, i^* the interest rate on the corresponding foreign asset, and e the expected rate of depreciation of the domestic currency, then the differential return, d , between holding the domestic and foreign assets, without hedging the exchange risk in forward markets, is given by

$$d = i - i^* - e.$$

Under perfect capital mobility, expected returns on domestic and foreign assets should be equalized, so d should be zero. This situation is referred to as one in which uncovered parity holds. However, d is not directly observable; it depends on the unobserved expectation e . If that expectation is formed rationally, then uncovered interest parity implies that $E(d/\Omega) = 0$, where Ω is the information set used in forecasting e . Thus, d should not be correlated with any information contained in Ω . Joint tests of uncovered interest parity and rational expectations thus entail testing whether d is correlated with variables in Ω . However, a problem with standard tests of uncovered interest parity is the "peso problem"—a situation in which a nonzero probability of a future parity change produces a forward discount on the domestic currency (Krasker, 1980). This implies that rejection of the null hypothesis does not necessarily invalidate the assumption of perfect capital mobility.²¹

As argued by Willett et al. (2002), the use of covered interest parity tests is of limited value to assess the degree of capital mobility. While deviations from parity are clear evidence of limited capital mobility, the converse does not hold. Thus, covered parity is a necessary but not sufficient condition for perfect capital mobility. Their own estimate is that the degree of capital mobility in developing countries is not that high.

Alternative method identifies capital flight as unreported capital outflows, that is, those flows that are hidden from domestic authorities. This approach consists in (a) estimating the stock of total private claims on foreigners, and (b) subtracting the reported claims imputed from annual reported income, so as to obtain the stock of "unreported" holdings. Total claims are defined as cumulative capital outflows, plus errors and omissions, plus the discrepancy between two measures of external debt—that reported by the World Bank and that derived from cumulative recorded balance-of-payments liabilities. Chang et al. (1997) have shown, however, that in practice these methodologies do not lead to large measurement discrepancies.

21 An alternative approach, developed by Edwards and Khan (1985) and extended by Haque and Montiel (1991) and Reisen and Yehes (1993), is criticized by Willett et al. (2002).

Several applications of these tests been conducted for developing countries; see, for instance, Khor and Rojas-Suarez (1991) and Faruqe (1992). By and large, the results suggest that although the degree of integration with external financial markets may have increased in recent years for many developing countries, domestic interest rates depart substantially from their covered parity.

A.3 | Tests of Monetary Autonomy

Under perfect capital mobility, the "offset coefficient" that relates changes in the stock of domestic assets of the central bank to changes in reserve flows normally takes a value of -1 , because any expansion of the domestic assets of the central bank will give rise to an offsetting capital outflow, leaving the stock of money unchanged and implying a loss of monetary autonomy. A separate strand of investigation of the capital mobility issue in developing countries tests for this loss of monetary autonomy. By and large, early empirical studies based on this approach—such as Cumby and Obstfeld (1983), Kamas (1986) and Reinhack and Mondino (1988)—found that in some cases perfect capital mobility does not hold for some countries; slow portfolio adjustment and imperfect asset substitutability allowed them to retain at least some short-run monetary autonomy during that period, with an offset coefficient significantly less than unity.

An implication of maintaining some scope for independent monetary policy is, of course, that policy-induced changes in domestic financial aggregates will affect macroeconomic variables other than the capital account. Thus, the identification of domestic macroeconomic effects arising from monetary policy shocks under fixed exchange rates provides an indirect confirmation of the retention of at least some degree of monetary autonomy. Some studies have found indeed that domestic interest rates are significantly affected only by domestic factors, with little evidence of a role for foreign interest rates.

A.4 | Saving-Investment Correlations

An influential paper by Feldstein and Horioka (1980) argued that the degree of capital mobility among industrial countries could be tested by examining the degree of correlation between saving and investment rates, with the reasoning that under perfect capital mobility domestic saving and investment rates should be uncorrelated. Several investigators (including Dooley et al., 1987) who have constructed such tests included a number of developing countries in their cross-section samples and considered the effect of including such countries on their results. Surprisingly, these authors concurred in finding that the inclusion of developing nations reduced the strength of the saving-investment correlation in their samples. This was unexpected, because these countries were perceived