Macroeconomics in Emerging Markets

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1

Macroeconomics and Development

Why should someone who is primarily concerned with long-term growth and development in emerging-market economies concern themselves with short-run macroeconomic performance? The answer to this question is that short-run macroeconomic stability has increasingly been recognized as an important determinant of long-term growth performance in such economies. Indeed, over the past two decades a significant consensus has emerged among professional economists and policymakers in developing countries that providing a stable and predictable macroeconomic policy environment and getting key macroeconomic relative prices "right" help to induce the accumulation of physical and human capital as well as the improvements in productivity that are the basic ingredients of long-term economic growth. A wide array of evidence is consistent with this proposition, derived from cross-country experience as well as from case studies of both successful and unsuccessful developing economies. The growing attention paid to macroeconomic issues by development-oriented institutions such as the World Bank is one consequence of this new perception.

What do we mean, however, by macroeconomic stability, and by "key macroeconomic relative prices"? In the emerging-market context, "stability" has come to mean the avoidance of high and variable rates of inflation, as well as of "financial" crises – a term that covers a variety of sins, including the public sector's inability to service its debts, domestic banks' inability to fulfill their obligations to their depositors, and the central bank's inability to sustain the value of the currency. The key macroeconomic relative prices are those that guide the allocation of production and consumption between present and future goods, as well as between domestic and foreign ones. Those relative prices are the real interest rate and real exchange rate, respectively.

The most important policies that influence macroeconomic performance in each of these areas are the management of the public sector's budget and its financing (fiscal and monetary policies), policies directed at the domestic financial sector, and exchange rate management. This book is concerned with the effects that the quality of domestic policies in each of these areas can have on domestic macroeconomic stability and the behavior of key macroeconomic relative prices.

What are the links between fiscal management, financial sector policies, and exchange rate management, on the one hand, and long-run growth, on the other? That is the question we will address in this chapter. By way of motivating the issues that will concern us throughout the rest of the book, in this first chapter we will briefly review the theory and evidence linking macroeconomic stability to long-term growth. We will begin by reviewing the basic factors that underlie long-term economic growth, as summarized in aggregate production functions, before turning to a theoretical consideration of how such factors may be affected by short-run macroeconomic performance. Then we will briefly discuss some recent empirical research that investigates the importance of these links in practice.

I. THE AGGREGATE PRODUCTION FUNCTION

At the heart of the link between short-run macroeconomic performance and long-term economic growth is the concept of the "production function", a technological relationship that summarizes how the feasible level of output of a particular good is influenced by the state of technology and the efficiency of resource allocation, as well as by the amounts used of whatever inputs are relevant for the production of the particular good. Because production functions specify the factors that determine the level of real output that an economy is potentially capable of producing, they help us identify the channels through which short-run macroeconomic performance is capable of influencing the rate of growth of an economy's productive capacity.

a. Complete Specialization and the Aggregate Production Function

The first step in describing how goods are produced in a given economy is to specify how many distinct types of goods we must consider. For simplicity, it is convenient to assume that only one type of good is produced in the domestic economy (economists refer to this as *complete specialization in production*).[1] We will let the symbol Y denote the amount of this good produced during a given period of time. Notice that Y is a *real* quantity, since it is measured in units of goods, not of currency, and that it has the characteristics of a *flow* magnitude – that is, it is measured per unit of time. In the real world, Y would represent a country's *real GDP*. To produce the good, we will suppose that firms in the economy employ the services of labor and capital. The maximum amount of the good that can be produced with a given quantity of

[1] We can think of this single good as a composite, possibly consisting of many individual goods. Our assumption of complete specialization just means that we will not be analyzing changes in relative prices among goods produced domestically.

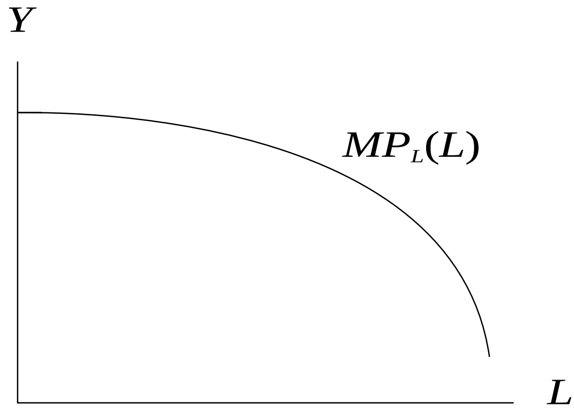

Figure 1.1. The Marginal Product of Labor

labor and capital services is determined by the *aggregate production function*, which we will write in the form:

$$Y = AF(L, K), \tag{1.1}$$

where A is a parameter that serves as an index of the productivity of the resources employed, L denotes the level of employment, and K is the capital stock, which determines the level of capital services employed in production each period.[2] An increase in A means that the economy becomes more productive, in the sense that more output can be produced with the same amounts of labor and capital services. Because changes in A correspond to changes in the productivity of both factors of production, A is usually referred to as an indicator of *total factor productivity*.

In order to use this production function, we will need to say something about its properties. We will assume that this function has three properties that are typical of *neoclassical* production functions. First, the function will be assumed to be *continuously differentiable*. This just means that each of the factors of production can be varied continuously, and that such variations will produce continuous changes in the level of output. The change in the level of output corresponding to a small increase in one of the factors, holding the other constant, is the *marginal product* of that factor. A second property is that these marginal products are positive and decreasing (the familiar property of diminishing marginal returns) for both labor and capital. This means that we can draw the marginal products of labor and capital as negatively sloped curves in the positive quadrant. For example, the marginal product of labor can be depicted as in Figure 1.1. A similar picture could be drawn for the marginal product of capital. This property turns out to be important in short-run macroeconomic models such as one we will be building in the next chapter. Finally, the function will be assumed to exhibit *constant returns to scale (CRTS)*,

[2] An appendix to this chapter contains a very brief review of mathematical functions.

which implies that if both of the factors of production are multiplied by a positive constant (i.e., if they are both changed by the same proportion), the level of output will change by a factor equal to that same constant (e.g., doubling the amounts of capital and labor used in production doubles the amount of output produced).

b. Short Run and Long Run in Macroeconomics

In the next three chapters, we will build a simple macroeconomic model that can be used to study the economy's short-run equilibrium. The macroeconomic "short run" is usually defined as a period of time over which the capital stock and technology are fixed. The basic intuition is that stocks of capital and knowledge tend to change very slowly compared to the pace at which several other important macroeconomic phenomena play themselves out.[3]

Given the capital stock and technology, the level of output that the economy can produce depends on how much labor is employed. Heuristically, "full employment" refers to a situation in which everyone who wants a job can get one. When total employment L is at its full-employment level, say L_P, the resulting level of output is variously referred to as the *potential*, *capacity*, or *full-employment* level of GDP. Thus, potential GDP is given by:

$$Y_P = AF(L_P, K). \tag{1.2}$$

Short-run macroeconomics is typically concerned with stabilization of employment around its full-employment level, the determination of the average price level, and the behavior of various items in the economy's balance of payments. The "long run," by contrast, is a period of time long enough that the capital stock and technology can change. Long-run macroeconomics is primarily concerned with what determines how the level of the economy's productive capacity (potential GDP) changes over time. Increases in economic capacity are what we refer to when we use the phrase "economic growth."

Notice that this means that growth does not just refer to an increase in real GDP, but to an increase in productive "capacity," whether that capacity is used or not. It is useful to clarify the distinction algebraically. Using the aggregate production function, we can approximate the change in (actual) output during any given period

[3] To get a sense for this, consider the following example illustrating "typical" annual changes in a country's capital stock. Suppose the ratio of the capital stock to annual output (the capital-output ratio) is 3, and that 7 percent of the capital stock wears out each year. Under these circumstances, gross domestic investment of 21 percent of GDP would be required to keep the capital stock from changing. If an economy invests 30 percent of GDP (a high figure), then the net addition to the capital stock each year would be 9 percent of GDP. But this is only a 3 percent change in the capital stock. In many countries, this would barely be enough to keep up with the expansion of the "effective" labor force (that is, labor force growth augmented by the change in worker productivity), so that the ratio of the capital stock to effective labor would remain unchanged. Thus, achieving large changes in the capital stock relative to the size of the economy would tend to be a slow process.

of time as the sum of contributions made by each of the three arguments in the production function, where the contribution of each is the change in that argument multiplied by its marginal product:

$$\Delta Y = MP_A \Delta A + MP_L \Delta L + MP_K \Delta K.$$

Dividing through by Y:

$$\begin{aligned}\Delta Y/Y &= MP_A(A/Y)\Delta A/A + MP_L(L/Y)\Delta L/L + MP_K(K/Y)\Delta K/K \\ &= \Delta A/A + MP_L(L/Y)\Delta L/L + MP_K(K/Y)\Delta K/K, \qquad (1.3)\end{aligned}$$

since MP_A, the marginal product of A, is just F, and $AF/Y = 1$. Recalling that $\Delta X/X$ is the *rate of growth of X*, this states that the growth of Y depends on the rates of growth of technology (alternatively, of total factor productivity), of the labor force, and of the capital stock.

Recall that under competitive conditions, the services of factors of production are remunerated at a rate equal to their marginal products. Thus, the quantities $MP_L L/Y$ and $MP_K K/Y$ are respectively the shares of the aggregate income generated in the economy that are received by labor and capital. Under constant returns to scale, these shares must sum to unity. To simplify matters further, let's assume that these shares are constant, and let the symbol θ denote the share of labor – that is, $\theta = MP_L(L/Y)$.[4] Then we can write equation (1.3) as:

$$\Delta Y/Y = \Delta A/A + \theta\Delta L/L + (1-\theta)\Delta K/K. \qquad (1.4)$$

Now, doing the same thing for potential GDP:

$$\Delta Y_P/Y_P = \Delta A/A + \theta\Delta L_P/L_P + (1-\theta)\Delta K/K. \qquad (1.5)$$

Subtracting the second of these equations from the first and reorganizing:

$$\Delta Y/Y = \theta(\Delta L/L - \Delta L_P/L_P) + \Delta Y_P/Y_P. \qquad (1.5')$$

This equation explains how the economy's actual growth (in the form of year-to-year changes in output) can differ from the growth in its productive capacity. Growth of actual real GDP and growth of productive capacity (given by the last term on the right) are not the same thing. They differ whenever the rate of growth of employment differs from that of the labor force.

II. MACROECONOMIC STABILITY AND LONG-RUN GROWTH: THEORY

The actual rate of growth of employment $\Delta L/L$ cannot permanently exceed or fall short of the average growth rate of the labor force $\Delta L_P/L_P$. A basic tenet of

[4] This means that the aggregate production function takes the Cobb-Douglas form $Y = AL^{\theta}K^{1-\theta}$.

modern macroeconomics is that the economy contains a number of mechanisms that tend to drive it back sooner or later to a position of full employment after a shock that drives L away from L_P. Thus, when averaged over enough time periods, the first term on the right-hand side of equation (1.5′) must be approximately zero, and the economy's average growth rate must approximate the rate of growth of its productive capacity. An important question, however, is whether it makes any difference for the growth rate of productive capacity $\Delta Y_P/Y_P$ how stable or unstable actual year-to-year economic performance (that is, $\Delta Y/Y$) tends to be around its long-run average. In other words, how – if at all – does short-run macroeconomic management affect the rate of growth of the economy's productive capacity?

Equation (1.5) indicates that if it does so at all, it must do so through one or more of three potential channels of influence:

a. The rate of growth of total factor productivity $\Delta A/A$.
b. The rate of growth of the labor force $\Delta L_P/L_P$.
c. The rate of growth of the capital stock (net investment) $\Delta K/K$.

Macroeconomists typically assume that the growth of the size of the labor force is affected primarily by longer-term demographic factors, rather than by short-run macroeconomic events. If this is true, we are left with two channels through which short-run macroeconomic events can affect the rate of growth in long-run productive capacity: growth in total factor productivity and investment in the physical capital stock.

a. Macroeconomic Instability, Total Factor Productivity, and Capital Accumulation

Why might these be influenced by short-run macroeconomic performance? The key reason is that in a market economy, resource allocation is guided by intratemporal and intertemporal relative prices. Intratemporal relative prices such as the real exchange rate provide the incentives that guide the allocation of resources between broad sectors of the economy, such as those that produce traded and nontraded goods. If relative prices such as these are not "right" – that is, do not reflect true social scarcities – then resources such as capital will be guided into uses that are not as productive as they might otherwise have been, reducing the rate of growth of total factor productivity in the economy. On the other hand, intertemporal relative prices (the real interest rate) convey information to the economy about the relative value to society of goods that are available at different points in time. They thus provide the incentives to shift resources between the production of present or future goods – that is, to defer consumption and accumulate capital. If an economy that has access to highly productive technologies cannot signal the need to defer consumption through a high real interest rate – meaning it cannot get the real interest rate "right" – the capital accumulation required to implement these technologies will not take place, and the economy's growth rate will be lower than it would otherwise have been.

But getting the key relative prices "right" on average is not enough. It is also important that economic agents be able to respond to these relative prices. The stability of the domestic macroeconomic environment is important in allowing these relative prices to convey their information efficiently.

Macroeconomic instability tends to generate uncertainty, and in particular, uncertainty about whether the relative prices observed in the present will prove to be permanent or transitory. This is important because the reallocation of resources from one type of economic activity to another often involves incurring a fixed cost – such as the costs of acquiring irreversible physical capital (meaning capital that, once invested, cannot be converted to other uses). In the presence of such costs, the relative prices that determine the allocation of resources are "normal" or "permanent" relative prices, not necessarily the relative prices that are observed at any given time. The problem is, of course, that when there is uncertainty about the future, the relevant "permanent" prices cannot be observed directly. Instead, they must be inferred. This situation has important implications both for growth of total factor productivity as well as for the accumulation of productive factors.

Effects on the growth of total factor productivity arise from two sources:

a. The inference problem involved in generating estimates of "permanent" relative prices itself absorbs resources. This has a direct effect on total factor productivity, because the resources absorbed in generating and processing information are not available to be used in the production of goods and services.
b. Moreover, even under the best of circumstances, the expenditure of resources in solving this inference problem will be unable to resolve all uncertainty about future relative prices. In the presence of risk aversion (that is, when economic agents have to be compensated for bearing risk), the remaining uncertainty will cause economic agents to demand a risk premium in order to undertake activities – such as resource reallocations in the presence of fixed costs – that have highly uncertain payoffs. Such risk premia act as the equivalent of a tax on such activities, reducing the efficiency with which resources are allocated and thus the level of total factor productivity.

These considerations, which adversely affect the efficiency of the economy's intratemporal allocation of resources, also discourage the accumulation of productive factors – that is, the *intertemporal* efficiency of resource allocation. The reasons are similar. Uncertainty has negative effects on investment due to the irreversible character of much fixed capital. When capital is irreversible, a potential investor in effect owns a valuable option before he or she makes the commitment to invest, the option being not to undertake the investment. The value of this option is higher when there is uncertainty, because the potential gains from not investing (in the form of losses avoided) are larger the greater the degree of uncertainty in the economic environment. When capital is irreversible, making the decision to invest means surrendering this option, which thus represents an important opportunity cost of investment. By increasing the degree of uncertainty in the environment, short-run macroeconomic instability thus increases the value of the option to wait rather than invest, and thereby discourages the accumulation of physical capital.

b. Symptoms of Macroeconomic Instability

But what precisely do we mean by macroeconomic instability? At a heuristic level the answer is obvious: it refers to a situation in which the future evolution of key macroeconomic variables is difficult to predict. But how might this situation arise? The symptoms of macroeconomic instability can take many forms, but in the context of emerging market economies, certain specific manifestations have been of particular importance over the past two decades:

1. Prospective Fiscal Insolvency

When a country's government is prospectively insolvent, something has to change. Either the government will have to make a fiscal adjustment, which may involve reducing expenditures that benefit some economic activities or raising taxes on others; it may increase its reliance on the inflation tax, thereby triggering high inflation; or it may simply *de jure* or *de facto* repudiate its debt. Debt repudiation, in turn, may generate a variety of macroeconomic dislocations through the actions of the government's creditors. We will discuss this in detail in Chapter 7.

2. High Inflation

As we shall see in Chapter 5, the government can seek to remain solvent by relying on monetary financing of fiscal deficits, which has the effect of increasing the domestic rate of inflation. If the government opts for high inflation to maintain its financial solvency, one form of uncertainty (the nature of the government's response to its prospective insolvency) will be replaced by another – that associated directly with high inflation. High inflation creates uncertainty both because high inflation tends to be unstable inflation, increasing the uncertainty associated with intertemporal relative prices, as well as because different speeds of nominal price adjustment imply that high and unstable inflation is associated with instability in intratemporal relative prices. The consequences of this type of macroeconomic instability for long-term growth are explored in Chapter 6.

3. Financial Sector Fragility

Similarly, weaknesses in the financial sector, in the form of low net worth of banks coupled with poor financial regulation and supervision, affect growth directly by impairing the sector's ability to allocate investment resources efficiently across alternative uses as well as by sending inappropriate signals about intertemporal relative prices. In addition, however, financial fragility tends to magnify macroeconomic boom-bust cycles, both by generating such cycles as well as by amplifying them when they originate outside the financial sector itself. Extreme swings in economic activity are likely to be associated with greater uncertainty for both intra- and intertemporal relative prices. Moreover, generalized insolvency in the financial sector is likely to be associated with potential fiscal insolvency as well, through the government's backing of the liabilities of the financial system. Financial fragility is the subject of Chapter 12.

4. Exchange Rate Misalignment

Finally, large and persistent real exchange rate misalignment also increases the uncertainty associated with intratemporal as well as intertemporal relative prices. When the real exchange rate is known to be far from its equilibrium value, that equilibrium value becomes unobservable and therefore uncertain. Moreover, when the country's capital account is open, the expectation of a real exchange rate adjustment will affect the level of the country's equilibrium real interest rate through international financial parity conditions, as well as the potential dispersion around the expected real interest rate. We will return to this subject in Chapter 15.

As mentioned before, these are not the only conceivable symptoms of macroeconomic instability, but they seem to have been the most important ones in emerging economies during the past two decades. The major macroeconomic crisis that afflicted many developing countries during the eighties – the international debt crisis – was at bottom a fiscal phenomenon, while the major crises of the nineties – the Mexican and Asian crises – arose from interactions between inappropriate financial sector and exchange rate policies in a context of increased financial integration.

III. MACROECONOMIC STABILITY AND LONG-RUN GROWTH: EVIDENCE

The previous section described some analytical links between short-run macroeconomic performance and the rate of growth of the economy's productive capacity, highlighting the potential role of macroeconomic instability in impairing growth of total factor productivity and the accumulation of productive factors through its effects on uncertainty and the information content of relative prices. It also identified some specific phenomena that can be interpreted as symptoms of this macroeconomic uncertainty. But is there any evidence that such phenomena have indeed been associated with slower growth of productive capacity?

To answer this question we first face a methodological issue: how would we determine empirically whether these theoretical arguments are right? They basically claim that there is a cause-and-effect relationship between macroeconomic uncertainty and growth. This suggests an association between these two variables in the data. How do we find out if this is true?

a. Cross-Country Evidence

Consider, for example, the link between high inflation and the rate of growth of productive capacity. A naïve way to test whether a negative association indeed exists between these two variables is to see whether changes in real GDP and changes in the price level are correlated in some sample, either for a single country over time (a time series) or across countries (a cross-section). Notice, however, that the arguments we discussed above refer to links between long-run (capacity) growth and inflation. Thus, year-to-year correlations may be meaningless as evidence. The first step, therefore, is to make sure we have an appropriate operational definition of the variables.

Inflation can be observed directly, but growth of productive capacity cannot. It must be estimated. One way to get an empirical handle on it is to exploit the observation made above that the *actual* growth rate of GDP in a country during a given year tends to fluctuate around the growth of capacity, either because the production function is subject to random shocks or because random demand shocks cause temporary deviations from capacity output that are gradually eliminated through nominal wage flexibility (this mechanism is discussed more fully in the next chapter). From a statistical perspective, these fluctuations can be taken to be mean-zero serially correlated random shocks. With such a statistical model in mind, we could estimate the growth of productive capacity by taking the average of several years' growth rates during which we believe the statistical model to be valid. In other words, for a given country, the mean of several years' actual growth rates is taken to be a good estimate of capacity growth during those years in that country.

Thus, with an appropriately chosen sample, our best bet is to look at correlations between long-run average growth rates and long-run average inflation rates. This cannot generally be done for a single country, unless we have enough data to generate periods that are long enough for meaningful averages to be calculated. Thus, a natural approach is to look at cross-country experience – to use *cross-section* evidence.

To illustrate some of the methodological issues involved, consider as an example a well-known recent study by Fischer (1993) on the relationship between macroeconomic performance and long-run growth. Fischer describes various ways to examine empirically the links between macroeconomic stability and growth. One way to do it is to look at correlations across regions and for the same region over time between average rates of economic growth and various macro variables that serve as indicators of stability (Table 1 in Fischer 1993). Using Asia, Latin America, and Africa as the regions, and observations averaged for 1960–73, 1973–80, and 1980–88, he finds:

- Negative correlations between growth and inflation, as well as between growth and government budget deficits.

- Positive correlations between growth and the current account balance of the country's balance of payments, as well as between output growth and export growth.

But just how strong is evidence of this type? One problem with such evidence is that these correlations could simply reflect accidental outcomes. By using regions as our basic unit of observation, we do not have enough data to be statistically sure that this is not so – or at least, to form some idea of the likelihood that the outcome is purely accidental. Suppose, for example, that countries' long-run growth experience is unrelated to their inflation rates, contrary to the hypothesis above. In particular assume that, while countries differ with respect to their long-run growth rates, their "normal" inflation rates are all the same, but their actual inflation rate during any sample period is purely random. Then how could we be sure that the association we observe between growth rates and observed inflation rate does not simply reflect a lucky draw for the high-growth countries and an unlucky one for the low-growth countries?

The answer is, of course, that we cannot be sure. However, we can use statistical methods to quantify the extent of our uncertainty about the role of random factors. For example, since the hypothesis concerning the link between growth and macroeconomic stability is about countries in any event, suppose we use countries rather than regions as our unit of observations, and pose the question whether the normal inflation rate for high-growth countries is lower than that for low-growth countries. To address this question, we can classify countries according to their growth experience, and examine the differences between the average inflation rates of the high-growth and low-growth country groups. The more countries are in each group, the more precise the average inflation rate of each group will be as an estimate of the normal inflation rate in that group. The question, then, is what the likelihood would be that any observed difference between the average inflation rates of the two groups could emerge purely as the result of random factors if indeed there were no difference between the normal inflation rates of the two groups. This is precisely the kind of question that can be addressed through statistical "difference of means" tests.

For example, Fischer cites the work of Levine and Renelt (1992), who ranked countries by average growth rates and found statistically significant differences between fast (56 countries with growth above the mean) and slow growers in their sample of 109 countries (1960–89) with regard to the ratio of investment to GDP, the ratio of government consumption to GDP, the rate of inflation, and the black market premium (the percentage difference between the exchange rate in the unregulated foreign exchange market and that in the official market) as indicators of macroeconomic stability.

What can we learn from tests of this sort? These tests tell us whether long-run growth tends to be correlated with several indicators of macroeconomic stability, taken one at a time, in the cross-country evidence. However, the well-known adage that correlation does not establish causation should give us pause about taking such evidence too seriously. To address the question of whether macroeconomic stability fosters long-run growth, we need to investigate whether the variables that we use as indicators of macroeconomic stability have a causal association with growth. A systematic (non-random) negative correlation between growth and inflation could have arisen in any of three ways:

i. Greater instability reduces growth (the hypothesis we are considering).
ii. Some third factor causes high growth and lower instability and/or slow growth and high instability.
iii. Higher growth reduces instability (reverse causation).

We need to eliminate (ii) and (iii) if we are to believe (i). How can we do this?

Conceptually, think of running an experiment. Countries would be assigned randomly to control and treatment groups, and a dose of "instability" would be administered to the treatment group, allowing us to see what happens to growth in those countries as a result. The random assignment would ensure that third factors would be expected to behave similarly between the control and treatment groups, and would simultaneously ensure that the treatment was exogenous (i.e., not influenced by the country's growth performance). Thus, running a controlled experiment would allow us to eliminate the possibility that any correlation we observe in the data arises from the effects of third factors or from reverse causation.

But running such an experiment is obviously impossible. Since we cannot do so, to try to identify the *independent* (partial) correlation between each factor and the growth rate, we have to deal with the factors that complicate inference through statistical rather than experimental methods. The most commonly used tool by economists for this purpose is regression analysis.

b. Cross-Country Growth Regressions

Regression analysis is important in empirical economics because it provides a statistical means of controlling for the effects of "third factors" that may affect a particular economic relationship under study. In the context of this chapter, and in many other places in this book, we will be making reference to a particular application of regression analysis that has become common in the empirical study of growth determinants, usually referred to as "cross-country growth regressions."

These are typically multivariate cross-section regressions. The dependent variable in such regressions generally consists of the average growth rate recorded by individual countries over some extended period of time which, as we have seen, serves as a measure of capacity growth in the country during that time. Explanatory variables are specified to control for determinants of growth other than the one(s) that the investigator happens to be interested in. The variables that are taken to be "standard" growth determinants differ slightly across applications, but they typically include the country's initial level of real per capita GDP, a human capital measure such as the secondary school enrollment rate, the rate of growth of population, and a measure of political stability. Regional dummy variables, usually for Latin America and Sub-Saharan Africa, are often included as well to capture unmeasured region-specific influences on growth. The effects of particular policy variables on the long-run growth rate are then tested by adding the relevant variable to this "core" regression, to see whether the variable exhibits a significant partial correlation with the average growth rate – that is, whether its coefficient in the estimated regression has the theoretically expected sign and is measured with sufficient statistical precision.

If it does, then further investigation can shed light on whether the relevant variable affects the growth rate primarily by inducing greater accumulation of productive resources or by enhancing the efficiency of resource use in the economy. This is tested by adding the investment rate to the growth equation and determining whether the coefficient on the relevant variable retains its sign and statistical significance. If so, then an efficiency effect is detected, since any influences operating through investment are already accounted for by the inclusion of that variable in the regression. If not, and if the variable is statistically significant in an equation similar to the "core" regression but with the investment rate as the dependent variable, then its association with growth is attributed to a resource-accumulation effect.

Fischer adopted this approach as his third cut at investigating the effects of macroeconomic stability on long-term growth. As indicated above, the first step in implementing the method is to identify the full set of potential third factors that could influence the growth rate. Fischer thus began by specifying cross-section regressions of the type:

$$\Delta Y/Y = a_0 + a_1 Y_0 + a_2(I/Y) + a_3(\Delta N/N) + \sum a_j X_j.$$

The first four terms on the right-hand side of this equation capture the influence of standard growth determinants. Levine and Renelt (1992), for example, estimated cross-section growth regressions with a sample of 101 countries and data over 1960–89. They found that initial GDP, the level of secondary school enrollment in 1960, and the rate of population growth were all independently related to growth, as was the rate of investment. Fischer built on this by adding other variables, captured in the last term on the right-hand side (the *X*s). Using a sample of 73 countries with data averaged from 1970 to 1985, he found that, in addition to the Levine-Renelt variables, high growth was associated with low inflation and high budget surpluses. Other variables, such as the country's level of debt in 1980, while potentially (theoretically) important, were not statistically significant in the regression, though dummy variables for Sub-Saharan African and Latin American countries proved to have negative coefficients that were statistically significant, suggesting that some potential growth determinants had been omitted from the regression.

These results suggest that, if macroeconomic stability in the form of low inflation and responsible budgetary policies has independent effects on growth, these effects must operate at least partly through their influence on total factor productivity, since the regression already controls for the effect of investment on growth. To investigate whether the effects might also operate through influences on investment, Fischer replaced real output growth with the rate of growth of the capital stock as the dependent variable, and found that capital accumulation was negatively linked with inflation and the black market premium, though not with the other macro variables.

c. Evaluating the Evidence

What can we learn from studies such as the one just described?[5] Unfortunately, because they suffer from several methodological problems, probably the best we can hope for is to extract a set of suggestive empirical regularities from the data, and we will use studies of this type in that spirit throughout this book.

The most obvious problem with cross-country growth regressions is that heterogeneity among countries is likely to be very important. Because countries are different, what can emerge from cross-country regressions at best is an average relationship, not particularly applicable to any single country. One implication of heterogeneity, both across countries and over time, is that this empirical methodology suffers from a lack of robustness. That is, the variables of interest may cease to enter the regression with coefficients that bear the theoretically expected sign and are statistically significant when the sample changes, or once other "reasonable" variables are added to the growth regression.[6] Unfortunately, few of the variables typically included in such regressions fail to exhibit this property.

A second problem is one that is endemic in the use of statistical procedures to control for the possible influence of "third" factors in studying a hypothesized relationship between two economic variables. Specifically, note that while Fischer controlled for a variety of such factors that may affect growth, it is hard to ever establish that relevant ones have not been omitted. For example, as mentioned before, the fact that Sub-Saharan African and Latin American countries had systematically lower growth than the others, even after accounting for all of the variables included in the regression, suggests that systematic growth determinants have been omitted.

Third, even if the estimates can be shown to be robust, unless the reverse causation problem (interpretation (iii) above) is explicitly dealt with, all that the parameters may really indicate is the strength of a partial correlation.[7] That is, the finding of a statistically significant coefficient just indicates that there is a reasonably tight

[5] A systematic analysis of the problems associated with the application of cross-country regressions to learn about the effects of policies on growth is given by Levine and Renelt (1992).

[6] See Levine and Renelt (1992).

[7] Notice that Fischer did not attempt to deal with the problem of potential reverse causation.

relationship in the data between the explanatory variable of interest and the portion of the dependent variable not accounted for by other independent variables. It does not necessarily indicate a causal relationship running from the relevant independent to the dependent variable.

Finally, even if one can establish the direction of causation, the explanatory variable typically included to study the effects of policy is often not itself a policy variable, but a performance indicator that is endogenous to policy. Thus, the coefficient cannot be interpreted as revealing the long-run growth effect of a given change in policy.

There are ways to deal with each of these statistical problems, and some of the existing cross-country empirical growth work has implemented them. Heterogeneity, for example, has been tested by including slope and/or shift dummies for regions, and robustness has been investigated through sensitivity analyses, in which different sets of explanatory variables are included in the regression to detect whether the coefficients on the variables of interest are affected by the inclusion or exclusion of other variables in the regression. Statistical techniques are also available to attempt to deal with the problem of reverse causation – for example, by using initial values of explanatory variables, rather than average values during the sample period, or by using special statistical techniques designed for the purpose. Some of these are described in Chapter 5. Finally, alternative proxies for policies have been tried to examine the sensitivity of results to different ways of measuring the explanatory variables of interest.

We will review more of the evidence generated by cross-country growth regressions about the links between macroeconomic policies and long-run growth – keeping in mind these methodological concerns – later in this book. For now, however, we conclude that, while the evidence cannot be regarded as definitive, it is certainly suggestive of a positive relationship between macroeconomic stability and long-term economic growth.

IV. SUMMARY

This chapter has examined the basic proposition underlying this book: that good short-run macroeconomic performance, in the form of appropriate values of key macroeconomic relative prices as well as a predictable domestic macroeconomic environment, is conducive to long-term growth in emerging economies. We have examined the analytical channels through which appropriate relative prices, as well as a stable macroeconomic environment, could foster growth in an economy's total factor productivity as well as factor accumulation, and have reviewed some important and widely cited empirical evidence on the topic. We concluded that theory supports the presence of a link between short-run macroeconomic performance and growth of productive capacity, while the evidence we reviewed in this chapter is at least consistent with the existence of such a link.

Given this link between short-run macroeconomic performance and long-run growth, we next want to address the issue of how short-run macroeconomic performance in emerging economies is influenced by domestic macroeconomic policies. The first step in doing so is to develop an analytical framework linking macroeconomic policies to macroeconomic outcomes. That is the task that we will undertake in the next three chapters.

APPENDIX 1.1: A BRIEF REVIEW OF FUNCTIONS

Before moving to the construction of our model in the next chapter, it is useful to briefly review an analytical tool that will be employed repeatedly in the rest of the book: the concept of *functions*.

a. Functional Notation

A function is simply a relationship between two variables. When we want to say that the variable X affects the variable Y, we can use functional notation to do so by writing:

$$Y = F(X),$$

or Y is a function of X. This just says that Y depends on X in some way. If Y depends on variables other than X as well, say on Z, we can write the function as:

$$Y = F(X, Z, \ldots),$$

where the dots indicate that Y may depend things other than X and Z as well.

We will also be interested in the *way* that X or Z affect Y. That is, if X or Z increase, for example, we will want to know what will happen to Y. Will it increase or decrease? Suppose that an increase in X tends to increase Y, while an increase in Z tends to decrease Y. We can indicate this as follows:

$$Y = F(\underset{+}{X}, \underset{-}{Z}, \ldots),$$

where the symbols indicate the direction of influence running from X and Z respectively to Y.

b. Graphing Functions

Suppose we wanted to illustrate these relationships on a graph. If we want to show the relationship between X and Y holding Z constant, we can simply draw a pair of coordinate axes along which we measure the quantities of Y and X, as in Figure 1.2. If the influence of X on Y is positive, the curve depicting this relationship will have

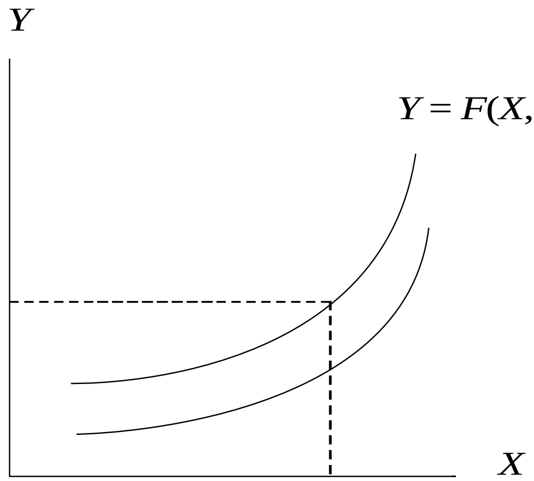

Figure 1.2. Graphing Functions

a positive slope. If the influence is negative, it would have a negative slope, and if there were no relationship, the curve would be a horizontal straight line.

How would we show the relationship between Z and Y? We can't simply plot a negatively sloped curve in the same picture, because Z is not on either axis. One option would be to draw another picture with Y and Z on the axes. But we can do it in the same picture that we used to show the relationship between X and Y by remembering that changing Z to see what happens to Y means holding X constant. Thus, we can show that if Z goes up, the value of *Y associated with a given X* would fall – that is, there would be a new Y, one not on the original curve, but below it. Since this would be true for any arbitrarily chosen X, the effect of increasing Z must be to shift the whole curve downward, as shown in the graph. If the function F also depended on some other variable, say W, which has a *positive* influence on Y, then an increase in W would have been reflected in an *upward* displacement of the curve.

Finally, consider holding Y constant, and asking what the set of combinations of X and Z, or X and W, looks like that are consistent with a given value of Y. Since X and W have positive partial effects on Y, while Z has negative partial effects, it is easy to show that, in X-Z space (that is, in a graph with X and Z on the axes), the set of combinations of X and Z associated with a given value of Y would have a *positive* slope, while in X-W space the set of combinations of X and W associated with a given value of Y would have a *negative* slope. This is because Z must *rise* to offset the effects on Y of an increase in X, while W would have to *fall* to offset the effects on Y of an increase in X.

These tools will prove very useful to us in analyzing macro models in the chapters that follow.