
SAVING AND INVESTMENT: PARADIGMS, PUZZLES, POLICIES

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The 1990s have seen a renewed interest in issues of capital accumulation and growth. New paradigms for saving, investment, and growth have been advanced to address theoretical and empirical puzzles and to guide the design of better policies. This paper provides a policy-oriented review of recent theoretical and empirical work on the determinants of saving and investment and on their links to growth. It takes stock of new findings as well as still unresolved questions and gives particular attention to empirical regularities and to the policy issues relevant to developing countries.

The mid-1990s have seen a resurgence of interest in themes of capital accumulation, technological progress, and economic growth. This renewal of interest reflects, on the one hand, a shift from the 1980s and early 1990s, when macroeconomic discussion was dominated by a concern with short-term adjustment and stabilization; it marks, on the other, the new consensus among development economists that better living standards and the elimination of poverty must be based on the sustained expansion of output.

Although questions of capital formation, technological progress, and saving have been at the core of economic analysis for two to three centuries, the connections among them and the directions of causality are still far from clear. Several factors may start and support growth. The transformation of an initial growth spurt into sustained expansion of output requires the accumulation of capital and its corresponding financing. Expansion, in turn, sets in motion a self-reinforcing process by which the anticipation of growth encourages investment, investment supports growth, and increased income raises saving.

The links in this process may be weak, however. As recent experience in Latin America shows, the resumption of investment and growth after a period of adjustment and depressed economic activity is far from automatic. Coordination failures, pervasive uncertainties, and irreversibilities in investment explain in

part why the recovery of growth is hard to achieve. The ability of governments to boost saving is often limited, moreover, and the scarcity of foreign financing can pose a binding constraint. Booms may produce problems as well, as has been recently illustrated in Mexico, for they may generate unsustainable growth trajectories and spending frenzies that eventually lead to busts. These transitional problems, although exciting for analysts, are a nightmare for policymakers. Steady growth remains elusive, and experiences of high growth sustained for several decades (as in East Asia since the 1960s) are exceptional and hard to replicate.

This article reviews recent theoretical and empirical work on saving and physical investment and their relation to growth. Because the research and policy agendas on saving and physical investment are broad, the discussion includes only those issues that evince new theoretical developments, significant policy shifts, or puzzles that theorists and policymakers have not yet been able to resolve. The empirical research reviewed concentrates on the evidence from developing countries.

Saving, Investment, and Growth: Correlations and Causalities

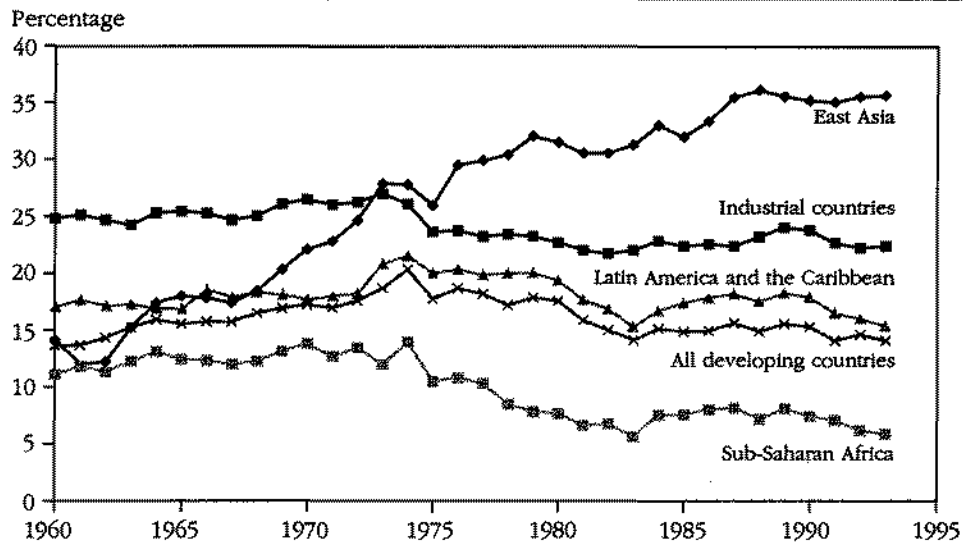
Saving and investment are subject to serious measurement problems, particularly in developing countries (see appendix). Nevertheless, the available international evidence on long-term patterns of saving and growth appears to support the conventional wisdom that virtuous circles of development and saving exist along with traps of undersaving and poverty.

Figure 1 shows the increasing disparity of saving rates in the developing world over the past thirty years. (Similar trends are observed for gross domestic investment rates.¹) From 1960 to the early 1990s, gross domestic saving more than doubled in East Asia relative to gross domestic product (GDP)—from 14 percent of GDP in the early 1960s to more than 35 percent in the 1990s. During the same period, saving rates stagnated in Latin America and collapsed in Sub-Saharan Africa—where they fell from about 12 percent of GDP in the 1960s to 6 percent in the early 1990s.

These divergent saving and investment experiences closely mirror the regions' respective growth performances. During the past twenty years, per capita growth in GDP averaged almost 5 percent in East Asia, about 1 percent in Latin America, and less than 0.5 percent in Sub-Saharan Africa. The apparent implication for policy might be that raising domestic saving should be a high priority in ensuring a sustainable path toward high per capita growth.

Recent economic research, however, has shed new light on the links among saving, investment, and growth. We draw from this research to examine three basic questions: What is the relation, and, specifically, the direction of causality, between growth and saving? What is the link between saving and investment, and is national saving translated into domestic investment? What is the contri-

Figure 1. *Gross Domestic Saving as a Percentage of GDP (Unweighted Averages, 1960–93)*



Source: World Bank data.

bution of capital accumulation to growth, and is investment crucial for growth? The answers to these queries are of critical importance for policy design. If saving drives growth through an automatic translation of saving into growth-enhancing investment, the main goal of policy should be to encourage saving. If investment is pushed by determinants other than saving, however, and saving follows higher investment, policies should promote investment. Finally, if growth results less from saving or investment (that is, less from physical capital accumulation) than from third factors such as technological innovation or improvements in human capital, these factors should be the main targets of policy.

Saving and Growth

Although the strong correlation between saving and income growth is firmly established, researchers have difficulty identifying the precise links between them. To start, consider the way in which saving reacts to cyclical income fluctuations.

Theory suggests that when households have access to credit and when they take the future into account in making their consumption and saving decisions, most temporary income fluctuations will be reflected by changes in saving rather than by changes in consumption. Ample evidence for industrial countries, how-

ever, and less systematic results for developing countries show that saving is not so strongly procyclical, responding to temporary income by less than what theory predicts.

Turn now to the relation between trend income (income averaged across cycles) and private saving, a connection that is more relevant from the viewpoint of long-term growth. Most cross-country empirical studies that include growth in real income as a determinant of saving report a strong positive effect of income growth on saving. Carroll and Weil (1994), however, note that these results are skewed, because they are driven largely by the outlying saving and growth performances of Japan and the newly industrialized economies of East Asia.

From the viewpoint of textbook consumption theory, this skewedness poses a puzzle. The two leading models of consumption—the permanent-income model of identical consumers planning consumption over an infinite horizon, and the life-cycle overlapping-generations model encompassing cohorts of finite-lived consumers—predict a negative effect of growth on saving as individuals adjust current consumption upward in anticipation of higher future income. A different result is obtained through the latter framework if it is assumed that growth takes place between cohorts, rather than within each cohort's lifetime. In such circumstances, growth increases aggregate saving for the simple reason that the income (and thus the saving) of the active cohorts is larger than the income (and dissaving) of the retired cohorts. But Carroll and Summers (1991) show for three industrial countries and Deaton (1989) shows for developing countries that actual age-consumption profiles are not consistent with the predictions of life-cycle theories, thereby undermining the empirical importance of this mechanism.

Several less conventional hypotheses on consumer behavior attempt to explain the positive link between saving and growth, but they are largely untested. One addresses the concentration of growth in households with high saving rates, such as rich or middle-aged households (Collins 1991). A related explanation is that growth raises poor consumers above a subsistence level of income below which they cannot save. Another suggests that saving by rich or older households may be driven by the desire to leave bequests to heirs, so that within a certain income range, higher income will be reflected primarily in higher saving leading to larger bequests.

Consumption habits that change slowly despite increased income may also contribute to higher saving rates in the face of rapid growth (Carroll, Overland, and Weil 1994). And a mixture of strong consumption habits with uncertain incomes (giving rise to precautionary saving) may also be a promising avenue for further research (Carroll and Weil 1994). A final unconventional hypothesis, reminiscent of classical thinking, is that consumers value both consumption and wealth (or capital). Higher growth raises wealth, but because wealth and consumption are interchangeable, consumption rises less than proportionately, thereby raising saving (Cole, Mailath, and Postlewaite 1992; Fershtman and Weiss 1993; Zou 1993).

An alternative explanation considers the reverse causality, that saving is automatically translated into capital accumulation and thereby growth, and that this translation is simply the mechanism underlying the positive correlation between saving and growth that is observed in practice. Some empirical evidence that this may not be the whole story is provided by Carroll and Weil (1994), who argue that saving typically follows, rather than precedes, growth. They conclude that the observed correlation between saving and growth reflects at least in part a reverse causation from growth to saving and that traditional estimates that fail to take into account such two-way endogeneity are likely to overstate the contribution of saving to growth, even under the maintained hypothesis that saving is fully translated into investment.

Saving and Investment

Understanding the link between saving and investment is important for at least two reasons. First, as just argued, it may hold the key to the positive correlation between saving and growth. Second, if capital accumulation is indeed the engine of growth, understanding the interaction between saving and investment is crucial to assessing the validity of the traditional recipe that raising saving is the surest way to increase growth, a notion that implicitly requires that each country's extra saving be automatically translated into higher domestic investment.

Textbook macroeconomics emphasizes that the determinants of saving are different from those of investment, that saving depends mainly on income and wealth, and that investment depends on profitability and risk. Because saving and investment result from two independent decisions, they clearly can differ *ex ante*. Nevertheless, in a closed economy, national saving and domestic investment must be equal *ex post*; if saving rises, investment must also rise. According to the textbook, the adjustment mechanism making this equalization possible would be a reduction in income, a reduction in interest rates, or a reduction in both.

Matters are more complicated in an open economy, because capital flows introduce a distinction between *ex post* national saving and domestic investment. National saving need not be used for domestic investment; it may be invested abroad. In a world of unrestricted capital mobility, each country's saving ideally would flow to whatever part of the world offers the highest private rate of return. An increase in national saving would thus be reflected primarily in a larger current account surplus (or reduced deficit), rather than in higher domestic investment and growth. This mechanism seems all the more relevant in view of the substantial decline over the past twenty years in barriers to international capital flows, especially among the industrial countries.

This reasoning, however, directly contradicts the empirical evidence reported by Feldstein and Horioka (1980) and updated by Feldstein and Bacchetta (1991) that in the long term gross national saving and domestic investment rates show a strong positive correlation. For a sample of industrial countries, these authors

find a correlation coefficient close to 0.9. Other studies find a similarly strong correlation for developing countries, although at a somewhat lower magnitude (Dooley, Frankel, and Mathieson 1987; Summers 1988).

There has been considerable debate about whether this result is evidence of international capital immobility. One view, defended by Feldstein and his associates, holds that international capital mobility is indeed limited, that even though barriers to mobility are relatively low, capital fails to move across national borders because its owners prefer to keep it at home to avoid currency and political risks (Feldstein 1994). Studies of international portfolio diversification, which find a significant "home-country bias" in investment portfolios, seem to support this view (Mussa and Goldstein 1994; Tesar and Werner 1992). Thus national saving is largely retained in the home country, where it increases domestic investment (albeit through unspecified mechanisms).

An alternative view is that the observed correlation between saving and investment says little about international capital mobility and is mainly the result of policy reactions or common third factors that cause saving and investment to move together over the long term. A wide variety of mechanisms have been proposed to explain a strong saving-investment correlation even in the presence of high capital mobility (see Obstfeld 1994 for a comprehensive overview). Frankel (1992) argues, for example, that even under perfect capital mobility, shifts in saving alter the real interest rate, which in turn moves investment in the same direction as saving. This implies, however, that real interest rates will differ across countries even in the long term, so that, if differentials in international real interest rates reflect expected movements in real exchange rates, real exchange rates will have to keep changing even in the long term. A second explanation, by Obstfeld (1986), underscores the role of slowly changing demographic and technological factors that push saving and investment in the same direction. In the same vein, Taylor (1994) shows empirically that relative price and demographic variables influencing both saving and investment can account almost entirely for the Feldstein-Horioka result. A third alternative attributes the link between saving and investment to the operation of the economy's long-term budget constraint (Obstfeld 1986); in the long term, if the economy is close to a constant ratio of foreign assets to GDP, it is possible to demonstrate that saving and investment ratios cannot diverge much.

A different line of argument shifts the focus from international to domestic capital immobility, underscoring the close link between corporate investment (which accounts for the bulk of private investment in industrial countries) and retained earnings. Indeed, retained earnings typically represent the main source of corporate investment financing in industrial countries. The strong correlation in these countries between retained earnings and corporate investment may be the key to the aggregate saving-investment correlation, assuming that household saving does not decline and thereby offset a rise in saving by firms aimed at financing investment. This mechanism seems particularly relevant for developing countries, where capital market imperfections are widespread and borrow-

ing constraints are the norm, not only for organized corporations, but especially for households and firms in the informal sector, which in many developing economies accounts for the bulk of private investment.

Finally, Summers (1988) has suggested that restrictions on countries' current account imbalances may explain the correlation between saving and investment. Whether these restrictions are caused by lending constraints imposed by world capital markets on deficit countries or by systematic (and successful) current account targeting by policymakers, the result will be a strong *ex post* correlation between saving and investment. In the extreme situation of low (or zero) access to foreign capital, a condition faced by many developing countries during the 1980s, national saving and domestic investment will be highly (indeed perfectly) correlated. In such a circumstance, moreover, the supply of foreign saving will directly affect domestic saving and investment. This is in stark contrast to the textbook case of perfect capital mobility, in which foreign saving is determined residually by the excess of domestic investment over national saving, and any extra gross capital inflows are completely offset by gross outflows. Argimon and Roldan (1994) find, in this regard, that, in European Community countries enforcing capital controls (presumably to target the external balance), saving and investment display virtually unit correlation, and saving appears to precede investment.

Investment and Growth

The strong association between gross domestic investment ratios and long-term growth performance is well established. East Asia, the region most successful during the past thirty years in achieving rapid and sustained growth, is a good example. The East Asian economies have been able to maintain rates of GDP expansion on the order of 7–8 percent a year, supported by rates of gross capital formation of about 30 percent of GDP; high growth and high investment have thus gone hand in hand.

This critical role of investment in the growth process was challenged by the neoclassical growth theorists of the 1960s and 1970s. The neoclassical (Solow) model asserts that capital accumulation affects growth only during the transition to the steady state; long-term growth is determined only by the rate of technological change, which is assumed to be exogenous. This view attracted considerable criticism (for example, Kaldor 1957, Robinson 1962) on the grounds that the separation between investment and innovation (or technological change) was artificial, because most technological innovation is embodied in new machinery and equipment, a notion that dates back to Allyn Young (1928) and Schumpeter (1934).

Early growth-accounting exercises based on the neoclassical model appear to confirm that cross-country differences in investment ratios explain only part of the differences in growth during long periods and that technological change (or, more honestly, unidentified residual factors) might play a leading role in long-

term growth. The arithmetic of the Solow model, however, does not square well with the strong correlation between investment ratios and growth performance that is observed in practice. Recent work on this issue has brought capital accumulation back to center stage, suggesting an enhanced, albeit less direct, role for investment as a principal determinant of growth.

One line of research considers the complementarities between investment in physical capital and investment in human capital. New and technologically advanced equipment requires operators with adequate skills and education. The identification and design of profitable and innovative investment projects require resourceful, skilled entrepreneurs with an awareness of business opportunities. Along these lines, Mankiw, Romer, and Weil (1992) extend the Solow model to include human capital. Assuming that the accumulation of human capital is guided by that of physical capital, they find that investment performance can account directly and indirectly (through the parallel accumulation of human capital) for the bulk of the variation in growth across countries.

A second line of research emphasizes the close links between the accumulation of physical capital and technological change. If productivity growth is endogenous, rather than exogenous, and is related to the accumulation of physical (or human) capital, an increase in the rate of investment can raise the rate of growth in the steady state. This thinking, again, has old roots, most notably the "vintage capital" extension of the neoclassical model, in which technological progress is embodied in successive generations of capital equipment of increasing efficiency, and in Kenneth Arrow's "learning by doing" model, which makes society's stock of knowledge dependent on cumulative gross investment.

The correlation between technological progress and investment has also been documented. De Long and Summers (1993) estimate the determinants of total factor productivity growth for a large sample of developing countries and show a positive and statistically significant correlation between total factor productivity growth and the ratio of investment in equipment to GDP. In addition, if all firms benefit from economywide technological progress and if that progress is driven by aggregate investment, capital accumulation by any one firm will benefit other firms, creating an externality that opens a gap between the private and social returns to investment. In this vein, Romer (1987) estimates that the social marginal product of capital may be more than twice as high as the private marginal return.

THE CONTRIBUTION OF INVESTMENT TO GROWTH. The empirical correlation between investment and growth has been explored in some depth. Levine and Renelt (1992) test alternative specifications of the growth process to find the one that is least sensitive to changes in additional explanatory variables, to the sample of countries, and to the choice of periods. They find that the only robust regressor, across countries and time, is the ratio of physical investment to GDP.

This result is supported by other empirical analyses of the determinants of growth for different regions of the world.

The recent literature also considers the composition of investment and its consequences for real output and growth. De Long and Summers (1991, 1993) disaggregate investment into its "structures" (construction) and equipment components. Using a sample of both developing and industrial economies, they find that equipment investment contributes much more to per capita GDP growth than does structure investment. Although this conclusion agrees with the notion that technological progress is largely embodied in new machinery, the robustness of the results for some of the samples has recently been challenged by Auerbach, Hassett, and Oliner (1994).

An active line of research begun by Aschauer (1989a, 1989b) considers the impact of public investment on growth. Using an aggregate production function in which output depends on labor, private capital, and public capital, Aschauer estimates with U.S. data an extremely high rate of return for public capital—between two and five times as high as for private capital. He also finds that the accumulation of public capital has a sizable positive effect on private investment. These results would seem to suggest that an aggressive public investment strategy can be instrumental in raising growth.

Aschauer's work has been followed by a rapidly growing literature reexamining his results (see Gramlich 1994 for extensive references), which remain highly controversial. A strand of this literature has extended the empirical analysis to other countries (Berndt and Hansson 1992; Argimon, Gonzales-Paramo, and Roldan 1995). Servén and Solimano (1993) examine the impact of public investment on private investment in developing countries and show a positive and significant correlation in a panel of developing countries, as well as in separate studies of Latin America and East Asia.

For the most part, however, the literature has centered on the role of *aggregate* public investment, identifying it explicitly or implicitly with public infrastructure. Although this focus may be adequate for some industrial countries (such as the United States), where the public sector's involvement in commercial and industrial activities is negligible, it may be quite misleading for other countries (including most developing countries), where the state is engaged in multiple activities. In such circumstances, different types of public investment are likely to have different effects on private investment and overall growth. Public investment in ports, roads, and telecommunications builds the basic infrastructure needed for the profitable operation of private investment projects and is likely to have a maximum impact on growth. Public investment in conventional industrial and commercial activities, however, in which public enterprises compete with private firms, is likely to discourage private investment and to have a less favorable impact on growth.

This presumption is confirmed empirically by Easterly and Rebelo (1993), who use a large cross-country sample to explore the relation of different kinds of public investment to growth. Subject to some reservations about the quality

of the information available to them, they find that central government investment, which is most likely to include infrastructure projects, is positively correlated with both growth and private investment. Investment by public enterprises, however, which presumably competes more closely with private investment, is negatively correlated with growth. By sector, they find that the strongest growth effect corresponds to public investment in transport and communications.

IS INVESTMENT NECESSARY FOR GROWTH? IS IT SUFFICIENT? Although the empirical results reviewed above underscore the link between investment and growth, they say little about the direction of causation. As with saving, the distinction between the cycle and the long term may be relevant. In the short term, investment has been shown to depend on the rate of output growth, the rate of capacity utilization, or both, as indicators of future demand and the severity of liquidity constraints faced by firms—two variables critical to decisions to expand productive capacity. Thus, during the course of the business cycle, output may lead investment in an accelerator-like fashion (Servén and Solimano 1993). It is worth noting that this sensitivity of investment to cyclical variations in output (or other short-term factors) suggests that a short-term recession may have long-term effects by causing a deep investment slump that permanently traps the economy in a low-growth, low-investment equilibrium. In other words, the growth process may be path-dependent.

Development economics has traditionally maintained that capital accumulation is a fundamental *cause* of growth over the long term. Recently, however, this view has been challenged by the argument that the co-movement of investment ratios and growth rates may be largely caused by the action of a third factor—technological innovation—that is driving both capital accumulation and output expansion (Benhabib and Jovanovic 1991; King and Levine 1994). An extreme interpretation of this view would hold that capital accumulation is a consequence, rather than a cause, of the growth process, which is caused by technological factors. Along these lines, Blomstrom, Lipsey, and Zejan (1993), using a large cross-country sample, argue that growth appears to precede, not follow, investment.

This extreme view seems implausible. Few would dispute that investment is a *necessary* condition for sustained growth, and it is difficult to find countries that have been able to grow at high and sustained rates for long periods without an important effort at capital formation. The simplistic, albeit popular, notion that physical capital accumulation is *sufficient* to guarantee long-term growth, however, is clearly untenable. Sustained growth depends not only on the accumulation of physical capital, but on two additional ingredients as well.

The first ingredient is the accumulation of other complementary inputs, notably, human capital and technological knowledge. Expenditures on their acquisition are treated mainly as consumption in conventional national accounting, although their economic role is similar to that of investment in physical capital. The second ingredient is the efficiency (or quality) of physical investment. A

large effort at capital accumulation may have little effect on growth if it is concentrated in activities with low social productivity. The experience of many developing countries in the 1970s, when massive foreign borrowing was used to finance capital-intensive industrial projects that proved to be white elephants, is an example; these low-quality investments were one of the main factors behind the explosion of the debt crisis in the early 1980s. Similarly, low-quality investment has been blamed for Europe's inferior growth performance relative to the United States—despite a higher investment rate in Europe—and for the growth slowdown in Japan since the late 1970s—despite a very high investment rate in Japan.

One primary determinant of the social productivity of investment is the degree of distortions in the economy. If distortions are severe, increased investment may do more harm than good; it may actually lower social welfare and *reduce* growth as measured at shadow (that is, distortion-free) prices. Extreme cases of this situation may be found among the former socialist economies, in which decades of massive capital accumulation in pursuit of scale economies yielded little growth or welfare (Easterly and Fischer 1994). Other less extreme examples are provided by developing countries with high barriers to market forces or foreign trade, or with relative price misalignment, mandatory credit allocation schemes, investment licensing practices, and so forth. In such environments, additional investment tends to exacerbate the welfare cost of the distortions, because the extra capital is misallocated to socially inefficient activities. In general, investment involves giving up current consumption in exchange for higher output and thus increased consumption in the future. Economic distortions tend to make the tradeoff more adverse by reducing the social payoff to investment for future consumption, by raising the cost of investment for current consumption, or both, thereby lowering the rate of investment that is socially desirable.

To conclude, the recent literature supports the view that investment may not be the sole engine of growth, but it continues to place capital accumulation at the center of the growth process. One of the main merits of the recent work lies perhaps in its renewed emphasis on technological change and on the external effects of physical investment as principal determinants of growth—filling what Romer (1993) labels the “idea gap,” as opposed to the “object gap.” The latter can be filled simply by accumulating material inputs. As noted above, the notion that technological progress is largely embodied in new capital goods is hardly new to growth theory. From this perspective, the recent literature's emphasis on the importance of productivity gains for long-term growth enhances, rather than lessens, the significance of capital accumulation for the growth process.

The extent to which “ideas” matter in practice, however, remains controversial. Alwyn Young (1994a, 1994b) forcefully argues that, except for Hong Kong, East Asia's stellar growth performance can be explained largely by its unusually high investment ratios, not by any extraordinary growth in productivity, which, by Young's estimates, has proceeded at a rate fairly close to the world average.

Saving: Unresolved Questions

Saving is the aggregate perhaps most resistant to both economic definition and the influence of policy. Whatever definition is used, however, saving shows large differences over regions and over time (see figure 1). Even within countries, the variations are striking. In Mexico gross domestic saving rates shrank from 26.4 percent of GDP during 1980–87 to 20.7 percent during 1988–94, thus contributing to the 1994–95 crisis. In Chile saving rates grew from 17.0 percent of GDP during 1974–87 to 28.8 percent during 1988–94, thus contributing to Chile's economic success. In the United States saving rates fell from 19.7 percent of GDP during 1960–79, to 17.4 percent during the 1980s, and to 15.3 percent during 1990–93.

Recent research on saving and consumption has gone beyond the structuralist two-class consumption theories of the 1950s and the neoclassical permanent-income and life-cycle hypotheses (although the latter are still the two most popular paradigms used to explain consumption and saving behavior). Newer hypotheses address precautionary saving (uncertainty, separation of risk, and intertemporal substitution), borrowing constraints (buffer stocks, housing), bequests, and consumption habits. Although each of these theories sheds light on a particular aspect of intertemporal consumption decisions, none individually is able to explain the large international differences in saving levels, the strong cross-country correlations between saving and growth, or the large shifts within countries in saving rates since 1960.

This section reviews questions on saving behavior that remain unresolved but are central to policy design in developing countries. The questions address three areas in which policy shifts have been particularly large: the contribution of public saving to national saving, the influence of foreign resource inflows on domestic saving, and the effectiveness of financial and tax incentives in raising private saving.

How Effective Is Fiscal Policy in Raising National Saving?

It is useful to distinguish between the transfer aspect of fiscal policy that affects overall consumer wealth (for example, by raising taxes or cutting government consumption) and taxes or subsidies that aim primarily at changing the net rate of return on saving and thus the intertemporal allocation of lifetime resources. The two dominant paradigms in modern neoclassical macroeconomics offer strikingly opposite views on the effectiveness of fiscal policy in raising national saving. When the economy is seen as an aggregation of different generations, each saving primarily for retirement, public saving should affect national saving (and, in a closed economy, investment), because it shifts resources across generations that are only weakly, or not at all, connected to each other. Alternatively, when the economy is seen as an infinite succession of generations, closely related through gifts and bequests, and when, in addition, each of these

cohorts adjusts its expenditures in response to the taxes that their offspring will pay in the future, changes in public saving should be exactly offset by changes in private saving. What matters for private consumption decisions is the level of current government expenditure; it does not matter whether it is financed by taxes or by debt. The latter paradigm is the well-known Ricardian equivalence proposition.

What does the evidence show? Most surveys of the empirical evidence for industrial countries reject Ricardian equivalence. Recent studies for developing countries also dismiss it in its pure form but agree that private saving offsets some public saving (Haque and Montiel 1989; Corbo and Schmidt-Hebbel 1991; Easterly, Rodríguez, and Schmidt-Hebbel 1994; Edwards 1995). Rejection of Ricardian equivalence could imply, however, that real world consumption is bound by many features assumed away by the proposition. These might include weak intergenerational links, financial market imperfections (including borrowing constraints), consumer myopia, and precautionary saving resulting from uncertainty.

Existing country estimates of the extent to which private saving offsets public saving are few, dissimilar, and based on widely differing samples. Even when they use a common methodology, the estimates of these public-to-private saving offset coefficients vary widely. Corbo and Schmidt-Hebbel (1991), for example, develop an encompassing framework that distinguishes among Keynesian, permanent-income, and Ricardian consumption hypotheses, and they apply that framework to a cross-sectional sample of thirteen developing countries. They find an overall public-to-private saving offset coefficient of 0.47; this result, however, conceals, a large variation across individual countries. Edwards (1995) reports offset coefficients for a sample of industrial and developing countries that show similar variation, from 0.43 to 0.58, depending on the regression specification. This frequent rejection of Ricardian equivalence implies that public saving is an effective tool in raising national saving.

Do Foreign Resource Inflows Crowd Out Domestic Saving?

Foreign and national saving decisions may affect each other in either direction. As noted above, the higher the mobility of international capital, the greater the degree of endogeneity of foreign saving to domestic investment and national saving decisions. What does the empirical literature say, however, about the influence of foreign resource inflows on domestic saving? We look first at the consequences of overall foreign saving and then at the effects of foreign aid.

Two analytically essential points should be, but seldom are, addressed in the empirical literature. First, a distinction should be made between nonconcessional foreign resource inflows (foreign investment plus nonconcessional lending) and foreign aid (unilateral transfers plus the grant component of concessional lending); only the latter implies a wealth transfer. Second, the issue of resource fungibility must be explicitly addressed. External resources are perfectly fungible,

for example, when the recipient country does not raise spending in response to additional foreign lending but simply accumulates foreign assets instead.

Chenery and Strout (1966) find a negative initial effect of foreign capital inflows on domestic saving, although second-round effects on capacity growth tend to increase saving. Giovannini (1983) finds that coefficients on foreign saving for developing countries have mixed signs and are insignificant in regression equations for domestic saving. Fry (1978, 1980) and Giovannini (1985) find that the effects of capital inflows are significant and negative, although small. Schmidt-Hebbel, Webb, and Corsetti (1992) show a significant negative effect of foreign saving on household saving for a panel sample of ten developing countries. Gupta (1987), who obtains the most extreme results, reports crowding-in (instead of crowding-out), as reflected by *positive* coefficients on foreign saving that are significant for Latin America, although not for Asia.

Studies of the effects of foreign aid typically focus on the way it is spent on consumption and investment, that is, on empirical estimates of the marginal propensities to consume (MPC) and invest (MPI) from foreign aid transfers. Griffin (1970, 1971), using ordinary least-squares regressions for a cross-section of developing countries, finds a negative correlation between saving and aid, with an implied MPC of aid equal to 0.73. Subsequent studies by Weisskopf (1972), Papanek (1972, 1973), and Chenery and Eckstein (1970) generally find lower consumption propensities, implying that foreign aid is more effective in financing investment. Chenery and Syrquin (1975), however, find that, on average, only 45 percent of an increase in foreign resources is translated into higher investment, with the remainder financing higher consumption. More recently, Levy (1988) finds an MPC from anticipated foreign transfers equal to 0.4. The Global Coalition for Africa (1993) claims a negative and significant effect of foreign aid on domestic saving for a sample of Sub-Saharan countries. The World Bank (1994a) reports an MPC of 0.4 and an MPI of 0.6 for net transfers received by Sub-Saharan countries in the late 1980s.

Much of this literature is haunted by biases stemming from data measurement errors, misspecification, and simultaneity (including selectivity), as well as from an inadequate treatment of resource fungibility. A recent study by Boone (1994) corrects for the more severe sources of bias and uses a large panel data base of ninety-seven developing countries to estimate marginal propensities to consume and invest out of foreign aid. When his sample is restricted to the eighty-two countries in which foreign aid accounts for less than 15 percent of gross national product (GNP)—that is, most of the developing countries—he finds that all of the aid is spent on consumption. When he uses the full sample—including the fifteen small Sub-Saharan African and island economies that receive more than 15 percent of their GNP in aid—the estimated MPC drops to 0.45 and the MPI climbs from zero to 0.35, suggesting that the lack of resource fungibility is severe in poor countries receiving massive aid financing mainly investment projects.

Foreign aid may affect saving and investment indirectly through higher productivity growth. Private investment and growth may rise, for example, if the conditionality attached to foreign aid promotes beneficial policy reforms and a better allocation of public expenditure, thereby raising the productivity of private investment. Boone's results show, however, that foreign aid does not encourage growth in the overwhelming majority of developing countries, where it accounts for less than 15 percent of GNP, but that it assists growth in those fifteen small countries where it exceeds 15 percent.

We draw two conclusions from this research. First, empirical estimates of the effects on saving of foreign aid (and of foreign saving in general) vary widely with the samples, model specifications, and empirical methods used. Second, the extent of resource fungibility is a critical determinant of the extent to which nonconcessional external loans and foreign aid are channeled into higher domestic consumption or investment.

Do Financial and Tax Incentives Raise Private Saving?

Governments have tried to raise private saving through interest liberalization, direct tax incentives, capital market reforms, and other means. The failure of many of these attempts, however, raises questions about the responsiveness of saving to such policies.

IS PRIVATE SAVING SENSITIVE TO THE REAL INTEREST RATE AND TO TAX INCENTIVES? The evidence generally shows that interest rates and tax incentives have little or no effect on saving. There are two ways of looking at this relationship. One is by testing for the interest effect on saving or consumption levels. By this traditional method, country and cross-country studies generally show that interest rates do not much influence saving (Giovannini 1983, 1985; Corbo and Schmidt-Hebbel 1991; Deaton 1992; Edwards 1995). In those exceptional cases in which saving shows a positive response to the interest rate, that response is very small (Gupta 1987; Fry 1988). There are many possible explanations for this finding. One is that the effects of a rise in interest rate on real income and on the allocation of consumption over time may offset each other when consumers do not face borrowing constraints (Schmidt-Hebbel 1987 and Arrau 1989 for the Southern Cone countries). Another is that savers respond little to changes in interest rates or tax incentives when borrowing constraints are binding, although evidence shows that borrowing constraints themselves have a significant and positive effect on private and national saving rates (Jappelli and Pagano 1994; Easterly, Rodríguez, and Schmidt-Hebbel 1994). Reynoso (1988) provides evidence that a nonmonotonic relation may exist between saving and interest rates arising from income concentration when interest rates rise. Such a relation would imply that at low and negative real interest rates, higher rates would increase saving, whereas at high interest rates, the saving schedule would bend backward.

A less conventional way of looking at this issue is by testing how sensitive the rate of consumption growth is to the interest rate, that is, the extent to which consumers substitute future for current consumption when the interest rate rises. Evidence reported by Deaton (1989) suggests a weak positive effect across a large number of countries. Giovannini (1985) finds positive substitution effects for five developing countries and no effects for thirteen. Econometric studies for the United States surprisingly fail to find significant positive effects (Deaton 1992).

If private saving is generally insensitive to the (after-tax) real interest rate, three policy implications should follow. Fiscal stabilization that lowers the real interest rate would not automatically depress private saving. Financial reform that raises the real interest rate would not automatically raise private saving (although it may shift savers' portfolios from flight capital to domestically held assets). And tax incentives for saving would be ineffective in raising private saving.

Much research has examined the effect of tax incentives on saving in industrial countries, using cross-sectional household data that are typically unavailable in developing countries. The results of studies for U.S. saving incentive plans (such as IRAs, 401(k) plans, and other plans that offer tax deductions on contributions and accrual of interest but impose limits on annual contributions and withdrawals) are inconclusive with regard to their effects on overall national saving. Engen, Gale, and Scholz (1994) find that although U.S. saving incentive plans appear to have been ineffective in raising national saving, they may raise saving after two generations as a result of shifting income toward future generations.

CAN FINANCIAL AND CAPITAL MARKET REFORMS RAISE PRIVATE SAVING? Financial and capital market reforms may affect private saving through various channels, the effects of which may be negative or positive. First, capital market reforms (and macroeconomic stabilization) may reverse capital flight, thereby raising the portfolio share of domestic assets and increasing measured income, measured net exports, and measured domestic saving, but having little effect on overall (correctly measured) private saving. Second, financial liberalization and capital market deepening may raise the efficiency of intermediation, thereby increasing growth and thus private saving. Third, financial liberalization, and the consequent increase in geographical density of financial institutions, the range of financial instruments, and the quality of financial regulation and supervision, typically lead to financial deepening that will be reflected in a permanent increase in the stocks (and a temporary increase in the flows) of financial savings. Although this increase might simply reflect a portfolio shift, and not an increase in overall private saving, it has been argued for East Asia that financial deepening has contributed to the observed growth in overall saving (World Bank 1993). Fourth, but in the opposite direction, financial liberalization typically leads to expanded consumer lending and to less stringent constraints on consumer borrowing, both of which will decrease private saving.

Studies have typically used a measure of broad money to serve as a proxy for financial deepening, but broad money may be negatively correlated with consumer borrowing constraints (and thus positively with consumption) and positively correlated with consumer wealth (and, again, with consumption). Its relation with saving is therefore ambiguous, and so are the results for cross-country samples. Corbo and Schmidt-Hebbel (1991) and Schmidt-Hebbel, Webb, and Corsetti (1992) report negative effects of broad money on saving in developing countries; Edwards (1995) reports positive effects for both industrial and developing countries.

Variables that more closely reflect borrowing constraints are reported to have less ambiguous effects on saving. Jappelli and Pagano (1994) find a significant negative effect of loan-to-asset-value ratios on net national saving in industrial countries; Edwards (1995) finds a negative, but statistically insignificant, effect of consumer credit on private saving in both industrial and developing countries.

A final question arises about the potential effects on private and national saving of the introduction of mandatory pension plans and the replacement of pay-as-you-go (PAYG) pension systems by fully funded plans. These effects on saving are typically analyzed in the framework of an economy that is an aggregate of different generations saving primarily for their own retirement and not for their offspring.

Useful results are obtained from simulations of general-equilibrium models considering both the transfers across generations that result from pension systems and the factor market distortions of PAYG schemes. Results for the United States show that starting unfunded social security reduces long-term saving and output levels by modest amounts (Auerbach and Kotlikoff 1987). Results for a group of representative economies show that the long-term effects of tax-financed transitions in pension reform are small to moderate and reaped only in the very long term (Arrau and Schmidt-Hebbel 1993; Cifuentes and Valdés-Prieto, forthcoming). The dynamic effects on saving and long-term growth through capital market deepening and labor shifts from informal to formal markets may be much more significant, however, and reaped much earlier (Corsetti and Schmidt-Hebbel, forthcoming).

By contrast, the considerable econometric evidence for industrial countries based on single-equation consumption or saving functions shows little or no effects of unfunded social security on contemporaneous private saving levels (World Bank 1994b). A significant exception is Feldstein's (1974, 1995) work for the United States, which shows that social security programs reduce overall private saving by 40 to 60 percent. Econometric evidence for developing countries suggests that government social security benefits (typically through PAYG schemes) lower private saving (Edwards 1995). Some evidence on Singapore's fully funded Central Provident Fund shows that it has boosted aggregate saving (World Bank 1993, 1994b). And evidence for Chile suggests that the substitution of fully funded for PAYG plans after 1981 has contributed to Chile's large increase in private saving (Corsetti and Schmidt-Hebbel, forthcoming).

These findings may reflect two points. First, leaving bequests may be a more important motivation for saving than saving for retirement, so that starting a mandatory PAYG system will not affect private saving much. This is because pensioners will undo the mandatory PAYG transfer they receive from active workers by leaving higher bequests to their offspring. This conclusion is supported by indirect evidence from household surveys around the world that show saving rates for the elderly are as high as or higher than rates for younger households (Deaton 1995). Second, even if saving for bequests dominates saving for retirement, there are still large numbers of households that are credit-constrained and saving little. Starting a fully funded pension plan (as in Singapore) or substituting a fully funded scheme for PAYG (as in Chile) will force these households to save more than they voluntarily would save, thus raising overall saving ratios.

Investment: New Developments

This section reviews recent developments in three areas of inquiry: uncertainty and investment irreversibility, investment incentives, and the investment impact of property rights and income distribution.

Uncertainty and Irreversibility

Conventional investment theories focus on the cost of capital and the replacement cost, as opposed to market value, of new capital goods. They fail to consider, first, that most investment decisions face inherent *uncertainty* about future benefits and costs; the best investors can do is to attach (subjective) probabilities to the net returns of various investment projects; second, that investors can control the *timing* of investment, waiting for relevant information that may reduce investment uncertainty; and, third, that most investment decisions are partly or completely *irreversible*; once the capital stock is installed, it cannot be put to new uses without incurring a substantial economic cost (Dixit and Pindyck 1994).

These crucial features have led to a new *option approach* that sees an investment opportunity as an option to buy an asset at different points in time, balancing the value of waiting with the opportunity cost of postponing investment decisions. The option approach shows that the standard net-present-value rule of investment (invest when the purchase and installation cost equals the expected return) must be modified. The correct rule is that the anticipated return on the new investment project must *exceed* the purchase and installation cost by an amount equal to the value of keeping the investment option alive.

Recent empirical studies of investment confirm the practical relevance of the value of waiting (Pindyck and Solimano 1993). Simulation studies reveal that, at the corporate level, the value of waiting may be considerable, especially in a highly uncertain environment. Econometric estimates using aggregate invest-

ment data for a few developing countries also show that, in the face of uncertainty, investment may display strong inertia and an insensitivity to changes in profitability (Servén and Solimano 1993). An important policy implication of these studies is that uncertainty tends to make investment less responsive to incentives such as subsidies and tax concessions and that huge incentives would therefore be necessary to counteract the adverse impact of high uncertainty on private investment.

The option view of investment is particularly applicable in addressing conditions of economic and political instability. Large external shocks, financial crises, exacerbated social and political conflicts, all typically create considerable uncertainty about variables that are critical to decisions to invest. The result is a large increase in the value of waiting for new information with which to revise the probabilities attached to the various eventualities. Thus, even when external and domestic conditions for investment improve (say, after adoption of an adjustment program), it takes time before potential investors revise their expectations significantly; in the meantime, there is a protracted investment slump.

Political instability that is reflected in rapid government turnover may also hamper investment if it leads to an unstable incentive and policy framework (Alesina and Perotti 1993; Mauro 1993). An adverse impact on investment is especially likely if the political change involves a redefinition of the basic "rules of the game" (investment codes, property rights, tax laws) and, in particular, if it raises the risks of expropriation (as in Egypt in the 1950s and Nicaragua in the 1980s).

Investment Incentives

In both industrial and developing countries, a variety of policy instruments have been used to affect aggregate investment and its distribution across sectors, assets, and time by affecting the rate of return on capital. In theory, investment incentives can be justified by the existence of market failures that lead to socially insufficient investment—for example, the public-good nature of some investments in research and development (R&D), imperfect information among financiers about the quality of projects, imperfect competition, and scale economies.

Tax concessions are by far the most commonly encountered investment incentives. They take a variety of forms: preferential tax rates for specific types of investment, tax holidays, accelerated depreciation allowances, investment tax credits, and so forth. At a very general level, tax incentives may be characterized in three ways. First, they may be automatic (available to any firm or investor meeting specific standards about the type, size, and location of the investment) or discretionary (granted on a case-by-case basis). Automatic incentives are more transparent and certain than discretionary incentives and are thus likely to be more effective than the latter, which are comparatively more responsive to noneconomic factors. Second, tax in-

centives may be temporary or permanent; temporary incentives are more likely to affect the timing of investment than the long-term capital stock. Third, tax incentives may be general or selective (with eligibility determined by considerations such as the type of asset or economic sector). In general, and in the absence of market failures, selective incentives are bound to distort the allocation of investment across sectors or assets.

The recent investment literature examines the impact of tax incentives in both industrial and developing countries (Feldstein 1987; Jorgenson and Landau 1993; Cummins, Hassett, and Hubbard 1995). Most empirical studies of industrial countries find only small effects (Chirinko 1993). In developing countries, the effectiveness of investment incentives is severely limited by the weakness of the tax administration system and by market distortions such as credit rationing or administrative intervention in the allocation of foreign exchange. In the presence of such conditions, tax concessions may affect the allocation of rents more than they affect investment decisions (Shah, forthcoming).

Some conclusions may be drawn about the effectiveness of the specific types of tax incentives most commonly used in developing countries. Preferential corporate tax rates are shown to be poor instruments for promoting new investment, because the tax concession is not directly related to the volume of new investment. Its impact on fiscal revenue loss is therefore often larger than its impact on extra capital. An extreme form of such an incentive is the granting of tax holidays. These are relatively common in developing countries and pose the added problem of encouraging the shift of taxable income into the firms enjoying the holidays (Mintz, forthcoming). Investment tax credits for R&D and the acquisition of equipment embodying advanced technologies are, by contrast, analytically more defensible and empirically more effective.

The use of fiscal incentives also presents several practical problems that are likely to be particularly severe in developing countries. It is difficult to identify and measure the divergences between social and private rates of return on investment that justify special fiscal treatment, and the administration of any fiscal incentives places significant burdens on the tax management system. Tax concessions encourage lobbying by potential beneficiaries. The loss of fiscal revenue—implicit in incentive schemes—has an obvious opportunity cost. And attempts to fine-tune the tax system to direct the allocation of resources may lead to profound systemic distortions (Bird 1992).

Stability and predictability of the tax regime are thus prerequisite to the effectiveness of investment incentives. Indeed, a regime of stable corporate tax rates at international levels offers greater promise for investment than a system of large incentives with high and unstable rates (Shah, forthcoming). This conclusion agrees well with the results from the irreversibility literature summarized above. In sum, from the perspective of investment, tax incentives are probably less effective than is the elimination of disincentives such as unstable policies, infrastructural deficiencies, and inadequate regulatory codes.

Property Rights and Income Distribution

Recent strands of the investment literature have begun to consider nonconventional determinants that are thought to be of particular relevance for developing and transitional economies. Among these are the enforcement of property rights, the elimination of unnecessary regulation, and the implications of income distribution for a stable investment climate.

The importance of property rights for investment is well established. From a practical point of view, however, the formal definition of property rights must be complemented by a judicial system that guarantees their effective enforcement (Shleifer 1994). The lack of impartial mechanisms to resolve contractual disputes increases the cost of doing business by increasing the probability that contracts will not be respected and that expenses such as bribes will become necessary to enforce them.

The issue of corruption is a critical matter for investment projects because implementing the project may involve many administrative steps, particularly in highly regulated economies. The cost of doing business may rise substantially if the investor is forced to pay bribes to expedite passage through the system. Corruption thus effectively amounts to a tax on investment. Recent cross-country work by Knack and Keefer (1994) and Mauro (1995) shows that higher levels of corruption and poor contract enforcement are associated with a significantly worse-than-average investment performance.

Eliminating unnecessary regulations and reforming the civil service to reduce corruption can therefore promote investment and growth. If, to eliminate corruption, it is necessary to raise taxes to increase salaries of civil servants, it may appear that formal taxation will just replace informal corruption levies, leaving capital formation and growth unaffected. Ethical issues aside, however, the two regimes still differ in critical respects; most important among these is that corruption "contracts," unlike formal contracts, are notoriously difficult to enforce and thus leave unresolved the central question of property rights.

Income distribution affects capital accumulation by influencing the choice of public policies and the degree of social and political stability. An uneven distribution of income may encourage workers' demands and incite labor militancy, increasing the degree of political conflict. It might also compel governments to seek populist policies of rapid redistribution of income that may be fiscally and economically destabilizing, as witnessed several times in Latin America during the past few decades (Dornbusch and Edwards 1991). If redistributive policies are, in turn, financed through higher taxes on capital, they will further discourage investment and growth.

Because the relation between investment and income distribution is filtered through political institutions, it may be stronger in democracies than in nondemocracies. Persson and Tabellini (1992) show for a cross-section of industrial countries a positive and marginally significant correlation between equality in income distribution and the ratio of investment to GDP, although the in-

come distribution data used, which are typically derived from household surveys, are subject to serious bias (see appendix).

Alesina and Rodrik (1992) obtain similar results. In cross-sectional regressions using the ratio of total physical investment to GDP as the dependent variable and controlling for the type of political regime (democracies or nondemocracies), they find a positive correlation between the degree of income equality and the investment ratio. They obtain a similar result when using average GDP growth rates as the dependent variable, thus suggesting that investment is an important channel through which income distribution affects the growth of GDP.

Conclusions and Policy Implications

Despite the virtuous circles of high saving, investment, and rapid growth experienced by some countries (notably in East Asia), the connections among these three variables are complex, and causality may run in several directions. Nevertheless, the recent theoretical and empirical literature supports four main conclusions. First, saving and growth reinforce each other—causality runs in both directions. Second, saving and investment are highly correlated due to low capital mobility, domestic policies that restrict large current-account imbalances, or common factors that push both variables in the same direction. Third, physical investment is a necessary, but not sufficient, condition for growth. And fourth, human capital investment, technological innovation, and appropriate policies are also necessary for sustained high growth.

Encouraging Saving

Ensuring adequate levels of saving remains a central policy concern, not only to guarantee sufficient financing for capital accumulation, but to avoid an excess of investment over saving, which may create inflationary pressures or balance of payments disequilibria. In developing countries, moreover, where extensive capital market imperfections and liquidity constraints on firms and households are the norm, increasing private saving may be essential to expanding investment.

Five lessons about the effectiveness of policies may be derived from our discussion of saving determinants and their relevance in developing countries. First, raising public saving is an effective and direct way to raise *national* saving, because the evidence shows that public saving does not crowd out private saving one to one. Indeed, available data show that the private sector offsets each dollar of public saving by dissaving only \$0.25 to \$0.50.

Second, inflows of foreign saving should be allowed and encouraged to support domestic investment—even if they help to finance consumption—as long as the country's domestic economic policy framework is sustainable, its banking

system effectively regulated and supervised, and its government restrained from providing guarantees on foreign credit flows. Foreign aid, however, is less effective than nonconcessional capital inflows in boosting domestic investment. The historical literature suggests that foreign aid finances consumption and investment in roughly equal proportions. More recent and systematic evidence, however, estimates that most aid is spent on consumption and that little goes to investment, with the exception of those countries receiving aid in excess of 15 percent of GNP. For these countries, the effects on consumption and investment are approximately equal, a result that shows that the larger the recipient economy is in relation to the amount of aid, the more fungible are foreign aid resources.

Third, one should not expect private saving to rise in response to interest rate liberalization. The evidence shows that market-determined interest rates are likely to improve financial intermediation, the quality of investment, and the quality of portfolio choices (thus avoiding or reversing capital flight and possibly raising measured saving flows). Interest rates will be ineffective, however, in increasing overall saving flows.

Fourth, financial deepening, as reflected by larger stocks of financial savings, has ambiguous effects on private saving. Relaxing constraints on consumer borrowing depresses private saving, sometimes contributing to unsustainable consumption booms, such as those in Latin America during the early 1980s and in Mexico during the early 1990s. Fifth, the evidence on the effects of mandatory unfunded social security on private saving rates is mixed, possibly because saving for bequests takes precedence over saving for retirement. Because large numbers of (poor and young) households have little or no access to credit, however, and are not saving much for retirement, starting a mandatory, fully funded pension system may boost private saving significantly.

Raising Investment

If investment and innovation are essential to sustainable growth, is an activist investment and innovation policy necessary to boost growth? In theory, the need for an activist policy can be justified by the existence of investment externalities—implied, for example, by the “public-good” nature of many technological innovations and R&D activities—that result in insufficient social investment. To correct the externality, the conventional policy response would involve subsidies, tax exemptions, or both. Alternatively, encouraging investment in public infrastructure or in human capital, both of which show strong complementarities to private investment, could also promote growth.

Although a direct intervention policy involving tax concessions and subsidies might theoretically boost growth, there are, in practice, serious limitations to the administrative and institutional abilities of government agencies to target the “right” investments and to avoid rent-seeking. In addition, recent investment studies show that, under conditions of uncertainty or

macroeconomic instability, large investment incentives will be necessary to overcome the "value of waiting" and to have a material effect on private investment.

A less direct, but potentially very effective, way to promote capital formation, product innovation, technological advancement, and growth is to provide a supportive policy and institutional framework. Such a framework would consist of four ingredients: (1) macroeconomic stability, to reduce the uncertainty surrounding investment; (2) a comparatively distortion-free relative price structure, to raise the productivity of investment; (3) a well-defined (and effectively enforced) code of property rights, to create an environment conducive to a low cost of doing business; and (4) adequate political institutions, to foster social consensus and political stability.

Appendix: Data Measurement and Quality

Available data for income, saving, and investment suffer from inadequacies, inconsistencies, and biases that undoubtedly affect the quality of empirical work (discussed in detail by Visaria 1980; Berry 1985; Fry 1988; Gersovitz 1988; Deaton 1989; and Srinivasan 1993, 1994). The following list of problems is surely not meant to stop empirical research. Its purposes are to raise awareness of possible sources of bias in existing data and to call for better data.

Saving, Investment, and Consumption

Aggregate data from national income and product accounts (NIPAS) suffer from accounting deficiencies and inconsistencies in accounting methods across time and countries.

Much income and production is excluded from NIPAS; in particular, that of informal and illegal sectors, subsistence agriculture, and households. The omission of noncash (more generally, nonrecorded) components from both income and consumption causes ratios of saving and investment to GDP to be overstated. The omission of noncash investment from income causes saving and investment ratios to be understated. The levels of saving and investment are unaffected by the omission.

Saving and investment are systematically undermeasured because purchases of consumer durables and resources spent on human capital formation (education, health, training) are misrecorded as consumption instead of investment. Theory suggests that a more adequate consumption measure should be based on the flow of services of currently owned consumer durables and part of the services rendered by human capital.

Unrecorded capital flight (underreporting of net exports) is an overestimation of external saving. It implies an underestimation of gross domestic saving, an overestimation of gross domestic investment, or both.

Investment

Gross domestic investment is often obtained as the sum of additions to overall capital by capital categories, that is, machinery and equipment, construction, and inventories. Gross investment by the public and private corporate sectors is often independently estimated from reported corporate statements. Gross investment of the rest of the economy (households and unincorporated businesses) is a residual between gross domestic investment and corporate sector investment.

The distinction between inputs and capital goods in production sectors is frequently arbitrary. The difference between gross and net investment (and saving) flows often results from arbitrary depreciation calculations for which methods vary across countries.

Maintenance of public sector capital is typically misrecorded as current expenditure, that is, as government consumption. In the United States, current and capital public expenditures are not separated; all public expenditure is misclassified as current.

Intertemporal comparisons of investment are partly spurious because they involve capital of different vintages and quality. (A similar point may be made about consumption goods.) Even in the spatial dimension, capital heterogeneity makes it difficult to compare and aggregate investment from different sectors of origin.

Consumption and Saving

Some countries construct their NIPAs by computing consumption from independent household surveys. In most cases, however, aggregate consumption is obtained residually as GDP minus investment and net exports.

Estimates of public sector consumption are obtained from central and local governments. Private consumption is typically obtained as the residual difference between aggregate and public consumption. Household consumption is residually defined as private consumption minus consumption by nonprofit institutions.

Aggregate and sector saving data are the ultimate residual: they are defined as income minus (typically residual) consumption. In addition to reflecting the errors and biases in measuring all preceding variables, this definition of saving follows an arbitrary accounting convention that bears little relation to economic theory. The reason is that reported saving is inconsistent with changes in nonhuman wealth stocks because it excludes the capital gains on assets held by the consumer. For instance, private interest income from public debt and external assets (and, thus, private saving) is overstated by the inflation component of nominal interest payments on public debt and by the exchange rate depreciation component of nominal foreign interest payments. Private saving also excludes the capital loss from inflation suffered by money holders and, more generally,

any other net capital loss or gain caused by changing asset prices. Some research has been done on adjusted saving measures that include capital gains on some assets and liabilities, but such measures are typically not comprehensive because assets and liabilities are underreported.

Aggregate (NIPA) saving data also suffer from the problem of aggregation over age cohorts, income groups, or any other relevant dimension. This problem is avoided by using household survey data, which provide microspecific information. The standard household survey, however, severely underestimates overall, and thus individual, income and saving levels. Many surveys report grossly implausible values for saving; they show, for example, large numbers of dissaving households. Because income is underreported in relation to consumption, saving ratios and levels are underestimated. The most severe discrepancies are for nonlabor income and self-employed income. In addition, household survey data suffer from accounting problems similar to those affecting aggregate data, including the omission of capital gains and losses. Finally, household data are for households, not individuals, and they reflect features that are not valid at the individual level.

Notes

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1. The unweighted average saving ratios depicted in figure 1 are for twenty-one industrial countries and ninety-seven developing countries. Within the latter group the figure depicts separately unweighted average saving ratios for eight East Asian, twenty-five Latin American and Caribbean, and thirty-nine Sub-Saharan African countries.

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