

# 3

## Capital-Based Macroeconomics

Macroeconomics in the Austrian tradition owes its uniqueness to the Austrian capital theory on which it is based. This is the central message of Chapter 2. But as hinted in Chapter 1, there are critics within the tradition who take “Austrian Macroeconomics” to be a term at war with itself. The Austrian label usually denotes (1) subjectivism, as applied to both values and expectations, and (2) methodological individualism with its emphasis on the differences among individuals—differences that account for the give and take of the marketplace and for the very nature of the market process. These essential features of Austrianism stand in contrast to the features of the macroeconomics that has evolved over the last several decades.

Conventional macroeconomics has developed a reputation for abstracting from individual market participants and focusing primarily, if not exclusively, on aggregate magnitudes, such as the economy’s total output and its employment of labor. Even when the incentives and constraints relevant to individuals are brought into view, the focus is on the so-called representative agent, which deliberately abstracts from the interactions among the different agents and hence represents, if anything, the averages or aggregates of conventional macroeconomics.

The graphical analysis presented in this chapter allows us to deal with the enduring issues of macroeconomics without losing sight of the market process that gives rise to them. To base macroeconomics on capital theory—or, more precisely, to base it on a theory of the market process in the context of an intertemporal capital structure—is to maintain a strong link to the ideas of the Austrian school. Entrepreneurs operating at different stages of production make

decisions on the basis of their own knowledge, hunches and expectations, informed by movements in prices, wages, and interest rates. Collectively, these entrepreneurial decisions result in a particular allocation of resources over time.

The intertemporal allocation may be internally consistent and hence sustainable, or it may involve some systematic internal inconsistency, in which case its sustainability is threatened. The distinction between sustainable and unsustainable patterns of resource allocation is, or should be, a major focus of macroeconomic theorizing. Systematic inconsistencies can cause the market process to turn against itself. If market signals—and especially interest rates—are “wrong,” inconsistencies will develop. Movements of resources will be met by “countermovements,” as recognized early by Ludwig von Mises ([1912] 1953, p. 363). What initially appears to be genuine economic growth can turn out to be a disruption of the market process attributable to some disingenuous intervention on the part of the monetary authority.

Though committed to the precepts of methodological individualism, the Austrian economists need not shy away from the issues of macroeconomics. Some features of the market process are macroeconomic in their scope. Production takes time and involves a sequence of stages of production; exchanges among different producers operating in different stages as well as sales at the final stage to consumers is facilitated by the use of a common medium of exchange. Time and money are the common denominators of macroeconomic theorizing. While the causes of macroeconomic phenomena can be traced to the actions of individual market participants, the consequences manifest themselves broadly as variations in macroeconomic magnitudes. The most straightforward concretization of the macroeconomics of time and money is the intertemporal structure of capital—hence, capital-based macroeconomics.

Capital-based macroeconomics rejects the Keynes-inspired distinction between macroeconomics and the economics of growth. This unfortunate distinction, in fact, derives from the inadequate attention to the intertemporal capital structure. Conventional macroeconomics deals with economy-wide disequilibria while abstracting from issues involving a changing stock of capital; modern growth theory deals with a growing capital stock while abstracting from issues involving economy-wide disequilibria. With this criterion for defining the subdisciplines within economics, the thorny issues of disequilibrium and the thorny issues of capital theory are addressed one at a

time. Our contention is that economic reality mixes the two issues in ways that render the one-at-a-time treatments profoundly inadequate. Economy-wide disequilibria in the context of a changing capital structure escape the attention of both conventional macroeconomists and modern growth theorists. But the issues involving the market's ability to allocate resources over time have a natural home in capital-based macroeconomics. Here, the short-run issues of cyclical variation and the long-run issues of secular expansion enjoy a blend that is simply ruled out by construction in mainstream theorizing.

### THE ELEMENTS OF CAPITAL-BASED MACROECONOMICS

Three elementary graphical devices serve as building blocks for an Austrian-oriented, or capital-based, macroeconomics. Graphs representing (1) the market for loanable funds, (2) the production possibilities frontier, and (3) the intertemporal structure of production all have reputable histories. The first two are well known to all macroeconomists; the third is well-known to many Austrian economists. The novelty of the capital-based macroeconomics presented in this and the two succeeding chapters is in their integration and application. Auxiliary graphs that link markets for capital goods and markets for labor can extend the analysis and help establish the relationship between our capital-based macroeconomics and the more conventional labor-based macroeconomics.

The fundamentals of capital-based macroeconomics is set forth with the aid of a three-quadrant, interlocking graphical framework. Once assembled, our graphical construction can be put through its paces to deal with issues of secular growth, changes in resource endowments and in technology, intertemporal preference changes, booms and busts, and more. These graphics are not offered as a first step toward the determination of the equilibrium values of the various macroeconomics magnitudes. Rather, this framework is intended to provide a convenient basis for discussing the market process that allocates resources over time. (A framework and the discussion of the issues stand in the same relationship to one another as a hat rack and the hats.)

The explicit attention to intertemporal allocation of resources allows for a sharp distinction between sustainable and unsustainable growth. The underlying consistency (or inconsistency) between consumer preferences and production plans will determine whether the market process will play itself out

or do itself in. Our graphical framework demonstrates the coherence of the Austrian macroeconomics that was inspired early in the last century by Mises, who drew ideas from still earlier writers. It also sheds light on contemporary political debate. Nowadays candidates for the presidency and other high offices vie with one another for votes on the basis of their pledges to “grow the economy”; opposing candidates differ primarily in terms of just how they plan to grow it. The political rhetoric overlooks the fundamental issues of the very nature of economic growth. Is growth something that simply happens when the economy is left to its own devices? Or, is it something that a policy maker does to the economy? Is the verb “to grow,” as used in economic debate, an intransitive verb or a transitive verb? Capital-based macroeconomics provides us with reasons for associating this fundamentally intransitive verb with sustainable growth and its transitive variant with unsustainable growth. That is, the economy grows, but attempts to grow it can be self-defeating.

Our graphical framework serves also to demonstrate the essential unity between the Austrian theory of the business cycle, which is typically set out with reference only to the Hayekian triangle, and other implications of the Austrian macroeconomic relationships. The inclusion of the market for loanable funds allows us to deal with the consequences of the policy of deficit finance. The implications of mainstream theories that the method of financing government spending is largely if not wholly irrelevant (the Ricardian Equivalence Theorem) and even the summary judgments of Austrian economists to this same effect will be called into question. The inclusion of the production possibilities frontier allows us to deal with certain aspects of tax reform. These and related issues are discussed in Chapter 5. We turn now to the individual elements of the graphical construction.

**The market for loanable funds** “Loanable funds” is a commonly used generic term to refer to both sides of the market that is brought into balance by movements of the interest rate broadly conceived. The supply of loanable funds, which represents the willingness to lend at different interest rates, and the demand for loanable funds, which represents the eagerness to borrow, are shown in Figure 3.1. For use in macroeconomics, two modifications to this straightforward interpretation are needed, both of which are common to macroeconomic theorizing. First, consumer lending is netted out on the supply

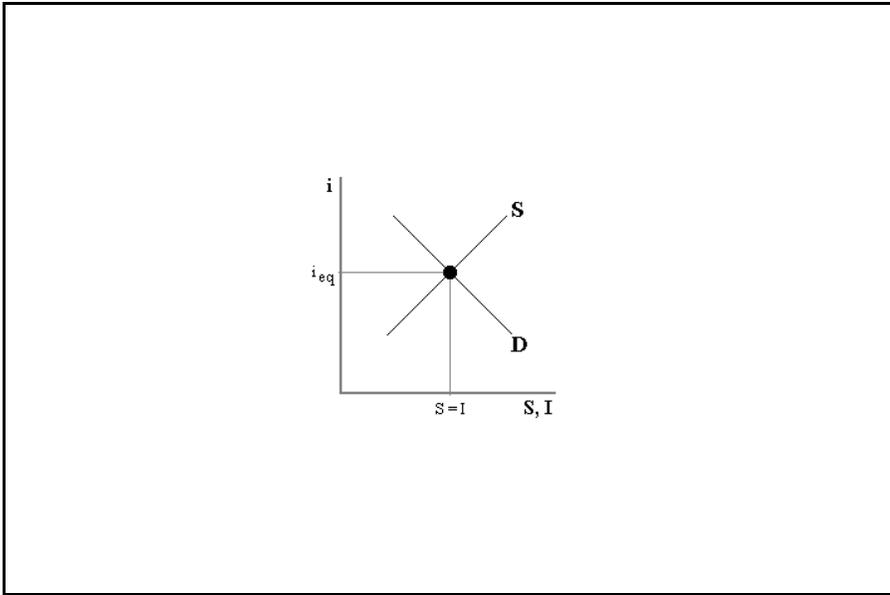


Figure 3.1: The Market for Loanable Funds (or for Investable Resources)

side of this market. That is, each instance of consumer lending represents saving on the part of the lender and dissaving on the part of the borrower. Net lending, then, is saving in the macroeconomically relevant sense. It is the saving by all income-earners made available to the business community to finance investment, to facilitate capital accumulation, to maintain and expand the economy's capital structure. Second, though narrowed to exclude consumer loans, the lending and borrowing represented in the supply and demand for loanable funds is broadened to include retained earnings and saving in the form of the purchasing of equity shares. Retained earnings can be understood as funds that a business firm lends to (and borrows from) itself. Equity shares are included on the grounds of their strong family resemblance, macroeconomically speaking, to debt instruments. The distinction between debt and equity, which is vitally important in a theory of the structure of finance, is largely dispensable in our treatment of the structure of capital. The supply of loanable funds, then, represents that part of total income not spent on consumer

goods but put to work instead earning interest (or dividends).

Böhm-Bawerk, who drew heavily from the classical tradition, thought of the loanable funds market as the market for “subsistence”—a term that is avoided here only because of the classical inclination to take the subsistence fund as fixed and to see it as a stock of consumption goods for sustaining the labor force during the production period. In view of the netting out of consumer lending and the broadening to include retained earnings and equity shares, “loanable funds” may be better understood as “investable resources,” a term that emphasizes the purpose of the borrowing. This understanding is consistent with that of Keynes (1936, p. 175): “[According to the classical theory], investment represents the demand for investable resources and saving represents the supply, whilst the rate of interest is the ‘price’ of investable resources at which the two are equated.”

Beyond the adjustments mentioned above, we should recognize that there remains a small portion of income which is neither spent nor lent. The possibility for holding funds liquid puts some potential slippage into our construction. Money holdings constitute saving in the sense of their not being spent on current consumption, but this form of saving translates only in an indirect way into loanable funds. Our graphical construction can easily allow for variation in liquidity preferences and hence in the demand for money: To the extent that an increase in saving is accompanied by an increase in liquidity preferences, it does not substantially increase the supply of loanable funds and hence has little effect on the rate of interest. However, in contrast to its role in Keynesian macroeconomics, this particular slippage is not a primary focus of the analysis.

Consistent with our understanding of the supply of loanable funds, the demand for loanable funds represents the borrowers' intentions to participate in the economy's production process. Investment in this context refers not to financial instruments but to plant and equipment, tools and machinery. More broadly, it refers to the means of production, which include goods in process as well as durable capital goods and human capital. In some contexts investment could include even consumer durables (automobiles and refrigerators), in which case only the services of those consumer durables would count as consumption. However, to align the market for loanable funds with other elements in the graphical analysis, consumer durables themselves

are categorized as consumption rather than investment (see p. 56 below). While our graphical apparatus is most straightforwardly interpreted on the basis of a goods-in-process conception of investment goods, our discussion often allows for alternative conceptions.

The demand for loanable funds reflects the willingness of individuals in the business community operating in the various stages of production to pay input prices now in order to sell output at some (expected) price in the future. With consumers spending part of their incomes on the output of the final stage of production and saving the rest, the market for loanable funds facilitates the coordination of production plans with consumer preferences. Individual investment decisions in the business community tend to bring into uniformity the interest rate available in the loan market more narrowly conceived and the interest rates implicit in the relative prices of outputs in comparison with inputs of the stages of production. The market process that allocates resources intertemporally consists precisely of individuals taking advantage of profit opportunities in the form of interest-rate discrepancies implied by the existing pattern of input and output prices. And, of course, exploiting the intertemporal profit opportunities reduces the discrepancies. In the limit and with the unrealistic assumption of no change in the underlying economic realities, all wealth holders would be earning the market rate of interest.

In reality, of course, some amount of discoordination is inherent in the very nature of the market process. The market for loanable funds registers the expected rate of return net of the losses that this discoordination entails. For this reason, the loan rate of interest is not a “pure” rate. It reflects more than the underlying time preferences of market participants. On the demand side, changes in the level of “expected losses from discoordination” are identified in conventional macroeconomics as changes in the level of “business confidence.” But business confidence, or, alternatively, business optimism and pessimism—or the waxing and waning of “animal spirits,” to use Keynes’s colorful phrase—seem to call for a psychological explanation. In capital-based macroeconomics, the expected losses from discoordination call for an economic explanation. Thus, the normal assumption will be: no change in the general level of business confidence (of expected loss from discoordination), except in circumstances where our analysis of the market process suggests that there is a basis for such a change.

On the supply side of the market for loanable funds, a similar contrast between conventional macroeconomics and capital-based macroeconomics can be made. Savers, who can partially insulate themselves through diversification from particular instances of discoordination in the business community, may nonetheless be concerned about the general health of the economy. Diversified or not, savers who want to put their savings at interest must bear a lenders’ risk. What manifests itself on the demand side of the loan market as a loss of business confidence manifests itself on the supply side as an increase in liquidity preference. Savers may prefer, sometimes more so than others, to hold their wealth liquid rather than to put it at interest. But like business confidence, liquidity preference—or, all the more, Keynes’s fetish of liquidity—seems to call for a psychological explanation. By contrast, lenders’ risk, which is the more appropriate term in capital-based macroeconomics, calls for an economic explanation. The normal assumption, especially in the light of opportunities for diversification, will be: no change in lenders’ risk—except, again, in circumstances where our analysis of the market process suggests that there is a basis for such a change.

This interplay between the market for loanable funds and markets for investment goods, the discussion of which anticipates other elements of our graphical analysis, is brought into view here so as to warn against too narrow a conception of the interest rate. In the broadest sense, the equilibrium rate of interest is simply the equilibrium rate of intertemporal exchange, which manifests itself both in the loan market and in markets for (present) investment goods in the light of their perceived relationship to (future) consumer goods. The market for loanable funds, however, warrants special attention. The most direct and obvious manifestation of intertemporal exchange, the loan rate that clears this market is vital in translating the intertemporal consumption preferences of income earners into intertemporal production plans of the business community. And, significantly, this same loan rate is also crucial in translating stimulation policies implemented by the monetary authority into their intended—and their unintended—consequences.

The supply and demand for loanable funds, shown in Figure 3.1, identifies a market-clearing, or equilibrium, rate of interest  $i_{eq}$ , at which saving (S) and investment (I) are brought into equality. This is the conventional understanding of the loanable-funds market. In application, however, one feature of this

market, critical to its incorporation into capital-based macroeconomics, involves an understanding that is not quite conventional. Mainstream theorizing relies on two separate and conflicting constructions—one for the short run and one for the long run. In macroeconomics as well as in growth theory, “to save” simply means “not to consume.” Increased saving means decreased consumption. Resources that could have been consumed are instead made available for other purposes—for investment, for expanding the productive capacity of the economy. In long-run growth theory, where problems of disequilibria are assumed away, the actual utilization of saving for expanding capacity and hence increasing the growth rate of output (of both consumer goods and investment goods) is not in doubt. In the conventional macroeconomics of the short run—especially in Keynesian macroeconomics, where economy-wide disequilibrium (the Keynesians would say unemployment equilibrium) is the normal state of affairs—the actual utilization of saving by the investment community is very much in doubt. Decreased consumption now is likely to be taken by members of the business community as a permanently lower level of consumption. Saving can depress economic activity all around. The well known “paradox of thrift” is based squarely on this all-but-certain cause-and-effect relationship between increased saving and decreased economic activity. This particular contrast between the short-run effect and the long-run effect of an increase in saving is undoubtedly what Robert Solow, as quoted in Chapter 1, had in mind when he identified as a major weakness in modern macroeconomics the lack of real coupling between the short run and the long run.

Significantly, our understanding of saving in capital-based macroeconomics lies somewhere between the understandings of neoclassical growth theory and of Keynesian macroeconomics. As in many other issues, the Austrians adopt a middle-ground position (Garrison, 1982). People do not just save (S); they save-up-for-something (SUFS). Their abstaining from present consumption serves a purpose; saving implies the intent to consume later. SUFS, our unaesthetic acronym (which we will resist employing repeatedly throughout this volume), stands in contrast to the conventional distinction between “saving,” the flow concept (so much per year—from now on?) and “savings,” the corresponding stock concept (the accumulation of so many years of saving—to what end?). Saving in capital-based macroeconomics means the

accumulation of purchasing power to be exercised sometime in the future. It is true, of course, that individual savers do not indicate by their acts of saving just what they are saving for or just when they intend to consume. (They may not know these things in any detail themselves.) But this is only to say that the economy is not a clockwork. Future consumer demands are not determinate. The future is risky, uncertain, unknowable. The services of entrepreneurs, each with his or her own knowledge about the present and expectations about the future, are an essential requirement for the healthy working of the market economy. Increased saving now means increased consumption sometime in the future and hence increased profitability for resources committed to meet that future consumption demand.

The market process does not work “automatically,” as commonly assumed in growth theory, and it does not “automatically” fail, as implied by the Keynesian paradox of thrift. To help identify instances in which the market process works—or fails to work—requires the perspective offered by the production possibilities frontier, which is the second element in capital-based macroeconomics.

**The Production Possibilities Frontier** The production possibilities frontier (PPF) appears in all introductory textbooks but is never integrated into either Keynesian or classical macroeconomic analysis. Typically, the PPF makes its appearance only in the preliminary discussions of scarcity. Following Samuelson, the older texts (and some new ones) identify the alternative goods to be produced as guns and butter. In its simplicity, the guns-and-butter construction allows us to see that we can have more wartime goods but only if we make do with fewer peacetime goods. The two alternative outputs are negatively related to one another. And while some of the economy’s resources are suitable for producing either output, some are better suited to meeting our wartime needs, some to meeting our peacetime needs. When it becomes necessary for the economy to change its mix of outputs, it must use resources better suited for one output for producing the other. Hence, we must forego ever-increasing quantities of peacetime goods in order to produce additional quantities of wartime goods. Figure 3.2 shows a guns-and-butter PPF with its increasingly negative slope.

The PPF is sometimes used for comparing different countries in terms of

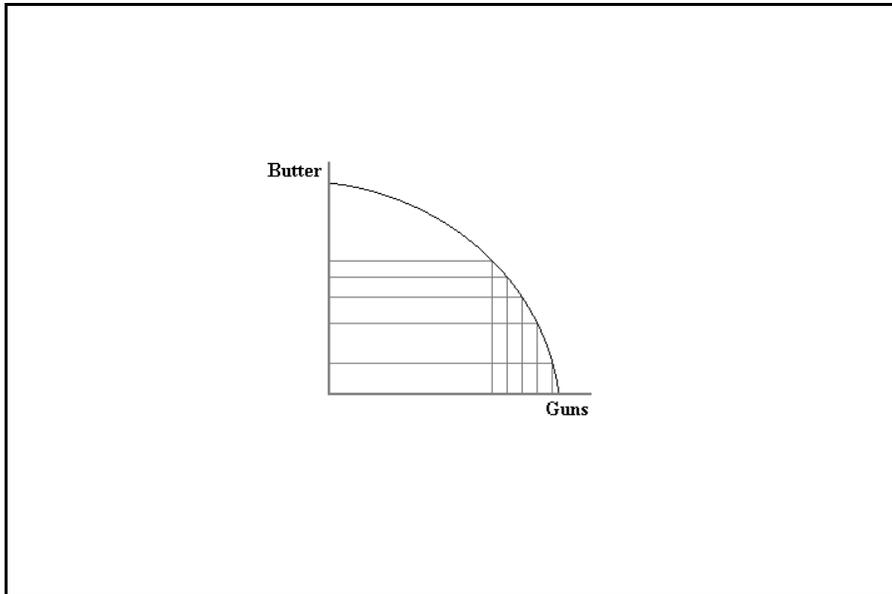


Figure 3.2: The Production Possibilities Frontier (Guns and Butter)

their economic performances over time. For this purpose, the fundamental trade-off between consumer goods and capital goods is presented in a PPF format. In this application, we simply call attention to the fact that the economy grows to the extent that it uses its resources for the production of capital goods rather than for the production of consumer goods. While the trade-off in any given year is made on the basis of that year's PPF, the year-to-year expansion of the PPF itself depends on just how that trade-off is made. For instance, post-war Japan, whose location on the PPF reflected a considerable sacrifice of consumer goods in favor of capital goods (or exportable goods), grew rapidly from the mid 1950s through the mid 1970s, as depicted by large year-to-year outward shifts in the frontier itself; the United States, whose location on the PPF reflected sacrifices in the other direction, grew more slowly. Compare in Figure 3.3 the location of Japan and the United States on their respective (and normalized) PPFs with the corresponding rates of expansion.

The same PPF that illustrates the possibilities of growth in the face of scarcity can easily be adapted for use in our capital-based macroeconomics.

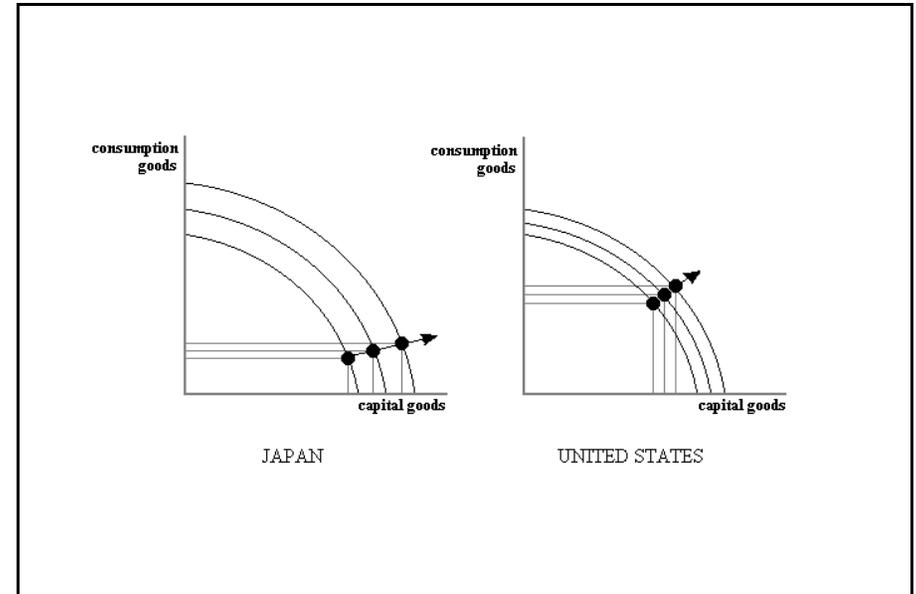


Figure 3.3: Capital and Growth (Postwar Japan and the United States)

Any one year's production of capital goods is simply the amount of gross investment for that year. Accordingly, our PPF shows the trade-off between consumption (C) and investment (I). This construction allows for an obvious link with the supply and demand for loanable funds, and it also gives us a link to the more conventional macroeconomic theories which use these same aggregates, (C, I, and S) as their building blocks.

Unlike the investment magnitude in conventional constructions, however, our investment is measured in gross terms, allowing for capital maintenance as well as for capital expansion. There is some point on the frontier, then, for which gross investment is just enough to offset capital depreciation. With no net investment, we have a stationary, or no-growth, economy. Combinations of consumption and investment lying to the southeast of the no-growth point imply an expansion of the PPF; combinations lying to the northwest imply a contraction. Contraction, Stationarity, and expansion are shown in Figure 3.4.

Applying the PPF to a mixed economy requires us to make room for government spending (G) and taxes (T). In conventional macroeconomics,

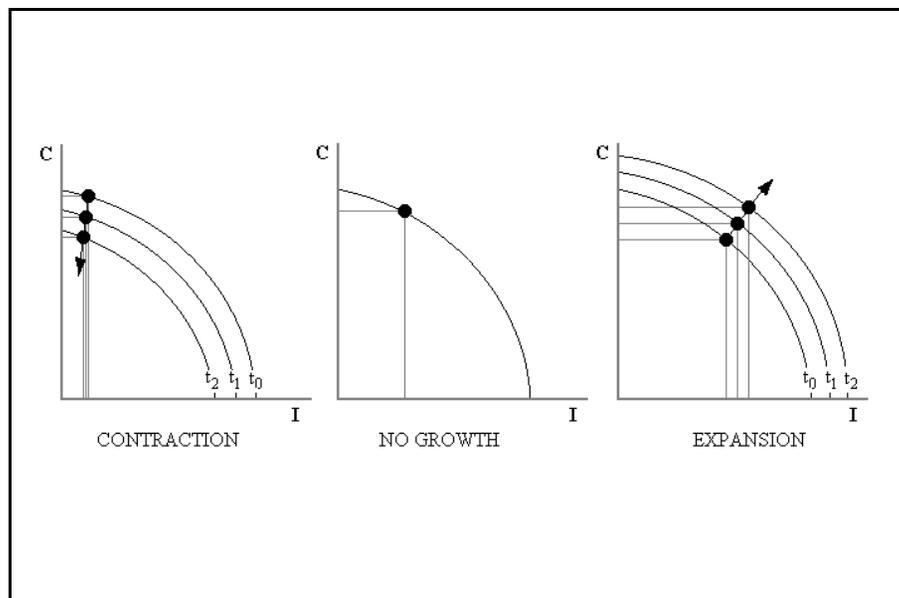


Figure 3.4: Gross Investment and Growth (Contraction, Stationarity, and Expansion)

which is based on the Keynesian aggregates, total expenditures ( $E$ ) in a mixed economy is written as the sum of three components:  $E = C + I + G$ . Consumption is the stable component; investment is the unstable component; and government spending is the stabilizing component. Keynesian theory hinges importantly on a separation of consumption, which exhibits a strong and stable dependence on current after-tax income, and the other two components ( $I$  and  $G$ ), which are not directly related to current income. Investment in the simplest Keynesian construction is largely “autonomous” and government spending is a key policy variable. This conceptualization leads almost immediately to the conclusion that if unpredictable and disruptive changes in investment spending are countered by changes (equal in magnitude and opposite in direction) in government spending, then the mixed economy will enjoy a stability that a wholly private economy could not have achieved on its own. The level of taxation ( $T$ ), which affects disposable income and hence consumption spending, can serve as an alternative policy variable—or as a companion policy variable—in the policy maker’s prescriptions for stabilizing

the economy.

How do  $G$  and  $T$  fit into capital-based macroeconomics? The PPFs of Figures 3.3 and 3.4 are drawn on a set of axes labeled  $C$  and  $I$ , suggesting that they apply to a wholly private economy. But there is some scope for extending the analysis to apply to a mixed economy, one that includes both a private sector and a public sector. Adapting our PPF to deal with relevant aspects of the public sector involves considerations quite different from those just mentioned. In the simplest—and most implausible—case, where the government imposes a lump-sum tax (a head tax), spends the revenues in ways that are wholly unrelated to private-sector activities, and maintains a balanced budget ( $G = T$ ), the PPF simply applies to the private sector of a mixed economy. It represents the production possibilities after the government has extracted a certain portion of the economy’s resources for use in the public sector.

More generally, drawing the PPF net of tax-financed government spending will involve more than simply scaling down the PPF. Just how the shape of the PPF might change (gross-to-net) and just where on the net PPF the economy might find itself will depend importantly on the particular design of the tax system and the particular use of the revenues. An income tax would have a different effect than a consumption tax would have (Reform in the direction of a consumption tax is discussed in Chapter 5), and a tax-financed food-stamp program would have a different effect than a tax-financed airport-construction project. Strong arguments can be made that, in large part, the U.S. economy is pushed toward increased consumption and the Japanese economy is pushed away from it by the two countries’ respective policies that govern taxing and spending. Just how far the net PPF for either country lies inside the corresponding PPFs that would have been relevant in the absence of a large public sector involves arguments and judgments that go beyond the scope of our analysis.

The gross-to-net adjustment discussed above pertains to a public sector whose budget is balanced or, more generally, to tax-financed government spending. However, a portion of government spending, namely that portion financed by borrowing, adds to the demand for loanable funds and hence can be represented more explicitly in our graphics. That is, to allow for public-sector borrowing, we can relabel the horizontal axis in the market for loanable funds  $I + G_d$ , where  $G_d$  is deficit-financed government spending, or (ignoring

here the possibility of inflationary finance) simply  $G = T$ . Note that private-sector investment and the deficit-financed portion of the public sector are taken to be additive both in conventional macroeconomics and in capital-based macroeconomics—but for different reasons. They are additive conventionally by virtue of their being two components (along with consumption and the tax-financed portion of the public sector) of total spending. In the present analysis, they are additive only because of their being two components of the demand for loanable funds. Both components impinge on the rate of interest, which affects the intertemporal allocation of resources. Deficit finance and the Ricardian Equivalence Theorem are discussed in Chapter 5.

In some cases, where the government spending is almost wholly unrelated to spending in the private sector (think of the construction of monuments or of conducting remote military operations), we may choose to employ a PPF that excludes this public-sector activity. In other cases, the relabeling of the horizontal axis of the loanable-funds market may apply as well to the horizontal axis of the PPF. That is, in certain applications, we might find it helpful to represent a part of the government's appropriation of resources as a distance along the horizontal axis of the PPF diagram. Consider, for instance, a nationalized industry, where the government issues bonds and competes with the private sector for resources. In this instance, we can add public investment to private investment. The similarities between the two types of investment are captured in the PPF, while the critical differences are captured elsewhere in the analysis. These alternative treatments of deficit-financed government spending, depending on the particular nature of the spending, will find application in Chapter 5.

As applied to a wholly private economy or to the private sector of a mixed economy for which  $G = T$ , the (net) PPF represents *sustainable* combinations of consumption and investment and implies a fully employed economy. Combinations of consumption and investment inside the frontier involve unemployment—of labor and of other resources. Such widespread unemployment, according to Keynes, is characteristic of a market economy. In circumstances of pervasive unemployment, it is possible for consumption and investment to move in the same direction. Idle resources can be mobilized to allow for more of each. Scarcity is not a binding constraint. The tradeoff is not between consumption and investment but between output of both kinds and

idleness. The object of Keynesian policy, of course, is to drive the economy to some point on the frontier and keep it there. Any point is consistent with Keynesian principles, although Keynes himself was partial to investment.

Keynes clearly recognized that once full-employment has been established, the classical theory (in which he included Austrian theory) comes into its own. The purpose of featuring the PPF in capital-based macroeconomic analysis is to give full play to those classical and Austrian relationships. The PPF for a given year constrains consumption and investment to move in opposite directions along the frontier. More strictly speaking, comparative-static analysis entails combinations of consumption and investment that lie on a given PPF. But as we shall see, the actual movement from one combination to the other, however, may involve a bubbling up above the frontier or a dipping down into its interior.

The constraint represented by the PPF, for capital-based analysis as well as for macroeconomic applications generally, is not absolute. Consumption and investment can move together beyond the frontier but only temporarily; in real terms, points beyond are not sustainable. And, of course, in conditions where malfunctioning markets have economy-wide consequences, consumption and investment can move together inside the frontier; where scarcity is not binding, idleness can be traded for more of both kinds of output.

Using the PPF as an elementary component of capital-based macroeconomics leaves unspecified (within a wide range) the particular temporal relationship between this year's investment and the corresponding consumption of future years. In a simple two-period framework, an increase in investment of  $\Delta I$  in period 1 permits an increase in consumption of  $\Delta C = (1+r)\Delta I$  in period 2, where  $r$  is the real rate of return on capital. In an equally simple stock-flow framework, in which infinitely-lived investment goods yield a stream of consumption services, an increase in investment of  $\Delta I$  in period 1 permits an increase in consumption of  $\Delta C = r\Delta I$  for each and every successive year.

Neither of these overly simple conceptions of intertemporal transformation give adequate play to capital in the sense of a collection of heterogeneous capital goods that can be combined in different ways to yield consumable output at various future dates. In neither is there any non-trivial meaning to the notion of a capital structure or any scope for a restructuring of capital. To allow

for the sort of problems that make the Austrian approach to macroeconomics worthwhile, a substantial portion of the economy's capital goods must be remote from consumable output, some more so than others. Capital must be heterogeneous, and the different capital goods must be related to one another by various degrees of complementarity and substitutability. The expression for intertemporal transformation in capital-based macroeconomics is itself changeable and lies somewhere in the intermediate range between the simple two-period conception and the simple stock-flow conception. Dealing more specifically with possible patterns and likely patterns of movements of, along, beyond, and within the frontier requires a specific account of the intertemporal structure of production, which is the third element of capital-based macroeconomics.

**The Intertemporal Structure of Production** Attention to the intertemporal structure of production is unique to Austrian macroeconomics. Elementary textbooks on macroeconomics all contain some mention of a sequence of stages of production, but only to warn against double counting in constructing the more aggregative national income accounts. The farmer sells grain to the miller; the miller sells flour to the baker; the baker sells cases of bread to the grocer, and the grocer sells individual loaves to the consumer. The emphasis in such examples is on the value dimension of the production process and not on the time dimension. One method of calculating total output is to subtract the value of the inputs from the value of the output for each stage to get the "value added" and then to sum these differences to get the total value of final output. Simply adding the outputs of the farmer, the miller, the baker, and the grocer would entail some double, triple, and quadruple counting.

Capital-based macroeconomics gives play to both the value dimension and the time dimension of the structure of production. The relationship between the final, or consumable, output of the production process and the production time that the sequence of stages entails is represented graphically as the legs of a right triangle. In its strictest interpretation, the structure of production is conceptualized as a continuous-input/point-output process. The horizontal leg of the triangle represents production time. The vertical leg measures the value of the consumable output of the production process. Vertical distances from the time axis to the hypotenuse represent the values of goods-in-process. The value

of a half-finished good, for instance, is systematically discounted relative to the finished good—and for two reasons: (1) further inputs are yet to be added and (2) the availability of the finished good lies some distance in the future. Alternatively stated, the slope of the hypotenuse represents value added (by time and factor input) on a continuous basis. The choice of a linear construction here over an exponential one maintains a simplicity of exposition without significant loss in any other relevant regard.

Although the goods-in-process example is the most straightforward way to conceptualize the triangle, our interpretation of this Hayekian construction can be extended to include all forms of capital that make up the economy's structure of production. We can take into account the fact that mining operations are far removed in time from the consumer goods that will ultimately emerge as the end result of the time-consuming production process, while retail operations are in relative close temporal proximity to final output. Figure 3.5 shows the Hayekian triangle and identifies five stages of production as mining, refining, manufacturing, wholesaling, and retailing. The identification of the individual stages is strictly for illustrative purposes. The choice of five stages rather than six or sixty is strictly a matter of convenience of exposition. To choose two stages would be to collapse the triangle into the two-way distinction between consumption and investment—the distinction that gets emphasis in the PPF. To choose more than five stages would be to add complexity for the sake of complexity. Five gives us the just the appropriate degree of flexibility: A structural change that shifts consumable output into the future, for instance, would involve an expansion of the early stages (with the first stage expanding more than the second), a contraction of the late stages (with the fifth stage contracting more than the fourth), and neither expansion nor contraction of the (third) stage that separates the early and late stages.

The time dimension that makes an explicit appearance on the horizontal leg of the Hayekian triangle has a double interpretation. First, it can depict goods in process moving through time from the inception to the completion of the production process. Second, it can represent the separate stages of production all of which exist in the present, each of which aims at consumption at different points in the future. This second interpretation allows for the most straightforward representation of the relationships of capital-based macroeconomics. The first interpretation comes into play during a transition

from one configuration to another. The double labeling of the horizontal axis in Figure 3.5 is intended to indicate the double interpretation: “Production Time” connotes a time-consuming process; “Stages of Production” connotes the configuration of the existing capital structure.

To illustrate the time element in the structure of production with an reference to the so-called smoke-stack industries may seem counter to trends in economic development over the past few decades. Mining and manufacturing may be in (relative) decline and the service and information industries on the rise. The mix of goods and services may be changing in favor of services, and human capital may have more claim on our attention than does heavy equipment. But as long as we think in terms of the employment of means, the achievement of ends, and the time element that separates the means and the ends, the Hayekian triangle remains applicable.

The continuous-input/point-output process that is depicted by the Hayekian triangle takes time into account but only as it relates to production. Adopting the point-output configuration gives us a straightforward link to the consumption magnitude featured in our PPF quadrant. But point output implies that consumption takes no time. Explicit treatment of consumer durables would involve extending the time dimension beyond the production phase of such durable goods. A second triangle representing the structure of consumption could be abutted onto the triangle representing the structure of production as shown in Figure 3.6. William Stanley Jevons offered this depiction of the investment process in his *Theory of Political Economy* ([1871] 1965, p. 231). The vertical distance to the hypotenuse of the second triangle might be interpreted as representing the capacity of consumer durables to provide services. The fact that these services, measured in value terms, decline over time is attributable to two considerations. First, consumer durables wear out, some more quickly than others, and old consumer durables provide less valuable services than new ones provide. Second, the time discount applies to consumption activities no less than to production activities. That is, the services to be provided in the remote future are discounted relative to the same services provided in the present. (Similarly, explicit treatment of durable capital goods

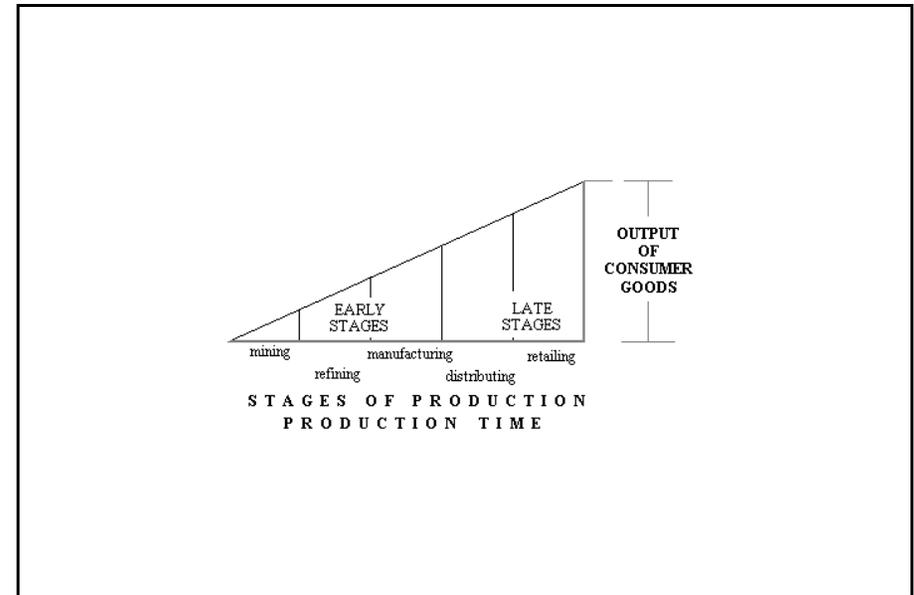
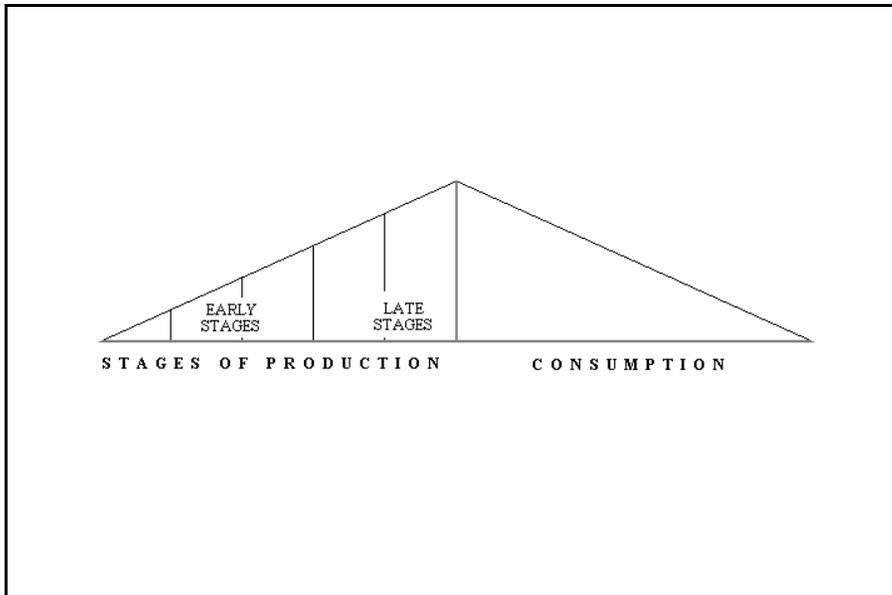


Figure 3.5: The Structure of Production (Continuous-Input/Point-Output)

employed in the various stages of production would require additional complicating modifications to the configuration.)

The notion of stages of consumption has much more limited interpretation than the corresponding stages of production. We might think of used-car lots, second-hand furniture stores, and junk shops as separating the stages. Although the allowance for consumption time as well as production time may constitute a move in the direction of realism, there is little to be gained analytically by replacing the multistage Hayekian triangle with the Jevonsian investment figure. Durable consumption goods and durable capital goods are obvious and, in some applications, important features of the market process. But to include these features explicitly would be to add complexity while clouding the fundamental relationships that are captured by the simpler construction. Instead, we avoid this graphical complication and rely on informal discussion to qualify our applications of the simple capital-based framework.

Conventional macroeconomics makes a first-order distinction between



**Figure 3.6: The Structure of Production (Continuous-Input/Continuous-Output)**

consumption and investment; capital-based macroeconomics owes many of its insights to the special attention to the time dimension in the investment sector, the temporal structure of production. The graphical depiction of a linear sequence of stages is not intended to suggest that the production process is actually that simple. There are many feedback loops, multiple-purpose outputs, and other instances of nonlinearities. Each stage may also involve the use of durable—but depreciating—capital goods, relatively specific and relatively nonspecific capital goods, and capital goods that are related with various degrees of substitutability and complementarity to the capital goods in other stages of production. Insights involving these and other complexities are best dealt with by careful and qualified application of Hayek’s original construction.

Even in the simple triangular construction, however, the reckoning of production time is anything but simple. While the vertical and horizontal dimensions of the triangle are intended to represent value and time separately, the relevant time dimension is not measured in pure time units. Instead, the

time dimension measures the extent to which valuable resources are tied up over time. Production time itself, then, has both a value dimension and a time dimension. Two dollars worth of resources tied up in the production process for three years amounts to six dollar-years (neglecting compounding) of production time. The complex unit of dollar-years is not foreign to capital theory. It measures Gustav Cassel’s (1903) “waiting” and underlies Böhm-Bawerk’s ([1889] 1959) roundaboutness. These two related concepts have been in for much misunderstanding and criticism. The dimensional complexity of an intertemporal production process is what gave play to the technique-switching and capital-reversing debates of the 1960s and accounts for most of the thorny and controversial issues of capital theory. It was precisely these thorny issues that underlay the eagerness of macroeconomists in the 1930s to drop capital theory out of macroeconomics.

If our objective were to set out the issues of the 1960s controversy, we would have to forego the simple Hayekian triangle in favor of an exponential function to allow for the compounding of interest, without which the controversies do not emerge. Thus, the key element of capital-based macroeconomics, the Hayekian triangle, is not intended to rid capital theory of its thorniness but rather to put those thorns aside in order to highlight the macroeconomic aspects of intertemporal equilibrium and intertemporal disequilibrium. Nor is it intended to help determine quantitatively the precise amount of waiting or the precise degree of roundaboutness that characterizes the structure of production. Rather, it is intended to indicate the general pattern of the allocation of resources over time and the general nature of changes in the intertemporal pattern. To this end, the still-unresolved—and possibly unresolvable—issues of capital theory can be kept at bay. The focus, instead, is on the most fundamental interrelationships among the separate elements of capital-based macroeconomics.

### **THE MACROECONOMICS OF CAPITAL STRUCTURE**

Having accounted separately for each of the three elements of capital-based macroeconomics, the basic interconnections among these elements follows almost without discussion. Figure 3.7 represents a wholly private economy or the private sector of a mixed economy whose public-sector budget is in balance. It shows just how the supply and demand for loanable funds, the

production possibility frontier, and the intertemporal structure of production relate to one another. The loanable-funds market and the PPF are explicitly connected by their common axes measuring investment. The PPF and the structure of production are explicitly connected by their common axes measuring consumption.

A critical connection between the structure of production and the loanable funds market is not quite as explicit as the others. The slope of hypotenuse of the Hayekian triangle reflects the market-clearing rate of interest in the market for loanable funds. “Reflects” is as strong a connection as can be made here. With a continuous-input construction, the slope of the hypotenuse reflects more than the interest rate. The value-differential across any given stage is partly attributable to inputs being added in that stage and partly attributable to the change in temporal proximity to final output. However, as applied to the private sector and under given institutional arrangements, the slope of the hypotenuse and the market-clearing rate of interest will move in the same direction. That is, a lower (or higher) rate of interest will imply a shallower (or steeper) slope. The qualifications suggest that public-sector spending can upset this relationship as can institutional reform, such as the replacement of an income tax with a consumption tax. These applications will be dealt with in Chapter 5.

The rate of interest—or rate of return on capital—could be depicted more explicitly by adopting an alternative construction. A point-input/point-output production process could be represented by a truncated Hayekian triangle, a trapezoid—with the shorter vertical side measuring input, the longer one measuring output. The trapezoid would depict a single input which would then mature with time into consumable output. Aging wine is the paradigm case. The rate of interest in this case, neglecting compounding, would be *equal* to the slope of a line that connects the value of the input to the value of the output. This construction together with the supply and demand for dated labor was used in my more classically oriented *Austrian Macroeconomics* (1978). However, the point-input construction does violence to the notion of a production process. Continuous input, divided for heuristic purposes into a number of stages, seems more in the spirit of Austrian capital theory.

The location of the economy on the PPF implies full employment, or, equivalently, the “natural” rate of unemployment. The mutual compatibility of

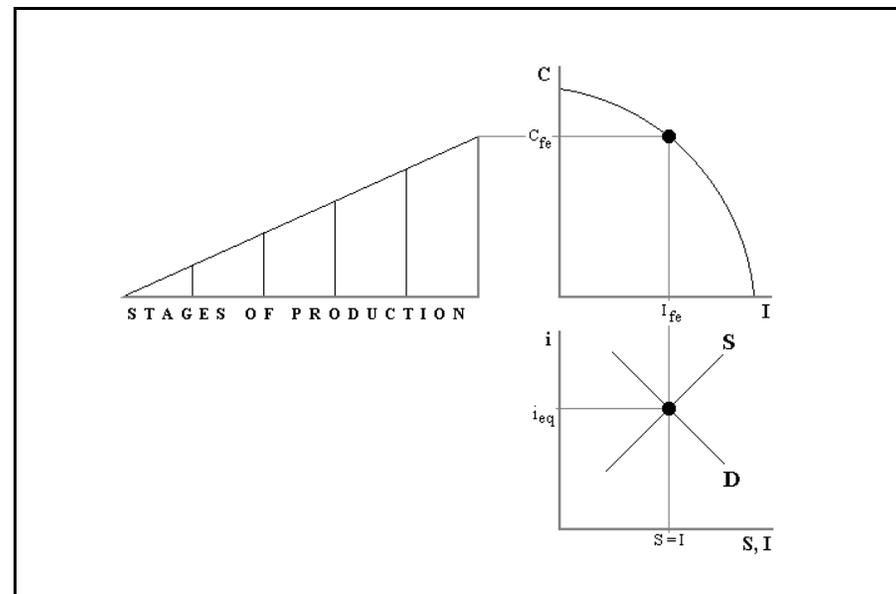


Figure 3.7: The Macroeconomics of Capital Structure

the three elements implies that the market-clearing interest rate is the “natural” rate of interest. (Note that the natural rate of interest cannot be defined solely in terms of the loanable-funds market.) In its simplest interpretation, Figure 3.7 represents a fully employed, no-growth economy, such as depicted in terms of the PPF alone in Figure 3.4. Resources devoted to gross investment,  $I_{fe}$ , are just sufficient to offset capital depreciation. This investment is distributed among the various stages of production so as to allow each stage to maintain its level of output. There is no net investment. Income earners continue to consume  $C_{fe}$  and to save an amount that just finances the gross investment. The rate of interest reflects the time preferences of market participants. These steady-state interrelationships provide a macroeconomic perspective on Mises’s Evenly Rotating Economy and constitute a macroeconomic benchmark for the analysis of secular growth and cyclical fluctuations.

Figure 3.7 looks dramatically different, to say the least, from the diagrammatics of conventional macroeconomics. The specific relationship

between capital-based macroeconomics and, say, ISLM analysis or Aggregate-Supply/Aggregate-Demand analysis is not readily apparent. To compare and contrast Austrian macroeconomics with its Anglo-American counterpart in any comprehensive way would take our discussion too far afield. A few particular points of contrast, however, will help to put the differences into perspective.

First, unlike ISLM analysis, the graphics in Figure 3.7 do not include a market for money. Neither the money supply nor money demand are explicitly represented. Both in reality and in our analysis of it, money has no market of its own. Understanding the broadest implications of this truth sets the research agenda for monetary disequilibrium theory, which we take up in Chapter 11. Austrians, too, recognize the uniqueness of money in this respect. With trivial exceptions, money appears on one side of every exchange. Money, by definition, is the medium of exchange. But neither the transactions demand for money, as embedded in the classical equation of exchange, nor the speculative demand for money, as conceived by Keynes, makes a direct appearance in the Austrian-oriented construction. Consistent with Hayek's understanding, capital-based macroeconomics treats money as a "loose joint" in the economic system. As Hayek ([1935] 1967, p. 127) indicated early on, "the task of monetary theory [is] nothing less than to cover a second time the whole field which is treated by pure theory under the assumption of barter." The three-quadrant construction in Figure 3.7 can be taken to depict, if not actually a barter system, a tight-jointed system. That is, money is assumed to allow market participants to avoid the inefficiencies of barter—without introducing any inefficiencies of its own. So interpreted, the interrelationships shown in Figure 3.7 belong to the realm of pure theory.

To deny money its own diagram and even its own axis is not to downplay or ignore monetary considerations. Money is actually on *every* axis of *every* diagram. Monetary phenomena in the context of capital-based macroeconomics are to be accounted for by allowing for some looseness in the market process that governs the intertemporal allocation of resources. Monetary theory entails the identification of possible instances in which the system is out of joint, instances in which the intermediation of money allows misallocations to persist long enough to cause a macroeconomic problem. The Austrian theory of boom and bust, which presupposes an essential loose-jointedness, identifies a systematic misallocation of resources that could not possibly characterize a

tight-jointed system. Policy-induced intertemporal disequilibrium is the essence of the unsustainable boom. Thus, despite our explicit focus on saving, investment, consumption, and production time, the theory of boom and bust (to be presented in Chapter 4) is, root and branch, a monetary theory.

Second, unlike AggS/AggD analysis, Figure 3.7 does not keep track of changes in the price level. Keeping the equation of exchange in the background is not to deny the kernel of truth in the quantity theory of money. But intertemporal allocation is not governed primarily by (actual or anticipated) changes in the price level. It is governed by changes in relative prices within the capital structure. Tracking changes in the general level of prices as well as in relative prices would complicate the theory without adding substantially to it. Hayek was critical of pre-Keynesian monetary theorists for their nearly exclusive attention to the relationship between money and the general level of prices. There are other relationships in his view that have a stronger claim on our attention.

It is true, of course, that a falling price level in conditions of less-than-full employment increases the real value of money. If market participants engage in additional spending because of the increase in value of their money balances, the economy will move in the direction of full employment. This aspect of the equilibrating process, which gets emphasis in Monetarist constructions and became the focus of attention during the protracted debates between Keynes and the Classics, is treated in Chapter 10. The significance of the real-balance effect is very different for Keynesian theory than for Austrian theory. In Keynesian theory, the real-balance effect was the only prospect—and a dim prospect it was, in Keynes's judgment—for the successful market solution to the problem of depression. In the absence of a viable real-balance effect, the Keynesians had the argument won. There was no other effect in contention. If real balances didn't push the economy toward full employment, the economy could settle into an unemployment equilibrium. And even with a real-balance effect the Keynesians could concede defeat but only as a matter of strict theory. As a practical matter—a policy matter—the adjustment of demand to prevailing price level could be favored over allowing the price level to adjust to prevailing market demands.

In Austrian theory, the existence of the real balance effect is not in dispute, and the strength of the real balance effect is not at issue. But there *is* another

effect that has a claim on our attention, namely, the capital-allocation effect. Capital-based macroeconomics is designed to show that quite independent of any movements in the general price level, the adjustments of relative prices within the capital structure can bring the intertemporal allocation of resources into line with intertemporal consumption preferences without idling labor or other resources. To factor in price-level changes and their significance for the performance of the macroeconomy would be to detract from the unique aspects of the Austrian theory. Austrian-oriented treatments of price-level changes (induced alternatively by real and by monetary forces) can be found in Selgin (1991), Garrison (1996a), and Horwitz (2000).

Finally, unlike ISLM analysis, in which the employment of labor is assumed to move in lockstep with output and income, and unlike AggS/AggD analysis, in which aggregate supply is firmly based on the supply of and demand for labor, our capital-based analysis does not feature the labor market. Labor, of course, counts as an important input for each and every stage of production. But the fact that capital-based macroeconomics allows for allocation of inputs among stages implies that thinking in terms of *the* labor market is inadequate. Changes in the rate of interest will cause the demand for labor in some stages to increase and the demand for labor in other stages to decrease. When the allocation of labor is at issue, auxiliary diagrams will be added at the different stages of production to show the relative movements in labor demands and wage rates.

ISLM analysis and AggS/AggD analysis are too far removed from the issues of capital-based macroeconomics and from the issues that interest most modern macroeconomists to make an extended treatment of these frameworks worthwhile. The chapters in Part III will offer a labor-based macroeconomics that is more faithful to its origins and more directly comparable with the capital-based macroeconomics offered here.

### THE MACROECONOMICS OF SECULAR GROWTH

While a no-growth economy allows for the simplest and most straightforward application of our graphical analysis, an expanding economy is the more general case. Secular growth occurs without having been provoked by policy or by technological advance or by a change in intertemporal preferences. Rather, the ongoing gross investment is sufficient for both capital maintenance

and capital accumulation. The macroeconomics of secular growth is depicted in Figure 3.8, which shows an initial configuration ( $t_0$ ) plus two successive periods ( $t_1$  and  $t_2$ ).

As in Figure 3.4, the growth in Figure 3.8 is depicted by outward shifts in the PPF—from  $t_0$  to  $t_1$  to  $t_2$ . But we now see what must be happening with the other two elements of the interlocking construction. The rightward shifts in both the supply and the demand for loanable funds are consistent with the absence of any intertemporal preference changes. Savers are supplying increasing amounts of loanable funds out of their increasing incomes; the business community is demanding increasing amounts of loanable funds to maintain a growing capital structure and to accommodate future demands for consumer goods that are growing in proportion to current demands. With ongoing shifts in the supply and demand for loanable funds, the equilibrium rate of interest, which also manifests itself as the ongoing rate of return on capital generally, remains constant. Historically, increasing wealth has typically been accompanied by decreasing time preferences. Accordingly, shifts in the supply of loanable funds will likely outpace the shifts in demand, causing the interest rate to fall. Our treatment of secular growth abstracts from this relationship between wealth and time preferences.

The unchanging rate of interest of Figure 3.8 translates into an unchanging slope of the hypotenuse for the successive Hayekian triangles. The interest rate allocates resources among the stages of production so as to change the size but not the intertemporal profile of the capital structure. As the economy grows, more resources are committed to the time-consuming production process, and more consumer goods emerge as output of that process. Over time and with technology and resource availability assumed constant, the increases in both consumption and saving implied by the outward expansion of the PPF is consistent with the conventionally conceived long-run consumption function. That is, consumption rises with rising income, but it rises less rapidly than income since saving, which equals—and enables—investment, rises, too.

The macroeconomics of secular growth provides a more realistic baseline for analyzing particular changes in preferences or policies. In putting the graphics through their paces, however, the secular component of growth will be kept in the background. Changes in intertemporal preferences as well as policy changes will be analyzed on the assumption that we begin with a no-

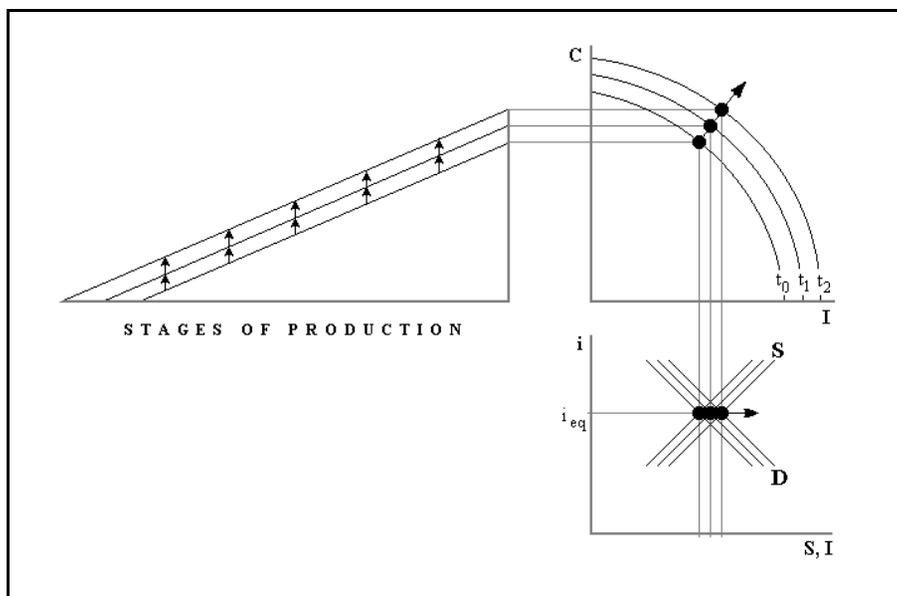


Figure 3.8: Secular Growth (with Assumed Interest-Rate Neutrality)

growth economy. With this simplifying assumption, the movement of the macroeconomy from one equilibrium to another will sometimes involve an absolute reduction in some macroeconomic magnitudes. Current consumption, for instance, might decrease while the economy's capacity to satisfy future consumer demands is being increased. In the fuller context of ongoing secular growth, the absolute decrease in consumption would translate into a reduced rate on increase in consumption. More generally, the macroeconomic adjustments required by some particular parametric or policy change are to be superimposed (conceptually if not graphically) onto the dynamics of the ongoing secular growth.

The macroeconomics of secular growth as depicted in Figure 3.8 does not keep track of the relationship between the money supply and the general level of prices. Money and prices can be kept in perspective, however, with the aid of the familiar equation of exchange,  $MV = PQ$ . For a given money supply ( $M$ ) and a given velocity of money ( $V$ ), the increases in both consumption and

investment ( $C+I=Q$ ) imply decreases in the general price level ( $P$ ). That is, secular growth is accompanied by secular price deflation. Unlike the deflationary pressures associated with an increase in the demand for money (or a decrease in the supply of money), growth-induced deflation does not imply monetary disequilibrium. Quite to the contrary, in a growing economy equilibrium lies in the direction of lower prices and wages. The downward market adjustments in the prices and wages take place in the particular markets where the growth is actually experienced, with the result that the average of prices is reduced. These are the issues dealt with by Selgin (1991), Garrison (1996a), and Horwitz (2000). The consequences of policy-induced changes in the price level will be deferred until the Austrian perspective on Monetarism is set out in Part IV.

The following chapter will deal with technology-induced changes in the economy's growth rate and with changes in the rate of interest and in the shape of the structure of production caused by changes in intertemporal preferences. Identifying the market process at work here is preliminary to the critical distinction between healthy economic growth, which is saving-induced (and hence sustainable), and artificial booms, which are policy-induced (and hence unsustainable).