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 are 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-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 of 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).
4 Sustainable and unsustainable growth

Secular growth characterizes a macroeconomy for which the ongoing rate of saving and investment exceeds the rate of capital depreciation. A change in the growth rate—or more generally—in the intertemporal pattern of consumable output may occur as a result of some change in the underlying economic realities. Advances in technology and additions to resource availabilities, as well as preference changes that favor future consumption over present consumption, impinge positively on the economy's growth rate. Such parametric changes have a direct effect in one or more of the panels of our capital-based macroeconomic framework and have indirect effects throughout. These instances of change in the sustainable growth rate are offered as preliminary to our discussion of the unsustainable growth induced by policy actions of the monetary authority.

Changes in technology and resource availabilities

Technological advance has a direct effect on the production possibilities frontier and on the market for loanable funds. Although a typical technological innovation occurs in one or a few markets, it allows, through resource reallocation, for increases in the production possibilities all around. That is, the frontier shifts outward (and possibly experiences a change in shape depending on the specific nature of the change in technology); the demand for loanable funds shifts to the right, as business firms take advantage of the new technological possibilities. The resulting higher incomes cause the supply of loanable funds to shift to the right as well.

The direction of movement of the interest rate is indeterminate, depending, as it does, on the relative magnitudes of the shifts in supply and in demand. This indeterminacy, however, presents us with no fundamental puzzle. It simply derives from the fact that the net gain attributable to the technological advance can be realized in part as greater consumption in current and near-future periods and in part as greater consumption in the more remote periods. Although the specific nature of the change in technology may set limits on the particular way in which the gains can be realized, there remains much scope for trading current consumption and
future consumption against one another. The advance in technology, whatever its particulars in terms of the timing of inputs and outputs, serves, in effect, to increase the potential of investable resources. To use the old Classical terminology, it is as if the subsistence fund had increased. There will almost always be ample opportunities to draw down the subsistence fund in ways not directly related to the change in technology (for instance, by decreasing current inventories of consumption goods) so as to take immediate advantage of the technological advance. While the rate of interest may rise temporarily while the economy is adjusting to the new technology, it is not necessarily the case—as it is in other macroeconomic constructions—that a (positive) technology shock causes the equilibrium rate of interest to rise.

Figure 4.1 depicts technology-induced growth in an instance where the technological change is interest-rate neutral. Here, we can identify two cases: (1) the technological advance affects all stages of production directly and proportionally, so that no reallocation of resources among the different stages is called for; and (2) scope for resource reallocation allows the implementation of technology that is usable only in one or a few stages to have an immediate or nearly immediate impact on current consumption. In either case, the economy's growth path would be shifted upward but would not otherwise change. The initial and subsequent equilibria are shown by the solid points in Figure 4.1. In the first case, there is no reason to believe that the interest rate would rise even temporarily. Investment, output, income, consumption, and saving would all rise together without putting pressure one way or the other on the rate of interest. In the second case, the demand for loanable funds rises first as producers seek to take advantage of new technology that directly affects, say, an early stage of production. The increase in investment is shown in Figure 4.1 by a rightward shift in the demand for loanable funds from D to D'. The interest rate rises, as indicated by the hollow point marking the intersection of S and D'. (Note also that the adjustment path between the initial PPF (t₀) and the subsequent PPF (t₁) exhibits an initial investment bias.) Because the technological advance occurred in an early stage, consumable output does not experience an immediate increase. However, the increased interest rate causes resources not directly involved in implementing the new technology to be reallocated towards the late and final stages of production, which allows consumption to increase. As incomes increase (due to increased investment spending) and consumption increases (due to resource reallocations), saving also increases. The supply of loanable funds shifts from S to S', and the interest rate is driven back to its initial level.

Apart from its showing the temporary increase in the rate of interest and the correspondingly bowed-out adjustment path between the two PPFs, our Figure 4.1, depicting technology-induced growth, is virtually identical to Figure 3.8, which depicts secular growth. We might as well have simply modified Figure 3.8 (p. 54) to show a discontinuity in consumable output occurring at the curves labeled τ₂ technological advance experience two y

The notion of technological advances has always been popular with economists, who have tried to help resolve the question of why some countries experience high rates of growth and others do not. However, the model of the business cycle that we have been using so far does not allow for technological shocks to have a direct impact on output. Instead, it is assumed that the economy adjusts to changes in technology through the allocation of resources. In other words, what looks like a discontinuity in the model is actually a smooth adjustment process that takes place over time.

Although a technological shock may have a temporary effect on output in the model, this effect is not permanent. The economy adjusts to the new technology through the allocation of resources, and the rate of growth returns to its previous level. This is in contrast to the real world, where technological shocks can have a lasting impact on output and the economy's growth rate.
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...in technology, whatever the new technology's outputs, serves, in the instances. To use the old technology to take advantage of the new technology (for instance, through the use of existing capital goods) so as to take immediate advantage of the higher rate of interest may save resources. Using the new technology, it is possible to make up for the diseconomic constructions in the equilibrium rate of interest (by a rightward shift in demand for services).

In an instance where the new technology produces a delay in production, we can identify two different stages of production directly as part of the model: the introduction of the new technology allows the implementation of the new technology to take place in a few stages to have an impact on the equilibrium rate of interest. In either case, the changes in the equilibrium rate of interest would be a result of the implication of the new technology. In the second case, resource producers seek to take advantage of the new technology at the early stage of production. For instance, a rightward shift in demand for services (as the interest rate rises, as shown by the intersection of S and D'). (Note that the demand curve S' is a rightward shift of S and D'.) The new technology allows the technological change, which does not experience resource price changes, to be reallocated to production, which allows for a rightward shift in the demand curve. The increased investment in the new technology (and reallocations), saving changes from S to S', and the...

...rate of interest and reallocation between the two PPFs, PPF_1 and PPF_2, is virtually identical to that in the case of the resource as well have simply increased in consumable output... occurring at the time of the change in technology. For instance, the set of curves labeled t_1 (in Fig. 3.8) could be relabeled t_2, indicating that a technological advance that had occurred in period t_1 allowed the economy to experience two years' worth of secular growth in a single year.

The notion that the economy experiences smooth secular growth has always been something of a fiction. By their very nature technological advances occur at irregular intervals and with some advances more dramatic than others. Knut Wicksell (1898) 1962: 165-77 relied on this irregularity to help reconcile observed movements in the rate of interest and the level of prices and to give plausibility to his rocking-horse theory of the business cycle. Joseph Schumpeter (1911) 1961: 57-64 featured the irregularity in his theory of economic development. Modern proponents of real business cycle theory (Nelson and Plosser, 1982) point to irregular technological shocks as the source of the variation of output that appears ... — to be cyclical in nature. That is, for real business cycle theorists, what looks like cyclical variation may be nothing but the market’s response to changes in technology.

Although a technological change is conceived as being interest-neutral in the comparative-statics sense, it is quite possible for the market process that takes a capital-intensive economy from one equilibrium to another to involve high interest rates for a substantial period. Unlike our second case above involving only a transitory change in the interest rate, the application...
of new technology may require committing resources to capital-intensive and hence time-consuming production processes in circumstances where the scope for reallocating other resources toward the late stages is limited. In this case, the increased demand for loanable funds may have a dominating effect on the interest rate for some time. Alternatively stated, if the increased supply of loanable funds is not fully accommodating (because higher-priced consumer goods have claimed a larger portion of incomes), the interest rate will rise, serving as a partial brake against fully exploiting the technological advance. The structure of production is being pushed in the direction of increased production time by the technological change itself and pulled in the opposite direction by people’s reluctance to forgo current consumption.

It is possible to conceive of a technological change that causes the rate of interest to fall during the adjustment process. Imagine the discovery of some simple process that can quickly and almost effortlessly convert kudzu (a worthless vine that blankets the south-eastern United States) into grits and other consumables. The immediate result of the new technology is that income earners are awash in current consumption. With demands for current output more fully satisfied than before, they willingly put more of their incomes at interest. The increase in the supply of loanable funds lowers the rate of interest and channels funds into the implementation of longer-term projects, using technology that, though not new, can only now be profitably implemented. The fact that the kudzu-to-grits technology seems a bit contrived gives plausibility to the more common association between technological advance and a (temporarily) higher interest rate.

As suggested by our reference to Figure 3.8, tracking the changes of the macroeconomic magnitudes after a technological innovation requires that these changes be superimposed onto the secular growth that the economy was experiencing even before the innovation. It may well be that the initial increase in the interest rate, which acts as a brake on the rate at which technological advance is exploited, is followed by a decrease in the interest rate, as the accelerated accumulation of wealth (relative to accumulation prior to the innovation) is accompanied by a change in intertemporal consumption preferences. Allowing for this effect (from innovation to increased wealth to lower time preferences), we see technological innovation as causing the equilibrium rate of interest to fall even though the adjustment to this new equilibrium may involve a temporarily high interest rate. More importantly for the application of our capital-based macroeconomic framework, the economy’s pattern of growth, as boosted by the technological advance, is a sustainable one. That is, the change in the underlying economic realities imply an altered growth path; the market process translates the technological advance into the new preferred growth path; and there is nothing in the nature of this market process that turns the process against itself.

The possible consequences of an increase in resource availabilities are similar to those of technological advance. Discovering new mineral deposits is equivalent if extracting mine... 

Changes in int...
is equivalent in many respects to discovering new and better ways of extracting minerals from old deposits. In either case, the economy's post-discovery growth path is sustainable in the above-mentioned sense. In each instance of increased resource availabilities and technological advance, the specifics of the market process triggered by the parametric change depend on the specifics of the parametric change itself. Apart from our suggested reinterpretation of Figure 3.8 and the incorporation of the wealth effects on intertemporal consumption preferences and hence on the interest rate, the attempt to identify and deal further with some general case is not likely to be worthwhile.

In contrast to changes in technology and resource availabilities, a change in intertemporal consumption preferences has consequences for which the direction of change in the rate of interest and related macroeconomic magnitudes is determinate and for which a general case can be identified. Further, the parallels between the consequences of a change in intertemporal preferences and the consequences of a policy of credit expansion by the monetary authority give special relevance to these preference changes and policy actions.

**Changes in intertemporal preferences**

Changes in technology and resource availabilities give rise to permanent, or sustainable, changes in the economy's growth path. Sustainable growth can also be set in motion by changes in intertemporal preferences. Our framework is well suited to trace out the consequences of such a preference change. It is convenient simply to hypothesize an autonomous economy-wide change in intertemporal preferences: people become more thrifty, more future oriented in their consumption plans. In reality, of course, intertemporal preference changes are undoubtedly gradual and most likely related to demographics or cultural changes. For instance, baby boomers enter their high-saving years. Or increasing doubts about the viability of Social Security cause people to save more for their retirement. Or education-conscious parents begin saving more for their children's college years. The essential point is that intertemporal preferences can and do change and that these changes have implications for the intertemporal allocation of resources.

The assumption underlying labor-based macroeconomics is that there is a high degree of complementarity between consuming in one period and consuming in the next. On the basis of this assumption, it is believed, changes in intertemporal preferences can be safely ruled out of consideration. By contrast, capital-based macroeconomics allows for some degree of intertemporal substitutability of consumption. Rejecting the assumption of strict intertemporal complementarity does not imply - as Cowen (1997: 84), for one, suggests that it does - that the actual changes experienced are frequent and dramatic. Quite to the contrary, the claim is that over time even small changes have a significant and cumulative effect on the
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Pattern of resource allocation. More pointedly, capital-based macroeconomics suggests that if the interest rate reports a small change when none actually occurred (or fails to report a small change that actually did occur), the consequences can be cumulative misallocations that eventually lead to a dramatic correction.

In Figure 4.2 an increase in thriftiness — in people’s willingness to save — is represented by a rightward shift in the supply of loanable funds. The implied decrease in current consumption is consistent with a change in the intertemporal pattern of consumption demand: people restrict their consumption now in order to be able to consume more in the future. The implication of higher consumption demand in the future was expressed in Chapter 3 as SUFS: saving-up-for-something. This understanding of the nature of saving gives rise to a key macroeconomic question: How does the market process translate changes in intertemporal preferences into the appropriate changes in intertemporal production decisions? To presuppose, following Keynes, that reduced consumption demand in the current period implies proportionally low consumption demands in subsequent periods is wholly unwarranted. It would follow trivially that for an economy in which the expectations of the business community were governed by such a presupposition, the market process would experience systematic coordination failures whenever saving behavior changed. This rather telling aspect of the Keynesian vision begs the question about the viability of a market economy in circumstances where intertemporal preferences can change and raises the more fundamental question of how the current intertemporal pattern of resource allocation ever got to be what it is.

![Figure 4.2 Saving-induced capital restructuring.](image-url)
Straightforwardly, the change in credit-market conditions results in a decrease in the rate of interest and an increase in the amount of funds borrowed by the business community, as depicted by the solid point marking the new equilibrium in the loanable-funds market. The corresponding solid point in the PPF diagram shows that the resources freed up by the reduced consumption can be used instead for investment purposes. Note the consistency in the propositions that (1) there is a movement along the PPF rather than off the PPF; and (2) there is no significant income effect on the supply of loanable funds. If consumption decreased without there being any offsetting increase in investment, then incomes would decrease as well and so too would saving and hence the supply of loanable funds. The negative income effect on the supply of loanable funds would largely if not wholly negate the effects of the preference change. Keynes’s paradox of thrift would be confirmed: increased thriftiness leads not to an increased growth rate but to decreased incomes. Making matters worse, the decreased incomes and hence decreased spending may well induce a pessimism into the business community, which would result in a leftward shift in the demand for loanable funds. These and other perceived perversities will be explored more fully in Chapter 8.

In our capital-based macroeconomics, allowing a shift of the supply of loanable funds to move us along a given demand, allowing a lower interest rate to induce a higher level of investment, and allowing the economy to stay on its production possibilities frontier are just mutually reinforcing ways of acknowledging that markets, even intertemporal markets, need not function perversely. The mutually reinforcing views about the different aspects of the market system is what Keynes had in mind when he indicated at the close of his chapter on the "Postulates of Classical Economics" that those postulates all stand or fall together. Figure 4.2 reflects the view that our postulates stand together. The market works. But just how the intertemporal markets work requires that we shift our attention to the intertemporal structure of production. The alleged shape of the Hayekian triangle shows just how the additional investment funds are used. The rate of interest governs the intertemporal pattern of investment as well as the overall level. The lower interest rate, which is reflected in the more shallow slope of the triangle’s hypotenuse, favors relatively long-term investments. Resources are bid away from late stages of production, where demand is weak because of the currently low consumption, and into early stages, where demand is strong because of the lower rate of interest. That is, if the marginal increment of investment in early stages was just worthwhile, given the costs of borrowing, then additional increments will be seen as worthwhile, given the new, lower costs of borrowing. While many firms are simply reacting to the spread between their output prices and their input prices in the light of the reduced cost of borrowing, the general pattern of intertemporal restructuring is consistent with an anticipation of a strengthened future demand for consumption goods made possible by the increased
saving. It is not actually necessary, of course, for any one entrepreneur or for entrepreneurs collectively to explicitly form an expectation about future aggregate consumption demand.

The triangle depicts relative changes in spending patterns attributable to increased savings; it does not show the ultimate increase in output of consumption goods made possible by increased investment. To visualize the intertemporal pattern of consumption that follows an increase in thrift, we must superimpose the relative changes depicted in Figure 4.2 onto the secular growth depicted in Figure 3.8. Figure 4.2 by itself suggests an actual fall in consumption. The two figures taken together suggest a slowing of the growth of consumption while the capital restructuring is being completed followed by an acceleration of the growth rate. The growth rate after the capital restructuring will be higher than it was before the preference change. The rate of increase in consumption may go from 2 percent to 1½ percent to 2½ percent. This pattern of output is consistent with the hypothesized change in intertemporal preferences.

Figure 4.3 differs from Figure 4.2 only by its including some auxiliary diagrams that track the movement of labor during the capital restructuring. The increased saving can be seen as having two separate effects on labor demand. The two concepts at play here, already discussed in the context of the Hayekian triangle itself, are derived demand and time discount. (1) Labor demand is a derived demand. Thus, a reduction in the demand for consumption goods implies a proportionate reduction in the labor that produces those consumption goods. For stages of production sufficiently close to final output, this effect dominates. The demand for retail sales personnel, for instance, falls in virtual lockstep with the demand for the products they sell. (2) Like all factors of production in a time-consuming production process, labor is valued at a discount. The reduction in the interest rate lessens the discount and hence increases the value of labor. In the late stages of production, this effect is negligible; in the earliest stages of production, it dominates. The two effects, then, work in opposite directions — with the magnitude of the time-discount effect increasing with temporal remoteness from the final stage of production. Together, they change the shape of the Hayekian triangle. The intersection of the two hypotenuses (that characterize the capital structure before and after the intertemporal preference change) marks the point where the two effects just offset one another.

The structure of production in Figure 4.3 is cut at three different points to illustrate the workings of labor markets. Labor experiences a net decrease in demand for the stage between the intersection of the hypotenuses and final output; labor experiences a net increase in demand for the stage between the intersection of the hypotenuses and the earliest input. Initially the wage rate falls in the late stage and rises in the early stage. After the pattern of employment fully adjusts itself to the new market conditions (with workers moving from the late stage to the early stage) the wage rate returns to its initial level. Also, the increased saving is newly created every year. Employment before the increase in thrift and capital restructuring is supplied via the demand for labor that is typical in specific markets for long-run equilibrium (1967: 80) as a “factor of current potential changes in the economy.”

Labor in this respect is a factor production, but one that is replaceable from stage to another. This is a crucial element in long-run supply of factors of production in two directions. First, it allows us to identify a particular stage of the cycle as a significant part of the capital structure that will move from one stage to another to increase or suffer a decrease.

Second, the auxiliary diagrams for labor also depict the movement of a factor simply move from one stage of production to another of the time discount curve, for example, horses and lawn furniture. In general, these factors undergo primarily one production stage change.
initial level. Also shown is the labor market for a stage of production that is newly created as a result of the preference changes. The supply and demand for labor at this stage did not intersect at a positive level of employment before the reduction of the interest rate; after the reduction, some employment is supplied and demanded. The pattern of demand in our stage-specific markets for labor is consistent with that shown by Hayek ([1935] 1967: 80) as a “family of discount curves,” with which he tracks the differential changes in labor demand in five separate stages of production.

Labor in this reckoning is treated as a wholly nonspecific factor of production, but one that has to be enticed by higher wage rate to move from one stage to another. That is, the short-run supply curve is upward-sloping, the long-run supply curve is not. This construction requires qualification in two directions. First, skills that make a particular type of labor specific to a particular stage would have to be classified as (human) capital, an integral part of the capital structure itself. Workers with such skills would not move from one stage to another. Instead, they would enjoy a wage-rate increase or suffer a wage-rate decrease, depending upon the particular stage. Second, the auxiliary graphs depicting movements of nonspecific labor could also depict the movements of nonspecific capital. These capital goods will simply move from one stage to another in response to the differential effects of the time discounting. For instance, trucks that had been hauling sawhorses and lawn furniture may start hauling more sawhorses and less lawn furniture. In general and for any given stage of production, the specific factors undergo price adjustments; the nonspecific factors undergo quantity
adjustments. This understanding allows full scope, of course, for both price and quantity adjustments for the various degrees of specificity that characterize the different kinds of capital and labor. In putting our capital-based macroeconomic framework through its paces, however, it is often convenient—and is consistent with convention—to think of labor as representing the nonspecific factor of production.

The idea that the wage rate returns to its initial level after all the relative adjustments have been made deserves further comment. In Figure 4.3, the interest rate falls; the wage rate remains unchanged. This pattern of change stands in contrast to the pattern that characterizes the analytics offered, for instance, by Samuelson (1962). The neoclassical construction features a so-called factor-price frontier that depicts a negative relationship between the wage rate and the interest rate. In this reckoning, however, labor is cast in the role of the time-intensive factor of production. Inputs consist of dated labor that matures with time into consumable output. Capital, which is nothing but the not-yet-fully-matured labor input, is by construction closer in time to final output than is labor itself. Hence, a fall in the rate of interest would lead, by virtue of the time-discount effect, to a rise in the wage rate. This relationship has its parallel in our capital-based macroeconomics: a fall in the interest rate leads to a rise in the prices of factors of production that are employed in the early stages. The rise is permanent for the specific factors; temporary for the nonspecific factors.

Our treatment of labor in Figure 4.3 also stands in contrast to certain aspects of classical theory, such as is found in David Ricardo's ([1817] 1911: 263–71) treatment of labor and machinery. In his writing, capital is treated as the long-term, or time-intensive, factor of production and labor is treated as the short-term factor. A reduction in the rate of interest, then, favors the use of machinery over the use of labor. If this were Ricardo's whole story, then interest rates and wage rates would move up and down together. In the final analysis, however, displaced labor is hired to help produce the machines. This is the general thrust of Mill's ([1848] 1895: 65) fourth fundamental proposition respecting capital: "demand for commodities [i.e. consumption goods] is not demand for labor." Though slightly cryptic, this once famous aphorism simply means that the principle of derived demand does not apply to labor as a whole. The time-discount effect is sufficiently offsetting in the earlier stages of production that the net effect on total demand for labor is nil. Ultimately, that is, the change in the interest rate affects the pattern of employment and not the magnitude. This is the message in Hayek's third and final appendix in his Pure Theory of Capital, "Demand for Commodities is Not Demand for Labor" versus the Doctrine of 'Derived Demand.'

In our capital-based macroeconomics, labor is treated as a nonspecific factor of production that is employed in all stages of production. It is neither so predominantly concentrated in the early stages of production that the wage rate rises when the interest rate falls nor so predominantly concen-

trated in the late stages of production that the wage rate rises as the interest rate falls. Of course, these two extremes could be distorted in relative prices if the wage rate is driven up by the supply of labor or if the interest rate is driven down by the demand for capital. Figure 4.3 must be interpreted with caution.

Finally, we can think of the wage rate as a demand function against any surplus of labor that exists. In the context of capital's effects within the production process, the wage rate is a time-weighted average of the interest rate; in the context of capital's transitional adjustment to the auxiliary labor demand, it is a relative wage; in the context of labor's demand for durables, it is a price to match the relative wages of labor's fellow workers.

The macrocredit

Understanding the relationship between investments and average prices is perhaps the most important macrocredit relationship. The price level, or (more correctly) the relative price level but with a twist, is the relevant relative price level.

Our understanding of movements in the relative demand for labor is an important focus, however, is not simply a matter of listening to the forces that are driving the relative price level. Our attention to this aspect of the economy is also important because of the role played by Hayek ([1928] 1933) in relative prices of labor and capital. The reason for focusing on the relative price level is not simply that it is an important determinant of the relative price level, but also that it is an important determinant of the relative price level.
trated in the late stages that the wage rate falls along with a falling interest rate. Of course, in particular applications, if labor is for some reason believed to be disproportionately concentrated in early stages or in late stages, then Figure 4.3 must be modified to show the corresponding change in the wage rate.

Finally, we can note that the treatment of labor in Figure 4.3 warns against any summary treatment of the labor market. The market’s ability to adjust to a change in the interest rate hinges critically on differential effects within the more broadly conceived market for labor. In the late stages of production, wages fall and then rise in response to a reduced interest rate; in the early stages, wages rise and then fall. (The opposing transitional adjustments in wage rates are shown by the hollow points in the auxiliary labor-market diagrams in Figure 4.3.) These are the critical relative wage effects that adjust the intertemporal structure of production to match the new intertemporal preferences.

The macroeconomics of boom and bust

Understanding the market process that translates a change in intertemporal preferences into a reshaping of the economy’s intertemporal structure of production is prerequisite to understanding the business cycle, or more narrowly, boom and bust. Capital-based macroeconomics allows for the identification of the essential differences between genuine growth and an artificial boom. The key differences derive from the differing roles played by savers and by the monetary authority.

The intertemporal reallocations brought about by a preference change, as illustrated in Figures 4.2 and 4.3, did not involve the monetary authority in any important respect. The different aspects of the market process that transformed the macroeconomy from one intertemporal configuration to another were mutually compatible, even mutually reinforcing. Equilibrium forces were taken to prevail whether the central bank held the money supply constant, in which case real economic growth would entail a declining price level, or (somehow) increased the money supply so as to maintain a constant price level but without the monetary injections themselves affecting any of the relevant relative prices.

Our understanding of boom and bust requires us to take monetary considerations explicitly into account for two reasons. First, the relative-price changes that initiate the boom are attributable to a monetary injection. The focus, however, is not on the quantity of money created and the consequent (actual or expected) change in the general level of prices. The nearly exclusive attention to this aspect of monetary theory was the target of early criticism by Hayek ([1928] 1975a: 103–9). Rather, following Mises and Hayek, our focus is on the point of entry of the new money and the consequent changes in relative prices that govern the allocation of resources over time. A second reason for featuring money in this context is very much related to the first.
The different aspects of the market process set in motion by a monetary injection, unlike the market process discussed with the aid of Figures 4.2 and 4.3, are not mutually compatible. They work at cross-purposes. But money — to use Hayek’s imagery — is a loose joint in an otherwise self-equilibrating system. The conflicting aspects of the market process can have their separate real effects before the conflict itself brings the process to an end. The very fact that the separate effects are playing themselves out in intertemporal markets means that time is an important dimension in our understanding of this process.

Daring from the early work of Ragnar Frisch (1933), it has been the practice to categorize business cycle theory in terms of the impulse (which triggers the cycle) and the propagation mechanism (which allows the cycle to play itself out). Describing the Austrian theory of the business cycle as monetary in nature on both counts is largely accurate. Money, or more pointedly, credit expansion, is the triggering device. And although in a strict sense the relative-price changes within the intertemporal structure of production constitute the proximate propagation mechanism, money — because of the looseness that is inherent in the nature of indirect exchange — plays a key enabling role.

Figure 4.4 depicts the macroeconomy's response to credit expansion. Intertemporal preferences are assumed to be unchanging. The money supply is assumed to be under the control of a monetary authority, which we will refer to as the Federal Reserve. The supply of loanable funds includes both saving by income earners and funds made available by the Federal Reserve. The notion that new money enters the economy through credit markets is consistent with both the institutional details of the Federal Reserve and with the history of central banking generally. Students of macroeconomics find themselves learning early on the differences among the three policy tools used by the Federal Reserve to change the money supply: (1) the required reserve ratio set by the Federal Reserve and imposed on commercial banks; (2) the discount rate set by the Federal Reserve and used to govern the level of direct short-term lending to commercial banks; and (3) open market operations through which the Federal Reserve lends to the government by acquiring securities issued by the Treasury. These tools differ from one another in terms of the frequency of use, the intensity of media attention, and the implication about the future course of monetary policy.

Of overriding significance for our application of capital-based macroeconomics, however, is the characteristic common to all these tools. The three alternative policy tools are simply three ways of lending money into existence. Reducing the required reserve ratio means that commercial banks have more funds to lend, which means they will have to reduce the interest rate to find additional borrowers. Lowering the discount rate will cause banks to borrow more from the Federal Reserve — with competition among the banks reducing their lending rates as well. Central bank purchases of Treasury securities constitute lending directly to the federal government.

We see that, on the supply of the credit (loanable funds) is $4.3. This constitutes additional boom. The initial effect of the induced boom may not translate into an increase in the level of money balances, with effects of the boom having positive effects on the economy.

The initial effect of the induced boom is positive, but the effects are dampened by the sterilization of the additional credit by the central bank.
which, like other instances of increased lending, puts downward pressure on the interest rate.

We see the direct effect of lending money into existence, the impulse, on the supply side of the loanable-funds market in Figure 4.4. The extent of the credit expansion (the horizontal displacement of the supply of loanable funds) is set to match the increase in saving shown in Figures 4.2 and 4.3. This construction gives us the sharpest contrast between a preference-induced boom and a policy-induced boom. The new money in the form of additional credit is labeled ΔM, in recognition that monetary expansion may not translate fully into credit expansion. Some people may choose to increase their holdings, or hoards, of money (by ΔM_h) in response to policy-induced changes in the interest rate. Such changes in the demand for cash balances, while certainly not ruled out of consideration and not without effects of their own, are of secondary importance to our capital-based account of boom and bust.

The initial effect on the rate of interest is much the same for both the preference-induced boom of Figure 4.2 and the policy-induced boom of Figure 4.4. An increased supply of loanable funds causes the interest rate to fall. In application, of course, we must gauge this "fall" relative to the rate that would have prevailed in the absence of credit expansion. What matters is the divergence between the market rate and the natural rate (to use Wicksell's terminology). Suppose, for instance, that there is upward pressure on the natural rate because of technological innovations that directly
affect the early stages of production (as depicted in Figure 4.1) but that the Federal Reserve expands credit to keep interest rates from rising. There is no basis for believing that the unchanged rate of interest would allow the market to adjust more quickly or more efficiently to the change in technology. Rather, our analysis of boom and bust would still apply—due allowances being made for the market's simultaneous attempt to adjust for changes in the underlying economic realities.

The telling difference between Figures 4.2 and 4.4 is in terms of the relationship between saving and investment. In Figure 4.2, investment increases to match the increase in saving. But in Figure 4.4, these two magnitudes move in opposite directions. Padding the supply of loanable funds with newly created money drives a wedge between saving and investment. With no change in intertemporal preferences, the actual amount of saving decreases as the interest rate falls, while the amount of investment, financed in part by the newly created funds, increases.

We can trace upward to the PPF to get a second perspective on the conflicting movements in saving and investment. Less saving means more consumption. Market forces reflecting the preferences of income-earners are pulling in the direction of more consumption. Market forces stemming from the effect of the artificially cheap credit are pulling in the direction of more investment. One set of forces is pulling north (parallel to the C axis); the other set pulling east (parallel to the I axis). The two forces resolve themselves into an outward movement—toward the north-east. Increases in the employment of all resources, including labor, beyond the level associated with a fully employed economy cause the economy to produce at a level beyond the PPF.

Is it possible for the economy to produce beyond the production possibilities frontier? Yes, the PPF is defined as sustainable combinations of consumption and investment. Why is it that the opposing market forces do not simply cancel one another, such that the economy is left sitting at its original location on the PPF? There are two ways to answer this question both of which derive from Hayek's notion of money as a loose joint.

First, because of the inherent looseness, the decisions of the income-earner-cum-consumer-saver and the separate (and ultimately conflicting) decisions of the entrepreneur-cum-investor can each be carried out at least in part before the underlying incompatibility of these decisions become apparent. The temporary success of monetary stimulation policies as experienced by all central banks of all Western countries is strong evidence of the scope for real consequences of the sort shown. Second, and equivalently, the movement beyond the PPF is in fact the first part of the market process through which the opposing forces do ultimately cancel one another.

If this temporary movement beyond the frontier were the essence of capital-based account of boom and bust, then our capital-based theory and the widely exposted labor-based theory that involves a play-off between the short-run Phillips curve and the long-run Phillips curve would be very similar. At this point the two theories are not independent because the dominated in the former is (somehow) inoperative and impinges on the latter. The directness of this problem is so that lacking in the labor market it is often implicit in the differential prices of the relevant aspects of labor.

Also significant is the role of the labor-market in the economy as applicable since the level of prices is not dependent on the level of prices. For a constant price level to hold pressure on the economy, the pressure on the price level does not apply. Inflation lagging behind analysis hinges on changes in the gene.

In other words, the response to the labor-based shift is still significant in other words, still significant in this analysis, and still significant in others. The question is whether a change in the demand for labor or a change in the supply of labor affects the PPF for the demand for labor and investment in the economy in opposite directions. The process requires that we think about the relative rate of interest levels and the demand for labor and investment in the economy in opposite directions. The process requires that we think about the relative rate of interest levels and the demand for labor and investment in the economy in opposite directions. The process requires that we think about the relative rate of interest levels and the demand for labor and investment in the economy in opposite directions. The process requires that we think about the relative rate of interest levels and the demand for labor and investment in the economy in opposite directions.
similar. At this point in the analysis, the most salient difference between the two theories stems from the difference in the way money is injected. In our capital-based analysis, money is injected through credit markets and impinges in the first instance on interest rates. In Phillips curve analysis, money is (somehow) injected directly into spending streams of income earners and impinges in due course on (perceived and actual) wage rates. The directness of the capital-based analysis gives it a certain plausibility that is lacking in the labor-based analysis. The labor-based analysis has to incorporate some counterfactual method of injection money — such as Friedman’s often invoked supposition that the money is dropped from a helicopter — in order to eliminate injection effects and focus attention on the differential perceptions of employers and employees, which, in turn, affect the supply and demand for labor. A full discussion of this and other relevant aspects of Monetarism is offered in Chapter 10.

Also significant is the fact that the capital-based analysis is more broadly applicable since the market process set in motion by credit expansion does not depend in any essential way on there being a change in the general level of prices. For instance, during the boom of the 1920s, the relatively constant price level was the net result of genuine growth, which put downward pressure on the price level, and credit expansion, which put upward pressure on the price level. The short-run/long-run Phillips curve analysis simply does not apply to this episode since there is no scope for expected inflation lagging behind actual inflation. There was no inflation. Our capital-based analysis, hinging as it does on relative price changes and not on changes in the general level of prices, does apply to the 1920s episode. In other words, the boom and bust of the inter-war years is an exception to the labor-based story but is a primary example of our capital-based story. Still other important differences — pertaining to the two theories’ differing implications — will be identified below.

Figure 4.4 shows that the initial phase of the market process triggered by credit expansion is driven by the conflicting behavior of consumers and investors and involves the over-production of both categories of goods. The wedge between saving and investment shown in the loanable-funds market translates to the PPF as a tug-of-war (with a stretchable rope) between consumers and investors. Conflicting market forces are trying to pull the economy in opposite directions. Understanding subsequent phases of this process requires that we assess the relative strengths of the combatants in this tug-of-war. As the rope begins to stretch, the conflict is initiated initially in favor of investment spending — because the investment community has more to pull with, namely, the new money that was lent into existence at an attractive rate of interest. In the Austrian analysis, while an increased labor input — and a general over-production — is undoubtedly part of story, there is also a significant change in the pattern of the capital input. The movement beyond the frontier gives way to a clockwise movement; the unsustainable combination of consumption and investment takes on a distinct investment bias.
We have seen that a change in intertemporal preferences sets in motion a process of capital restructuring, as depicted by the Hayekian triangles of Figure 4.2. Credit expansion sets in motion two conflicting processes of capital restructuring, as depicted in Figure 4.4. The tug-of-war between investors and consumers that sends the economy beyond its PPF pulls the Hayekian triangle in two directions. Having access to investment funds at a lower rate of interest, investors find the longer-term investment projects to be relatively more attractive. A less steeply sloped hypotenuse illustrates the general pattern of reallocation in the early stages of the structure of production. Some resources are bid away from the intermediate and relatively late stages of production and into the early stages. At the same time, income earners, for whom that same lower interest rate discourages saving, spend more on consumption. A more steeply sloped hypotenuse illustrates the general pattern of reallocation in the final and late stages of production. Some resources are bid away from intermediate and relatively early stages into these late and final stages. Mises (1966: 559, 567, and 575) emphasizes the "malinvestment and over-consumption" that are characteristic of the boom. In effect, the Hayekian triangle is being pulled at both ends (by cheap credit and strong consumer demand) at the expense of the middle — a tell-tale sign of the boom's unsustainability. Our two incomplete and differentially sloped hypotenuses bear a distinct relationship to the aggregate supply vector and aggregate demand vector suggested by Mark Skousen (1990: 297) and are consistent with the expositions provided by Lionel Robbins ([1934] 1971: 30–43) and Murray Rothbard ([1963] 1972: 11–39).

In sum, credit expansion sets into motion a process of capital restructuring that is at odds with the changed preferences and hence is ultimately ill-fated. The relative changes within the capital structure were appropriately termed malinvestment by Mises. The broken line in the upper reaches of the less steeply sloped hypotenuse indicates that the restructuring cannot actually be completed. The boom is unsustainable; the changes in the intertemporal structure of production are self-defeating. Resource scarcities and a continuing high demand for current consumption eventually turn boom into bust. 

At some point in the process beyond what is shown in Figure 4.4, entrepreneurs encounter resource scarcities that are more constraining than was implied by the pattern of wages, prices, and interest rates that characterized the early phase of the boom. Here, changing expectations are clearly endogenous to the process. The bidding for increasingly scarce resources and the accompanying increased demands for credit put upward pressure on the interest rate (not shown in Figure 4.4). The unusually high (real) interest rates on the eve of the bust is accounted for in capital-based macroeconomics in terms of Hayek's ([1937] 1975c) "Investment that Raises the Demand for Capital." The "investment" in the title of this neglected article refers to the allocation of resources to the early stages of production; the "demand for capital" is best understood as the demand for resources to meet the rising demand for current consumption. In this way, the demand for capital is equivalent to the demand for ready-made goods and services, which is equivalent to the demand for current consumption. The "demand for capital" is best understood as the demand for consumer goods and services, which is equivalent to the demand for current consumption.


"demand for capital" (and hence the demand for loanable funds) refers to complementary resources needed in the later stages of production. The inadvisability of theorizing in terms of the demand for investment goods — and hence of assuming that the components of investment are related to one another primarily in terms of their substitutability — is the central message of Hayek's article. Though without reference to Hayek or the Austrian School, Milton Friedman coined the term "distress borrowing" (Brimelow, 1982: 6) and linked the high real rates of interest on the eve of the bust to "commitments" made by the business community during the preceding monetary expansion. While Friedman sees the distress borrowing as only incidental to a particular cyclical episode (correspondence), capital-based macroeconomics shows it to be integral to the market process set in motion by credit expansion. These issues are raised again in Chapters 10 and 11.

Inevitably, the unsustainability of the production process manifests itself as the abandonment or curtailment of some production projects. The consequent unemployment of labor and other resources impinge directly and negatively on incomes and expenditures. The period of unsustainably high level of output comes to an end as the economy falls back in the direction of the PPF. Significantly, the economy does not simply retrace its path back to its original location on the frontier. During the period of over-production, investment decisions were biased by an artificially low rate of interest in the direction of long-term undertakings. Hence, the path crosses the frontier at a point that involves more investment and less consumption than the original mix.

Had investors been wholly triumphant in the tug-of-war, the economy would have been pulled clockwise along the frontier to the hollow point, fully reflecting the increase in loanable funds. The vertical component of this movement along the PPF would represent the upper limits of forced saving. That is, contrary to the demands of consumers, resources would be bid away from the late and final stage and reallocated in the earlier stages. The horizontal component of the movement along the PPF represents the over-investment that corresponds to this level of forced saving. (Had consumers been wholly triumphant in the tug-of-war, the economy would have been pulled counter-clockwise along the frontier, fully reflecting the policy-induced decrease in saving. The vertical component of this movement along the PPF represents the upper limits of the corresponding over-consumption.)

Since the counterforces in the form of consumer spending are at work from the beginning of the credit expansion, the actual forced saving and over-investment associated with a credit expansion are considerably less than the genuine saving and sustainable investment associated with a change in intertemporal preferences. (Notice also that the actual forced saving is not inconsistent with the actual over-consumption that characterized an earlier part of the process.) The path of consumption and investment shown in Figure 4.4 has the economy experiencing about half the movement along
the PPF as was experienced in the case of an intertemporal preference change. The only substantive claims suggested by our depiction is that the direction of the movement will be the same (in Figure 4.4 as in Figure 4.2) and that the magnitude will be attenuated by the counterforces. Alternatively stated, our construction suggests that the counterforces are at work but do not work so quickly and so completely as to prevent the economy from ever moving away from its original location on the PPF. This is only to say that a market economy, in which the medium of exchange loosens the relationships that must hold in a barter economy, does not and cannot experience instantaneous adjustments.

Although the point at which the adjustment path crosses the PPF is a sustainable level of output, it is not a sustainable mix. Here, capital-based macroeconomics highlights a dimension of the analysis of an unsustainable boom that is simply missing in short-run/long-run Phillips curve analysis. With its exclusive focus on labor markets and its wholesale neglect of injection effects, the economy’s return to its natural rate of unemployment leaves the mix of output unaltered. In these circumstances, prospects for a “soft landing” at the natural rate seem good. Considerations of the economy’s capital structure, however, cause these prospects to dim. There is no market process that can limit the problem of malinvestment to the period of overinvestment. We could not expect – or even quite imagine – that the economy’s adjustment path would entail a sharp right turn at the PPF. Almost inevitably, some of the malinvestment in early stages of production would involve capital that is sufficiently durable and sufficiently specific to preclude such a quick resolution. Here, a key difference between the effects of a change in technology and the effects of a cheap-credit policy are worth noting. In the case of technological innovation, we argued that the drawing down of inventories in the late stages can convert some stage-specific change in technology into greater consumption without the particulars of the technological change having a dominating effect on the time pattern of consumption. By contrast, the general reallocation of resources towards long-term projects during a period of decreased saving can result in a structure of production that has limited scope for accommodating current and near-future consumption demands. The specificity and durability of the long-term capital does not allow for a general and timely reversal. The limitations on a timely recovery are stressed by Hayek (1945a) and more recently by McCulloch (1981: 112–14) with specific reference to movements off and along the PPF.

Further, the conventionally understood interaction between incomes and expenditures that initially propelled the economy beyond the PPF and then brought it back to the PPF would still be working in its downward mode as the adjustment path crosses the frontier. There would be nothing to prevent the spiraling downward of both incomes and expenditures from taking the economy well inside its PPF. And leftward shifts in the supply and demand of loanable funds can compound themselves as savers begin to hold their savings in illiquid form, that is, self-aggravating deflation. The situation in liquidity – in malinvestment – is no different. Mankind but retaliates when it is under economy-wide “secondary deflation,” if one will call it that. For something else: the short-run, the long-run, the term, malinvestment.

Through resource reallocation to capital, labor, and other factors, the economy will be inevitable. And hence comes the full discussion of capital and labor-based models.

The Australian situation is less specific, for their particular circumstances are such that the bias is intrinsic and cannot be neutralized. In a particular manner in which the fashion for an investment bubble is affected by trends and characteristics of the scenario. This is the appearance as the “debt crisis,” the story of a credit crunch.

The output may reflect this bias. The initial expansion of resources from the capital to the labor side of capital specific investment in the temporary premium for capital. A strong demand for investment (for the purposes of consumption and production) that would move beyond the point at which the investor would be arrested. And decisions would not be the same. In the case of credit expansion, the economy is a spiraling down. There is, is least one important sense of an immediate and nature more readily averted. Conversely, for this reason, the economy is not a credit expansion.

Figure 4.5. "A picture of the natures of monetary conditions.
hold their savings liquid and as investors lose confidence in the economy. That is, self-reversing changes in the capital structure give way to a self-aggravating downward spiral in both income and spending. This increase in liquidity preference — or even a seemingly fetishesitic attitude toward liquidity — is not to be linked to some deep-seated psychological trait of mankind but rather is to be understood as risk aversion in the face of an economy-wide crisis. The spiral downward, which is the primary focus of conventionally interpreted Keynesianism, was described by Hayek as the "secondary deflation" — in recognition that the primary problem was something else: the intertemporal misallocation of resources, or, to use Mises's term, malinvestment.

Through relative and absolute adjustments in the prices of final output, labor, and other resources, the economy can eventually recover, but there will be inevitable losses of wealth as a result of the boom-bust episode. A fuller discussion of depression and recovery must await the treatment of labor-based macroeconomics in Part III.

The Austrian theory of the business cycle is sometimes criticized for being too specific, for not applying generally to monetary disturbances whatever their particular nature (Cowen, 1997: 11). We can certainly acknowledge that the bias in the direction of investment is directly related to the particular manner in which the new money is injected. Credit expansion implies an investment bias. Lending money into existence, as we have already noted, accords with much historical experience. We can certainly imagine alternative scenarios. Suppose, for instance the new money makes its initial appearance as transfer payments to consumers. The story of a transfer expansion (Bellante and Garrison, 1988) has a strong family resemblance to the story of a credit expansion, but it differs in many of the particulars.

The output mix during a transfer expansion would exhibit a consumption bias. The initial increase in consumer spending would favor the reallocation of resources from early stages to late stages of production, but considerations of capital specificity would limit the scope for such reallocations. Thus the temporary premium on consumption goods would result in an increase in the demand for investment funds to expand late-stage investment activities. Both consumption and, to a lesser extent, investment would rise. The economy would move beyond its production possibilities frontier, and the rate of interest would be artificially high. Subsequent spending patterns and production decisions would eventually bring the economy back to its frontier. As in the case of credit expansion, the intertemporal discoordination could give way to a spiral downward into recession. The recovery phase would differ in at least one important respect. Excessive late-stage investments are by their very nature more readily liquidated than excessive early-stage investments. If only for this reason, we would expect a transfer expansion to be less disruptive than a credit expansion.

Figure 4.5, "A generalization of the Austrian theory," shows three possible cases of monetary expansion: credit, credit-and-transfer, and transfer. The