THE "VALUES-RICHES" MODEL: AN ALTERNATIVE TO GARRISON'S MODEL IN AUSTRIAN MACROECONOMICS OF GROWTH AND CYCLE

RENAUD FILLIEULE

The "values-riches" model is a pedagogical and graphical representation of Austrian macroeconomics, combining four elements: the concept of "invariable money" (Reisman 1996), the capitalization theory of interest of Fetter (1904, 1914) and Mises (1998), the Hayekian structure of production (Hayek 1931), and the growth theory of Böhm-Bawerk (1959). This model offers a simple visual illustration of equilibrium, growth, and business cycle as they may be conceived in an Austrian framework. The graphical approach of this model is heavily influenced by Garrison (2001). It will be argued below that Garrison's model represents and relates real macroeconomic magnitudes. The "values-riches" model,[1] on the other hand, seeks to display the relations between the great macroeconomic nominal variables ("values") and the flows of quantities of consumer goods ("riches"). The two models are therefore to some extent complementary, offering two different viewpoints on the production process. But there are also a number of theoretical disagreements between them, specially about the theory of interest, that must not be overlooked and will be pointed out in this paper.

MACROECONOMIC EQUILIBRIUM

The Three Panels of the Model

The values-riches model is composed of three interdependent panels.

(1) The first panel (figure 1) represents the *line of aggregate expenditure*. The annual aggregate expenditure E in the economic system is the sum of the

RENAUD FILLIEULE is *maître de conférences* at the University of Lille 1 (USTL), Villeneuve d'Ascq, France, and member of the CLERSÉ research unit (Centre lillois d'études et de recherches sociologiques et économiques). The author wishes to thank the two anonymous referees for remarks that have helped to improve the final version of this paper.

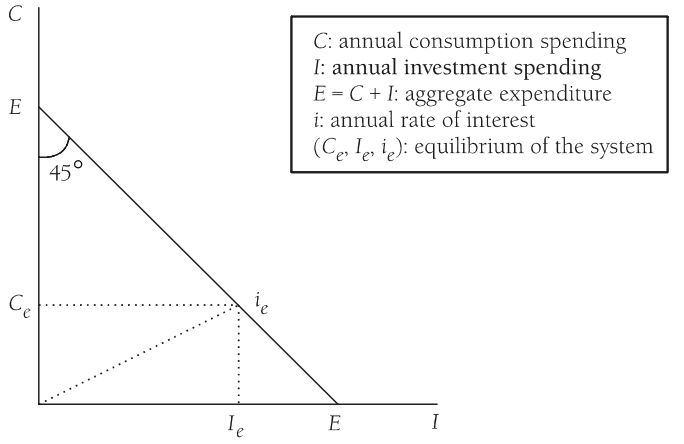
[1]This name refers to the title of chapter 20 in Ricardo's *Principles* ("Value and Riches, their Distinctive Properties").

annual consumption spending C and the annual investment spending[2] I: $E = C + I$. This panel illustrates the concept of an "invariable money" of Reisman (1996, pp. 536–40). According to him, macroeconomic reasoning should begin by supposing that aggregate expenditure is a constant, i.e., that money is "invariable." This assumption makes it possible to understand that an increase in investment spending implies, everything else equal, a corresponding diminution of consumption spending. It is therefore essential in order to study the economic growth originating in a lowering of time preference (see the section below "Lowering of the Preference for the Present"). And then, in a second moment, monetary interferences should be taken into account through variations of aggregate expenditure E (see "Money and Business Cycle" below).

This first panel shows the equilibrium point of the economic system (C_e, I_e, i_e). Everything else equal, i.e., if preferences do not change (particularly intertemporal preferences), if there is no technical progress, and if offers of originary factors remain the same, then the economic system converges towards a final equilibrium with equilibrium values C_e for consumption spending, I_e for investment spending and i_e for the annual rate of interest. Saying that money is "invariable" means that the sum ($C + I$) is a constant and that the point representing the system moves along the line EE in figure 1 (this line cuts the two axes for the value E).

How are saving/investment and the rate of interest to be explained? Skousen (1990, p. 204) and Garrison (2001, pp. 36–40) resort to the theory of

Figure 1
The Line of Aggregate Expenditure EE
(Equation $E = C + I$)



[2]This investment spending I encompasses the *totality* of the annual expenditures on factors of production, whatever their nature, including the expenditures on the intermediary goods (that are excluded from the calculation of the narrow aggregate called "investment" in the Gross Domestic Product).

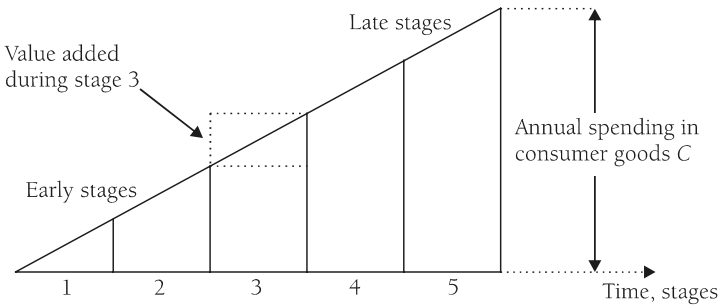
the market for loanable funds. But this theory does not belong to the Austrian tradition. It is found, neither in Böhm-Bawerk (1959), neither in Mises nor Rothbard (both of them explicitly reject it),[3] neither in Hayek (who upholds a productivity theory in Hayek 1941). The theory used in the values-riches model is the capitalization theory developed by Fetter (1904) and adopted by Mises (1998, chap. 19): the rate of interest is explained by the preference for the present, which implies that factors of production are bought with a discount, i.e., at a price lower than that of the good they will produce in the future. This price differential is the (originary) interest. Entrepreneurial competition tends to equalize these rates between firms and sectors of production, and a unique rate would prevail if a final equilibrium was reached (but recurrent and unanticipated dynamic changes prevent this outcome to happen). If the preference for the present diminishes among the agents, then the demand for (and the value of) present goods is reduced and the demand for (and the value of) factors of production increases: the originary rate of interest (relative price differential between the factors and their produce) and the ratio C_e/I_e are both lowered. Under these circumstances, with an "invariable money," the point of equilibrium in panel 1 moves downward along the line *EE:* C_e diminishes, I_e increases, the sum $C_e + I_e$ remains constant (= E), and i_e diminishes (see figure 6).

(2) The second panel (figure 2) represents the *Hayekian structure of production* (Hayek 1931; Rothbard 1962; Skousen 1990). The simplest illustration of this structure is found in Garrison (2001, p. 47): a triangle whose horizontal side represents time and the successive stages of production, and whose vertical side represents prices (values). The structure in figure 2 has five stages and its horizontal side measures the total length of the period of production. Supposing that each stage lasts one year, the total length of the structure is here five years. The vertical side on the right measures the annual aggregate value of consumer goods. The third side (hypotenuse) represents the added value at each stage, which is the sum of the prices of originary factors used at this stage (non produced factors of production: labor, standing room, natural resources) and of the interest on capital invested at this stage. The sum of all these added values is the aggregate value of the annual output of consumer goods. Extractive industries like mining are to be found in the early stages (on the left of the structure, far away from final consumption), manufacturing industries are located towards the center of the structure, and retailing industries in the last stage (on the right of the structure).

Given the equilibrium values for consumption, investment and the rate of interest (C_e, I_e, i_e), and with two supplementary hypotheses, one on the length

[3]"Originary interest is not a price determined on the market by the interplay of the demand for and the supply of capital or capital goods" (Mises 1998, pp. 523-24). "[The rate of interest] is determined by factors that have nothing to do with the usual discussion by economists of the producers' loan market" (Rothbard 1962, p. 364).

Figure 2
The Structure of Production



Source: Adapted from Garrison (2001, p. 47)

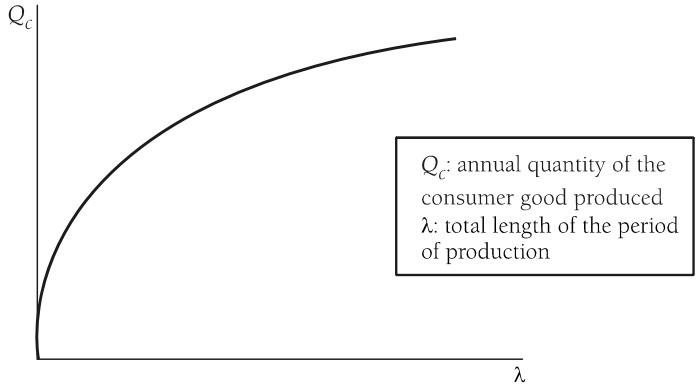
of each stage of production and another on the ratio of the value of originary factors to investment at each stage, the structure of figure 1 is *univocally* determined.[4] There is thus a relation of determination from the point representing the economic system on the line of aggregate expenditure (figure 1) to the shape and length of the structure of production (figure 2).

(3) The third panel (figure 3) represents the *global production function* of the economic system. According to Böhm-Bawerk's theory of roundaboutness in production (1959, pp. 81–88), the quantity (or quality) of goods produced increases, everything else equal, when the period of production of the structure increases. The *ceteris paribus* assumption implies that the total quantity of labor used in the structure of production is a constant. In order to make things as simple as possible, only the total period of the structure will be considered here.[5] This period is equal to the length of the horizontal side of the triangle in figure 2. Böhm-Bawerk's theory of growth must not be misunderstood. It does not mean that just any lengthening of the structure is productive, but only that among the countless possibilities of lengthening, some are productive (particularly those that would be chosen by economic agents in the case of an increase of investment relative to consumption). This physical productivity of the lengthening of the period of production is explained by the fact that it enables labor to use additional natural forces and resources (Hayek 1941, pp. 60–64).

[4]See the calculation in Fillieule (2004). Supposing that each stage lasts one year and that the ratio of the value of originary factors to investment at each stage is a constant a (for instance, at each stage, the aggregate value of originary factors divided by investment at this stage is equal to 20%, $a = 0.2$), Fillieule (2004) shows that the average length of the structure is $\lambda = (1 + i_e)/(i_e + a)$, where ie is the annual equilibrium rate of interest.

[5]The more rigorous concept of *average* length should be used here, but it requires a detailed description of the structure of production that goes beyond the scope of this paper (see the previous footnote and the reference therein).

Figure 3
The Production Function of the Economic System



Let us suppose that only one kind of consumer good is produced by the economic system. The annual quantity produced is Q_C. With a given quantity of labor and a given level of technology, the quantity Q_C increases with the total length of the structure. But the returns of the lengthening of the period of production are decreasing since the quantity of labor is given and constitutes a fixed factor. If λ is the length of the structure, then the production function may for instance be written $Q_C = A\lambda^{\alpha}$, with $0 < \alpha < 1$. Coefficient A is a parameter that augments if the quantity of labor increases and if technologies progress. This function is monotonic (theory of roundaboutness) and concave (decreasing returns of lengthening), as shown in figure 3.[6]

The Complete Model

The three interdependent panels are shown in figure 4. They allow us to visualize the relations between macroeconomic variables in equilibrium: consumption C_e, investment I_e, rate of interest i_e, length of the structure λ_e, and quantity of consumer goods produced Q_{Ce}. In panel 1, the point on the line of aggregate expenditure shows macroeconomic monetary spending at equilibrium ("values"). In panel 2, the structure of production relates these monetary variables (measured along the vertical dimension) with the length of the structure of production, i.e., with a period of time (measured along the horizontal dimension). In panel 3, the length of the structure is related by the production function to the quantity of consumer goods annually produced ("riches").[7]

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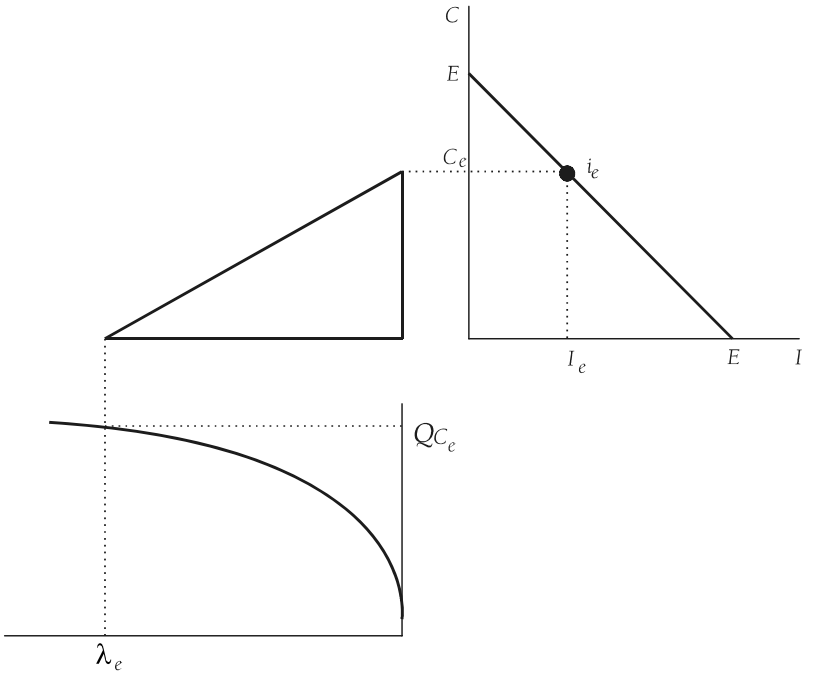
[6]The lengthening of the structure is obviously a very complex phenomenon, because of the heterogeneity and various degrees of specificity of capital goods. This underlying complexity will not be explored any further in the present paper (see Garrison 1986 for a classical statement on this subject).

[7]This scheme neglects the necessary decreasing returns in the extractive industries. Everything else equal, it becomes more and more difficult to collect ore, natural gas and oil from the ground. With time, the physical productivity of the economic system diminishes and the function of production rotates counterclockwise.

Figure 4
Macroeconomic Equilibrium in the Values-Riches Model

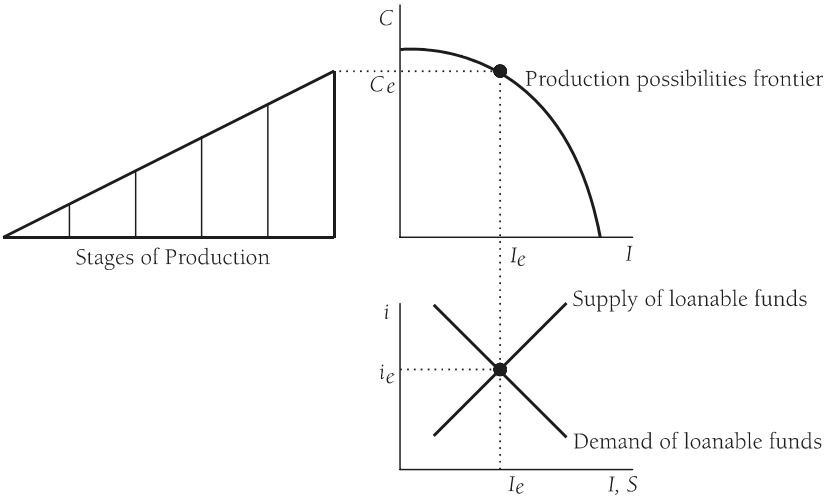


Comparison with Garrison's Model

Garrison (2001, p. 50) has propounded a model represented in figure 5 and composed of three panels: (1) the market for loanable funds, (2) the production possibilities frontier, and (3) the structure of production.

In spite of its undeniable pedagogical and theoretical qualities, Garrison's model appears unsatisfactory for two reasons. The first one has already been suggested and has to do with the theory of interest. The panel 1 on the lower left illustrates the theory of the market for loanable funds, which may be considered as defective and in any case does not belong to the Austrian tradition (see above and also Fetter 1915, p. 308; Salerno 2001, pp. 52–54). This panel has therefore not been integrated to the values-riches model, when it would have been very easy to do so since there is an unoccupied place under the line of aggregate expenditure. Our second disagreement concerns the production possibilities frontier. This concept is well known in macroeconomic analysis (see for instance Samuelson and Nordhaus [1989, p. 28], and the famous example of guns and butter). Garrison uses it in order to explain "the fundamental trade-off between consumer goods and capital goods" (Garrison 2001, p. 41). It is doubtful whether the production possibilities frontier is in fact appropriate to illustrate this kind of trade-off. Does it not rather pertain to the trade-off between two consumption goods? But the important point here is that this frontier relates variables *C* and *I* that are *quantities* of goods, when the structure of production and the market for

Figure 5
Garrison's Model



Source: Adapted from Garrison (2001, p. 50)

loanable funds relate variables *C* and *I* that are *monetary* expenses respectively on consumer and on producer goods (originary factors and capital goods). In Garrison's own words: "The vertical leg [of the structure of production] measures the *value* of the consumable output of the production process" (Garrison 2001, p. 46; emphasis added). To the extent that the production possibilities frontier serves as an intermediary between the market for loanable funds and the structure of production, a confusion seems to occur in Garrison's model between real and nominal variables (see also Hülsmann 2001, p. 40). This confusion is all the more worrying in that these values and quantities may in some cases move in opposite directions, for instance the values may diminish while the quantities of goods increase (see below figure 6 where the nominal value of consumption diminishes while the quantity of consumer goods increases). This is precisely the point that was underlined by Ricardo (1951) in his chapter on "Value and Riches" (Reisman 1996, p. 496 and pp. 712–15, offers an in-depth analysis on this subject). The only way to avoid this difficulty is, in our opinion, to interpret all the variables of Garrison's model in real terms. But then a complementary model is needed in order to visualize the relations between the main real and nominal variables-and this is precisely the function of the "values-riches" model.

Growth

The main sources of growth are (1) a lowering of the preference for the present (which favors investment and thus growth), (2) technical progress

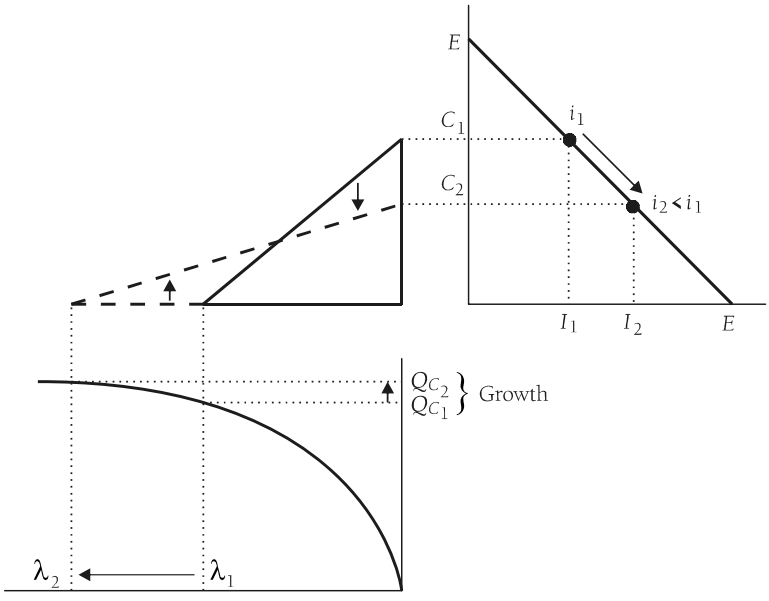
(including organizational progress or an intensification of the division of labor), and (3) an increase of the quantity (or quality) of labor. Since in the models propounded here the quantity of labor is a constant, only the first two sources of growth are taken into account (for present purposes, the trade-off between labor and leisure is not taken into account either). It should be pointed out that growth is conceived here, not as a continuous increase in the flow of consumption goods, but rather as a one-shot movement from a stationary equilibrium to another with a higher level of production.

Lowering of the preference for the present

When the preference for the present diminishes, agents reduce their consumption spending and add to their investment spending. The prices of consumer goods tend to diminish and those of factors of production tend to rise. As a consequence, the equilibrium rate of interest (relative price differential between stages) becomes smaller. Under the "invariable money" assumption, the point of equilibrium of the system moves along the line of aggregate spending *EE* from point (C_1, I_1, i_1) to (C_2, I_2, i_2) in figure 6. The shape of the structure changes: its height diminishes (since C becomes smaller) and its length augments (since I increases), $C + I = E$ remaining a constant. This lengthening from λ_1 to λ_2 leads to an increase of the annual quantity of consumer goods produced from Q_{C1} to Q_{C2}, this increase constituting of course the phenomenon of growth.

Growth does not happen immediately because, at first, economic agents give up a part of their (real) consumption in order to finance the additional

Figure 6
Growth Induced by a Lowering of the Preference for the Present



investment and the intertemporal restructuring of capital. After a while, when the new structure is finally functional, the quantity of consumer goods produced begins to rise and ends up above the former level of production because the longer production process is more productive. The transition period (when production Q_C goes down) is not represented in figure 6. Another remark: this kind of growth may to a certain extent be endogenous. Once people have become richer after a first episode of growth, they may decide to save and invest more. In this case, their time preference is again reduced and gives birth to a new process of growth. It may therefore happen that a first lowering of the preference for the present triggers a second one, then a third one, and so on.

Technical progress

Technical progress is very easily represented by a rotation clockwise of the production function. Figure 7 shows that this rotation implies an increased annual production Q_C for a structure of a given length.

The question is: will this growth through technical progress change the shape of the structure of production? This shape will change only if there is a modification of time preference (monetary interferences are excluded here and will be treated below in "Money and the Business Cycle"). Technical progress has made people richer (on average). Will this induce a change in their time preference? Three cases may occur: (1) "neutral" technical progress that does not change time preference, (2) technical progress favoring investment (lower time preference), and (3) technical progress favoring consumption (higher time preference). The basic case is the "neutral" technical progress represented in

Figure 7
Growth Induced by "Neutral" Technical Progress

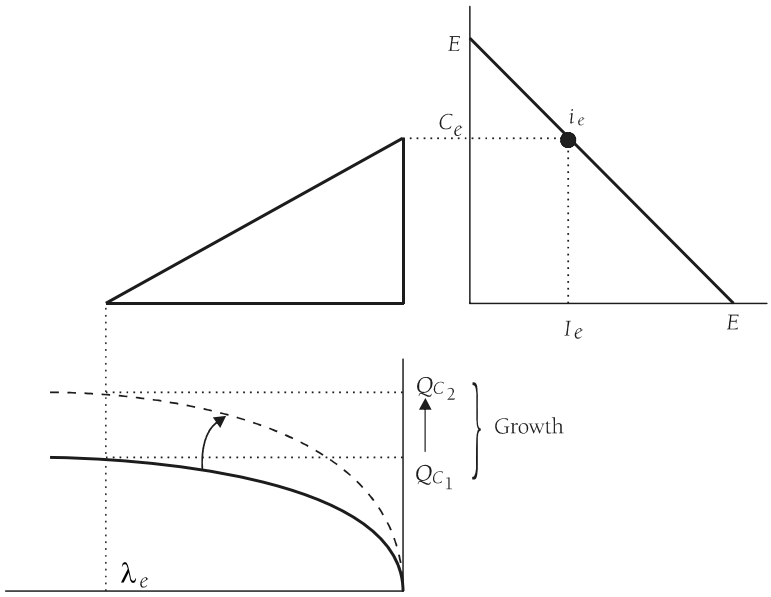
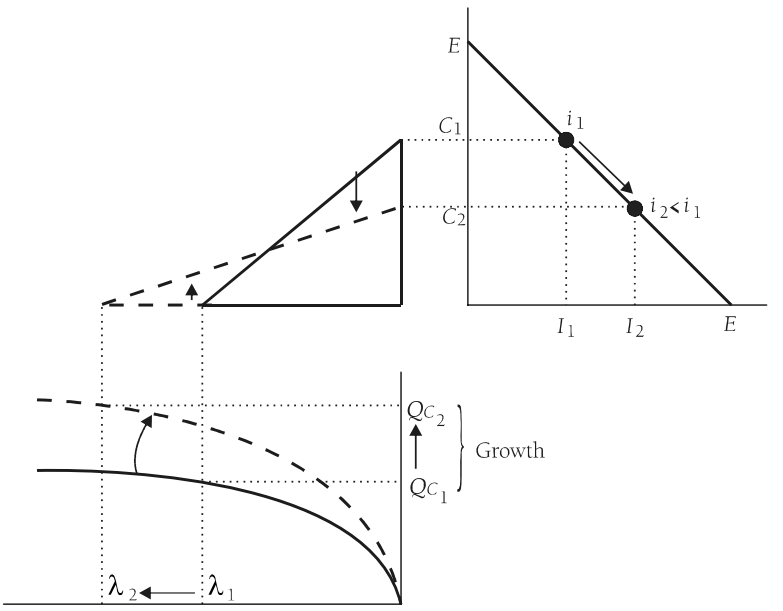


figure 7: thanks to technical progress, agents are richer in the present but also in the future, and they choose not to change their relative evaluation of present and future goods; the rate of interest and the ratio C/I do not vary. The case of technical progress favoring investment is represented in figure 8: agents have become richer and decide to save more; their time preference has thus diminished, which implies a lowering of the interest rate and of the ratio C/I ($C + I$ remaining constant according to the "invariable money" assumption). Growth then comes from two sources adding up: first from technical progress, and second from a lowering of time preference.[8]

The models of figures 7 and 8 may form the basis of a theory of endogenous growth, i.e., of a growth that persists, at least temporarily, because of its own consequences: a lowering of time preference may bring about another lowering (see above) and technical progress may provoke a lowering of time preference. In these ways, an initial shock to time preference or to technology may lead the economic system along a path of growth. But in all likelihood this growth would not be long-lasting. A new exogenous lowering of time preference or (above all) new technical progress would be required in order to bring additional increases of the annual production of consumer goods.

Figure 8
Growth Induced by Technical Progress Favoring Investment



[8]A change of time preference has not the same meaning as in the previous Subsection. In the present context, it does *not* mean that the maps of intertemporal preferences (the intertemporal utility functions) of the agents have changed, but rather that in their new economic situation–after the growth–the agents decide to alter their ratio of consumption to investment (a lower time preference implying a lower ratio C/I, and conversely).

Figure 9
Growth Induced by Technical Progress Favoring Consumption

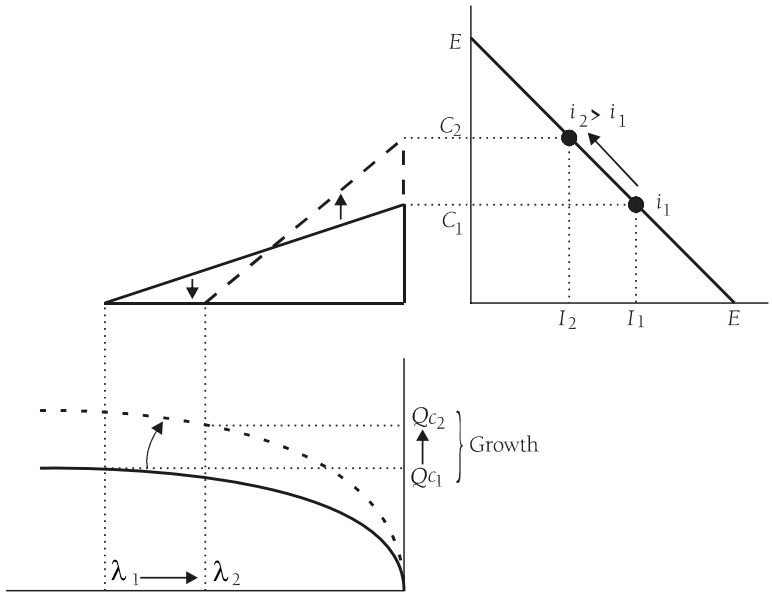


Figure 9 shows the case when technical progress favors consumption instead of investment: while people become richer thanks to technical progress, they decide to spend relatively more on consumption. The structure of production shortens and the rate of interest rises. As a result, growth is not as important as it could have been since the effect of the higher time preference is subtracted from the effect of technical progress.

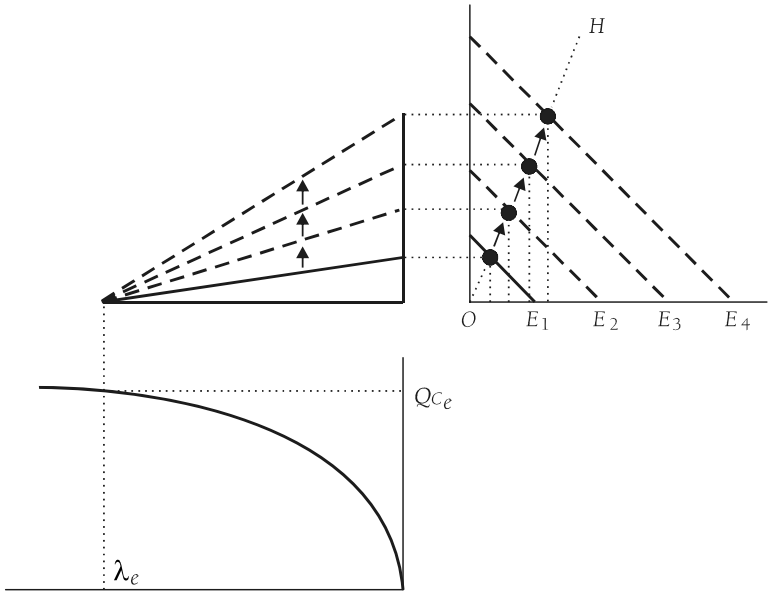
Money and the Business Cycle

In a system with paper money, the central bank expands the quantity of money mainly by means of open market operations and of cutbacks of its discount rate.[9] If this expansion could be "neutral," then all prices would rise at the same rate.[10] Even though the increase in the quantity of money is never

[9]In an open market operation, the central bank buys Treasury bills with a newly created standard money that is thus injected in the economic system (and gives birth to a pyramid of fiduciary media through the channel of the banks where it is deposited). When the Central Bank lowers its discount rate, it becomes easier for commercial banks to borrow money from it and then to create new fiduciary money.

[10]The concept of "neutrality" is used here in the sense of an equiproportional effect on all the prices of the increase of the quantity of money (see the discussion in Horwitz 2000, pp. 96-97). From the macroeconomic point of view, a much weaker form of "neutrality" is required in which the aggregate prices of factors at each stage are affected equiproportionally.

Figure 10
Effects of Successive and "Neutral" Increases of the Quantity of Money



"neutral" in this sense, it is instructive to study this simple case before approaching the more complex case where the expansion of money is not "neutral" and disturbs the intertemporal equilibrium of the system, giving birth to boom and bust.

A "Neutral" Monetary Expansion

If the quantity of money increases at rate m% from one year to the next, and if this increase is neutral, then all prices increase at rate m%. As a result, consumption spending C, investment spending I and aggregate expenditure E also rise at rate m%. Figure 10 illustrates the effects of three successive and neutral expansions of the quantity of money: the line of aggregate expenditure EE moves in the upper-right direction; the ratio C/I does not change and the point of equilibrium of the system remains therefore on the same line OH; the structure expands in the vertical direction at the same rates as the quantity of money; the quantity of consumer goods annually produced Q_C does not vary since only nominal values are modified;[11] the nominal rate of interest includes a price premium equal to the increase in the quantity of money and in price.

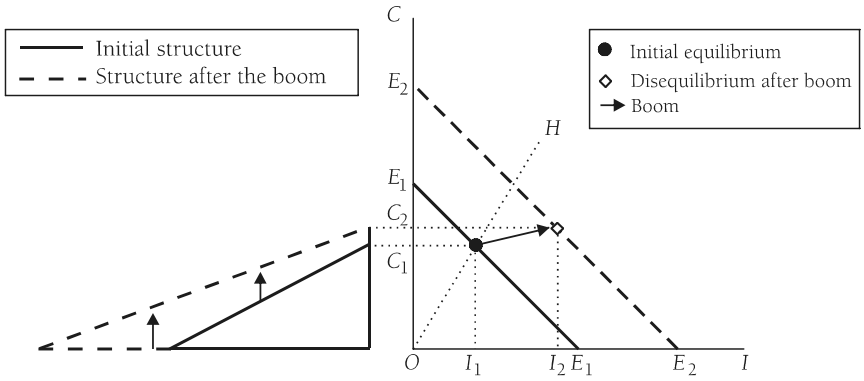
[11]Some of the costs of inflation might be taken into account ("shoe-leather" costs and "menu" costs), through which the production function would slightly rotate counterclockwise (see Horwitz 2000, pp. 106-07, and for a more detailed treatment Horwitz 2003).

Boom and Bust

Let us suppose that a monetary expansion is not "neutral" and that the new money injected in the system is lent by the banks to businesses.[12] This flow of loanable funds tends to lower the ratio C/I and the rate of interest below their long-term equilibrium values (the nominal rate of interest becomes smaller than the sum of its long-term equilibrium value and the price premium). If this monetary expansion lasts for a sufficiently long time, then entrepreneurs begin to carry out the reallocation of convertible factors of production toward the early stages of production where the profitability has raised more than in the late stages. Figure 11 illustrates this boom. The point representing the state of the system in the right panel follows a path that deviates from the equilibrium line OH: the system follows a trajectory that is beneath this equilibrium line and leads to a point where the rate of return on investment and the ratio C/I are below their equilibrium value ($C_2/I_2 < C_1/I_1$). The point reached by the system (represented by the symbol ◇ in figure 11) is a disequilibrium point. The structure of production expands more in the horizontal than in the vertical direction. The function of production (panel 3) is not represented in figure 11 because it has no meaning outside of equilibrium.[13]

This boom can last for a few months or years, but it cannot last forever because there finally comes a time when the credit expansion slows down or stops altogether (if this slowing down or braking was not decided by the monetary authorities, the economic system would run the risk of suffering from

Figure 11
The Boom

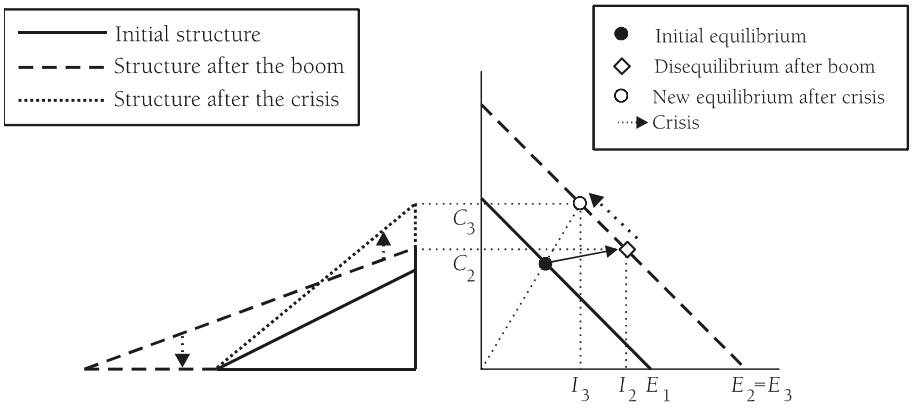


[12]Standard accounts of the Austrian theory of business cycle are found in Hayek (1931), Mises (1998, chap. 20) and Rothbard (1962, chap. 12).

[13]The Böhm-Bawerkian function of production is constructed in a frame of comparative statics. The structure of production, on the other hand, represents flows of spending that exist in equilibrium as well as in disequilibrium. The structure after the boom in figure 11, for instance, is in disequilibrium.

higher and higher levels of inflation, and even from hyperinflation). As soon as this is the case, the agents restore their preferred ratio C/I, which is higher than it was during the boom ($C_3/I_3 = C_1/I_1 > C_2/I_2$). The factors of production (especially labor and land) that had been allocated to early stages suddenly lose a large part of their value. Their profitableness can only be reestablished through a new allocation, this time toward the late stages (i.e., toward the right of the structure). The crisis brings the system back to equilibrium (figure 12) and is characterized by a waste of capital goods and a temporary unemployment.

Figure 12
The Crisis
(With Constant Aggregate Expenditure $E_2 = E_3$)



Deflationist and Stagflationist Crises

In the case of figure 12 above, aggregate expenditure E remains constant during the crisis. This is the simplest case, but of course not the most likely. In figure 13, the cycle ends up with a *deflationist* crisis: aggregate spending diminishes during the crisis, for instance because of a massive destruction of fiduciary money due to a series of bank failures in a system of gold money with fractional reserve banking.

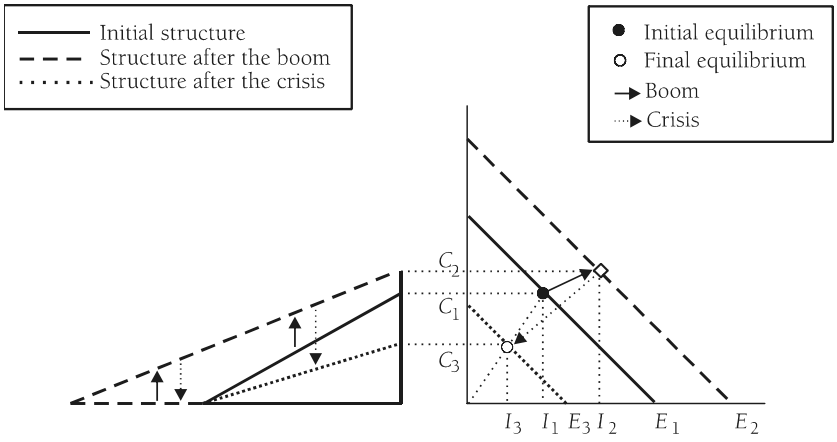
In figure 14, the cycle ends up with an inflationist or a *stagflationist* crisis (unemployment and prices go up together): the quantity of money and aggregate expenditure keep increasing during the crisis, but not enough to prevent the crisis, i.e., to prevent the reallocation of factors from the early to the late stages.

"Non-neutral" Cycle

All the cycles that have been represented until now were "neutral"[14] in the sense that the equilibrium ratio C/I and the length of the structure were the

[14]Three very different notions of neutrality have been used in this paper: the neutrality of technical progress, the neutrality of money, and the neutrality of cycles. They obviously must not be confused.

Figure 13
A Cycle With a Deflationist Crisis



same before the boom and after the crisis (the quantity produced Q_C therefore remained the same before and after the cycle). This simplifying assumption may of course be suppressed and more complicated cases can be illustrated. Figure 15 presents the case of a cycle during which time preference becomes higher, whether because of a distribution effect (more riches accrues to agents with a high time preference) or because of an increased distrust of the future. The final structure is shorter than the initial one, the equilibrium ratio C/I is higher after the crisis than before the boom, and the quantity of consumer goods annually produced is consequently reduced (from Q_{C1} to Q_{C3}).

Final Remarks

The "values-riches" model permits an easy and gradual presentation of some of the main theories of Austrian macroeconomics. It may serve as an introduction to the much more detailed works of Skousen (1990), Reisman (1996),

Figure 14
A Cycle With a Stagflationist Crisis

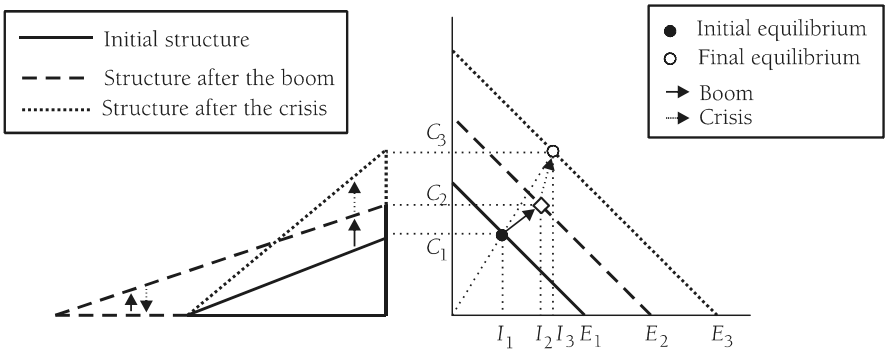
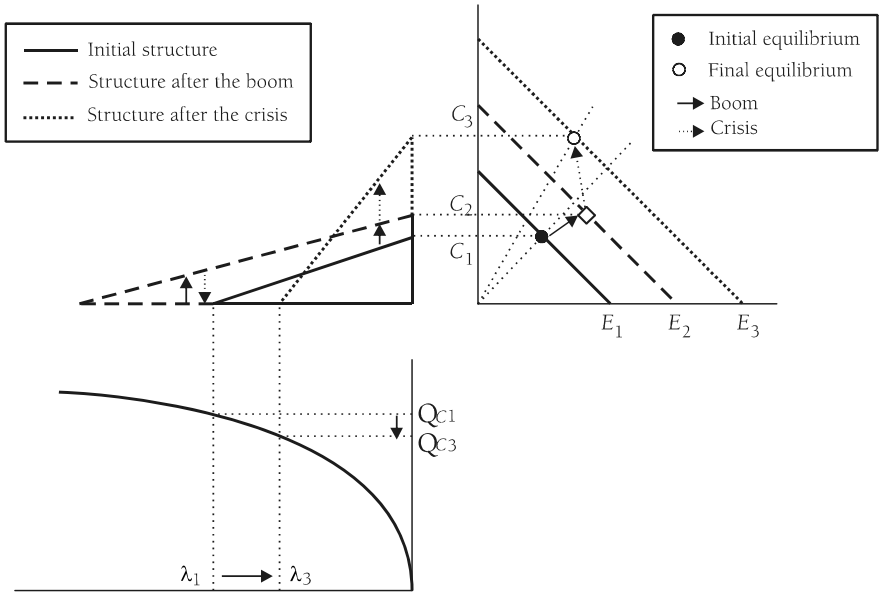


Figure 15
A "Non-neutral" Cycle



Horwitz (2000) and Garrison (2001). But because of its simplicity, this model suffers from a number of shortcomings. Here are three of them. First, the illustration of the structure of production as a triangle, even if it may suffice in a first approach, should be supplemented by a more rigorous representation, in order to be able to draw accurately the changes in the shape of the structure and to calculate the average length of the structure (Fillieule 2004). Second, the movements from one equilibrium to another or from equilibrium to disequilibrium and back again should be analyzed more thoroughly by displaying the underlying microeconomic processes. And third, the values-riches model, contrary to Garrison's model, does not allow to know how (real) consumption varies during the business cycle. It thus cannot answer the question as to whether real consumption increases during the boom, as Garrison asserts (2001, p. 69), or as Hülsmann maintains (2001, p. 39), this is not the case.

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