MATHIAS BINSWANGER

Is there a growth imperative in capitalist economies? a circular flow perspective

Abstract: *This paper postulates the existence of a growth imperative in capitalist economies. The argument is based on a simple circular flow model of a pure credit economy, where production takes time. In this economy, positive growth rates are necessary in the long run in order to enable firms to make profits in the aggregate. If the growth rate falls below a certain positive threshold level, firms will make losses. Under these circumstances, they will go out of business, which moves the whole economy into a downward spiral. According to the model presented, capitalist economies can either grow (at a sufficiently high rate) or shrink if the growth rate falls below the positive threshold level. Therefore, a zero growth economy is not feasible in the long run.*

Key words: *bank money, credit, growth, profits.*

In a recent article, Gordon and Rosenthal (2003) postulated a growth imperative for firms operating in competitive markets, as they are typical for modern capitalist economies. The authors argue that the risk of going bankrupt is too high in an economy where there is a zero or negative average growth rate of consumption, investment, and the capital stock over the years. Only positive mean growth rates of a sufficiently high level lower the long-run probability of bankruptcy to a level that is low enough to be tolerable for firms.

In this paper, I provide an alternative explanation for a growth imperative in modern capitalist economies, which are also credit money economies. The present argument is based on a simple circular flow model of a pure credit economy, where production takes time. According to the model presented, a sufficiently high positive mean growth rate is necessary because otherwise firms, in the aggregate, will not be able to realize profits. And firms that are not able to realize profits over

Mathias Binswanger is a professor of economics at the University of Applied Sciences of Northwestern Switzerland, Olten. He thanks Guido Beltrani, Sergio Rossi, and an anonymous referee for helpful suggestions and comments.

0160–3477/2009 $9.50 + 0.00.
DOI 10.2753/PKE0160-3477310410

longer periods, will stop investing and eventually go out of business, resulting in a downturn of the whole economy, as also implied by the model of Gordon and Rosenthal (2003). Based on this argument, we can derive an important conclusion concerning the role of growth in capitalist economies. In the long run, abstracting from business cycle fluctuations, capitalist economies can either grow (at a sufficiently high rate) or shrink if the growth rate falls below a positive threshold level. A zero growth economy is not feasible in the long run. This result may also help to explain why economic growth has always been the major goal of economic policy in capitalist economies even though average subjective well-being does not increase any further along with income in developed economies (see, for example, Blanchflower and Oswald, 2004; Easterlin, 2001).[1]

According to conventional, neoclassical growth theory (including new growth theory), a zero growth (or even negative growth) economy would always be feasible. In these models, growth is a matter of taste (Gordon and Rosenthal, 2003, p. 26), and it is the preference between present and future consumption that determines saving and investment. In the original Solow growth model, even saving does not matter, once the economy has reached a steady state. The exogenous growth rates of population and technological progress determine the growth rate in the steady state, and if these growth rates become zero, the growth rate of the economy becomes zero as well.

However, neoclassical growth theory abstracts from important institutional features of modern capitalist economies. The most important one concerns the ability of banks to create additional money by credit expansion. This essential feature of modern capitalist economies was emphasized by Keynes and Schumpeter. They both came to the conclusion that modern capitalist economies cannot be described in the same way as traditional economies, where credit money did not exist yet. Keynes (1973a; 1973b) distinguished between "real exchange economies," where money is just used as an instrument that facilitates the exchange of goods and services, and "monetary economies," where banks possess the ability to increase the money supply by credit expansion. Schumpeter (1934) made a similar distinction between "pure exchange economies" and "capitalist economies." Both economists also recognized that growth would not be possible without banks and their ability to increase the

[1] The existence of a growth imperative also provides a challenge to concepts of sustainable development, which have criticized the goal of economic growth due to its negative effects on the environment (see, for example, Daly, 1996).

supply of money. Keynes stated that "the banks hold the key position in the transition from a lower to a higher scale of activity" (1937b, p. 667). And Schumpeter wrote: "Without the creation of new purchasing power by bank credits . . . financing of industrial development in modern economies would have been impossible" (1927, p. 86, translated by the author).

Keynes and Schumpeter also stressed the fact that an increase in investment spending cannot be financed by previous saving, if the economy is supposed to grow (see Bertocco, 2007; Binswanger, 1996). Whenever saving increases, it reduces consumption by the same amount. Therefore, if investment is financed by additional saving, the increase in demand by investment spending is offset by a corresponding decrease in consumption spending.[2] Under these circumstances, the economy cannot expand in nominal terms.

According to Keynes, investment determines saving and not the other way around. He wrote: "Credit expansion provides not an alternative to increased saving but a necessary preparation for it. It is the parent, not the twin of increased saving" (1939, p. 572). This view is radically different from neoclassical growth theory, where investment is determined by saving and where credit expansion has no role to play.

Not many economists after Keynes and Schumpeter (not even Keynesians or Schumpeterians) paid attention to the role of money and credit in the growth process, which features so prominently in Keynes's and Schumpeter's work.[3] Only one leading exponent of growth theory, Domar, recognized the importance of money creation, when he wrote:

> It is not sufficient . . . that savings of yesterday be invested today, or, as it is often expressed, that investment offset savings. Investment today must

[2] To be precise, this is true for a closed economy. In an open economy, an increase in investment can also be financed by an inflow of foreign savings, which allows for imports of capital goods from other countries. In this case, there is no corresponding decrease in domestic consumption spending. But for the aggregate world economy, the situation is the same as for a closed economy.

[3] Keynes developed his ideas on the crucial role of credit expansion by banks in some articles, which were published after the *General Theory* (see Keynes, 1937a; 1937b; 1939). In the *General Theory,* Keynes did not tackle this issue because he assumed that all agents have at all times sufficient money to carry out desired expenditure. But few economists paid attention to Keynes's writings after the *General Theory;* therefore, these writings soon fell into oblivion in spite of Keynes's fame as an economist. Keynes's view of saving and finance was thoroughly discussed by some authors in the *Journal of Post Keynesian Economics* in 1986 and 1987 (Asimakopulos, 1986; Davidson, 1986; Kregel, 1986; Terzi, 1986–87).

> always exceed the savings of yesterday. . . . An injection of new money . . . must take place every day. (1957, p. 92)

But in spite of this remark, Domar did not further investigate the link between money creation and growth. Generally, mainstream economic theory has continued to neglect this link. Money creation and growth have been treated as two totally different phenomena, as growth (in the long run) is not supposed to be influenced by monetary variables.

The few economists who continue to emphasize the link between money creation and growth are mainly associated with the "Post Keynesian school of thought" or with the related "monetary circuit school of thought."[4] These "schools of thought" emphasize the fact that commercial banks are able to create money by the creation of credit, as "loans make deposits." They advocate the theory of "endogenous money creation," where the money supply is not exogenously determined by the central bank. Instead, the money supply depends on banks' lending activity (or the demand for loans by firms), and the central bank accommodates their additional need for reserves and "deposits make reserves" (see, for example, Wray, 1991). Furthermore, many Post Keynesians and Circuitists also acknowledge that production takes time, implying that investment projects must be financed before they lead to profits at a later date. Taken together, "endogenous money creation" and the fact that production takes time establish an important role for banks and credit creation in the growth process.[5] Banks then "hold the key position in the transition from a lower to a higher scale of activity," as described by Keynes (1937b). Otherwise, it is not possible to finance an increase in productive activities. "In a monetary economy of production, credit is needed to enable firms to continue and expand production. There is a definitive link between bank credit and economic growth" (Rochon and Rossi, 2004, p. 146). However, to my knowledge, none of the exponents of the "Post Keynesian" or the "monetary circuit" school of thought has derived a growth imperative up to date, as Gordon and Rosenthal did in their 2003 article.

The aim of this paper is to show that capitalist economies indeed need to grow, as otherwise firms will not be able to realize profits. In order to demonstrate this relation, I construct a simple circular flow model of an

[4] There are, of course, some differences between these schools of thought as well as differences between adherents of the Post Keynesian school (such as "horizontalists" versus "structuralists"). But they all agree on the importance of credit money in capitalist economies.

[5] This link is also emphasized by Binswanger (2006), who describes the economic process as a "growth spiral."

economy, which incorporates some further institutional details of modern capitalist economies. The paper shows some simulation results based on the model developed, which illustrate the growth imperative.

The model

The following model assumes a closed, pure credit economy, where the only exchange media are bank liabilities (deposits). The model is formulated in nominal terms; therefore, the growth rates of all variables are nominal growth rates. However, nominal growth eventually has to be supported by real growth, as banks would stop providing further loans to firms that use these loans in unproductive ways, which would result in inflation instead of in an increase in the production of goods and services. The model only provides a valid description of reality if money creation also affects the real economy. In the model, this is implied by the fact that positive net investment increases the stock of capital, and therefore the productive capacity of the economy. This will finally result in the production of more goods and services (real growth) even though the real growth rate will usually differ from the nominal growth rate.

There are three sectors in the model—households, firms, and banks; the government is omitted in order to keep the model as simple as possible. The economy is modeled from a circular flow perspective, and, except for real capital (a stock), it includes only flow variables. Loans demanded by firms are assumed to grow at an exogenous growth rate w, which will also determine the growth rate of the economy in the steady state. Furthermore, the model takes care of the temporal ordering of financial flows and, therefore, is a multiperiod model. During one period, households, firms, and banks spend their income once. This implies that the income velocity of money is constant and equal to one.

The main purpose of the model is to demonstrate how firms' profits are linked to money creation and growth, which allows us to establish the growth imperative postulated at the beginning of this paper. Due to its simplifications, the model is not suited to explain business cycle fluctuations. It highlights the link between bank credit, growth, and profits in the long run. Furthermore, the model does not aim to give a full description of a modern capitalist economy. In this respect, the model should be distinguished from some recent modeling attempts in the Post Keynesian tradition (e.g., DosSantos, 2006; Godley, 1999; Lavoie and Godley, 2006) which set out to provide "comprehensive, fully articulated, theoretical models," that could serve as a "blueprint for an empirical representation of a whole economic system" (Godley, 1999, p. 394). The structure of

the model, however, is similar to Lavoie's (2001) "growth model with private money" and to the model of a "pure credit-money economy" presented in Park (2004). It is also inspired by the models presented in Beltrani (1999) and Binswanger (2006).

Major premises

Most important, the present model is built on some premises that are characteristic for modern capitalist economies and which will turn out to be essential for establishing the growth imperative. These premises are as follows:

1. An increase in firms' aggregate spending must be financed by credit expansion of banks (an increase in the money supply)[6] and cannot be financed by additional saving, because in this case the increase in aggregate demand by investment spending is offset by a corresponding decrease in consumption spending. "Financing investment by additional saving is a zero-sum game, which only reallocates financial resources" (Chick, 2000, p. 133).
2. Production takes time. The output of goods produced in the current period is not available for sale until the next period.
3. The aggregate business sector must be able to realize profits, meaning that the sum of profits (after interest) of successful firms must exceed the sum of losses of nonsuccessful firms. If this were not the case, aggregate spending of the business sector would start to decline causing profits to become even smaller and forcing the whole economy into a downward spiral with negative growth rates.
4. Banks have to increase their capital on the liability side of their balance sheet (equity and reserves) along with the increase in loans, as a certain fraction of loans (a risky asset) must be covered by owners' capital. Therefore, a portion of banks' income is not put back into circulation but is used to increase banks' capital, which does not represent money.

Premises 1 to 3 are common assumptions in Post Keynesian approaches (see, e.g., Chick, 2000; Davidson 1986; Lavoie and Godley, 2006; Wray, 1991). Premise 4, on the other hand, has not been considered to be a crucial feature of capitalist economies so far.[7] However, in some recent

[6] This is the "initial finance" needed by firms at the beginning of the period, as described in Graziani (1990) and Lavoie (2001).

[7] For example, Park (2004), who provides a Post Keynesian model of a credit money economy, assumes that interest revenue to banks is entirely paid out to those who work for banks.

contributions, Binswanger (2006, p. 331) and Douthwaite (1999, p. 24) argued that one should not overlook the development of the liability side of banks' balance sheets in a credit money economy. And, indeed, as will be seen from the simulations presented in the next section, Premise 4 is crucial for establishing the growth imperative. Therefore, I explain this premise in a bit more detail.

In the simple model presented in this section, banks' income exclusively comes from interest payments,[8] which they receive from firms (fees and commissions as further sources of income are neglected). Therefore, in each period, an amount of money equal to the interest payments is removed from circulation by banks, as this amount of money is withdrawn from firms' accounts (which represent money) and put into accounts in the banks' own names (which do not represent money). Of course, a large share of this income is put back into circulation, when banks pay wages to their employees (the amount is credited to employees' accounts), pay their operating expenses, and invest in machines and equipment (the amount is credited to firms' accounts), and pay out dividends (the amount is credited to the accounts of shareholders).[9] However, a portion of banks' profits (retained profits) remains in accounts in the bank's own name; therefore, there is a "net removal" of money from circulation. This amount serves to increase owners' capital, which, in a sound financial system, must grow roughly in line with loans. If this is not the case, owners' capital will fall continuously in relation to loans, which increases the risk of financial crises.[10]

An increase in capital along with loans is, to a certain degree, also enforced by capital adequacy ratios, which require that owners' capital not fall below a certain fraction of banks' risky assets. The Basle Committee on Banking Regulation and Supervision established these capital

[8] More precisely, net interest payments (the difference between interest received and interest paid) are equal to banks' income, because banks also have to pay interest to customers, who hold money in their bank accounts.

[9] In the following model, I only consider wages paid to banks' employees and neglect operating expenses, investment in machines and equipment, and dividends.

[10] If we look at the income statements and balance sheets of commercial banks in various countries (OECD, Bank Profitability Statistics), we can observe that banks' capital (including reserves) on the liability side of the consolidated balance sheet of commercial banks has grown substantially from 1979 to 2003. In the United States, the average annual growth rate of banks' capital was 8.4 percent, and loans, on average, grew at a rate of 6.6 percent. In Germany, the average annual growth rate of banks' capital was 9.3 percent, and loans grew at a rate of 7.0 percent during the same period. These growth rates imply that banks have used a substantial portion of their income to increase their own capital, which therefore is not put back into circulation and is lost to the rest of the economy.

adequacy ratios in the early 1990s and they are enforced in all major economies today.[11] Traditionally, loans are the most important risky asset on a bank's balance sheet. Therefore, an increase in loans also requires an increase in owners' capital, as otherwise capital adequacy ratios will fall below the required minimum level.

Institutional and behavioral assumptions

Firms

There are two types of firms: firms in the consumption goods sector and firms in the investment goods sector. In each period, business firms in the consumption goods sector produce goods X using labor N and capital K. Labor costs are equal to wages, WC, paid to households; interest Z paid to banks; and the depreciation of real capital, dK, where d stands for the depreciation rate. Because production takes time (Premise 2), we assume that the output of consumption goods X_{t-1} produced in period $t-1$ is not available for sale until the next period t. Therefore, when period t begins, firms will be holding stocks of the last period's output X_{t-1}, which are ready for sale at a price P_t. Firms receive income in period t at an amount equal to P_tX_{t-1}, which in turn is equal to consumption C_t in period t.

$$C_t = P_tX_{t-1}. \tag{1}$$

Firms' costs in period t are all associated with the production of the consumption goods in period $t-1$. These costs consist of wages, WC_{t-1}, paid to households; interest, Z_{t-1}, paid to banks; and depreciation of the capital stock, dK_{t-1}. Profits (net of interest payments on loans), Π_t, are determined by firms' income in period t, which is equal to spending on consumption goods, C_t,[12] minus the costs associated with the production of X_{t-1}, which include wages, WC_{t-1}, interest payments, Z_{t-1}, and depreciation, dK_{t-1}:

$$\Pi_t = C_t - WC_{t-1} - Z_{t-1} - dK_{t-1}. \tag{2}$$

At the beginning of period t, a portion of profits from the previous period, $(1-r)\Pi_{t-1}$, is paid out as dividends, D_t, and a portion, $r\Pi_{t-1}$, is retained (business saving) and fully reinvested in the company.

[11] The exact definition of these capital adequacy ratios has varied over time (from Basle I to Basle II), as the Basle Committee tries to distinguish between various categories of risky assets.

[12] In the terminology of Graziani (1990) and Lavoie (2001), C_t represents the "final finance" as firms recover their spending on wages, WC_t, their spending on investment, I_t, their dividend payments D_t, and a portion of their interest payments Z_t. See Equation (8).

$$D_t = (1 - r)\Pi_{t-1}, \tag{3}$$

Therefore, r ($0 \leq r \leq 1$) indicates the fraction of profits, which are reinvested in the firms.

Firms in the consumption goods sector demand loans, L_t, from banks at the beginning of period t (initial finance). A portion of these loans, cL_t, together with retained profits from the previous period, $r\Pi_{t-1}$, is used to finance investment in real capital of period t, I_t

$$I_t = r\Pi_{t-1} + cL_t. \tag{4}$$

Equation (4) can be interpreted as an investment function, where investment depends on profits from the previous period, Π_{t-1}, and on firms' demand for loans, L_t, which is determined by the exogenous growth rate w (see Equation (11)). The parameter c ($0 \leq c \leq 1$) indicates the portion of loans, which is used for financing investment; therefore, c is termed *investment ratio*. The other portion of loans, $(1 - c)L_t$, is used to finance the wage bill:

$$WC_t = (1 - c)L_t. \tag{5}$$

A constant amount of bank loans provides the "revolving fund of finance" (Keynes, 1937a, p. 247; see also Wray, 1991, p. 956), which allows firms to finance a constant level of spending. If firms plan to expand their business activities, bank loans also have to be expanded to finance a higher level of spending. We can assume that firms pay back their loans L_t at the end of period t and then borrow an amount L_{t+1} in period $t + 1$. Or we can assume that loans are not paid back but that firms always borrow some more money—that is, the difference between L_{t+1} and L_t, in order to increase spending from period t to period $t + 1$.

The stock of real capital in the consumption goods sector at the end of period t, K_t, is equal to the capital stock inherited from period $t - 1$, K_{t-1}, minus deprecation, dK_{t-1}, plus investment in period t, I_t:

$$K_t = (1 - d)K_{t-1} + I_t. \tag{6}$$

Moreover, there are also firms producing investment goods (firms in the investment goods sector), but they are not explicitly modeled in this simple three-sector model. It is assumed that all money spent on investment goods, I_t, is paid out as wages to households WI_t.

$$WI_t = I_t. \tag{7}$$

By making this simplifying assumption, we abstract from profits and dividends of firms in the investment goods sector and we also neglect

their own investment expenses. Including these variables would substantially increase the complexity of the model. In this case, there would also be retained profits by firms in the investment goods sector; therefore, a portion of investment spending of firms in the consumption goods sector would not flow back to them immediately. Instead, firms in the investment goods sector would use these retained profits to finance their own investment in real capital, which, however, at a later date, would still flow back to firms in the consumption goods sector. Therefore, the basic message of the model will not be changed by the simplifying assumption that firms in the investment goods sector spent all their income on wages. The overall effect of the assumption is a slight understatement of the growth imperative, as, in reality, firms in the investment goods sector also demand bank credits, which increases interest payments to banks, of which a portion will not flow back to the economy (see below).

Households

In the beginning of period t, households receive income from wages, WC_t, which they earn by working for firms in the consumption goods sector; from wages, WI_t, which they earn by working for firms in the investment goods sector; and wages, WB_t, which they earn by working for banks. They also receive dividends D_t, as they own all the shares of firms in the consumptions goods sector. Furthermore, we make the simplifying assumption that households do not save and that they spent all their income during the same period on consumption goods, C_t. Therefore, households' spending is captured by the following equation:

$$C_t = WC_t + WI_t + WB_t + D_t. \tag{8}$$

It would also be possible to include households' saving, but again this would make the model a lot more complex without changing its basic message. Positive household saving would, on one hand, lower profits of firms in the consumption goods sector, as a portion of WC_t would no longer be spent on consumption goods. But, on the other hand, household saving could be used to finance investment, and then it would increase wages paid in the investment goods sector in the next period, WI_{t+1}, which compensates for the decline in WC_t. In order to keep the model as simple as possible, I only consider business saving (retained profits of firms in the consumption goods sector), which, in most economies, represents the largest share of total saving. Moreover, households do not receive loans from banks, and there is no household debt.

Banks

At the beginning of period t, banks provide loans L_t to business firms, which they credit to firms' bank accounts (loans make deposits). In exchange for these loans, they receive interest payments Z_t at the end of the same period t. This is their only income, and we neglect other sources of banks' income (mainly fees and commissions). The interest paid on loans, Z_t, is equal to the amount of loans, L_t, times the interest rate z:

$$Z_t = zL_t. \tag{9}$$

A portion b of the interest income Z_t is paid out to the employees of banks at the beginning of the next period $t + 1$. Therefore, wages paid out in period t, WB_t, are equal to the fraction of interest income from period $t - 1$, bZ_{t-1}, as they are financed by banks' income of period $t - 1$:

$$WB_t = bZ_{t-1}. \tag{10}$$

The other portion of interest income, $(1 - b)Z_{t-1}$, which is equal to banks' profits, is retained and entirely used to increase banks' own capital as stated in Premise 4. This portion does not flow back to the economy and the money supply in the economy is diminished by the same amount. Therefore, we denote b $(0 \leq b \leq 1)$ as the banks' payout ratio, as, in the present model, it determines the portion of banks' income, which banks pay out to their employees.

In fact, interest income Z_t of banks should be interpreted as net interest income, as banks also pay interest to households and firms, who all have accounts at banks in a pure credit money economy. Z_t stands for interest paid by firms for borrowing money from banks minus the interest paid to the holders of bank deposits. However, for simplicity, we just consider the net income flow to banks. Furthermore, same as for firms in the investment goods sector, we abstract from dividends and investment of banks. Banks spend their income to pay their employees, and the rest of their income (banks' profits) is used to increase owners' capital.

Profits and growth in the steady state

Equations (1) to (10) represent a system of 10 difference equations with 11 endogenous variables in period t (C_t, P_t, Π_t, D_t, I_t, L_t, K_t, Z_t, WC_t, WI_t, WB_t). Therefore, we need one more equation in order to find a solution to this system. The additional Equation (11) describes the growth in loans, which is determined by the exogenously given growth rate w:

$$L_t = (1 + w)L_{t-1}. \tag{11}$$

The growth rate of loans, w, captures the average increase of firms' demand for loans, which in reality will depend on their optimism about future economic development (animal spirits). It is the crucial exogenous variable in the present model. In the steady state, all variables will grow at the growth rate, w, as will be shown in the next section. Therefore, w is also the growth rate of the economy in the steady state and it determines the magnitude of firms' profits.

If we combine the system of difference Equations (1) to (11), we get the following linear constant-coefficient difference equation for Π_t:

$$\Pi_t = (1-r)\Pi_{t-1} + r\Pi_{t-1} + cL_t + (1-c)L_t + bzL_{t-1} - dK_{t-1} - (1-c)L_{t-1} - zL_{t-1}$$

or

$$\Pi_t = \Pi_{t-1} + L_t - (1 - c + z(1-b))L_{t-1} - dK_{t-1}. \tag{12}$$

Current profits are a function of current loans and of past profits and past loans either directly or indirectly through K_{t-1}. The capital stock K_{t-1} is determined by past investment, which in turn is determined by past profits and loans.

If we use Equation (11) and substitute for L_t, we can write

$$\Pi_t = \Pi_{t-1} + (w + c - z(1-b))L_{t-1} - dK_{t-1}. \tag{12a}$$

The system will be in a steady state, once profits (and also the other variables) grow at the same rate as loans. Therefore, we can define the steady state by a constant profit-to-loans ratio in the consumption goods sector, π:

$$\pi = \frac{\Pi_{t-1}}{L_{t-1}} = \frac{\Pi_t}{L_t}. \tag{13}$$

We find the stationary level for π by using Equation (4) and substituting for I_t in Equation (6). In this case, the capital stock K_t can be expressed as

$$K_t = (1-d)K_{t-1} + r\Pi_{t-1} + cL_t. \tag{14}$$

Starting at time $t-1$ and substituting recursively, we get

$$\begin{aligned} K_{t-1} = {} & cL_{t-1} + (1-d)cL_{t-2} + (1-d)^2 cL_{t-3} + \ldots + (1-d)^{n-1} cL_{t-n} \\ & + r\Pi_{t-2} + (1-d)r\Pi_{t-3} + \ldots + (1-d)^{n-1} cL_{t-n-1} + (1-d)^{n-1} K_{t-n}. \end{aligned} \tag{15}$$

After many periods, as n becomes very large, the last term, $(1-d)^{n-1}K_{t-n}$, goes toward zero. Therefore, in the steady state, the capital stock is just determined by past loans and profits, which have always grown at the rate w. In this case, we can express K_{t-1} as

$$\begin{aligned} K_{t-1} = cL_{t-1}\left[1+\frac{1-d}{1+w}+\left(\frac{1-d}{1+w}\right)^2+\ldots+\left(\frac{1-d}{1+w}\right)^n\right] \\ +r\Pi_{t-2}\left[1+\frac{1-d}{1+w}+\left(\frac{1-d}{1+w}\right)^2+\ldots+\left(\frac{1-d}{1+w}\right)^n\right]. \end{aligned} \tag{16}$$

If n goes toward infinity, the terms in brackets on the right-hand side of the equation are infinite converging geometric series, as $(1-d)/(1+w)<1$. Applying the formula for the sum of an infinite converging geometric series, we get

$$K_{t-1} = \frac{c(1+w)}{d+w}L_{t-1}+\frac{r(1+w)}{d+w}\Pi_{t-2} \quad (\text{if } t\to\infty). \tag{17}$$

Substituting Equation (17) for K_{t-1} in (12a) leads to

$$\begin{aligned} \Pi_t = \Pi_{t-1}+\big(w+c-z(1-b)\big)L_{t-1}-\frac{dc(1+w)}{d+w}L_{t-1} \\ -\frac{dr(1+w)}{d+w}\Pi_{t-2} \quad (\text{if } t\to\infty). \end{aligned} \tag{18}$$

In the steady state, Π_t and L_t must grow at the same rate w. Therefore, if we divide Equation (18) by Π_{t-1} and use condition (13), the profit-to-loans ratio in the steady state, π, is

$$\pi = \frac{w+c-z(1-b)-\dfrac{dc(1+w)}{d+w}}{1+w-\dfrac{d(1-r)+w}{d+w}}. \tag{19}$$

From Equation (19), we can see that a zero growth rate ($w = 0$) will result in a negative value of π, because profits (the nominator) will be negative in this case. We get

$$\pi = \frac{-z(1-b)}{r}<0. \tag{20}$$

If there is no growth, firms in the consumptions goods sector will make losses. Hence, we can conclude from Equations (19) and (20) that a negative or zero growth rate will result in losses and that there is a minimal positive growth rate at which the economy must grow so that firms can realize profits.

In order to determine this minimal growth rate, we define a particular steady state, where profits are always equal to zero. We will call the corresponding growth rate, w_o, zero profit growth rate. It is characterized by the condition

$$\frac{\Pi_{t-1}}{L_{t-1}} = \frac{\Pi_t}{L_t} = \Pi_t = \Pi_{t-1} = 0. \tag{21}$$

In this special case, K_{t-1} can be expressed as

$$K_{t-1} = cL_{t-1}\left[1 + \frac{1-d}{1+w_o} + \left(\frac{1-d}{1+w_0}\right)^2 + \ldots + \left(\frac{1-d}{1+w_0}\right)^n\right]. \tag{22}$$

Setting Equation (19) equal to zero allows us to calculate the growth rate w_o as the positive root of the equation:[13]

$$w_0 = \frac{-c-d+cd+z(1-b)+\sqrt{\left[c+d-cd-z(1-b)\right]^2+4dz(1-b)}}{2}. \tag{23}$$

The zero profit growth rate w_o depends on the values of the parameters, c, d, z, b, and firms' dividend policy, as expressed by r, is irrelevant in this respect.

From Equations (19) and (20), it follows that firms are only able to realize profits if the steady-state growth rate w exceeds w_o. If w falls below w_o, firms will incur losses. Furthermore, if either the interest rate, z, or the depreciation rate, d, are zero, the zero profit growth rate is zero as well. The same is also true if the payout ratio b is equal to 1 (i.e., if banks accepted zero retained profits). In these special cases, any positive growth rate w of the economy will ensure positive profits.

The first derivatives of w_o in Equation (23) with respect to the parameters c, d, z, b have no definite sign. Therefore, it is not possible to generally determine the impact of changes in these parameters on the zero profit growth rate without imposing further restrictions on parameter

[13] The negative root is not relevant in the context of the present model.

values. But we can analyze their impact on w_o by using plausible values for these parameters in the following section.

Simulations

In the following simulations, no significance should be attributed to the magnitude of the endogenous variables, because these values depend on the arbitrary initial values X_0, Π_0, L_0, K_0, Z_0, WC_0. The focus of the simulations is on the development of firms' profits over time and its relation to the growth rate of the economy.

We will assume plausible values for the parameters, r, c, z, d, and b in order to make our model economy as realistic as possible. However, we have to keep in mind that our economy is simplified, and there is no government and no foreign sector. In particular, we assume that $r = 0.5$, which implies that 50 percent of firms' profits are reinvested, and 50 percent are paid out as dividends. The value for the investment ratio c is chosen to be 0.4. This value for the investment ratio leads to a share of investment in the steady state, which is about 30 percent of the gross domestic product (GDP) (which in our model consists only of consumption and investment). The interest rate is set at 10 percent ($z = 0.1$), and the depreciation rate d is also assumed to be 10 percent ($d = 0.1$).

Finally, we also have to choose a realistic value for banks' payout ratio b. Based on data of the income statements and balance sheets of commercial banks in the OECD Bank Profitability Statistics database ranging from 1979 to 2003, we can calculate the average increase in capital and reserves as a percentage of the average net interest income over these years. In the United States, this percentage is 18.3 percent, and in Germany it is 19.3 percent. Therefore, we choose a value of 0.8 for banks' payout ratio ($b = 0.8$), implying that about 20 percent of banks' income is not put back into circulation.

The simulations are run for 1000 periods. Figures 1–3 show the results from period 200 to 1,000. During the first 200 periods, results are strongly influenced by the arbitrarily chosen initial values for the variables, which also determine the dynamics of the system while moving toward the steady state. The system exhibits oscillatory convergence toward the steady state, but after 200 periods, these oscillations have largely died out.

From Figure 1, we can see that a growth rate, w, of 0.5 percent enables firms to make positive profits, which in the steady state, also grow at a rate of 0.5 percent. Profits on firms' capital, which correspond to the growth rate of 0.5 percent, are equal to 0.1 percent, as can be seen from

Figure 1 Simulations: profits

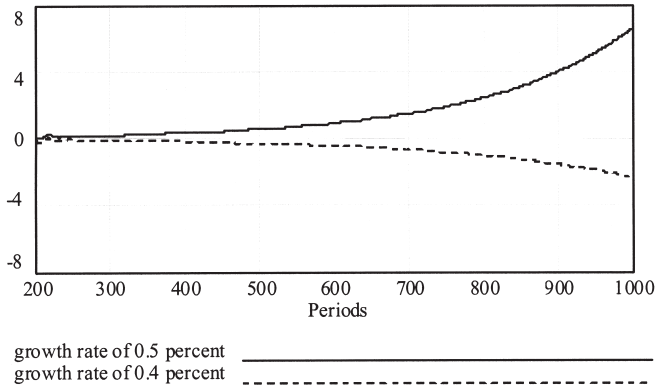


Figure 2. However, if the growth rate drops from 0.5 to 0.4 percent, profits turn into losses, which, again, will grow at a rate of 0.4 percent in the steady state. Therefore, losses will constantly increase in absolute value, which is not feasible in the long run. The corresponding profits on firms' capital in the steady state is –0.1 percent as shown in Figure 2. Although consumption (and also investment) would still grow at a rate of 0.4 percent in this economy (Figure 3), firms will always incur losses.[14] In order to understand this result, we have to remember that in the steady state, the money supply grows at a rate of 0.4 percent. However, this rate is not sufficient to compensate for the portion of interest payments to banks, which is used to increase banks' capital and which does not flow back to the economy. The inflow of new money by credit expansion must exceed the outflow of money due to an increase in banks' capital, which is the case at a growth rate of 0.5 percent but not at a growth rate of 0.4 percent.

Using Equation (23), we can calculate the value of the growth rate, w_o, where firms will make zero profits. This growth rate turns out to be 0.45 percent. Whenever the growth rate of our model economy exceeds 0.45 percent, firms will make profits in the aggregate. If the growth rate falls below 0.45 percent, firms, in the aggregate, will incur losses.

A nominal growth rate of 0.45 percent does not appear to be very high; therefore, one could conclude that already a growth rate of 0.5 percent will be sufficient, as it ensures positive profits. However, in reality, the required profits on firms' capital may substantially exceed the interest

[14] This is, of course, a hypothetical situation, as firms will stop investing if they continue incurring losses, which will result in a shrinking economy.

Figure 2 Simulations: profits on firms' capital (in percent)

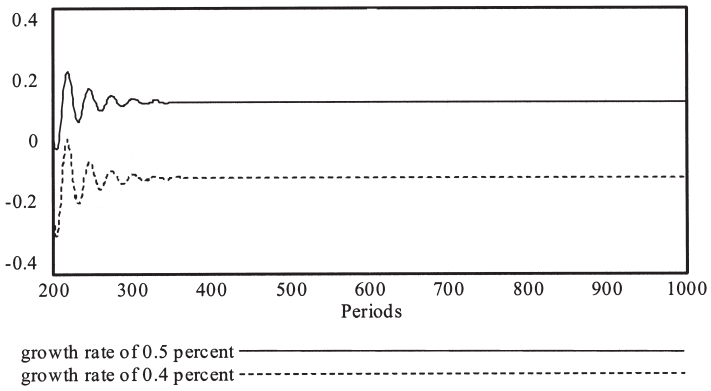
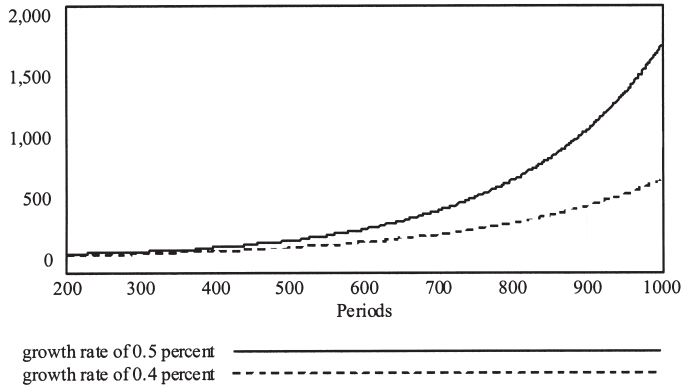


Figure 3 Simulations: consumption



rate because of the risk associated with investment projects. Firms will only borrow additional money from banks if they expect to make profits, which are on a sufficiently high level. In this case, the growth imperative becomes stronger than implied by the zero profit growth rate, and the economy must grow at a higher rate.

Varying the values of each of the individual parameters z, d, and b and holding all the other parameter values constant shows that the growth rate w_o becomes the higher, the higher is the interest rate z, the higher is the depreciation rate d, and the lower is the banks' payout ratio b. An economy with high interest rates and high depreciation rates is subject to a stronger growth imperative than an economy with low interest rates and low depreciation rates. And the more banks use interest income to

increase their own capital, the higher will be the growth rate, which is necessary to make profits.

Conclusion

This paper postulated the existence of a growth imperative in capitalist economies. The argument is based on a simple circular flow model of a pure credit economy, where production takes time. In this economy, positive growth rates are necessary in the long run in order to enable firms to make profits in the aggregate. If the growth rate falls below a certain positive threshold level, the zero profit growth rate, firms, in the aggregate, will incur losses. Under these circumstances, they will go out of business, which moves the whole economy into a downward spiral. Therefore, according to the model presented in this paper, capitalist economies can either grow (at a sufficiently high rate) or shrink, if the growth rate falls below a positive threshold level. A zero growth economy is not feasible in the long run. This conclusion is in accordance with Gordon and Rosenthal (2003), who also establish a growth imperative for capitalist economies. However, the explanation provided in this paper differs substantially from the explanation offered by Gordon and Rosenthal (ibid.).

The growth imperative established in this paper crucially depends on some institutional features of capitalist economies, which are neglected in conventional growth theory. Therefore, the growth imperative can only be understood once we are ready to include these features in theory. Most importantly, this concerns the role of banks that are able to create additional money by credit expansion. Such a credit expansion is necessary in order to finance an increase in aggregate spending, as has been argued by Keynes and Schumpeter. If, additionally, we take care of the fact that production takes time, we can establish a fundamental link between credit expansion (money creation), aggregate spending, and growth. Whenever aggregate spending increases due to credit expansion, firms immediately receive more income, as the newly created money is spent on goods and services. But these goods and services have been produced previously (production takes time); therefore, yesterday's supply meets today's (higher) demand. This explains how firms are able to make profits in the aggregate, as long as credit expansion continues. A continuous credit expansion enables a continuous increase in aggregate spending, which in turn results in profits and, as long as firms operate successfully, continuous growth. We can indeed observe this development

over the history of capitalist economies, if we abstract from short-run business cycle fluctuations.

However, there is one more crucial feature of capitalist economies, concerning the role of banks, which turned out to be essential for establishing the growth imperative. Banks have to increase their own capital (equity and reserves) along with the increase in loans, as a certain fraction of loans must be covered by owners' capital. Therefore, a portion of banks' profits is retained and not put back into circulation.[15] Instead it is used to increase bank owners' capital. This represents a constant loss of income to firms, as some portion of their interest payments to banks does not flow back to them. This loss must be compensated by an inflow of new money, if firms are to make profits in the aggregate. But only a growing economy can sustain a continuous inflow of new money by credit expansion, which compensates for the increase in bank owners' capital.

In our numerical example, we got a rather low value for the zero profit growth rate, which must be maintained to avoid losses of firms in the aggregate. Based on plausible parameter values, the zero profit growth rate was found to be just 0.45 percent. This growth rate is below the average nominal growth rate of most economies and way below the average growth rate of the world economy over the last decades. Therefore, it is tempting to conclude that the growth imperative exists but that it is rather mild. Or to put it in other words, economic growth could be slowed down considerably, and positive profits would still be feasible.

However, we have to take care of the fact that our model, from which we derived the zero profit growth rate of 0.45 percent, is quite simple. For example, it abstracted from household saving, the government sector, financial markets, and risk. The latter may be especially important, as firms in the real world usually will only invest in new capital, if the return to capital exceeds the interest rate by a certain amount (allowing for a risk premium). Therefore, the growth imperative is likely to be stronger in reality than implied by the zero profit growth rate calculated from our model. The higher the uncertainty about future profits in an economy, the higher is the required rate of return. And, consequently, the economy has to grow at a higher average rate in order to allow for profits, which are sufficiently high to cover the risk associated with investment projects. In this respect, there is a link to the growth imperative

[15] In the model presented in this paper, all profits are retained, as we abstract from dividends paid out to shareholders of the banks. Furthermore, in reality, a portion of banks will also be used to finance investment in real capital, which is also neglected here.

established by Gordon and Rosenthal (2003), who emphasize the risk of going bankrupt in an economy, where uncertainty about firms' profits is high. Uncertainty about future profits amplifies the growth imperative, and higher growth rates are necessary as compared to an economy without uncertainty about future profits.

REFERENCES

Asimakopulos, A. "Finance, Liquidity, Saving, and Investment." *Journal of Post Keynesian Economics,* Fall 1986, *9* (1), 79–90.

Beltrani, G. "Monetäre Aspekte des Wirtschaftswachstums" [Monetary Aspects of Economic Growth]. Ph.D. dissertation, University of St. Gallen, St. Gallen, Switzerland, 1999.

Bertocco, G. "The Characteristics of a Monetary Economy: A Keynes–Schumpeter Approach." *Cambridge Journal of Economics,* January 2007, *31,* 101–122.

Binswanger, H.C. *Die Wachstumsspirale* [The Growth Spiral]. Marburg, Germany: Metropolis, 2006.

Binswanger, M. "Money Creation, Profits and Growth: Monetary Aspects of Economic Evolution." In E. Helmstädter and M. Perlman (eds.), *Behavioral Norms, Technological Progress and Economic Dynamics: Studies in Schumpeterian Economics.* Ann Arbor: University of Michigan Press, 1996, pp. 413–437.

Blanchflower, D.G., and Oswald, A.J. "Well-Being Over Time in Britain and the USA." *Journal of Public Economics,* July 2004, *88,* 1359–1386.

Chick, V. "Money and Effective Demand." In J. Smithin (ed.), *What Is Money?* London: Routledge, 2000, pp. 124–138.

Daly, H. *Beyond Growth: The Economics of Sustainable Development.* Boston: Beacon Press, 1996.

Davidson, P. "Finance, Funding, Saving and Investment." *Journal of Post Keynesian Economics,* Fall 1986, *9* (1), 101–110.

Domar, E. *Essays in the Theory of Economic Growth.* New York: Oxford University Press, 1957.

DosSantos, C. "Keynesian Theorising During Hard Times: Stock-Flow Consistent Models as an Unexplored 'Frontier' of Keynesian Macroeconomics." *Cambridge Journal of Economics,* July 2006, *30,* 541–565.

Douthwaite, R. *The Ecology of Money.* Dartington, UK: Green Books, 1999.

Easterlin, R.A. "Income and Happiness: Towards a Unified Theory." *Economic Journal,* July 2001, *111,* 465–484.

Godley, W. "Money and Credit in a Keynesian Model of Income Determination." *Cambridge Journal of Economics,* 1999, *23* (4), 393–411.

Gordon, M., and Rosenthal, J. "Capitalism's Growth Imperative." *Cambridge Journal of Economics,* January 2003, *27,* 25–48.

Graziani, A. "The Theory of the Monetary Circuit." *Economies et Sociétés, Monnaie et Production,* 1990, *24* (7), 7–36.

Keynes, J.M. "Alternative Theories of the Rate of Interest." *Economic Journal,* June 1937a, *47,* 241–252.

———. "The 'Ex Ante' Theory of the Rate of Interest." *Economic Journal,* December 1937b, *47,* 663–669.

———. "The Process of Capital Formation." *Economic Journal,* September 1939, *49,* 569–575.

———. "The Distinction Between a Co-operative Economy and an Entrepreneur Economy." In D. Moggridge (ed.), *The Collected Writings of John Maynard Keynes, Vol. XXIX.* London: Macmillan, 1973a. [Originally published in 1933.]

———. "A Monetary Theory of Production." In D. Moggridge (ed.), *The Collected Writings of John Maynard Keynes, Vol. XIII.* London: Macmillan, 1973b. [Originally published in 1933.]

Kregel, J.A. "A Note on Finance, Liquidity, Saving, and Investment." *Journal of Post Keynesian Economics,* Fall 1986, *9* (1), 91–99.

Lavoie, M. "Endogenous Money in a Coherent Stock-Flow Framework." Working Paper no. 325, Department of Economics, University of Ottawa, 2001.

Lavoie, M., and Godley, W. *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth.* Basingstoke, UK: Macmillan, 2006.

Park, M.-S. "A Pure Credit Money Economy: A Simple Steady-State Model." *Journal of Post Keynesian Economics,* Fall 2004, *27* (1), 141–162.

Rochon, L.-P., and Rossi, S. "Central Banking in the Monetary Circuit." In M. Lavoie and M. Secarecia (eds.), *Central Banking in the Modern World: Alternative Perspectives.* Cheltenham, UK: Edward Elgar, 2004, pp. 144–163.

Schumpeter, J. *The Theory of Economic Development.* Cambridge: Harvard University Press, 1934. [Originally published in 1912.]

———. "Die goldene Bremse an der Kreditmaschine" [The Golden Fetters of the Credit Machine]. In J. Schumpeter (ed.), *Kölner Vorträge, Band I, die Kreditwirtschaft 1.* Leipzig: Gloeckner, 1927, pp. 80–106.

Terzi, A. "The Independence of Finance from Saving: A Flow-of-Funds Interpretation. *Journal of Post Keynesian Economics,* Winter 1986–87, *9* (2), 188–197.

Wray, L. "Saving, Profits and Speculation in Capitalist Economies." *Journal of Economic Issues,* December 1991, *25,* 951–975.