

Is there a growth imperative in capitalist economies?
A review of theories from Keynes and Schumpeter to modern approaches
Part I: Monetary Theories

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Abstract

Does the capitalist system have a kind of built-in growth imperative? Must it grow in order to be stable? This paper reviews some older and more recent theories that seek to prove that there is (or is not) such a growth imperative; the various theories are presented and compared.

In many theories, the monetary system is regarded as a major reason for a growth imperative in capitalism. Therefore, the starting point is SCHUMPETER's *Theory of Economic Development*, which emphasised the importance of monetary relations in analysing the capitalist system. Whilst SCHUMPETER himself did not appear to see a necessity for capitalism to grow permanently, more modern authors employ theories of the monetary system inspired by KEYNES and SCHUMPETER; they seek to demonstrate that a growth imperative arises chiefly from the interplay between firms' investment behaviour and the banking system's money creation. They therefore propose changes to the monetary system aimed at preventing or restricting the banking system's ability to create money.

This paper focuses on the analysis of a model of the growth imperative developed by HANS CHRISTOPH BINSWANGER. Using the method of balance mechanics, it is shown that the proposed mechanism of the growth imperative is not convincing. On the other hand, it can be argued that there is a monetary growth imperative, but that it operates at a different level.

All in all, it appears that the theories attributing the growth imperative to the monetary system are more questionable than those emphasising technological progress and market constraints.

Keywords: growth imperative, money creation, balance mechanics

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1. Introduction

Is there a growth imperative in the capitalist economy? This question is posed at regular intervals and answered in very different ways – both positively and negatively. A recent review article (KEYßER/STEINBERGER/SCHMELZER 2025) lists 112 mechanisms cited in the literature that are said to lead to growth dependency and a growth imperative in the capitalist system.

Broadly speaking, these mechanisms can be divided into those that are seen as causing the growth imperative in the monetary economy (e.g. growth imperative through credit creation and interest rates) and those that regard real-economy growth imperatives (competition, the necessity of exploiting economies of scale and the associated expansion of production) as the primary cause.

This paper is part of a larger project in which the validity of potential growth imperatives in a capitalist economy is to be examined. Consequently, the focus will then be on addressing the question of what economic policy implications must be drawn if such a growth imperative does indeed exist and, for instance, conflicts with the goal of sustainability. The degrowth movement, after all, sees a significant need for action in this regard.

In this context, older theories that address growth imperatives will also be analysed. This paper will initially focus only on monetary theories that address growth imperatives, and here, as a representative example of several others, on HANS CHRISTOPH BINSWANGER's theory of the growth spiral (BINSWANGER 2013). For the discussion of this and other approaches, however, an older concept proves fruitful, namely the mechanics of financial balances (balance mechanics – *Saldenmechanik*), which was elaborated in detail primarily by the German economist WOLFGANG STÜTZEL (STÜTZEL 1978, 1979). Growth imperatives arising from the real economy, which also draw on Marxist-inspired theories, will be the subject of a separate paper.

The paper is therefore structured as follows: as a prelude, so to speak, to the analysis of the theory of a monetary growth imperative, Section 2 first presents some key basic principles of balance mechanics, which can serve to highlight the weaknesses of theories of a monetary growth imperative. Section 3 then briefly examines SCHUMPETER's theory of economic development, as it represents one of the first attempts to link economic growth directly to money or money creation; however, SCHUMPETER does not yet consider the concept of a growth imperative. Section 4 then examines the approach of HANS CHRISTOPH BINSWANGER, for whom the significance of money creation for economic growth and the resulting growth imperative was one of the central questions of his research career. Section 5 then addresses the problems inherent in both SCHUMPETER's and BINSWANGER's approaches that arise when the tools of balance mechanics are applied to them. Section 6 then shows that the balance-mechanics considerations lead to a fairly simple answer to the question of whether, and under what circumstances, there is a growth imperative in a monetary economy. Section 7 draws some preliminary conclusions for economic policy reform efforts, and Chapter 8 contains some concluding remarks.

2. Basic principles of balance mechanics

The principles of balance mechanics were primarily developed by the German economist WOLFGANG STÜTZEL (STÜTZEL 1978). Apart from a short – and rather negative – review in the American Economic Review (HEIN 1959) following the publication of the first edition of Stützel’s book, the approach has not been adopted in the international debate. There are certain similarities to the stock-flow consistent modelling of Post-Keynesian theory (e.g. GODLEY/LAVOIE 2007), but balance mechanics offers a simpler approach. The importance of balance mechanics for macroeconomic theory and policy has been analysed by SCHMIDT (2011, 2012, 2017); LINDNER (2012, 2015) has developed a more formal presentation.

The starting point of balance mechanics is the division of an aggregate economy (a closed economy or the world as a whole) into a *group* and a *complementary group*. A group can be a single economic unit, a sector of the economy or any other relevant subset, depending on the problem at hand. The central message of balance mechanics is the fact that many economic statements are only true for single economic units or a group of economic units but not for the aggregate economy. The statement which is valid only for a single economic unit or a group is called *partial statement*; the statement which is valid only for the aggregate economy is called *global statement*; and the *relational statement* makes clear how the apparently paradoxical relation between the other two statements can be resolved.

STÜTZEL himself begins by explaining the connection using an example that clearly illustrates the principle of balance mechanics: the audience in the auditorium, seated in their chairs and watching a performance from one side of the room – for example, in a cinema. The following *partial statement* applies to each individual: ‘For every participant, standing up always increases their field of vision more than it would if they (and only they) remained seated.’ (STÜTZEL 1978, p. 25)¹ However, whether an individual spectator’s field of view actually changes is determined only by the *relational statement*: every individual cinema-goer and every group of cinema-goers “gains an enlargement of their field of view relative to their previous field of view only in the event and to the extent that the complementary set increases their viewing height less” (STÜTZEL 1978, p. 25) than the individual or the group. To really see better, a spectator must therefore gain an *advantage* over the others, for example by standing up and towering over the others in height, thereby improving their own view but, in doing so, impairing the view of those standing behind them. This then leads STÜTZEL to the *global statement*: “The group as a whole cannot improve its field of vision by standing up” (STÜTZEL 1978, p. 25). If everyone – in the sense of: all together – stands up, the spectators as a whole do not gain a better field of vision.

The main area of application for the balance mechanism in economic theory is the analysis of financial asset flows, where there is indeed a stark contrast between statements valid at the microeconomic and macroeconomic levels. The net financial assets of an economic agent are, after all, defined as the balance of claims and liabilities. They change as a result of revenues and expenditures.

¹ All translations of German texts are my own.

Here, the following *partial statement* applies: ‘For every economic agent and every group of economic agents, an increase in expenditure implies a decrease in net financial assets, an increase in revenue implies an increase in net financial assets, and vice versa.’ (STÜTZEL 1978, p. 72). For each individual economic agent, this results in a clear relationship between their expenditure and their net financial assets.

However, from a macroeconomic perspective, it must be noted that one party’s expenditure is always another’s revenue. If every economic agent increases their expenditure, this expenditure will inevitably appear as revenue for some other economic agent, so that it is not immediately clear whether an economic agent’s net financial assets are increasing or decreasing. The following *relational statement* applies: ‘Each person (or group) reduces their net financial assets only to the extent that they increase their expenditure more (or reduce it less) than the complementary group’. (STÜTZEL 1978, p. 73). A surplus of expenditure over revenue – and thus a reduction in one’s own net financial assets – can therefore only be achieved through increased expenditure if other economic agents achieve a financial surplus and thus increase their net financial assets.

This means, however, that whether an economic agent or a group of economic agents achieves a financial deficit (financial surplus) is not primarily a consequence of a mere increase (reduction) in expenditure, but rather of the fact that an economic agent increases (reduces) its expenditure more than the complementary group of other economic agents; in other words, that one group of economic agents gains an advantage over the others. This leads to the *global statement*: “The totality of all economic agents can never alter their net financial assets by increasing or decreasing expenditure or revenue”. (STÜTZEL 1978, p. 73).

In the same way, credit is purely a phenomenon of a loan: Admittedly, in the sense of a *partial statement*, it is correct that there is a positive correlation between an increase in expenditure (e.g. on investment) and the creation of an expenditure surplus; for each individual economic agent, therefore, the higher the investment expenditure, the greater the need for credit in order to maintain a certain stock of cash and thus constant liquidity. With regard to the *relational statement*, however, there is in fact no direct correlation between the level (or rate of increase) of investment expenditure by an economic agent (or a group of economic agents) and its credit requirement for maintaining liquidity. Rather, the credit requirement for maintaining liquidity status arises from the extent of financial asset accumulation by the complementary group: For if the complementary group does not accumulate financial assets – that is, if it immediately spends the revenue it receives from the expenditure of the group of investing economic agents – the investing group immediately receives cash or financial assets to the corresponding extent, entirely independently of the level of investment expenditure. It is therefore not the *level* of expenditure that is decisive for liquidity requirements, but rather the extent to which economic agents *differ* from one another in their spending behaviour. As a *global statement*, this implies that, for the aggregate of all economic agents, the credit requirement for maintaining a constant liquidity status is zero, regardless of how investment expenditure develops.

To put it another way: if economic agents do not plan to accumulate any (significant) financial assets, but instead use their revenue immediately for further expenditure, there is no significant credit requirement. “Even if individual entrepreneurs in such a situation assume that they must draw on high credit lines to make investments – by the first entrepreneur making the initial

investment expenditure, he already increases the revenue and thus the self-financing opportunities of the second; if the second invests the revenue flowing to him, he creates self-financing opportunities for the third; higher (wage and tax) expenditure on non-entrepreneurs merely increases their expenditure and thus, in turn, the entrepreneurs' revenues, and so on in a cycle, so that ultimately the revenues of the first entrepreneur also increase more than expected and the entrepreneurs as a whole need to draw on far less credit than they initially had to assume on the basis of their investment plans" (GRASS/STÜTZEL 1988, p. 331).

One important qualification is the idea of "behaviour in lockstep" (STÜTZEL 1978, p. 29 and 50): that leads to the peculiar result that the global statement applies also to each single economic unit. Referring to revenues and expenditures that means that every economic unit has exactly the same amount of revenues as of expenditures, so that there are no balances (or already existing balances stay the same). If all economic units increase their expenditures in lockstep the initial amount of each person's net financial assets is no brake for increasing expenditures as it does not change. If, for example, a unit possesses net financial assets of \$ 1,000 at a certain point in time, that does not hinder it from making expenditures of \$ 100,000 – as long as it receives revenues of \$ 100,000 at the same time. As long as expenditures and revenues move in perfect lockstep there is no limit to expenditures. Therefore the stock of net financial assets at a certain point in time does not limit expenditures as such but only the possibility of deviating from lockstep behaviour.

3. SCHUMPETER'S *Theory of Economic Development*

SCHUMPETER was full of admiration for WALRAS' theoretical achievement, which he described as the "Magna Carta of economic theory" (SCHUMPETER 1954, p. 254); but he faces the problem that he cannot find a place for profit, interest and business cycles within the Walrasian system.² His research was in fact guided by the question of what causes the business cycles that recur constantly in the economy; he sought to provide an answer to this in his work. And summarised in a single sentence, his answer is: business cycles are the necessary accompaniment of economic development and economic growth; without economic development there are no business cycles, without business cycles there is no economic development. This has to do with the particular structure of his explanation of how economic development proceeds, and this is where money and the lending activities of the banking system also come into play.

3.1 The stationary economy

The starting point of his *theory of economic development*, as the first chapter is titled, is "the circular flow of economic life as conditioned by given circumstances (Schumpeter 1997 [1934]: 1). That is to say, Schumpeter begins with a stationary economy. In this stationary economy, there is no endogenous economic change. Economic agents are more or less well adapted to economic circumstances on the basis of their experience, and each economic cycle proceeds in

² Accordingly, from the second edition onwards, he chose as the subtitle of the *Theory*: 'An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle.

a similar manner. Equilibrium prevails in the sense of SAY's law: everyone can sell their output as planned and can acquire the goods and services they had planned to purchase.

In this economy, money is a pure medium of exchange and is completely neutral with regard to real economic processes. The money supply is just large enough to ensure the smooth circulation of goods.

Furthermore, production in this stationary economy proceeds more or less routinely and requires no special entrepreneurial effort. Consequently, there are no entrepreneurs and no entrepreneurial profit in this stationary economy. There are only what SCHUMPETER calls 'static businessmen, who receive a wage for their routine organisational activities.

SCHUMPETER thus paints a very simple picture of a stationary economy: this economy produces more or less the same thing year in, year out; economic agents exchange their labour and land for the desired products; capital as a separate factor of production exists just as little as interest and entrepreneurial profit; money is merely a neutral medium of exchange. The whole thing is an economy of adjustment: all economic agents merely adapt to exogenous data. The question now is how a process of development can take place in this stationary economy.

3.2 The development process in Schumpeter

SCHUMPETER is, of course, best known for the figure of the dynamic entrepreneur, whom he introduced into the literature and whom he describes in vivid terms in his *Theory of Economic Development*. It is precisely this dynamic entrepreneur who does not adapt to data, but acts and thereby brings about development by taking the initiative and introducing new products and production processes. For Schumpeter, consumers play a completely passive role in the process of change and development.

The dynamic entrepreneur thus joins the ranks of the old, existing producers. But these new entrepreneurs now face a significant problem: they require goods and factors of production—that is, labour and land—to implement these new combinations. The question is where they obtain these goods and factors, or rather the necessary funds for financing.

SCHUMPETER's answer: from the credit creation of the banking system. Through credit creation, the entrepreneur obtains the necessary purchasing power to acquire the goods and factors of production required to implement the new combinations he has planned, and to withdraw them from their previous uses. Here, money influences the real economic relationships and is no longer merely a neutral medium of exchange.

Bank credit is created by banks *on an ad hoc basis* and does not depend on the existence of savings. Banks therefore do not simply transfer existing purchasing power from savers to investors; rather, through credit creation, they generate new purchasing power or new demand. In SCHUMPETER's words:

The banker, therefore, is not so much primarily a middleman in the commodity purchasing power" as a *producer* of this commodity. However, since all reserve funds and savings to-day usually flow to him, and the total demand for free purchasing power, whether existing or to be created, concentrates on him, he has either replaced private capitalists or become their agent; he has himself become the capitalist par excellence. He stands between those who wish to form new combinations and the possessors of

productive means. He is essentially a phenomenon of development, though only when no central authority directs the social process. He makes possible the carrying out of new combinations, authorises people, in the name of society as it were, to form them. He is the ephor of the exchange economy.” (Schumpeter 1955, p. 53 f., emphasis added by SCHUMPETER)

Development therefore requires an actively engaged entrepreneur and the creation of new purchasing power by the banks. SCHUMPETER emphasises that, in principle, only the entrepreneur requires credit, and thus credit is necessary for industrial development. Credit creation is closely linked to new combinations; and the entrepreneur is the typical debtor. Consumer credit naturally exists as well, but it is not relevant in this context.

Credit thus allows the entrepreneur to divert resources from traditional production channels and make purchases even before he has contributed to the flow of income. Through credit, the entrepreneur gains purchasing power – that is, money as a means of payment – even before he has produced new goods. With this money, he purchases factors of production or their services. In this process, price increases occur, at least initially: The prices of factors of production and existing goods may rise, as the newly created purchasing power increases demand; there is therefore a risk of inflation. But this risk is only temporary; for if the entrepreneur succeeds in new production, this increase in the means of payment or the money supply is offset by the entrepreneur’s new production.

It is only in this context that phenomena such as capital, entrepreneurial profit and interest come into play for SCHUMPETER; these, just like credit, are phenomena of development and economic growth and cannot be explained within the framework of a stationary economy.

For SCHUMPETER, capital is not a bundle of concrete goods, but rather purchasing power that enables the entrepreneur to acquire the goods and factors of production he requires.

“That form of economic organisation in which the goods necessary for new production are withdrawn from their settled place in the circular flow by the intervention of purchasing power created ad hoc is the capitalist economy, while those forms of economy in which this happens through any kind of power of command or through agreement of all concerned represent noncapitalistic production. *Capital is nothing hut the lever by which the entrepreneur subjects to his control the concrete goods which he needs nothing but a means of diverting the factors of production to new uses, or of dictating a new direction to production.* This is the only function of capital, and by it the place of capital in the economic organism is completely characterised.” (SCHUMPETER 1955, p. 85, emphasis added by SCHUMPETER)

Capital is thus defined by SCHUMPETER through its function, and it is the function of the appropriation of goods that is central here. Capital is therefore a purely monetary phenomenon: it consists of the money entrusted to the entrepreneur to purchase factors of production. Capital does not exist in a command economy or under socialism because, in such systems, the acquisition of goods takes place through planning and the associated state directives. But in a free economy, this option is not available; here, the entrepreneur is dependent on purchasing factors and means of production with the aid of money.

For SCHUMPETER, the entrepreneur’s profit is now linked to this concept of development. For profit arises only with the development and implementation of new combinations by the entrepreneur. The new combination enables the entrepreneur, for example, to bring a new product

to market, or to produce an existing product more cheaply; SCHUMPETER's example is the introduction of powerlooms (SCHUMPETER 1955, p. 95 ff.). In any case, a temporary surplus of value arises – a surplus of revenue over production costs in the new enterprise – as long as the prices of the factors of production have not yet risen to the point where a new steady-state equilibrium is reached. And for SCHUMPETER, this temporary surplus of value is the source of entrepreneurial profit. This entrepreneurial profit now also attracts imitators into the relevant industry, leading to further increases in production, competitive struggles, etc., until eventually the law of costs prevails once more, so that all factors of production are remunerated according to their marginal product and, in a new equilibrium, there is no longer any room for entrepreneurial profit. In the new steady-state equilibrium, as was the case before the development began, there is no entrepreneurial profit, because new routines have emerged that allow production to return to its usual course and do not require any special entrepreneurial activity. This competitive struggle, the reorganisation of the economy towards a new steady-state equilibrium at a higher level (i.e. with higher productivity and higher national income), then also forms the framework of SCHUMPETER's theory of business cycles and crises, which, however – just like his theory of interest – will not be discussed further here.

In summary, then, development according to SCHUMPETER requires two things: the actively engaged entrepreneur who implements new combinations, and secondly, the newly created purchasing power through money and credit creation, with which the entrepreneur purchases factors of production and then uses them differently, i.e. more productively. Linked to this in SCHUMPETER's work are capital, entrepreneurial profit, interest and the business cycle.

What SCHUMPETER does not, however, address is a growth imperative. It is clear from his account that he considers it possible, at least in theory, that following a wave of dynamic development, the economy may revert to a stationary state – albeit at a higher level – which is then broken by a new dynamic entrepreneur in another period.

4. BINSWANGER's thesis on the monetary growth imperative

In his academic work, the Swiss economist HANS CHRISTOPH BINSWANGER (1929 – 2018) has examined the causes of economic growth in depth, emphasising the link between money and money creation. In numerous essays and, most recently, in his book *The Growth Spiral*, he has sought to establish a connection between money creation and economic growth – his aim being to demonstrate that there is a direct link between growth and money creation. BINSWANGER takes SCHUMPETER's line of thought further – without referring to him – in that he asserts that the modern monetary economy is subject to a growth imperative. Money creation through the banking system is, on the one hand, a necessary condition for economic growth to take place at all; however – and here BINSWANGER disagrees with SCHUMPETER – it cannot simply revert to a steady state, but rather the only choice is between growth or contraction.

In the following, this aspect of BINSWANGER's thinking and the model based on it will be presented. The focus here is deliberately on the assertion of a monetarily driven growth imperative. BINSWANGER's work contains much more besides regarding the explanation of growth: he emphasises the importance of nature, or rather natural resources, and human imagination, as well

as the role of competition, when it comes to the conditions necessary for sustained real economic growth. However, it was always central to him to demonstrate a direct link between money or money creation on the one hand, and the necessity of sustained economic growth on the other.

4.1 The image of the growth spiral

In short, for BINSWANGER (2013, p. 112), the modern economy is characterised by the fact that it is a monetary economy in which firms require monetary capital to operate; this capital must (on average) yield a profit, as otherwise no one would be willing to provide capital. In principle, this monetary capital can be increased at will through the banks' money creation, without the need for prior savings (in the sense of restricting consumption). To ensure that this growth is not merely nominal and thus inflationary, the use of natural resources is intensified; in particular, increasing amounts of energy are provided to supplement or replace labour, thereby boosting its productivity. At the same time, human imagination ensures that new products are invented which satisfy human needs or create new ones. This, together with the associated increase in demand, enables continuous further growth.

BINSWANGER uses here the eponymous image of a growth spiral, in which the economic process expands in every period (BINSWANGER 2013, pp. 115 ff.). This expansion arises from the investments of enterprises – which increase in number and size over time – the resulting rise in household incomes, and the increasing money and credit creation by the banking system; the whole is based on increasing exploitation of natural resources and the process and product innovations stimulated by human imagination.

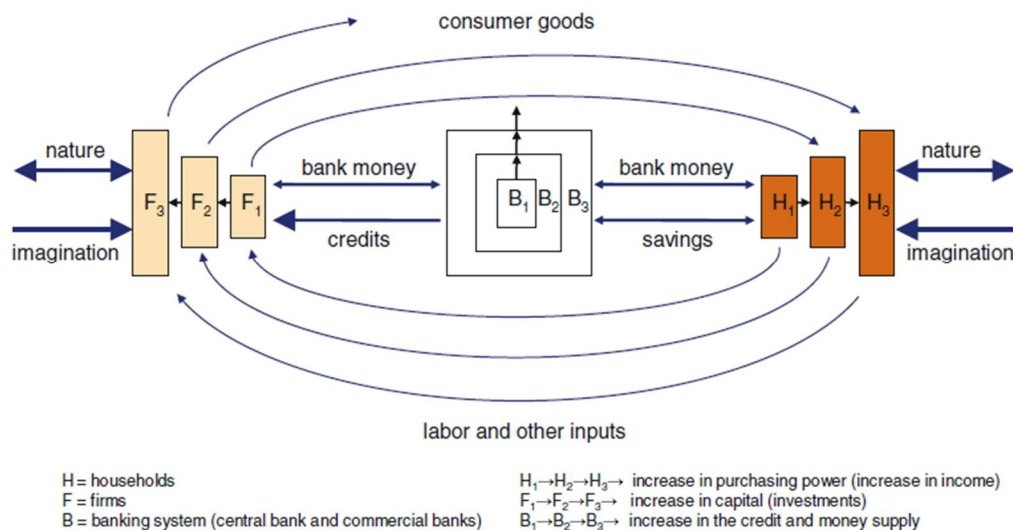


Fig. 1: The growth spiral
Source: BINSWANGER (2013), p. 116

BINSWANGER distinguishes between a monetarily driven growth *impetus*, resulting from capital gains arising from the stabilisation and increase in investment (BINSWANGER 2013, p.121 ff.), and, on the other hand, a growth *imperative* arising from the need to avoid losses. Once the

investment process has been set in motion, according to BINSWANGER, it is necessary to continue it indefinitely and thereby allow aggregate economic output to grow, because a transition to a steady state would result in losses for firms, which in the longer term would lead to a contraction in economic output. For the purposes of this paper, it is primarily this second part of BINSWANGER's analysis that is of interest.

4.2 BINSWANGER's model of the growth imperative

BINSWANGER's (2013, pp. 129 ff.) model operates with three sectors: firms, households and banks. The government and the rest of the world are omitted from the basic version of the model.³; I shall confine myself here to the model by Binswanger senior; Mathias Binswanger's model is essentially the same.

The firms, all of which are organised as public limited companies, produce goods in one period (t) which are placed in stock and sold in the following period ($t + 1$). For production, they require capital (K_t) in the form of an advance payment to purchase the necessary inputs (labour, energy, resources). They obtain this capital partly as equity (K_t^E) from households, and partly as debt (K_t^B) from banks, with a constant ratio between debt and equity assumed at ($K_t^B = dK_t^E$). As it is uncertain whether the goods produced can actually be sold, equity and debt capital providers demand a profit or interest. Without the prospect of an – on average – positive profit or interest, equity and debt capital providers would not be willing to provide capital. The firms do not produce durable means of production such as machinery or similar. The firms' tangible assets therefore consist exclusively of the goods produced in the period t , which are placed in stock and sold in the following period; the stocks are thereby completely emptied and then replenished with the goods produced in the period $t + 1$; in other words: depreciation amounts to 100% in each period, and net investment in a period consists of the difference between goods production in period t and that in period $t + 1$ ($I_t = K_t - K_{t-1}$). Part of the profit is distributed to households as dividends (D_t), and part is reinvested (this forms the equity component of investment in the following period). In addition to the remuneration for households' services and dividend payments, firms must also pay interest (R_t) to the banks at the start of each period for loans taken out in the previous period; the interest rate (r) is set by the central bank and is exogenous in the model; therefore, the following applies: $R_t = rK_{t-1}^B$.

Banks grant loans to businesses, which are credited to those businesses as demand deposits, thereby increasing the money supply; all of this money is deposit money, with no account taken of the existence of cash. Of the interest income R_t received by the banks, they pay a portion (bR_t) as wages to their employees; the remainder of the interest income $[(1 - b)R_t]$ is retained by the banks to increase their equity capital and thus keep pace with the volume of credit, which rises over time, and consequently with their demand liabilities. This leads to a reduction in the money supply in circulation.

Households derive their income in the period t from their employment with firms (K_t) and banks (bR_t), to which they provide goods and services, and from the dividends (D_t) they receive as shareholders. Households are assumed not to accumulate wealth, but to spend their entire

³ I shall confine myself here to the model by BINSWANGER senior; his son MATHIAS has developed a similar model (BINSWANGER 2009) which rests basically on similar mechanisms.

income on consumption. In doing so, they spend the income earned in the period t within the same period.

BINSWANGER assumes that every instance of production and every investment requires money creation by the banking system in an amount equal to the use of borrowed capital. In doing so, he assumes – and this is a crucial assumption – that the velocity of circulation is 1. This establishes from the outset that every investment is dependent on money creation.

The growth imperative arises, therefore, from the fact that⁴, because the banks retain a portion of their interest income, the net financial assets of firms decrease over a period; revenues are lower than expenditure. For the following holds:

$$revenue = K_t + brK_{t-1}^B + D_t$$

$$expenditure = K_t + rK_{t-1}^B + D_t$$

Since $b < 1$, net financial assets decrease by $(1 - b)rK_{t-1}^B$. At the same time, firms' real assets increase in a given period by the amount of investment ($I_t = K_t - K_{t-1}$). To avoid a reduction in net assets, the following must therefore hold:

$$I_t > (1 - b)rK_{t-1}^B$$

However, this is only possible if investment is positive in every period and – since investment increases the capital stock and thus also the stock of debt and interest expenditure – continues to grow. Constant growth is therefore necessary for the stability of the economy. The reason for this is that, by retaining a portion of their interest income, banks withdraw a portion of the money in circulation. This must be offset by credit and money creation to finance investments.

To put it another way: a prerequisite for a stable economy is that firms, on average, make a profit. For only then will firms take on the risk of producing goods. The risk lies in the fact that one is producing *today* for a demand that is as yet unknown *tomorrow*. Admittedly, this says nothing about the level of profit of an individual firm – but total profits, or profit expectations, must be positive on average.

“As both the earnings and expenditures of firms, and thus also their difference in the form of profits, are the result of monetary transactions, it follows that positive profits accrue if more money is earned than spent. This can only be the case if there is a constant influx of money. Thanks to the ‘Trick of Reason’ (Hegel), the market process is arranged in such a way that the accrual of profits, which is essential to compensate for the risk of capital investment, is made possible by the expansion of investments financed on the basis of money creation. In turn, investments are motivated by the accrual of profits resulting from money creation.” (BINSWANGER 2013, pp. 118)

BINSWANGER derives a necessary minimum growth rate g_{min} from his considerations (BINSWANGER 2013, p. 139), the derivation of which can be found in the Appendix to this paper. This results from the interplay of the interest rate (r), the portion of interest income paid out by the banks to households (b), the ratio of debt to equity (d) and the minimum rate of return demanded by equity providers (j_{min}).

⁴ This simplified derivation of the growth imperative in the Binswanger model is presented in RICHTERS/SIMONEIT (2017), p. 121.

$$g_{min} = \frac{(1 - b)rd}{d - j_{min} - rd}$$

Since both the interest rate and the proportion of interest income retained by the banks are greater than zero – otherwise the banks would not be willing to grant loans – the minimum growth rate is also positive. Assuming an interest rate of 5% ($r = 0,05$), an equity ratio of 50% ($d = 1$), a minimum required rate of return of 10% ($j_{min} = 0,1$) and a bank payout ratio of 70% ($b = 0,7$), the minimum necessary growth rate is 1.8% (BINSWANGER 2013, p. 142).

If this minimum required growth rate is not achieved, cumulative losses occur and the economy eventually shrinks, as there are no longer sufficient incentives for the production of goods. This means that once a growth process has begun, it is not possible to exit it and transition to a steady state: within the current institutional structure, one has only the choice between growth or contraction.

5. The perspective of balance mechanics

5.1 SCHUMPETER's *Theory of Economic Development*

The benefit of the relationships of balance mechanics lies, first and foremost, in the fact that careful attention to them prevents the analyst from viewing circumstances as necessarily inter-related when in reality they are not. The apparent necessity of these circumstances coinciding is often merely a consequence of the thoughtless application of partial statements to the economy as a whole. STÜTZEL distinguishes between four different types of equality that are entirely independent of one another (see Stützel 1978, p. 266):

1. *Equilibrium*: this means the compatibility of economic agents' plans, i.e. that, for example, planned supply and planned demand correspond with one another and that economic agents are actually able to realise their plans in this regard;
2. *Lockstep*: this refers to the simultaneous change in revenue and expenditure among many or even all economic agents; as a result, no revenue-expenditure balances arise for individual economic agents, or any existing balances remain constant;
3. *Constancy of total expenditure*: total expenditure (and thus, of course, total revenue) in an economy over a given period remains the same as the level of expenditure (and revenue) in the previous period;
4. *Constancy of the real capital stock*: there are no positive net investments in the economy.

Nevertheless, two or even more of these four conditions are often tacitly or explicitly identified with one another, which STÜTZEL refers to as 'problem entanglement' (STÜTZEL 1978, p. 266). It is thus often argued that a positive net investment requires a corresponding creation of money or credit in the same amount so that the investment can be financed and carried out. In other words: the absence of characteristic 4 also implies the absence of characteristic 2; since the additional investment expenditure exceeds revenue, the balance between revenue and expenditure is thereby also disrupted. As has been shown, however, this is by no means the case.

The accusation of such a conflation of issues now also applies to SCHUMPETER's theory of economic development, regardless of all the other merits it contains.

In the first chapter a picture is presented of a stationary economy in which macroeconomic equilibrium prevails without economic profits (Characteristic 1), where the revenue and expenditure of economic agents are precisely matched (Characteristic 2), expenditure remains constant in amount from period to period (Characteristic 3), and finally, no development takes place whatsoever, which also implies the absence of positive net investment (Characteristic 4) – all of this appearing to be necessarily interrelated. The entrepreneur then breaks this steady-state cycle by introducing new combinations, i.e. (net) investment (absence of characteristic 4), which simultaneously increases the level of total expenditure compared to the previous period (absence of characteristic 3) and triggers a need for credit on the part of the entrepreneur to finance the investment (absence of characteristic 2); this leads, in the unbalanced transitional period, to entrepreneurial profits (absence of characteristic 1), which are then reduced again by the mass emergence of imitators until a new steady-state equilibrium is reached. SCHUMPETER again presents all this with the appearance of necessary interdependence.

STÜTZEL regards the 'intertwining of problems' observable in SCHUMPETER's work – that is, the identification of essentially unrelated phenomena – primarily as a legacy of WALRAS' theory (1954).⁵ For WALRAS, too, in his analysis of the steady-state economy, identifies *equilibrium* with *lockstep*. The equilibrium requirement implies that, for every good, supply should equal demand. However, it is also required that, for every individual economy, revenue should equal expenditure (WALRAS 1954, p. 238). This is, however, nothing other than the requirement for purchasing lockstep, so that no revenue-expenditure balances arise for economic agents.

The significance of this model in monetary theory lies in the fact that this assumption of purchasing lockstep leads to the neutrality of money. For as soon as every economic agent plans for strict parity between revenue and expenditure, this is essentially equivalent to the assumption that economic agents do not use money at all, but instead settle transactions directly with one another.

"The fact that money in the Walrasian system is merely a "numéraire", or even "neutral", has nothing to do with the fact that Walras is specifically examining an equilibrium system. It is solely due to the fact that he examines a lockstep system, i.e. he quite deliberately disregards all the balance problems that are constitutive of the nature of money; for: even in a lockstep model in which there is imbalance in all markets, *money remains a 'mere unit of account'*; conversely, in a model in which budget balances between purchases and sales occur in individual economies, *money is never a mere unit of account*, even if equilibrium prevails in all markets" (STÜTZEL 1978, p. 192, emphasis in the original).

5.2 BINSWANGER's model of the growth imperative

For BINSWANGER, too, this critique of WALRAS's barter-based modelling of the economy serves as the starting point, because it means that money no longer has any real function. Money is then merely a unit of account, but not a medium of exchange. However, BINSWANGER does not identify the possibility of balances as the primary effect of money, but rather the introduction of a temporal structure into the economic process. The introduction of money makes it possible

⁵ For further details on the following, see STÜTZEL (1978), pp. 185–191, and STÜTZEL (1979), pp. 84–101.

to produce goods *today* – using an advance of monetary capital, with which the necessary factors of production are purchased – that will only be sold *tomorrow*. This temporal structure then also creates an essential prerequisite for the growth imperative. The decisive element, however, is the retention of a portion of the money by the banking system.

RICHTERS/SIMONEIT (2017, p. 122) criticise this approach on the grounds that it ultimately fails to provide a convincing justification for why banks must, in every case, increase their capital and therefore remove money from circulation. Although it is stated that this is necessary to keep pace with the expansion of loans and thus the banks' demand liabilities, the model is constructed in such a way that the bank's equity capital must rise even if loans do not.

In my view, however, the real problem with the model lies elsewhere: it lies in the seemingly innocent assumption of a constant velocity of circulation of 1. All additional expenditure is financed, at least in part, by borrowing, i.e. by money creation; a further portion comes from equity capital, but the fact remains that there is a correlation between credit creation and the increase in expenditure. However, this correlation is not tenable in terms of balance mechanics. Here, BINSWANGER makes the mistake that WOLFGANG STÜTZEL has termed the 'evasion theorem' ("Ausweichtheorem"; STÜTZEL 1979, p. 252 ff.); namely, the attempt to evade the counterintuitive macroeconomic/global relationship that runs counter to the microeconomic/partial relationship. At the microeconomic level, it is indeed true that there is a correlation between lending and the expansion of expenditure. At the macroeconomic level, however, this correlation does not hold, as was shown in Section 2.

By setting the velocity of circulation to 1, an evasion theorem is now formulated: for then it follows that the proposition which applies only to the microeconomic level – more expenditure requires more credit – now also applies to the macroeconomic level. This is, however, a completely artificial assumption, against the relaxation of which the model is not robust. For since, at the macroeconomic level, there is no correlation between the level of expenditure and credit creation – from a microeconomic perspective, a loan finances an *increase in expenditure*; from a macroeconomic perspective, loans finance *expenditure surpluses* – a specific interest burden is no longer necessarily linked to higher expenditure; nor, therefore, is a specific reduction in the money supply through an increase in banks' equity capital. Consequently, the growth imperative also ceases to apply. This can also be seen in the formula for the necessary minimum growth rate, which is central to this section.

It is immediately apparent that the minimum required growth rate is zero if the interest rate is zero or if b equals 1, i.e. if the banks distribute all interest income. It is also true that the minimum required growth rate is all the greater the higher the interest rate, the higher the retained interest portion – the rate of money shrinkage $(1 - b)$ – the higher the minimum required rate of profit, and the lower the debt ratio (see the Appendix for this).

But once again: all these relationships only hold if one artificially assumes a velocity of 1 from the outset, or assumes that every additional expenditure requires the creation of money and credit.

Insufficient attention to the balance mechanics is also evident in the paragraph quoted in section 4.2, which states that, in macroeconomic terms, a profit requires a constant inflow of money, since otherwise the corporate sector's revenue cannot exceed its expenditure. It can be conceded

that in the present model, profit is indeed determined by the difference between revenue and expenditure, since the model abstracts from the existence of fixed assets used on a permanent basis and thus from depreciation; consequently, there is no longer any distinction between yield and revenue or between costs and expenditure. But even then, no permanent creation of new money is required. One must not forget that profits also accrue to someone and can then in turn be used to generate demand for goods. Provided that profits are spent in full, a profit can always be achieved in macroeconomic terms even with a constant money supply. Here, KALDOR's statement applies, with which he characterised KALECKI's theory: "capitalists earn what they spend, and workers spend what they earn" (KALDOR 1955/56, p. 96). What matters is not whether the expenditure is on consumer or capital goods, but whether the profits are spent in full.

6. To what extent is there actually a growth imperative?

This brings us to the central cause of a potential growth imperative in a modern monetary economy. Although this growth imperative is generally mentioned, it is often not identified as such. Moreover, it can be explained much more simply than is the case in BINSWANGER's complex model and in other approaches. BINSWANGER's model is ultimately a special case of the underlying problem. For a stationary economy presupposes that no sector is continuously accumulating financial assets. The continuous accumulation of financial assets by one sector means that another sector is continuously losing financial assets or that an existing net debtor position is continuously deteriorating. In the BINSWANGER model, it is the banking sector that continuously increases its financial assets, and this is only sustainable for the corporate sector if it is growing, because only then can it bear this growing net debtor position. In this sense, provided that this condition of the continuous accumulation of financial assets by one sector is met, there is indeed a macroeconomic growth imperative which, whilst monetarily determined, cannot be linked to money creation as such, as BINSWANGER envisaged.

Ultimately, it is a necessary, though certainly not sufficient, condition for a stationary economy that the change in financial assets for each sector is zero, so that no sector ends up with a net debtor position that eventually becomes unsustainable. However, this applies to every type of income; there is no type of income, such as interest, that is in any way particularly distinguished in this respect. If one were to hold interest as such responsible for a growth imperative, one would have to demonstrate that it is primarily interest income that is hoarded and not spent again. The view sometimes encountered in this context – that interest forces companies to grow because they have to repay more than they received in funds – overlooks the fact that recipients of interest income must also consume/generate demand until they receive the interest; they thus, so to speak, inject into the economic cycle themselves what they receive from it in income; KALDOR's statement quoted above applies here too.⁶ If this is taken into account, then, as has

⁶ ZEZZA (2012, p. 155) also writes the following about the Theory of the Monetary Circuit (TMC): "As the accounting is analysed, it appears that several, if not all, contributors to the TMC fail to take proper account of how banks' profits can be spent in the goods or financial markets. In several models, interest payments on loans made by firms to banks are not accounted for as part of national income, and simply disappear, instead of being treated as a possible source of demand for goods and/or financial assets. By ignoring the accounting and behavioural implications of interest payments, TMC models are usually characterised by a 'paradox of profits.'"

already been demonstrated on several occasions, interest is not a fundamental obstacle to a stationary economy.

It is somewhat surprising that, whilst this condition is mentioned, it is given little attention. At the model level, the main argument (e.g. in CAHEN-FOUROT/LAVOIE 2016, p. 166) is that any saving (in the sense of financial asset accumulation) from profits must be offset by sufficiently high consumption out of wealth; furthermore, if one assumes that saving from wage income is zero, then private saving is zero globally. Accordingly, the government's net borrowing must also be zero. However, this model-based reasoning contrasts with the actual situation in practically all developed economies: for in these economies, one sector does in fact continuously accumulate financial assets, namely the household sector. The financial sector, by contrast – unlike what BINSWANGER's model suggests – is a pass-through sector; over time, it builds up large gross positions on both the assets and liabilities sides, but the balance is practically zero. In contrast, the household sector almost always has a financial surplus; in the classical Keynesian view, this is a key argument for not restricting the scope for government borrowing too severely, as otherwise the accumulation of financial assets by households would reduce corporate profits. Conversely, however, it is unlikely that households' desire to accumulate financial assets will simply cease in a zero-growth economy; rather the opposite: one must perhaps assume that the general uncertainty of a capitalist economy in a world that is no longer growing will, at least from the individual's perspective, not diminish but increase, against which one seeks to protect oneself through increased accumulation of financial assets.

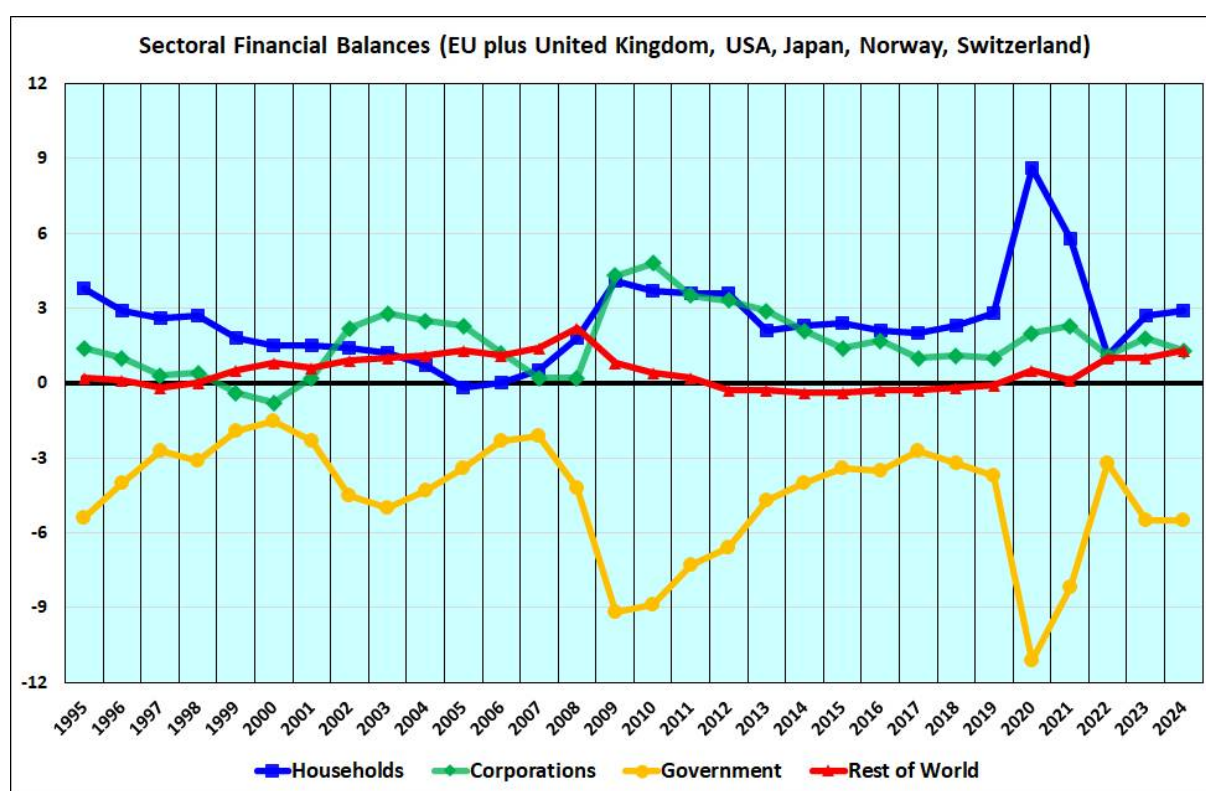


Fig. 2: Sectoral financial balances
Source: AMECO database, own calculations

7. Implications for reform proposals

What political conclusions can be drawn from this discussion of the growth imperatives imposed by the monetary economy? It seems to me, first of all, that many monetary reform proposals which ultimately amount to a restriction on money creation (such as sovereign money or 100 per cent reserves [FISHER 1935]) cannot really be properly justified. This is because they are all based on the assumption that money creation is necessarily linked to additional expenditure, or that every additional expenditure requires money creation, and therefore, conversely, that the volume of expenditure or the level of production can effectively be curbed by restricting money creation. However, this is not the case: considerations of the balance mechanics clearly show that, globally, there is no correlation between the level of expenditure and the money supply. Consequently, a restriction on money creation does not necessarily lead to a reduction in economic activity. Rather, two possibilities are conceivable: on the one hand, restricting money creation reduces the potential for deviation effects, meaning there is a compulsion towards greater synchronization (lockstep); smaller deviation effects are then accompanied by an increased velocity of circulation whilst overall activity remains constant (although, of course, it cannot be ruled out that this might subsequently lead to reduced economic activity; but that is by no means certain). A second possibility (and a potential source of instability) is as follows: even if one were to succeed in completely preventing banks from creating money, money creation might take place elsewhere: namely, by creating securities, at least within certain circles, that can take on the character of means of payment – just as, for example, bills of exchange did in the 18th century, which enabled the settlement of long-distance trade due to the underdeveloped state of the banking system (SANTAROSA 2015). If the banking system's money creation is severely restricted, it is likely that such processes will resume, largely escaping the control of the central bank – a new application of *Goodhart's law*. One could even put it this way: it is precisely the ability of commercial banks to create money (in the sense described) out of thin air, and the central bank's ability to influence this money creation through its monetary policy – even if it cannot control it perfectly – that helps ensure other forms of money remain insignificant niche products and thus do not cause any major problems.

Incidentally: the German central bank itself pointed out years ago (ANON. 2017, p. 34 ff.) that even a minimum reserve ratio of 100% or a so-called full-reserve banking system would not, in itself, restrict the banking system's ability to create credit, as the central bank accommodates the increased minimum reserve requirements and uses key interest rates to steer credit growth. Admittedly, banks would now need to hold more collateral to obtain the necessary central bank loans, meaning that the requirements for this collateral could make lending – and thus the creation of money by commercial banks – more difficult or restrict it. But they are not prevented from doing so.

The question of tax policy – or redistribution policy in general – seems to me to be far more significant. For one must start from two premises: firstly, the accumulation of financial assets is taking place primarily at the upper end of the income and wealth distribution, that is, amongst a group of people for whom consumption out of (and thus the depletion of) existing wealth is unlikely to occur. Secondly, the desire for financial asset accumulation in the household sector is most likely still strong; furthermore, it can be assumed that in a stagnant economy this desire is even more pronounced, as uncertainty about one's own position may be growing. This raises

the question of which economic policy instruments could be used to reduce the household sector's accumulation of financial assets to zero in aggregate and on average, without making it impossible for less affluent households in particular to accumulate financial assets. This seems to me to provide a further argument in favour of a wealth tax. This could potentially neutralise the accumulation of financial assets occurring elsewhere or, so to speak, compel the necessary consumption of wealth. Furthermore, one might ask whether the accumulation of financial assets resulting from uncertainty about the future can be reduced by an effective social security system.

8. Concluding remarks

HEINER FLASSBECK, a student of STÜTZEL, recounted an anecdote from his time in Stützel's seminar in an essay (FLASSBECK 2001, p. 409): Whenever a student presented a complex model, STÜTZEL would dismantle it using his balance mechanics and often demonstrated that the model failed to take elementary relationships into account, or that the phenomena considered in the model could be represented much more simply and clearly using balances mechanics. This was precisely Stützel's aim: "We intend ... to show that some prevailing theorems appear so complicated simply because the systematics of trivial relationships between variables have not been sufficiently clarified; ... The main purpose of this whole endeavour is to relieve the economic theoretical discussion of unnecessary disputes..." (STÜTZEL 1979, p. 81).

This seems to have been achieved in the context of BINSWANGER's model. On the one hand, the balance mechanics show that the derivation of the growth imperative is based on a highly problematic assumption – a velocity of circulation of 1 – against the relaxation of which the model is not robust; the derivation of the growth imperative thus fails. On the other hand, it becomes clear that the model describes a special case of the growth imperative that actually exists in the current state of the capitalist system: namely, the permanent accumulation of financial assets by one sector – the household sector – and the build-up of debt in other sectors, which can only be sustained without leading to a crisis if the overall system grows.

This alleviates the burden on the economic theory and economic policy debate insofar as it becomes clear that reforms aimed at mitigating or eliminating this growth imperative must not focus on the monetary system, but rather on distribution theory and policy. The questions that arise in the wake of this realisation are still difficult enough, but they are then situated in the field where they must actually be addressed.

What has not yet been addressed in this context are the real-economy drivers of growth, foremost among them competition, which almost certainly imposes a growth imperative on individual firms in the sense that firms generally have no choice but to introduce cost-cutting innovations, for example, to avoid losing market share or even being forced out of the market. This point is also mentioned in BINSWANGER's considerations in the growth spiral, but in the model they only operate in the background; yet to me they seem far more decisive for deriving a growth imperative.

Appendix: BINSWANGER's model of the growth imperative (BINSWANGER 2013, pp. 132 ff.)

Our model is based on the following variables:

K_t , the total amount of capital that the firms invest in order to purchase the production services

K_t^E , the equity capital of the firms or their shareholders (=households)

K_t^B , the borrowed capital of the firms (=loans from the banks)
whereby

$$K_t = K_t^E + K_t^B \quad (11.1)$$

I_t , the total investments of the firms (=increase in total capital)

I_t^E , the investments of the firms financed by equity capital (=increase in equity capital)

I_t^B , the investments of the firms financed by borrowed capital (=increase in borrowed capital)
whereby

$$I_t = I_t^E + I_t^B \quad (11.2)$$

and

$$I_t^E = K_t^E - K_{t-1}^E \quad (11.3)$$

or

$$I_t^B = K_t^B - K_{t-1}^B \quad (11.4)$$

G_t^F , the gain made by the firm (=firms' profit)

G_t , the gain assigned to the equity capital (=net profit)

R_t , the interest paid on the borrowed capital
whereby

$$G_t = G_t^F - R_t \quad (11.5)$$

D_t , the dividend, that is, the part of the net profit paid to the owners of the shares (=households)
whereby

$$D_t = G_t - I_t^E \quad (11.6)$$

P_t^F , the production costs that need to be prefurnished, that is, the income of the households from the sale of the production services
whereby

$$P_t^F = K_t \quad (11.7)$$

P_t^{BA} , the costs for bank transactions, that is, the income of the households from the sale of the service performances incl. the dividends paid by the banks

Y_t , the income of the households from the sale of the production services to the firms, the sale of the service performances to the banks, and the dividends paid by the firms and the banks so that

$$Y_t = P_t^F + P_t^{BA} + D_t \quad (11.8)$$

E_t , the revenues received by the firms from the sale of their products to the households (=firms' earnings) whereby

$$E_t = Y_t \quad (11.9)$$

O_t , the expenses ("outgoings") of firms when purchasing the production services whereby

$$O_t = P_t^F \quad (11.10)$$

C_t , the prefinanced costs of the production of the firms whereby

$$C_t = O_{t-1}. \quad (11.11)$$

The firms' profit that has been generated at the transition from the period $t - 1$ to the period t and is therefore given the suffix t (cf. p. 130 above) is

$$G_t^F = E_{t-1} - C_{t-1}. \quad (11.12)$$

The firms are creditworthy only if they have enough equity capital at their disposal. From the banks' point of view, the equity capital represents the security for granting a loan. For the sake of simplicity, it is being assumed that the ratio between borrowed and equity capital in the firm is fixed:

$$K_t^B = dK_t^E, \quad (11.13)$$

whereby the debt coefficient d , that is, the ratio between borrowed and equity capital, is determined by the business practice of the banks regarding their risk policy.

The relationship between the interest and the borrowed capital invested in the previous period is as follows:

$$R_t = rK_{t-1}^B, \quad (11.14)$$

and therefore,

$$r = \frac{R_t}{K_{t-1}^B}.$$

The interest rate r is determined by the central bank taking into account a sufficient profit margin for the banks with a view to—as far as possible inflation-free—continued growth of the economy.

Finally, it is being assumed that the banks will spend a fixed proportion of their revenues for the service performances of the households and the dividends:

$$P_t^{BA} = bR_t, \quad (11.15)$$

and therefore,

$$b = \frac{P_t^{BA}}{R_t}$$

and

$$1 - b = \frac{R_t - P_t^{BA}}{R_t},$$

whereby b stands for the ratio between the expenses of the banks and the interests (=revenue) they receive from the firms. Accordingly, $1 - b$ is that part of the income from interests (=revenue) that is used to increase the equity capital of the banks and thus the rate at which money disappears from circulation.

In order to prepare the solution for the system of equations (11.1)–(11.15), we will define another three variables that are constant if growth is balanced:

j , the profit rate, that is, the ratio between the net profit G_t and the equity capital of the firm invested in the previous period K_{t-1}^E , namely,

$$j = \frac{G_t}{K_{t-1}^E} \quad (11.16)$$

c , the reinvestment rate, that is, that part of the net profit of the firm, that is not paid out as a dividend, namely,

$$c = \frac{I_t^E}{G_t} = \frac{K_t^E - K_{t-1}^E}{G_t} \quad (11.17)$$

g^E , the growth rate of the equity capital, namely,

$$g^E = \frac{I_t^E}{K_{t-1}^E} = \frac{K_t^E - K_{t-1}^E}{K_{t-1}^E} \quad (11.18)$$

From the definition of these three variables, it follows that the growth rate of the equity capital is equivalent to the product of the reinvestment rate and the profit rate because

$$g^E = \frac{I_t^E}{G_t} \frac{G_t}{K_{t-1}^E} = \frac{I_t^E}{K_{t-1}^E} = cj. \quad (11.19)$$

The reinvestment rate c is the strategic variable within the growth process. At a given rate of profit, it determines the rate of growth. If growth is balanced, all variables grow at the same constant rate. The growth rate of the equity capital g^E is then equal to the growth rate of the borrowed capital g^B and thus also equal to the growth rate of the total capital g^K and to the growth rate of the social product or national income g , namely,

$$g^E = g^B = g^K = g = cj. \quad (11.20)$$

Equations (11.1)-(11.15) represent a linear system of 15 equations for the 16 variables $K_t, I_t, I_t^E, I_t^B, G_t, D_t, Y_t, E_t, O_t, C_t, G_t^E, K_t^B, R_t, P_t^{BA}$, and K_{t-1}^E . It is known, however, that a system of equations that contains fewer equations than variables is underdefined. The system therefore describes a whole bundle of possible growth paths. In order to derive the minimum growth rate in a given context, the equations must be extended by a further condition. We derive this further condition as follows:

The modern economy is based upon the continuous generation and reinvestment of profits. Shareholders will only invest if they can expect to achieve a minimal profit covering the investment risk. If we define the corresponding minimum profit rate as $j_{\min}$ then the minimum profit must be

$$G_t = j_{\min} K_{t-1}^E. \quad (11.21)$$

The minimum reinvestment rate $c_{\min}$ and the minimum growth rate $g_{\min}$ are the result of resolving the equation system (11.1)-(11.15) and (11.21).

We shall begin with equation (11.12) $G_t^E = E_{t-1} - C_{t-1}$ which determines the firms' profits as a residual value. This is calculated at the end of the period $t-1$ from the difference between the revenue E_{t-1} of the firms that is the result of the sales of products in period $t-1$ and the costs C_{t-1} of the products sold during period $t-1$.

In order to determine the net profit, the interest payments must be subtracted from the firms profit in accordance with Eq. (11.5). According to Eq. (11.14), the interest payments are in relation to the borrowed capital: $R_t = rK_{t-1}^B$. If these values are inserted into Eq. (11.5), the result is

$$G_t = E_{t-1} - C_{t-1} - rK_{t-1}^B. \quad (11.22)$$

The revenue of the firms E_{t-1} is equal to the income of the households Y_{t-1} so that according to Eq. (11.9),

$$E_{t-1} = Y_{t-1}.$$

According to Eq. (11.8), the income of the households in the period $t-1$ is made up of three components, namely:

- The income P_{t-1}^E that the households earn as remuneration for the production services they have provided in the period $t-1$
- The income P_{t-1}^{BA} that is paid to them by the banks as a remuneration for the service performances they have provided and as dividends in the period $t-1$
- The income D_{t-1} which they receive from the firms as dividends in the period $t-1$

The revenues of the firms from the sale of the products in the period $t-1$ are confronted by the costs C_{t-1} of the products in the same period $t-1$. These were carried forward by the firms from the previous period $t-2$ to the period $t-1$ with the sum which they had paid for the production. This means that the products were put on stock in period $t-2$ and sold from stock in period $t-1$. The stocks are valued at their production costs. The costs of the products that are sold in the period $t-1$ are therefore equivalent to the expenses ("outgoings") O_{t-2} or rather the production costs P_{t-2}^E of the period $t-2$ [cf. Eqs. (11.10) and (11.11)].

If we then replace in Eq. (11.22) E_{t-1} with $P_{t-1}^E + P_{t-1}^{BA} + D_{t-1}$ and C_{t-1} with P_{t-2}^E , the result is

$$G_t = P_{t-1}^E + P_{t-1}^{BA} + D_{t-1} - P_{t-2}^E - rK_{t-1}^B. \quad (11.23)$$

The three income components P_{t-1}^E (and P_{t-2}^E respectively), P_{t-1}^{BA} , and D_{t-1} are determined as follows:

- The income of the households, P_{t-1}^E , which they receive from the firms for the production services they have performed during the period $t-1$, is paid from

the total capital K_{t-1} that was invested at the beginning of the period $t - 1$ [Eq. (11.7)].

- The income of the households P_{t-1}^{BA} , which they receive from the banks for the *service performances plus dividends* provided by the banks [Eq. (11.15)].
 - The *dividend income* D_{t-1} that the households receive from the firms is the part of the net profit that is not reinvested [Eq. (11.6)].
- It therefore follows from Eq. (11.23) that

$$G_t = K_{t-1} + bK_{t-1} + G_{t-1} - I_{t-1}^E - K_{t-2} - rK_{t-1}^B \quad (11.24)$$

The interest R_{t-1} relates to the borrowed capital according to Eq. (11.14) as follows:

$$R_{t-1} = rK_{t-2}^B.$$

I_{t-1}^E corresponds, according to Eq. (11.3), to the increase in equity capital between the periods $t - 2$ and $t - 1$:

$$I_{t-1}^E = K_{t-1}^E - K_{t-2}^E.$$

It therefore follows from Eq. (11.24) that

$$G_t = K_{t-1} + brK_{t-1}^B + G_{t-1} - (K_{t-1}^E - K_{t-2}^E) - K_{t-2} - rK_{t-1}^B \quad (11.25)$$

The total capital is made up of the equity capital K_t^E and borrowed capital K_t^B [Eq. (11.1)]. The borrowed capital K_t^B that is invested in the period t is itself proportional to the equity capital invested, that is, in accordance with Eq. (11.13), $K_t^B = dK_t^E$, and therefore,

$$K_t = (1 + d)K_t^E,$$

and therefore, finally,

$$\begin{aligned} G_t - G_{t-1} &= dK_{t-1}^E + brdK_{t-2}^E - dK_{t-2}^E - r dK_{t-1}^E \\ &= (1 - r)dK_{t-1}^E - (1 - br)dK_{t-2}^E. \end{aligned} \quad (11.26)$$

If we insert Eq. (11.21) in Eq. (11.26), then it follows that

$$j_{\min}K_{t-1}^E - j_{\min}K_{t-2}^E = (1 - r)dK_{t-1}^E - (1 - br)dK_{t-2}^E$$

or

$$[(1 - r)d - j_{\min}]K_{t-1}^E = [(1 - br)d - j_{\min}]K_{t-2}^E \quad (11.27)$$

or

$$K_{t-1}^E = \frac{[(1 - br)d - j_{\min}]K_{t-2}^E}{(1 - r)d - j_{\min}}. \quad (11.28)$$

This leads us to the balanced minimum growth rate $\delta_{\min}^E$ of the equity capital:

$$\begin{aligned} \delta_{\min}^E &= \frac{K_{t-1}^E - K_{t-2}^E}{K_{t-2}^E} \\ &= \frac{(1 - br)d}{d - j_{\min} - rd}. \end{aligned} \quad (11.29)$$

When growth is balanced, the growth rates of all variables must be the same so that the same result also applies to the balanced minimum growth rate of the total capital and thus the social product. Thus, we receive as the result of the solution of the system of equations

$$\boxed{\delta_{\min} = \frac{(1 - b)rd}{d - j_{\min} - rd}} \quad (11.30)$$

The minimum balanced rate of reinvestment is, according to Eq. (11.20),

$$c_{\min} = \frac{\delta_{\min}}{j_{\min}} = \frac{(1 - b)rd}{(d - j_{\min} - rd)j_{\min}}. \quad (11.31)$$

Under the condition that

$$d(1 - r) - j_{\min} > 0,$$

the minimum balanced growth rate $\delta_{\min}$ is greater than zero because:

- The banks must make a profit in order to stay in business so that

$$b < 1.$$

- The banks will only grant loans if they receive interests that are in a fixed proportion to the loan (borrowed capital) so that

$$r > 0.$$

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