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# Schumpeter and the Essence of Profit

Egmont Kakarot-Handtke \*

## Abstract

Schumpeter had a clear vision of the developing economy, but he did not formalize it. The quest for a germane formal basis is in the following guided by the general question: what is the minimum set of foundational propositions for a consistent reconstruction of the evolving money economy? We start with three structural axioms. The claim of generality entails that it should be possible to free Schumpeter's approach from its irksome Walrasian legacy and to give a consistent formal account of the elementary circular flow that served him as a backdrop for the analysis of the entrepreneur-driven market system.

**JEL** : B41, E10, E25, E30, E40

**Keywords** New framework of concepts, Structure-centric, Axiom set, Profit, Money, Credit, Structural stress, Catching-up process, Monopoly

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In expanding old horizons Schumpeter achieved a lot, in fact, 'few of his predecessors, contemporaries, or successors could claim to have done more' (W. W. Rostow in Allen, 1991, p. xvi). His scientific work was guided by the vision of a coherent formal theory to explain the dynamics of the market system:

The highest ambition an economist can entertain who believes in the scientific character of economics would be fulfilled as soon as he succeeded in constructing a simple model displaying all the essential features of the economic process by means of a reasonably small number of equations connecting a reasonably small number of variables. Work on this line is laying the foundations of the economics of the future ... (Schumpeter, 1946, p. 3), see also (1970, pp. 624-626)

Since Schumpeter addressed his appeal to the economists of his time, thus indicating that he was still on the quest for what he regarded as the golden fleece of theoretical economics, it is somewhat paradoxical to reprimand him for not having finished the job himself:

... Schumpeter never succeeded in working out a precise mathematical formulation of his approach, a failure for which he has been criticized ... (Stolper, 1988, p. 14)

Schumpeter wrote extensively about methodology, about the respective merits of the inductive and the deductive method (1970, p. xv), about the 'helplessness of mere observation', and the necessity of gaining 'a definite point of view based on principles before approaching individual groups of facts' (1954, pp. 24, 27). He summarized the pursuit of pure theory taking the classics as a reference:

Their [the classical economists'] achievements therefore were analytical and it is this which is usually meant by the most unfortunate terms 'deductive', 'abstract', 'aprioristic'. Their chief aim was to order intellectually and to clarify the day to day happenings in the economy in order to arrive at an axiomatic understanding of its basic factors. (1954, p. 90)

By virtue of his comprehensive knowledge of both economic theory and history Schumpeter had an informed understanding of the scientific process: 'The first item to be mentioned is the economists' Vision of the economic process' (1994, p. 892). Analytical work begins with material provided by our vision of things and this is where a box of theoretical and statistical tools is needed (1994, pp. 42, 44). Parts of those tools are 'hypotheses or axioms or postulates or assumptions or even principles' (1994, p. 15), the remaining part consisting of the pertinent formal apparatus (1994,

p. 955). Schumpeter provided a verbalized vision of how the evolving money economy works. His own priority was not the application of mathematical tools. He knew them, appreciated them and he encouraged formalization:

Those who had the good fortune to know him personally report that he was always interested in a more precise and formal version of his theory. Competition among those trying to formalize and/or extend his theories is certainly in harmony with his desire. (Hanusch, 1988, p. 7)

The present paper contributes to this competition.

## **1 The case for axiomatization**

J. S. Mill clearly enunciated the question than stands at the beginning of any and every scientific inquiry:

What are the propositions which may reasonably be received without proof? That there must be some such propositions all are agreed, since there cannot be an infinite series of proof, a chain suspended from nothing. But to determine what these propositions are, is the *opus magnum* of the more recondite mental philosophy. (Mill, 2006, p. 746), original emphasis

The first one to undertake the opus magnum pursuant to Euclid's paradigm was Senior:

To Senior belongs the signal honor of having been the first to make the attempt to state, consciously and explicitly, the postulates that are necessary and sufficient in order to build up . . . that little analytic apparatus commonly known as economic theory, or to put it differently, to provide for it an axiomatic basis. (Schumpeter, 1994, p. 575)

In the 1960s Debreu radicalized and completed the ongoing axiomatization of the Walrasian approach (Debreu, 1959, p. x). Whether the project of Wald, von Neumann, Debreu, Arrow, McKenzie, Hahn, and others has met with success is no longer an open question. It is plain that 'anything based on this mock-up is unlikely to fly' (Hahn, 1981, p. 1036), see also (Ackerman, 2004), (Kirman, 1989, p. 126).

Post-Keynesians and heterodox economists as complementary group mostly rebut the 'deductivist Euclidean methodology' recommend a more pluralistic approach, and propose to give up the 'Euclidean hope' (Pålsson Syll, 2010, p. 52). Yet from the argument that the neoclassical behavioral axioms are unqualified does not

logically follow that the axiomatic method is useless or inappropriate in economics. An outstanding proponent of axiomatization like Poincaré simply did not accept Walras's behavioral hypotheses of selfishness and farsightedness as axioms (Kirman, 2009, p. 82). It only follows that some economists have not applied the method correctly, for whatever reasons (Hudson, 2010, pp. 15-16).

The crucial point is not axiomatization per se but the real world content of axioms. The specific thesis to start with suggests itself: neither neoclassical nor Keynesian economics possess, for quite different reasons, a satisfactory axiomatic basis, and heterodox economists erroneously maintain that they need none. In this they markedly differ from Schumpeter.

The general thesis of the present paper is that human behavior does not yield to the axiomatic method, yet the axiomatization of the money economy's fundamental structure is feasible. By choosing objective structural relationships as axioms behavioral hypotheses are not ruled out. On the contrary, the structural axiom set is open to *any* behavioral assumption and not restricted to the standard optimization calculus.

The present paper has three parts. The formal ground is prepared in sections 2 to 4. The analytical starting point, Schumpeter's 'reasonably small number of equations connecting a reasonably small number of variables', is given with the structural axiom set which represents the pure consumption economy. In sections 5 to 7 the definition of profit is introduced and its implications unfolded. The distinction between profit and distributed profit is crucial for the analysis of the functioning of the money economy. Standard profit theory is known to be incoherent (Desai, 2008), hence a new conceptual approach is in order.

In the main part, sections 8 to 12 the real world implications of the axioms are made explicit. The structural axiom set is consistently applied to one of Schumpeter's central themes, that is, the impact of process innovation on profits and the economy's structure.

Section 13 concludes.

## **2 Axioms**

The first three axioms relate to income, production, and expenditures in a period of arbitrary length. For the remainder of this inquiry the period length is conveniently assumed to be the calendar year. It can be shown that the applicability of the axiom set does not depend on the chosen period length. Simplicity demands that we have for the time being one world economy, one firm, and one product. Quantitative and

qualitative differentiation is obviously the next logical step after having worked out the implications of the following three axioms<sup>1</sup>.

Total income of the household sector  $Y$  is the sum of wage income, i.e. the product of wage rate  $W$  and working hours  $L$ , and distributed profit, i.e. the product of dividend  $D$  and the number of shares  $N$ .

$$Y = WL + DN \quad |t \quad (1)$$

Output of the business sector  $O$  is the product of productivity  $R$  and working hours.

$$O = RL \quad |t \quad (2)$$

Consumption expenditures  $C$  of the household sector is the product of price  $P$  and quantity bought  $X$ .

$$C = PX \quad |t \quad (3)$$

A set of axioms cannot be assessed *ex ante*, because the full range of implications is not immediately transparent. Self-evidence is neither necessary nor sufficient (Popper, 1980, pp. 71-72). Hence a set of axioms is either agreed upon as a *tentative* formal starting point or prematurely rejected out of hand. The assessment of axioms comes at the second stage with the interpretation of the logical implications of the formal world and the comparison with selected data and phenomena of the real world. Axioms should have an intuitive economic interpretation (von Neumann and Morgenstern, 2007, p. 25), (Chick, 1998, pp. 1860-1861). The economic meaning is rather obvious for the set of structural axioms. What deserves mention is that total income in (1) is the sum of wage income and *distributed profit* and not of wage income and profit. Profit and distributed profit are quite different things that have to be thoroughly kept apart.

### 3 Definitions

Definitions are supplemented by connecting variables on the right-hand side of the identity sign that have already been introduced by the axioms (Boylan and O’Gorman, 2007, p. 431). With (4) wage income  $Y_W$  and distributed profit income  $Y_D$  is defined:

$$Y_W \equiv WL \quad Y_D \equiv DN \quad |t \quad (4)$$

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<sup>1</sup> Differentiation ultimately leads to a structural axiomatic theory of value (Kakarot-Handtke, 2011c, pp. 5-7).

With (5) the expenditure ratio  $\rho_E$ , the sales ratio  $\rho_X$ , the distributed profit ratio  $\rho_D$ , and the factor cost ratio  $\rho_F$  is defined:

$$\rho_E \equiv \frac{C}{Y} \quad \rho_X \equiv \frac{X}{O} \quad \rho_D \equiv \frac{Y_D}{Y_W} \quad \rho_F \equiv \frac{W}{PR} \quad |t \quad (5)$$

Definitions add no new content to the set of axioms but determine the logical context of concepts. New variables are introduced with new axioms.

#### 4 The absolute formal minimum

The axioms and definitions are consolidated to one single equation:

$$\frac{\rho_F \rho_E (1 + \rho_D)}{\rho_X} = 1 \quad |t \quad (6)$$

The *period core* (6) determines the interdependencies of the measurable *key ratios* for each period. The period core is purely structural, i.e., free of any behavioral assumptions, unit-free, because all real and nominal dimensions cancel out<sup>2</sup>, and contingent. Contingency means that it is open until explicitly stated which of the variables are independent and which is dependent. The form of (6) precludes any notion of causality; it simply states the interdependence of the key ratios. The period core represents the pure consumption economy, that is, no investment expenditures, no foreign trade, and no taxes or any other state activity.

The factor cost ratio  $\rho_F$  summarizes the internal conditions of the firm. A value of  $\rho_F < 1$  signifies that the real wage is lower than the productivity or, in other words, that unit wage costs are lower than the price, or in still other words, that the value of output exceeds the value of input. In this case the profit per unit is positive. Then we have the conditions in the product market. An expenditure ratio  $\rho_E = 1$  indicates that consumption expenditures are equal to income and a value of  $\rho_X = 1$  of the sales ratio means that the quantities produced and sold are equal in period  $t$  or, in other words, that the product market is cleared. In the special case  $\rho_E = 1$  and  $\rho_X = 1$ , that invokes the notion of an equilibrium with market clearing and budget balancing, the profit per unit is determined solely by the distributed profit ratio  $\rho_D$ . In one sentence: the period core covers the key ratios about the firm, the market, and the income distribution and determines their mutual interdependencies.

<sup>2</sup> “This procedure is in accordance with the principle of objectivity requiring that the whole theory and its interpretations have to be independent of the choice of the units of measurement. And this requirement is met, if the theory is unit-free, the necessary condition stated in Buckingham’s II-theorem.” (Schmiechen, 2009, p. 176)

## 5 Profit

The business sector's profit in period  $t$  is defined with (7) as the difference between the sales revenues – for the economy as a whole identical with consumption expenditures  $C$  – and costs – here identical with wage income  $Y_W$ <sup>3</sup>:

$$Q_{fi} \equiv C - Y_W \quad |t \quad (7)$$

In explicit form, after the substitution of (3) and (4), this definition is identical with that of the theory of the firm:

$$Q_{fi} \equiv PX - WL \quad \text{with} \quad \rho_X = 1 \quad |t \quad (8)$$

Using the first axiom (1) and the definitions (4) and (5) one gets:

$$Q_{fi} \equiv C - Y + Y_D \quad \text{or} \quad Q_{fi} \equiv \left( \rho_E - \frac{1}{1 + \rho_D} \right) Y \quad |t \quad (9)$$

In the pure consumption economy profit is greater than zero if the expenditure ratio  $\rho_E$  is  $>1$  or the distributed profit ratio  $\rho_D$  is  $>0$ , or both. If distributed profit  $Y_D$  is set to zero, then profit or loss for the business sector is determined solely by the expenditure ratio. For the business sector as a whole to make a profit consumption expenditures  $C$  have in the simplest case to be greater than wage income  $Y_W$ . So that profit comes into existence in the pure consumption economy the household sector must run a deficit at least in one period. This in turn makes the inclusion of the financial sector mandatory (see section 11). A theory that does not include at least one bank that supports the concomitant credit expansion, which is covered by (23)<sup>4</sup>, cannot capture the essential features of the market economy. Schumpeter was well aware of this (Morishima and Cataphores, 1988, p. 42).

It needs hardly emphasis that in the investment economy the process of profit generation appears more complex. This does not affect the essence of profit but simply removes the *formal* necessity that the *households* have to incur a deficit to get the economy going. This is then done by the investing business sector. It is not advisable, though, to tackle the complexities of the investment economy before the pure consumption economy is fully understood.

<sup>3</sup> Profits from changes in the value of financial and non-financial assets are neglected here. One member of the latter class is the stock of products which may change with regard to quantity and valuation price if the product market is *not cleared* in successive periods. This case is excluded here by the condition  $\rho_X=1$ . For the general case profit has to be introduced with the 5th axiom as the sum of financial and non-financial profit.

<sup>4</sup> When the purchase of long lived consumption goods, e.g. houses, is correctly subsumed under consumption expenditures there arises no problem with regard to collateral for the banking industry and a sound credit expansion may proceed for an indefinite time in the pure consumption economy.

## 6 A cognitive dissonance, but no contradiction

The determinants of profit look essentially different depending on the perspective. For the firm price  $P$ , quantity  $X$ , wage rate  $W$ , and employment  $L$  in (8) appear to be all important; under the broader perspective of (9) these variables play no role at all. The profit definition provokes a cognitive dissonance between the micro and the macro view.

It is of utmost importance that profit  $Q_{fi}$  and distributed profit  $Y_D$  is clearly distinguished. The latter is a flow of income from the business to the household sector analogous to wage income. By contrast, profit is the difference of flows within the business sector. Profit is not connected to a factor input. So far, we have labor input as the sole factor of production and wage income as the corresponding factor remuneration. Since the factor capital is nonexistent in the pure consumption economy, profit cannot be assigned to it in functional terms. And since profit cannot be counted as factor income (2008, p. 153) there is no place for it in the theory of income distribution. This would plainly be a category mistake.

The individual firm is blind to the structural relationship as given by (9). On the firm's level profit is therefore subjectively interpreted as a reward for innovation or superior management skills or higher efficiency or toughness on wages or for risk taking or capitalizing on market imperfections or as the result of monopolistic practices. These factors play a role when it comes to the *distribution* of profits between firms and these phenomena become visible when similar firms of an industry are compared (see section 8). Business does not 'make' profit, it redistributes profit. The case is perfectly clear when there is only one firm. It is a matter of indifference whether the firm's management thinks that it needs profit to cover risks or to finance growth or whether it realizes the profit maximum or not. If the expenditure ratio is unity and the distributed profit ratio is zero, profit as defined by (8) will invariably be zero. The existence and magnitude of total profit is not explicable by the marginal principle.

Because of this, it is not wise to take the considerations of the individual firm's management as analytical starting-point and then to generalize. The microeconomic approach is inherently prone to the fallacy of composition. The profit definition entails a cognitive dissonance between micro and macro, but no logical contradiction. In fact (8) and (9) are formally equivalent. In the first place, that is, prior to any distribution between individual firms, total profit is a factor-independent residual (Ellerman, 1986, pp. 61-65).

Under the condition  $\rho_E=1$  profit  $Q_{fi}$  must, as a corollary of (9), be equal to distributed profit  $Y_D$ . The fundamental difference between the two variables is not an issue in this *limiting* case. The equality of profit and distributed profit is an implicit feature of equilibrium models and of general equilibrium theory in

particular (Patinkin, 1989, p. 329). Those models cannot find a counterpart in reality.

In the general case, profit or loss depends on consumer spending and profit distribution. If in the limiting case distributed profit is zero, then we have three logical alternatives for the numerical value of the expenditure ratio:  $\rho_E < 1$ ,  $\rho_E = 1$  or  $\rho_E > 1$ . The first alternative entails a loss for the business sector as a whole; the second means zero profit, and only the third leads to profit which in turn is the indispensable condition for a reproducible economy. Hence the real question is not about the existence of a zero-profit equilibrium, but how the market economy can, and in fact does, avoid this predicament over a longer time span.

The profit definition has another important implication. There is no real residual that corresponds to the nominal residual profit. Real ( $O, X$ ) and nominal ( $Y, C$ ) flows are to some degree independent. Profit belongs entirely to the nominal sphere, in a real model it cannot exist. This is the defining characteristic of what Keynes termed the entrepreneur economy (Rotheim, 1981, pp. 575, 577, 579).

Distributed profit, in contrast, can have a real counterpart. Since the product market is assumed to be cleared, i.e.  $\rho_X = 1$  according to (8), the whole output is shared between wage earners and the receivers of distributed profit according to their respective expenditure ratios. Since distributed profit has no relation whatsoever to the production function the marginal productivity theory of distribution cannot be true (for the determination of real shares see Kakarot-Handtke, 2011d, pp. 8-12).

## 7 The elusive zero profit economy

Schumpeter clearly realized the fundamental theoretical problem with profit, that is, ‘that the laws of cost and marginal productivity seem to exclude it’ (2008, p. 153). It cannot be said that this problem has been solved in the meantime to everybody’s satisfaction. The determination and interpretation of profit is ‘one of the most convoluted and muddled areas in economy theory’ (Mirowski, 1986, p. 234). The standard argument runs as follows:

[Producing agents] demand the services of the factors of production from resource owners and supply the final products that enter into consumption, but under conditions of equilibrium, the relative values associated with these exchanges leave the producers with a zero profit. ... This was, of course, the position of Walras. (Walsh and Gram, 1980, pp. 215, 243)

This was also the position of Karl Schlesinger and Abraham Wald, who essentially created modern general equilibrium theory (Leonhard, 1995, p. 736). Schumpeter,

too, defended zero profits: ‘if we are resolved to display the logical properties of perfect equilibrium in pure competition, Marshall’s profits will in fact vanish as completely as will Walras’’ (1994, p. 1050), see also (1994, p. 893 fn 3).

Post-Walrasian general equilibrium theory differs in several respects from the founding fathers. In Debreu’s private ownership economy there is profit and it is distributed:

... the consumers own the resources and control the producers. Thus, the  $i^{th}$  consumer receives the value of his resources ... and the shares ... of the profit of the  $1^{st}$ , ...,  $j^{th}$ , ...,  $n^{th}$  producer. ... Consider a private ownership economy  $E$ . When the price system is  $p$ , the  $j^{th}$  producer tries to maximize his profit on  $Y_j$ . Suppose that  $y_j$  does this; the profit  $\pi_j(p) = p \cdot y_j$  is distributed to shareholders. (Debreu, 1959, pp. 78-79)

This result has been contested, for example, by (Walsh and Gram, 1980, pp. 243-244), (Ellerman, 1986, p. 70), and (Hahn, 1984, p. 79).

In a way Schumpeter solved the problem of profit. He maintained zero profit for the stationary economy and explained the indubitable fact of continuing positive profits with the occurrence of disruptive entrepreneurs who, led by the prospect of extraordinary profits, are keen to carry out new combinations (2008, p. 66). Pure profit thereby became a disequilibrium phenomenon (1994, p. 1051). Schumpeter was in accordance with the equilibrium theory of Walras which, however, is no longer in accordance with the general equilibrium theory of the Arrow-Debreu type. As the Palgrave Dictionary concludes a comprehensive survey: ‘A satisfactory theory of profits is still elusive’ (Desai, 2008).

This predicament does not affect the structural axiomatic approach. A separate profit theory that depends on a perfect competitive equilibrium is not required because profit is already implicit in the axiom set and is made explicit with (7).

## 8 Profit and structural stress

When two (or more) non-identical firms operate in one market, which is assumed at the moment, total profits must be greater than zero or the number of firms eventually shrinks to one. This is obvious, since with zero total profit the profit of one firm is necessarily outweighed by a loss of the same amount in the other firm.

For two firms total profit is derived from (8) as:

$$Q_{fi} \equiv (P_1X_1 - W_1L_1) + (P_2X_2 - W_2L_2) \quad |t \quad (10)$$

To start with the simplest case four conditions are applied: the quantity bought from each firm is equal to output, i.e. the product market is cleared, and the price, the wage rate, and employment are identical for both firms:

$$X_1 = O_1, X_2 = O_2 \quad P_1 = P_2 = P \quad W_1 = W_2 = W \quad L_1 = L_2 = L_h \quad |t \quad (11)$$

Hence it is alone productivity that is different in both firms. Equation (10) thus reduces to:

$$Q_{fi} \equiv PL_h \left( R_1 - \frac{W}{P} + R_2 - \frac{W}{P} \right) \quad \text{if } \rho_{X1} = 1; \rho_{X2} = 1 \quad |t \quad (12)$$

We now ask what the minimum profit for the business sector as a whole must be under the additional condition that the profit of the firm with the lower productivity is at least zero. The structural minimum profit that keeps the marginal firm in the market is:

$$Q_{fi}^{min} \equiv PL_h R_2 \left( \frac{R_1}{R_2} - 1 \right) \quad \text{if } \frac{W}{PR_2} = 1 \quad |t \quad (13)$$

The expression on the right hand side states that the factor cost ratio  $\rho_F \equiv W/PR$  for firm<sub>2</sub> is unity or, what amounts to the same, that profit is zero according to (8). As the two firms can stay in the market total employment  $L=L_1+L_2=2L_h$  is maintained. The question of whether the economy is at full employment or not can be left open at this point (see section 12).

Under the given conditions the minimum profit (13) must be the higher for two otherwise identical firms the greater the productivity disparity between them. The degree of heterogeneity is expressed by the productivity ratio  $\rho_R \equiv R_1/R_2$ . If profit for the business sector as a whole is below this minimum profit the structure of the business sector is bound to change. Hence structural stress is a function of the profit for the business sector as a whole and the degree of heterogeneity within the business sector. When profit for the business sector is greater than the structural minimum profit all firms are making profits. A straightforward gauge of structural stress is given by:

$$\zeta \equiv \frac{Q_{fi}^{min}}{Q_{fi}} \quad |t \quad (14)$$

If  $\xi=0$  and  $Q_{fi}>0$  all firms make a profit relative to their size. If  $\xi=1$  the profit of the marginal firm is exactly zero, the whole profit accrues in firm<sub>1</sub>, and with  $\xi>1$  structural change sets in. When the structural minimum profit is given, then structural stress varies inversely with the development of profits for the business

sector as a whole. With any given total profit the stability of the economy increases with the degree of homogeneity.

Since productivity differentials are a normal and enduring feature of the economy profit must be greater than zero in the pure consumption economy and this means  $\rho_E > 1$  at least over some initial periods. This, however, is not a stationary economy in the sense of Schumpeter (2008, pp. 82-83 fn). To establish one, the expenditure ratio has to be unity and the following additional condition must hold:

$$Q_{fi}^{min} = Q_{fi} = Y_D \quad (15)$$

From (9), (13), and (5) then follows for the distributed profit ratio:

$$\rho_D = \frac{1}{2} (\rho_R - 1) \quad |t \quad (16)$$

Under this condition the profit of the marginal firm<sub>2</sub> is always zero and the profit of firm<sub>1</sub> is identical with the profit for the business sector as a whole. Exactly this amount is distributed to the households in period  $t$  and the same amount is spent together with wage income on the output of both firms in the stationary economy. The household sector's budget is balanced.

We therefore have an economy with more than one firm that is reproducible in principle for an indefinite time span. This economy is plainly different from Schumpeter's zero profit stationary circular flow. Since a zero profit economy is impossible with two or more firms with different productivities there must be profit in the stationary economy, too. It is only required that this profit and distributed profit are equal in each period. To be sure, this is a theoretical limiting case. In the real world profit and distributed profit are never equal.

From the fact that a positive profit for the business sector as a whole is the precondition for the existence of the market system with more than one firm it follows that models that apply the zero profit condition are a priori flawed. Therefore, Schumpeter's assertion that there can be no profit in the stationary circular flow (2008, p. 154), which is here formalized by the axioms of the pure consumption economy, has to be rejected. Just the opposite is true.

## 9 Wage rate adaptation and monopolization

When we allow for the differentiation of wages rates in (12) the general condition for the structural minimum profit reads:

$$Q_{fi}^{min} \equiv PL_t R_2 \left( \frac{R_1}{R_2} - \frac{W_1}{W_2} \right) \quad \text{if} \quad \frac{W_2}{PR_2} = 1 \quad |t \quad (17)$$

Structural stress is lowered when the wage ratio  $\rho_W \equiv W_1/W_2$  adapts to the productivity ratio  $\rho_R$ . So, either the wage rate in the marginal firm falls or it rises in the firm with the higher productivity or a combination of the two. In the limiting case the ratio of wage rates  $\rho_W$  thus becomes equal to the ratio of productivities  $\rho_R$ . Then structural stress  $\xi$  is zero and the distribution of profits between both firms is equal. To exclude side effects, this wage adaptation process should in the ideal case take place in such a manner that total income remains constant.

When we add the assumption that the law of one price holds for the wage rates in different firms then this adaptation is ruled out from the outset (2008, p. 145). In the general case, though, this process is logically and practically possible while the law of one price is at best a plausible tendency.

Actually wage differentials exist and in principle they may well persist. With wage reductions the marginal firm can stay in the market and counter the falling market price that follows according to (20) from the productivity increases of firm<sub>1</sub>.

When we add the assumption that the wage differential initiates a migration from the low-wage firm<sub>2</sub> to the high-wage firm<sub>1</sub>, then the latter grows and the former shrinks. To exclude side effects, this process should leave total employment unaffected. The logical result is a monopoly. Total profit stays put in the process if the expenditure ratio and the distributed profit ratio are kept constant. From this follows that monopoly is not a separate source of profit. Profit is simply redistributed from firm<sub>2</sub> to firm<sub>1</sub> as far as it is above the structural minimum profit. Hence we cannot adopt Schumpeter's distinction between entrepreneurial profit and temporary monopoly revenues (2008, p. 152). They are but two appearances of the same thing. On the other hand, Schumpeter's tenet that monopoly is not a priori a bad thing gets some support. The reallocation of employment between the two firms raises average productivity and the average wage rate.

The relation of the two variables affects the market clearing price. The price follows directly from the period core (6) as:

$$P = \frac{\rho_E}{\rho_X} \left( \frac{W}{R} + \frac{Y_D}{L} \right) \quad |t \quad (18)$$

The average wage rate  $W$  and the average productivity  $R$  are given by:

$$W = W_1 \frac{L_1}{L} + W_2 \frac{L_2}{L} \quad R = R_1 \frac{L_1}{L} + R_2 \frac{L_2}{L} \quad (19)$$

Under the conditions of market clearing,  $\rho_X=1$ , and budget balancing,  $\rho_E=1$ , the market clearing price  $P^*$  results as:

$$P^* = \frac{W}{R} + \frac{Q_{fi}^{min}}{L} \quad \text{if } \rho_E = 1; \rho_X = 1 \quad |t \quad (20)$$

This looks like a mark-up formula (cf. Lavoie, 1992, p. 129), but it is none. If initial minimum profit and employment are kept constant during the adaptation process and if average wage rate and average productivity ideally rise in lockstep, then the market clearing price remains unaltered. The profit of firm<sub>1</sub> that was initially necessary to keep firm<sub>2</sub> in the market appears now as monopoly profit. This profit is fully distributed in each period. Since absolute profit remains constant and firm<sub>1</sub> doubles its size profit per unit falls. Firm<sub>1</sub> does not gain much by full monopolization.

The ultimate result is hardly different when the law of one price is hypothesized. When the employees migrate without wage differential the average wage rate remains constant and with an increasing average productivity this entails a lower market clearing price. The effect on total profit is nil.

Can new entrants drive profit down to zero? No. New entrants can drive down the market clearing price and redistribute profit in their favor if their productivities are higher than that of incumbent firms. The profitability of the business sector as a whole is independent from the number of firms or the absolute size of the economy. The profit ratio  $\rho_Q$  is defined with (21) and this gives a succinct summary of the structural interrelation of the profit ratio, the expenditure ratio, and the distributed profit ratio for the business sector as a whole:

$$\rho_Q \equiv \rho_E (1 + \rho_D) - 1 \quad \Leftrightarrow \quad \rho_Q \equiv \frac{Q_{fi}}{Y_W} \quad |t \quad (21)$$

The overall profit ratio is positive if the expenditure ratio  $\rho_E$  is  $>1$  or the distributed profit ratio  $\rho_D$  is  $>0$ , or both. As long as the households stick to their spending pattern and distributed profits move in lockstep with wage income the profitability of the business sector is not affected by the entry and exit of firms.

## 10 The catching-up process

Structural stress is reduced and eventually eliminated according to (13) and (14) when the marginal firm catches up and boosts productivity to the level of firm<sub>1</sub>.

To elucidate in more detail the role of the Schumpeterian entrepreneur and the relation between efficiency and profit it is assumed that productivity and everything else is at first equal in firm<sub>1</sub> and firm<sub>2</sub>. The expenditure ratio is greater than unity, so both firms make equal profits. Suppose that a process innovation becomes known and is implemented (without capital investment) by both firms in the next period. This increases productivity. Then the price must fall to clear the market, i.e.  $\rho_X=1$ , according to (18) and the fruits of organizational progress are directly handed over to the households. Profits of both firms remain unchanged if the expenditure ratio

stays put. In this case there is no connection at all between efficiency and profit. Hence it is the time disparity of implementation between firms that is the crucial factor for the redistribution of the independently given overall profits between firms. The effect of efficiency improvements on profits is nil if both firms move in lockstep and it is immaterial whether they move fast or slow.

In contrast to a single-minded profit maximizer an entrepreneur tries to enlarge the average time disparity between the period of his own implementation and the periods of his competitors' implementations. This can be done by directly accelerating the own implementation and – if possible – decelerating all others. Therefore, new strategic options have to be adjoined to the standard concept of competition. It is rational for the firm to impede the dissemination of knowledge about a more efficient production process and thus time conscious individual rationality gets in the way of timeless welfare rationality.

Even if the trail blazing Schumpeterian entrepreneur (2008, pp. 132-133) cannot achieve a lasting redistribution of profits in his favor he almost certainly achieves 'the acceleration of just about everything' (Gleick). There is no obvious mechanism in the system that determines some kind of evolutionary optimum such that the 'velocity' as first derivative of economic growth becomes eventually equal to the marginal costs of obsolescence or destruction for the economy as a whole. The system simply accelerates with exogenous constraints as upper limits.

The entrepreneur may be formally characterized as the agent who realizes a productivity ratio  $\rho_R > 1$  and thus increases structural stress according to (14) in conjunction with (13). When he produces too much stress in the pure consumption economy he may contribute to the irreversible demise of firms and, at least in the first round, to a drop of employment. The entrepreneur precipitates uncompensated negative externalities. From the overall welfare perspective the lockstep process is preferable.

When we compare the lockstep process with the catching-up process and assume that the ultimate result is the same then the only difference is a temporary redistribution of profits within the business sector. The households benefit in either case from the productivity increase. The ultimate rationale for the stressful catching-up process is that the implementation of new production methods would not take place without the promise of temporary above-average profits and the threat of temporary below-average profits. This leaves open the question of how much promise and threat is needed (2008, pp. 154-155). We refrain at this point from further behavioral speculation.

The invisible hand is supposed to provide ample living space such that relatively inefficient firms and agents (50 percent by definition at all times of below-average intelligence, motivation, and management capabilities) can stay in the market in a full employment economy. This living space is determined by the level of total

profit. The greater the profit-relevant heterogeneity between firms in one market the higher is the required minimum profit (17) for the economy as a whole. With regard to the whole economy profit is first of all a structural necessity. Heterogeneity determines the distribution of total profit among firms but is not its ultimate source. Schumpeter's account of profit origination remains on the surface.

## 11 Money and credit

The money economy is the *real* economy. The dichotomization of the real and the monetary sphere was a central point of Keynes's methodological critique of orthodox economics:

The division of economics between the theory of value and distribution on the one hand and the theory of money on the other hand is, I think, a false division. (Keynes, 1973, p. 293)

Schumpeter had no qualms with the application of the quantity theory to the stationary circular flow. For him credit and the creation of new purchasing power were the distinguishing features of the developing economy because they enable the entrepreneurs to carry out new combinations (2008, pp. 101-102). Schumpeter gave an in-depth description of the pivotal role of the banking system. The formal task is now to show how money consistently follows from the given axiom set.

If income is higher than consumption expenditures the household sector's stock of money increases. It decreases when the expenditure ratio  $\rho_E$  is greater than unity. The change of the household sector's money stock in period  $t$  is defined as:

$$\Delta M_H \equiv Y - C \equiv Y(1 - \rho_E) \quad |t \quad (22)$$

The stock of money at the end of an arbitrary number of periods is defined as the numerical integral of the previous changes of the stock plus the initial endowment:

$$M_H \equiv \sum_{t=1}^t \Delta M_{Ht} + M_{H0} \quad (23)$$

The changes in the stock of money as seen from the business sector are symmetrical to those of the household sector:

$$\Delta M_B \equiv C - Y \equiv Y(\rho_E - 1) \quad |t \quad (24)$$

The business sector's stock of money at the end of an arbitrary number of periods is accordingly given by:

$$M_B \equiv \sum_{t=1}^t \Delta M_{Bt} + M_{B0} \quad (25)$$

To simplify matters here it is supposed that all financial transactions are carried out without costs by the central bank. The stock of money then takes the form of current deposits or current overdrafts (Wicksell, 1936, p. 70). Initial endowments can be set to zero. Then, if the household sector owns current deposits according to (23) the current overdrafts of the business sector are of equal amount according to (25) and vice versa if the business sector owns current deposits. Money and credit are symmetrical. The current assets and liabilities of the central bank are equal by construction. From its perspective the quantity of money at the end of an arbitrary number of periods is given by the absolute value either from (23) or (25):

$$M_t \equiv \left| \sum_{t=1}^t \Delta M_t \right| \equiv \left| \sum_{t=1}^t Y_t (\rho_{Et} - 1) \right| \quad \text{if } M_0 = 0 \quad (26)$$

The quantity of money thus follows directly from the axioms and this implies for the time being that the central bank plays an accommodative role. Thus it is not necessary for the firms and households to resort to funds that have been accumulated before period<sub>1</sub>. The central bank provides elastic currency roughly in accordance with the definition of the Federal Reserve Act: ‘Currency that can, by the actions of the central monetary authority, expand or contract in amount warranted by economic conditions’.

In the pure consumption economy it is the household sector that takes up credit if the expenditure ratio  $\rho_E$  is  $>1$  in period  $t$ . The cumulative development of credit is given by (23).

## 12 The elementary axiomatic circular flow

Schumpeter set the task to construct a ‘simple model displaying all the essential features of the economic process by means of a reasonably small number of equations connecting a reasonably small number of variables’. With the period core (6) the structural axiomatic approach provides the absolute minimum of equations. Out of it follows the employment equation:

$$L = \frac{Y_D}{PR \frac{\rho_X}{\rho_E} - W} \quad |t \quad (27)$$

As a purely formal relationship the period core must hold in each period. Its new form now implies the *additional* assumption that employment as dependent variable is determined by the rest of the system. This is an assumption about the direction of dependency in a system with complex and mutual interrelations and this *add-on* assumption is strictly independent of the axiom set which is clearly open to various dependency interpretations. Dependency is conceptually different from causality.

The employment equation states – with the other variables unaltered in each case:

- (i) An increase of the expenditure ratio  $\rho_E$  leads to higher employment. An expenditure ratio  $\rho_E > 1$  presupposes the existence of a banking system (see section 11).
- (ii) An increase of the wage rate leads to *higher* employment, i.e. to a lower unemployment rate.
- (iii) A price increase is conducive to *lower* employment .
- (iv) A productivity increase leads to lower employment.

Statements (i) to (iv) follow without regress to any behavioral assumptions from the axiom set and the ‘laws of algebra’ (Shaik, 1980, p. 83). When the axioms capture reality the logical implications are observable. Equation (27) is the structural axiomatic variant of the Phillips curve.

The counter-intuitive property (from the accustomed perspective) of the employment equation is that a wage rate reduction, which lowers the real wage, coincides with *lower* employment. This dissonance between standard behavioral assumptions and structural fact explains why the usual recipe for more employment does not succeed in getting the economy out of a slump. The microeconomic optimization calculus and Marshall’s pair of demand/supply scissors – designed for the isolated partial market – simply do not apply to the economy as a whole. When behavioral and structural logic are at odds, behavioral logic is conducive to frustrated plans and expectations. That is the normal state of economic affairs.

With regard to the process of adaptation of employment to changes of the independent variables equation (27) implies that the independent variables have to be fixed at the beginning of the period under consideration. Since the period length is arbitrary no great distortions arise from this idealization if the length is conveniently chosen.

The structural axiomatic approach asserts that in the consumption economy employment is determined solely by the expenditure ratio  $\rho_E (\equiv C/Y)$  and the factor cost ratio  $\rho_F (\equiv W/PR)$ . This follows from (27) under the conditions that the product

market is cleared, i.e.  $\rho_X=1$ , and that the relation of dividend to wage rate  $\rho_W$  is held constant:

$$L = \frac{\frac{DN}{PR}}{\frac{\rho_X}{\rho_E} - \frac{W}{PR}} = \frac{\rho_W N}{\frac{\rho_X}{\rho_E \rho_F} - 1} = \frac{(\cdot)}{\frac{1}{\rho_E \rho_F} - 1} \quad \text{if } \rho_X = 1, \rho_W \equiv \frac{D}{W} \quad |t \quad (28)$$

Since employment depends on the expenditure and the factor cost ratio there obviously exists an arbitrary number of configurations of the two ratios that are compatible with full employment (however defined). Here we leave open the question of how full employment could be established (see Kakarot-Handtke, 2011a, pp. 7-9). Under the conditions that the product market is cleared, i.e.  $\rho_X=1$ , and the household sector's budget is balanced, i.e.  $\rho_E=1$ , the period output is given by:

$$O = RL = \frac{(\cdot)}{\frac{P}{W} - \frac{1}{R}} \quad \text{if } \rho_X = 1; \rho_E = 1 \quad |t \quad (29)$$

Output depends ultimately on the outcome of the market price mechanism, i.e. the relation of wage rate, price, and productivity in each period.

The period values of the variables are connected formally by the familiar growth equation, which is added to the structural set as the fourth axiom:

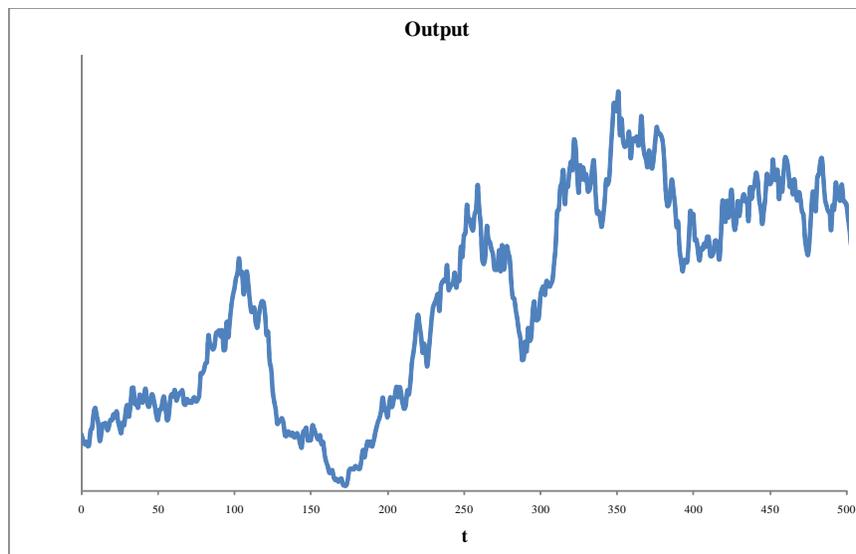
$$Z_t = Z_{t-1} (1 + \bar{Z}_t) \quad Z | W, P, R \quad (30)$$

The path of the representative variable  $Z_t$ , which stands for wage rate, price, and productivity, is then determined by the initial value  $Z_0$  and the rates of change  $\bar{Z}_t$  for each period:

$$Z_t = Z_0 (1 + \bar{Z}_1) (1 + \bar{Z}_2) \dots (1 + \bar{Z}_t) = Z_0 \prod_{i=1}^t (1 + \bar{Z}_i) \quad (31)$$

Equation (31) describes the paths of the variables with the rates of change as unknowns. These unknowns are in need of determination and explanation. Since we do not wish to get involved into speculations about human behavior at this stage, we choose the random hypothesis because:

The simplest hypothesis is that variation is random until the contrary is shown, the onus of the proof resting on the advocate of the more complicated hypothesis ... (Kreuzenkamp and McAleer, 1995, p. 12)



**Figure 1:** Random Cycles in the Pure Consumption Economy With Market Clearing, Budget Balancing, and Full Profit Distribution

By feeding (29) with random rates of change for wage rate, price, and productivity (500 changes between 0%–0.6%, 0%–0.4%, 0%–0.2% respectively) output in this simple random economy<sup>5</sup> develops over time as shown in Figure 1.

Since the product market is cleared and the budget is balanced output changes depend alone on relative random changes of wage rate  $W$ , price  $P$ , and productivity  $R$ . It should be noted in passing that Schumpeter held the ‘theory of random events’ in high esteem (1994, p. 448 fn 5), but he did not apply it himself.

From (29) follows that real wage and output are positively related. Productivity and output are negatively related because a productivity increase has a negative employment effect. This follows directly from the axiom set and is made explicit by (27). Schumpeter discussed this effect under the heading of technological unemployment (2008, p. 250).

Profits and distributed profits are equal in each period. Contrary to Schumpeter, profit is greater than zero and increases steadily. The chosen simulation comes, without taking over the Walrasian shortcomings, as close as possible to the elementary circular flow that served Schumpeter as a backdrop for the description of the entrepreneurial dynamics of the market system.

<sup>5</sup> The term random economy has been introduced for the equilibrium analysis of pure exchange economies (Föllmer, 1974). It is adopted in the present paper without this specific connotation.

One phenomenon deserves emphasis. It has been observed by Slutsky (1937, p. 114) that the summation of random causes may produce cyclic processes in the economy (and elsewhere). This seems also to be the case for output in Figure 1 although the cyclic pattern does not result from a simple summation but from the intricate economic structure that is given with (29). This kind of cycles needs no further explanation in terms of entrepreneurial behavior (a full account of the pure random consumption economy is given in Kakarot-Handtke, 2011b).

Applying four axioms, the laws of algebra and pure random changes we have formalized and rectified Schumpeter's zero profit circular flow in structural axiomatic terms. The 'reasonably small number of variables' consists of seven elementary variables (wage rate, price, productivity, employment, quantity bought, dividend, number of shares) and three composed variables (output, income, consumption expenditures). Profit, money and other variables are derived from these by definitions. To establish the interdependencies of all variables is the first and elementary part of the task that Schumpeter envisioned. The obvious next step is to take capital accumulation into the picture.

### **13 Summary and conclusions**

Behavioral assumptions, rational or otherwise, are not solid enough to be eligible as first principles of theoretical economics. Hence all endeavors to lay the formal foundation on a new site and at a deeper level actually need no further vindication. The present paper suggests three non-behavioral axioms as groundwork for the formal reconstruction of the evolving money economy.

The present paper has three parts. In the first, the logical interdependencies of the key variables that formally embody the firm, the market, and the income distribution are identified. In the second, the real world implications for the proper functioning of the market system are made explicit. In the third, Schumpeter's description of the stationary circular flow that is disturbed by the entrepreneurs is formalized in structural axiomatic terms.

The analytical priority claim of the structural axiomatic approach rests on the simple fact that, since the structure that is given by the axiom set does not adapt to behavior, behavior has to adapt to structure. When behavioral and structural logic are at odds, behavioral logic is conducive to frustrated plans and expectations. That is the normal state of economic affairs.

The main results of the inquiry are:

- A positive expenditure-income asymmetry is the ultimate structural originator of profit and therefore the indispensable prerequisite for favorable business

conditions. This holds for the elementary consumption economy and the complex investment economy in equal measure.

- In the pure consumption economy total profit of the business sector is greater than zero if the expenditure ratio is  $>1$  or the distributed profit ratio is  $>0$ , or both.
- Profit is not exclusively a disequilibrium phenomenon as Schumpeter maintained.
- The entrepreneur does not create profit; he changes only the distribution of profits among firms. This holds for the stationary economy as well as for the developing economy.
- Monopoly revenues are not qualitatively different from entrepreneurial profit as Schumpeter maintained. They are but two appearances of the same thing.
- When two (or more) non-identical firms operate in one market total profits must be greater than zero or the number of firms eventually shrinks to one. A zero profit equilibrium is impossible with more than one firm.
- The minimum profit for the economy as a whole must be the higher the greater the economically relevant heterogeneity between firms is. If total profit is lower than the minimum profit structural change sets in and leads to a drop of employment.
- Models that are based on the collapsed definition total income  $\equiv$  wages + profits are erroneous because profit and distributed profit is not the same thing.
- The axiomatic Schumpeterian model consists of seven elementary and three composed variables and their mutual interdependencies. It entails the process of creative destruction and leads to the threshold of business cycle theory.

Applying the axioms, the laws of algebra and pure random changes Schumpeter's description of the stationary circular flow has been formalized and turned into a simple model displaying the essential features of the elementary economic process. The structural axiomatic approach fits the Schumpeterian approach consistently into a general context.

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