Redemption and Depression

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Abstract

According to prevailing methodological criteria, standard economics is definitively refuted. Joan Robinson's wake-up call "Scrap the lot and start again" has therefore lost nothing of its original freshness and urgency. Yet, how can the restart succeed? This inquiry builds on structural axioms. First, conceptual consistency is assured and the confusion about profit and income is dissolved. The question of interest is then how a recession or depression develops as the result of the normal functioning of the monetary economy. This involves the identification of positive feedback. A very effective mechanism consists of the circular interaction of profit and distributed profit.

JEL B59, E32, E50

Keywords new framework of concepts; structure-centric; axiom set; randomness; market clearing; budget balancing; consumption economy; investment economy; credit expansion

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1 "Scrap the lot ...

> Whatever knowledge we possess is either knowledge of particular facts or scientific knowledge. (Russel, 1961, p. 620)

It is a fact that economics has accumulated in the course of time a lot of knowledge of particular facts. Because of historical specificity most of it has become obsolete and useless for the understanding of how the actual economy works. It is quite another question whether theoretical economics has accumulated much scientific knowledge. There is a dearth of positive examples. General equilibrium theory does not qualify. Neither does an empirical economics that focuses with a modicum of theory on apparently commonsensical particular facts. Scientific knowledge about the working of the economy we happen to live in is marginal.

Standard economics rests on behavioral assumptions that are formally expressed as axioms (Debreu, 1959; Arrow and Hahn, 1991). This approach has collapsed under the weight of material and conceptual inconsistencies (Ackerman and Nadal, 2004).

Conceptual rigor therefore demands, first, to discard the subjective-behavioral axioms and to take objective-structural axioms as the formal point of departure, and second, to clarify the ill-understood interrelations of the fundamental concepts income and profit.

The present paper looks for positive feedback in the elementary interactions of the monetary economy. This is the precondition for the explanation of recession or depression which are phenomena in their own right that cannot be understood as deviations from an imaginary optimal state.

First, Section 2 provides the new formal foundations with the set of three structural axioms. These represent the pure consumption economy as the most elementary economic configuration. In Section 3 overall and individual profit is defined and contrasted with income. This resolves some popular misunderstandings. Section 4 abandons determinism and specifies the properties of the pure random consumption economy. In Section 5 money, credit and the real stock of products make their appearance. With all necessary elements in their proper places it is then possible, in Section 6, to simulate stochastic market clearing and budget balancing in the evolving economy. In Section 7 the crucial positive feedback between profit and distributed profit is identified and formally defined. This renders general equilibrium obsolete and explains how the interaction of saving/dissaving and full or partial profit distribution produces boom or bust depending on the configuration of critical parameters. In Section 8 investment is taken into the picture. This enables the correct restatement of the relation between profit, investment expenditures, saving, and distributed profit that completes the explanation of the emergence of vicious cycles. The much talked about equality of saving and investment goes, at long last, definitely out of the window. It is formally untenable and this becomes immediately evident within the structural axiomatic context. Section 9 concludes.

2 ... and start again"

> The object of reasoning is to find out, from the consideration of what we already know, something else which we do not know. (Peirce, 1992, p. 111)

2.1 Axioms

The formal foundations of theoretical economics must be nonbehavioral and epitomize the interdependence of the real and nominal variables that constitutes the monetary economy.

The first three structural axioms relate to income, production, and expenditure in a period of arbitrary length. The period length is conveniently assumed to be the calendar year. Simplicity demands that we have for the beginning one world economy, one firm, and one product. Axiomatization is about ascertaining the *minimum* number of premises. Three suffice for the beginning.

Total income of the household sector Y in period t 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.

$$Y = WL + DN \quad |t \tag{1}$$

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

$$O = RL \quad |t \tag{2}$$

The productivity R depends on the underlying production process. The 2nd axiom should therefore not be misinterpreted as a linear production function.

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

$$C = PX \quad |t \tag{3}$$

The axioms represent the pure consumption economy, that is, no investment, no foreign trade, and no government.

The economic content of the structural axioms is plain. The sole point to mention is that total income in (1) is the sum of wage income and *distributed profit* and not of wage income and profit. This distinction makes all the difference between good or bad economics.

2.2 Definitions

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

$$Y_W \equiv WL \qquad Y_D \equiv DN \quad |t. \tag{4}$$

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

We define the sales ratio as:

$$\rho_X \equiv \frac{X}{O} \quad |t. \tag{5}$$

A sales ratio $\rho_X = 1$ indicates that the quantity sold X and the quantity produced O are equal or, in other words, that the product market is cleared.

We define the expenditure ratio as:

$$\rho_E \equiv \frac{C}{Y} \quad |t. \tag{6}$$

An expenditure ratio $\rho_E = 1$ indicates that consumption expenditures C are equal to total income Y, in other words, that the household sector's budget is balanced.

2.3 The market clearing price

From (3), (5), and (6) follows the price as dependent variable:

$$P = \frac{\rho_E}{\rho_X} \frac{W}{R} \left(1 + \frac{DN}{WL}\right) \quad |t. \tag{7}$$

Under the condition of market clearing follows:

$$P = \rho_E \frac{W}{R} (1 + \rho_D) \qquad |t. \tag{8}$$
$$\text{if} \quad \rho_X = 1 \quad \text{and with} \quad \rho_D \equiv \frac{Y_D}{Y_W}$$

This is the general structural axiomatic law of supply and demand for the pure consumption economy with one firm ('law' echos the accustomed parlance). Supply is represented by R, L, demand by ρ_E and indirectly by the income distribution as determined by W, L, D, N. The price equation (8) is testable in principle and supplants

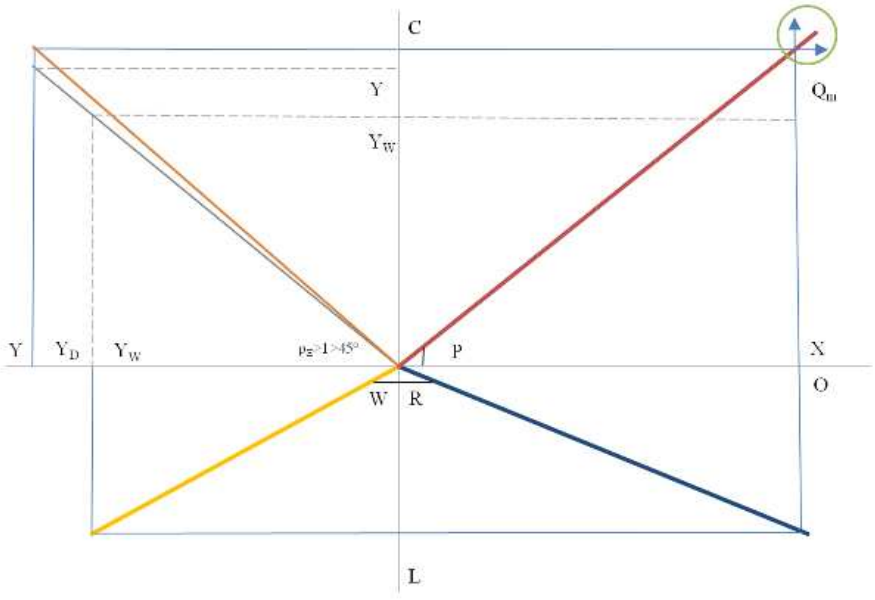

Figure 1: Determination of the market clearing price in the 4-quadrant scheme according to (8); the price rises with independently increasing demand and falls with independently increasing supply

the familiar one-fits-all tool, viz. supply-function–demand-function–equilibrium. Figure 1 shows how the market clearing price is geometrically determined.

Under the additional conditions of budget balancing and zero distributed profit then follows:

$$P = \frac{W}{R} \qquad \text{if} \quad \rho_E = 1, Y_D = 0, \rho_X = 1 \quad |t. \tag{9}$$

The market clearing price is equal to unit wage costs if the expenditure ratio is unity and distributed profit is zero. In this elementary case, profit per unit is zero and by consequence total profit is zero. All changes of the wage rate and the productivity affect the market clearing price in the period under consideration. We refer to this formal property as *conditional* price flexibility because (9) involves no assumption about human behavior, only the purely formal condition $\rho_X = 1$.

With (9) the real wage $\frac{W}{P}$ is *uno actu* given; it is under the enumerated conditions invariably equal to the hourly output R. Hence labor gets the whole product. The elementary consumption economy with product market clearing and budget balancing is reproducible at any level of employment.

Since profit is zero at all employment levels it makes no difference from the business sector's perspective whether full employment obtains or not. The principle of

indifference holds. There is no such thing as a profit maximum and there are no such things as equilibrium or disequilibrium. According to the principle of indifference, the business sector could establish full employment because this makes, at equal profits, the hitherto unemployed better off without making the already employed worse off, provided the productivity does not change in the relevant range. There is no preferred state for the business sector, profit maximization is inapplicable. The principle of indifference is more general than maximization because it does not rely on the methodologically inadmissible assumption of decreasing returns. It allows the business sector also, not to move at all, because this would not make any difference with regard to profit. This inertia is justified from the narrow perspective of the business sector but certainly not from the perspective of the economy as a whole. Note that wage rate changes have no effect on total profit but only on the market clearing price. The real wage is, according to (9) invariably equal to the productivity. This is a systemic property under the stated conditions. Human behavior or ethical considerations have nothing to do with it. Figure 1 looks the same whether the economy is at full employment or not.

3 Profit

> We need to know what profits have been, how they have been made, to what uses they have been put…: no light on these matters is shed by the analyses of value, of utility and disutility, that have preoccupied so many of us for so long. (Parry, 1921, p. 131)

Total profit consists of monetary and nonmonetary profit. Here we are at first concerned with monetary profit. Nonmonetary profit is treated at length in (2012).

3.1 Overall profit

The business sector's monetary profit/loss in period t is defined with (10) as the difference between the sales revenues – for the economy as a whole identical with consumption expenditure C – and costs – here identical with wage income Y_W:

$$Q_m \equiv C - Y_W \quad |t. \tag{10}$$

Because of (3) and (4) this is identical with:

$$Q_m \equiv PX - WL \quad |t. \tag{11}$$

This form is well-known from the theory of the firm.

From (10) and (1) finally follows:

$$Q_m \equiv C - Y + Y_D \quad |t. \tag{12}$$

The three equations are formally equivalent and show profit under different perspectives. Eq. (12) tells us that overall profit is zero if $\rho_E = 1$ and $Y_D = 0$. It is important to recall that we discuss at the moment the simplified case with zero distributed profit. Hence profit for the business sector as a whole depends solely on the relation of consumption expenditures C and income Y, i.e. on the expenditure ratio ρ_E. Then, with an expenditure ratio of unity profit of the business sector as a whole is zero.

3.2 Individual profits

For firm A eq. (11) reads in the case of market clearing:

$$Q_{mA} \equiv P_A R_A L_A \left(1 - \frac{W_A}{P_A R_A}\right) \quad \text{if} \quad \rho_{XA} = 1 \quad |t. \tag{13}$$

Monetary profit of firm A is zero under the condition that the quotient of wage rate, price, and productivity is unity. This holds independently of the level of employment or the size of the firm. From the zero profit condition follows:

$$P_A = \frac{W_A}{R_A} \quad |t. \tag{14}$$

The price of product A is equal to unit wage costs. This corresponds to (9).

In the same way one gets the individual profits and the zero profit market clearing prices for all other firms. With this, the structure of relative prices is determined.

3.3 Essential properties

From the structural axioms follows in direct lineage:

- The business sector's revenues can only be greater than costs if, in the simplest of all possible cases ($Y_D = 0$), consumption expenditures are greater than wage income.
- In order that profit comes into existence for the first time in the pure consumption economy the household sector must run a deficit at least in one period.
- Wage income is the factor remuneration of labor input L. Profit Q_m is not a factor income. Since capital is nonexistent in the pure consumption economy profit is not functionally attributable to capital.

- Profit has no real counterpart in the form of a piece of the output cake. Profit has a monetary counterpart.
- The existence and magnitude of profit does not depend on profit maximizing behavior of the firm but solely on the expenditure ratio of the household sector.
- The value of output is, in the general case, different from the sum of factor incomes. This is the defining property of the monetary economy.
- Only in the *limiting* case $Y_D = 0$, $\rho_X = 1$ and $\rho_E = 1$ is the value of output equal to factor income, i.e. $C = Y_W$. This is the overall zero profit case. Individual profits and losses may well exist but sum up to zero in this case.

It is a unique fact of the history of economic thought that neither Walrasians nor Keynesians nor Marxians nor Institutionialists, not to speak of Austrians or Sraffaians, ever came to grips with profit (Desai, 2008), (Tómasson and Bezemer, 2010), (Kakarot-Handtke, 2013a). The received profit theories are formally unacceptable and practically unusable. More is not to say about the present state of theoretical economics.

3.4 Retained profit and saving

Once profit has come into existence for the first time (that is: logically – a historical account is a quite different matter) the business sector has the option to distribute or to retain it. This in turn has an effect on profit. This effect is captured by (12) but it is invisible in (10). Both equations, though, are formally equivalent.

Retained profit Q_{re} is defined for the business sector as a whole as the difference between profit and distributed profit in period t:

$$Q_{re} \equiv Q_m - Y_D \quad \Rightarrow \quad Q_{re} \equiv C - Y \quad |t. \tag{15}$$

Retained profit is, due to (12), equal to the difference of consumption expenditures and total income.

The household sector's monetary saving is given as the difference of income and consumption expenditures:

$$S_m \equiv Y - C \quad |t. \tag{16}$$

In combination with (15) follows:

$$Q_{re} \equiv -S_m \quad |t. \tag{17}$$

Monetary saving and retained profit always move in opposite directions. This the Special Complementarity. It says that the complementary notion to saving is *not* investment but negative retained profit. Positive retained profit is the complementary of dissaving.

4 The random consumption economy

> To-day the order of ideas has been reversed: chance has become the primary notion, mechanics an expression of its quantitative laws, and the overwhelming evidence of causality with all its attributes in the realm of ordinary experience is satisfactorily explained by the statistical law of large numbers. (Born, 1949, p. 121)

The period values of the axiomatic variables are formally connected by the familiar growth equation, which is added to the structural set as the 4th axiom:

$$Z_t = Z_{t-1}\left(1+\dddot{Z}_t\right). \tag{18}$$

The path of the representative variable Z_t is then determined by the initial value Z_0 and the rates of change $\dddot{Z}_t$ for each period:

$$Z_t = Z_0\,(1+\dddot{Z}_1)\,(1+\dddot{Z}_2)\ldots(1+\dddot{Z}_t) = Z_0\prod_{t=1}^{t}(1+\dddot{Z}_t). \tag{19}$$

Equation (19) describes the path of a variable with the *rates of change* as unknowns. These unknowns are in need of determination and explanation. This has a straightforward methodological consequence:

> 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)

It is assumed now for a start that the elementary axiomatic variables vary at random and, more specifically, that the variations are symmetrical around zero. This produces an evolving economy that over a longer time span neither grows nor shrinks. The respective probability distributions are given by:

$$\begin{array}{l} Pr(\{-3\% \le W \le 3\%\}) \\ Pr(\{-3\% \le P \le 3\%\}) \\ Pr(\{-3\% \le R \le 3\%\}) \\ Pr(\{-3\% \le X \le 3\%\}) \quad |t. \\ Pr(\{-3\% \le L \le 3\%\}) \\ Pr(\{-3\% \le D \le 3\%\}) \\ Pr(\{-3\% \le N \le 3\%\}) \end{array} \tag{20}$$

For the simulation the random variates for each period are taken from the worksheet random number generator and are then appropriately adapted. The assumed probability distributions can at any time be replaced by distributions that have been observed over a reasonable time span. Empirical distributions bring the simulation closer to reality. There is, though, no need at this early stage to discus the merits and demerits of different probability distributions.

The axioms, combined with (18) and (20), formally constitute a simulation that produces at every run outcomes like that shown in Figure 2.

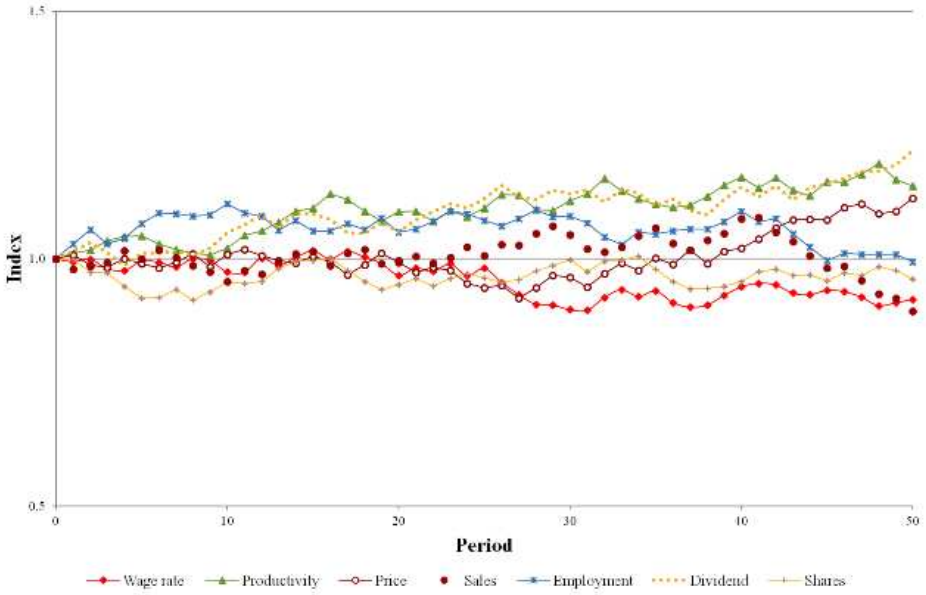

Figure 2: The symmetrically evolving consumption economy consists of independent random paths; assembled here are the elementary axiomatic variables

A simulation is a mathematical object just like a system of equations – with the advantage that dynamic randomness is easy to handle. A simulation can be either stochastic or deterministic. The latter alternative, though, has no counterpart in reality. To run a stochastic simulation is different from solving a set of equations, which amounts to the determination of a simultaneous equilibrium. The latter is a nonentity like ether or epicycles. Hence the stochastic simulation is the proper tool.

The graphic is open on the right hand side of the time axis, which means that the economy continues without reaching a definite state. There is no market clearing and no budget balancing in any one period. Nothing that could be characterized as equilibrium, just pure evolution. The paths are entirely independent. Neither does the price depend on the quantity, nor are consumption expenditures dependent on income. There are, to begin with, no functional dependencies, no causality, and no correlation of any sort. The drifting consumption economy is minimalistic and transparent.

Given the paths of the elementary variables, the development of profit is *uno actu* determined. Profit can be written either as (11) or alternatively as a combination of (12) and (16):

$$\begin{gathered} Q_t \equiv P_t X_t - W_t L_t \\ \text{alternatively} \\ Q_t \equiv D_t N_t - S_t \equiv Y_{Dt} - S_t \end{gathered} \tag{21}$$

Both equations are equivalent. For our purposes the second equation is more informative. It says: profit in period t is given by distributed profit minus saving/plus dissaving as shown in Figure 3.

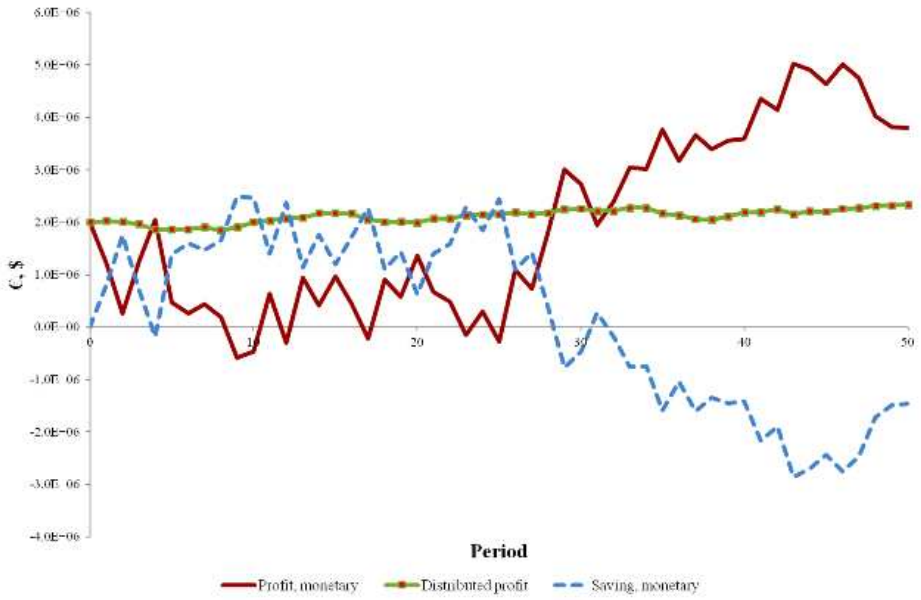

Figure 3: The relation between profit, distributed profit, and saving/dissaving (refers to the elementary variables of Figure 2)

Any pattern of saving/dissaving can be rationalized as intertemporal optimization. This behavioral speculation is a pointless exercise. It is really important, though, that the central bank accommodates all movements between deposits and overdrafts. More specifically, that it expands credit when the households or firms apply for it. Otherwise the expansion and contraction of credit cannot follow a pure random path. This condition keeps the central bank as an independent agent for a while out of the picture.

The profit path follows from the random variations of the independent elementary variables and the structure of the pure consumption economy which is ultimately given with the axiom set. The profit in each period is unequivocally determined by elementary axiomatic variables but not predictable because all four variables vary at random.

With this the random consumption economy is fully determined. Employment varies at random and since the labor supply also varies at random it remains open whether full employment is realized in any period or not.

The four axioms and the assumed probability distributions (20) constitute the *minimum* of premises. Given the essentials, the simulation delivers the concrete values of all variables for all future periods. These values are not predictable. The evolution of the economy is open. The simulation thus reproduces a constitutive characteristic of the actual economy. It should be noted in passing that the construction of deterministic equilibrium models, both partial and total, never has been more than a mindless exercise (cf. Mirowski, 1989, p. 466).

5 Stocks

> Economics is the science of confusing stocks and flows. (Kalecki, quoted in Keen, 2010, p. 29)

5.1 Money and credit

Money follows consistently from the given axiom set (for details see 2011a). If income is higher than consumption expenditures the household sector's stock of money increases. The change in period t is defined as:

$$\Delta\bar{\mathsf{M}}_{\mathbf{H}} \equiv^{m} Y - C \equiv^{m} Y\,(1-\rho_E) \quad |t. \tag{22}$$

The identity sign's superscript m indicates that the definition refers to the monetary sphere. There is no change of stock if the expenditure ratio is unity.

The stock of money $\bar{\mathsf{M}}_{\mathbf{H}}$ at the end of an arbitrary number of periods $\bar{t}$ is defined as the numerical integral of the previous changes of the stock plus the initial endowment:

$$\bar{\mathsf{M}}_{\mathbf{H}t} \equiv \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_{\mathbf{H}t} + \bar{\mathsf{M}}_{\mathbf{H}0}. \tag{23}$$

The interrelation between the expenditure ratio and the households sector's stock of money, is then given by:

$$\bar{\mathsf{M}}_{\mathbf{H}t} \equiv \sum_{t=1}^{t} Y_t\,(1-\rho_{Et}) \quad \text{if} \quad \bar{\mathsf{M}}_{\mathbf{H}0} = 0. \tag{24}$$

Formally, the expenditure ratio takes the role of the first derivative with $\rho_E = 1 \longleftrightarrow \dfrac{dy}{dx} = 0$.

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

$$\Delta\bar{\mathsf{M}}_{\mathbf{B}} \equiv^{m} C - Y \quad |t. \tag{25}$$

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

$$\bar{\mathsf{M}}_{\mathbf{B}t} \equiv \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_{\mathbf{B}t} + \bar{\mathsf{M}}_{\mathbf{B}0}. \tag{26}$$

The development of the stock of money follows without further assumptions from the axioms and is determined by variations of the elementary variables P, X, W and L.

In order to reduce the monetary phenomena to the essentials 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. Initial endowments can be set to zero. Then, if the household sector owns current deposits according to (24) the current overdrafts of the business sector are of equal amount according to (26) and vice versa if the business sector owns current deposits. Money and credit are symmetrical; the stock of money of each sector can be either positive or negative. 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 (24) or (26):

$$\bar{\mathsf{M}}_t \equiv \left| \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_t \right| \quad \text{if} \quad \bar{\mathsf{M}}_0 = 0. \tag{27}$$

While the stock of money can be either positive or negative the quantity of money is always positive. The development of the household sector's stock of money is depicted in Figure 4.

Eq. (27) implies for a start 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_1 and we can postpone the question of how the firms finance their operations. The central bank, which stands here for the banking industry, provides elastic currency and supports the autonomous transactions between the business and the household sector. Money is neutral.

5.2 Inventory

The change of the stock of products in period t is defined as the excess between output O and the quantity bought X by the households:

$$\Delta\bar{O} \equiv O - X \equiv O(1-\rho_X) \quad |t. \tag{28}$$

The stock at the end of an arbitrary number of periods $\bar{t}$ is given by definition as the numerical integral of all previous stock changes plus the initial endowment:[1]

$$\bar{O}_t \equiv \sum_{t=1}^{t} \Delta\bar{O}_t + \bar{O}_0. \tag{29}$$

The resulting interrelation between the sales ratio and the stock is given by

$$\bar{O}_t \equiv \sum_{t=1}^{t} O_t(1-\rho_{Xt}) \quad \text{if} \quad \bar{O}_0 = 0. \tag{30}$$

Figure 5 depicts a concrete simulation of (30).

Due to the underlying random changes of output and sales the stock of products may grow out of any proportion. This is, of course, possible in a simulation but not in reality. The business sector tries to keep the inventory in the vicinity of a target value. The same holds for the household sector's stock of money. Pure randomness therefore has to be replaced in part by purposeful action. This is done next.

6 Product market clearing and budget balancing in the course of time

> Much of economic theory is based on three questionable assumptions: (1) the world is deterministic; (2) decision makers act as if they know the values of all relevant parameters; and (3) consumers and firms respectively, act as if they were maximizing utility and profit. (Stigum, 1991, p. 29)

6.1 Directed random changes

The development of the household sector's stock of money is given with (24) and depends on the expenditure ratio.

The directed random change of the expenditure ratio consists of two elements: (a) direction, which depends on the deviation of the actual stock of products from its target value, and (b), magnitude, which depends on a plausible set of discrete random rates of change. For our simulations the rates of change are taken from

[1] This compares to the analogous treatment in continuous time of (Clower and Bushaw, 1954, p. 328).

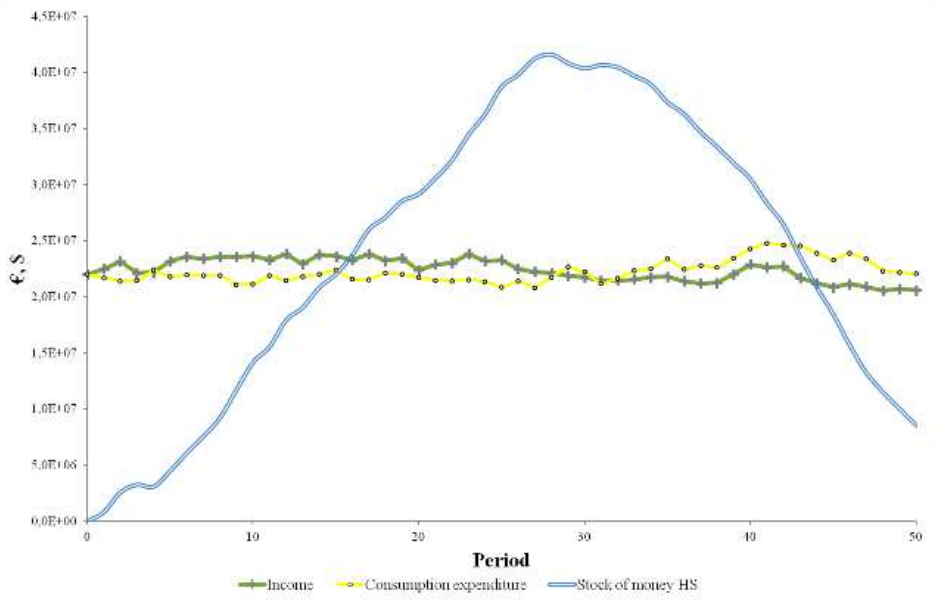

Figure 4: The difference between the paths of the composed variables income and consumption expenditure determines the increase and decrease of the household sector's stock of money which consists either of deposits (> 0) or overdrafts (< 0) at the central bank (refers to the elementary variables of Figure 2)

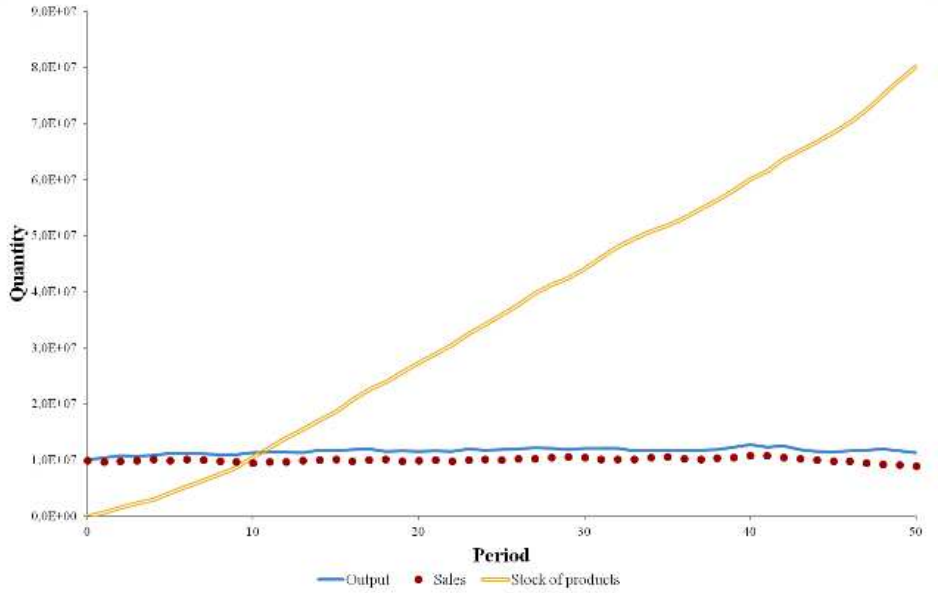

Figure 5: The difference between the paths of the variables output and sales determines the increase and decrease of the business sector's stock of products (refers to the elementary variables of Figure 2)

the worksheet random number generator. The change of the expenditure ratio in period t is accordingly given by:

$$\ddot{\rho}_E = \underbrace{\{-1,0,1\}}_{\text{direction}} \underbrace{Pr(\{0 \leq \ddot{\rho}_E \leq x\%\})}_{\text{magnitude}} \quad |t. \tag{31}$$

The direction the change of the expenditure ratio depends on the difference between the actual stock of money and the target or reference value as given by:

$$-1_t = sgn_{\rho_E}\left(sgn\left(\bar{\mathsf{M}}_{\mathbf{H}t-1} - \bar{\mathsf{M}}^{\theta}_{\mathbf{H}t-1}\right)\right) \tag{32}$$

If the sign of the difference is positive then the sign of direction is negative, and vice versa. This is not an immutable law but a plausible assumption. The determination of the reference value involves expectations. For our present purposes it is not necessary to occupy ourselves with the determination of targets, hence they are taken as given.

Eqs. (31) and (32) deliver the change rate of the expenditure ratio and this gives the new ratio for each period:

$$\rho_{Et} = 1 + \ddot{\rho}_{Et} \tag{33}$$

This new expenditure ratio is then fed into the simulation. The changing nominal demand in combination with the quantitative supply affects the price. Figure 6 gives an impression of the resulting price and inventory changes.

The development of the business sector's stock of products is given with (30) and depends on the sales ratio. Analogous to the expenditure ratio we have for the sales ratio:

$$\ddot{\rho}_X = \underbrace{\{-1,0,1\}}_{\text{direction}} \underbrace{Pr(\{0 \leq \ddot{\rho}_X \leq x\%\})}_{\text{magnitude}} \quad |t. \tag{34}$$

and

$$-1_t = sgn_{\rho_X}\left(sgn\left(\bar{O}_{t-1} - \bar{O}^{\theta}_{t-1}\right)\right) \tag{35}$$

Eqs. (34) and (35) deliver the change rate of the sales ratio and this gives the new ratio for each period:

$$\rho_{Xt} = 1 + \ddot{\rho}_{Xt} \tag{36}$$

Note that both the expenditure and the sales ratio fluctuate around unity. If the random variations in (33) and (36) cease then the budget is balanced and the product market is cleared in the respective period. In this case the stock of money and products remain unaltered. This is the discrete counterpart of two first derivatives equal to zero, which in turn defines some local extrema.

6.2 The product market

The price as dependent variable is given with eq. (7) which is reproduced here:

$$P = \frac{\rho_E}{\rho_X} \frac{W}{R} \left(1 + \frac{DN}{WL}\right) \quad |t. \tag{37}$$

The expenditure ratio ρ_E and the sales ratio ρ_X are determined as described in Section 6.1; the other variables W, R, D, N, L change at random. The working of the structural axiomatic law of supply and demand is visualized in Figure 6.

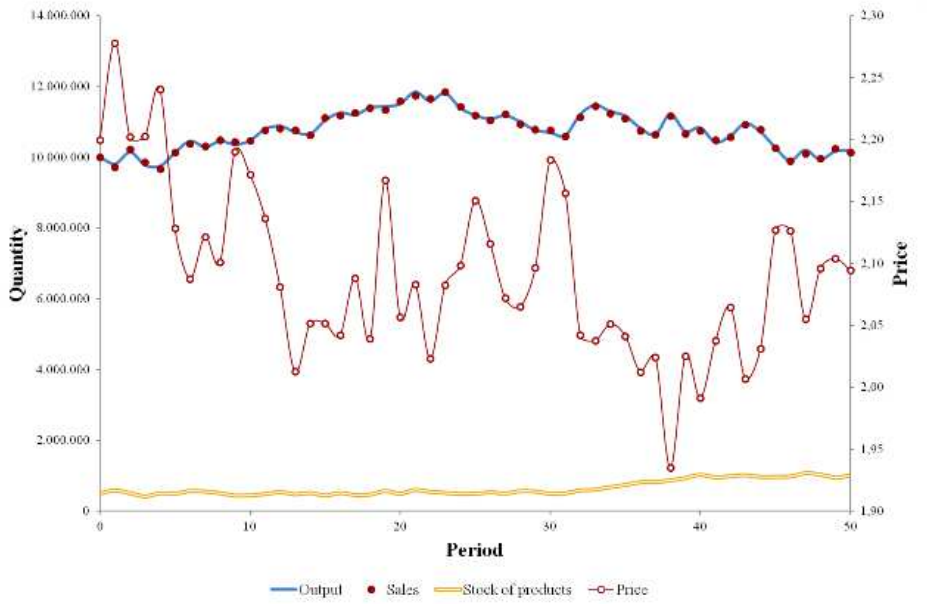

Figure 6: The three-dimensional (price, quantity, time) product market as constituent part of a random consumption economy with self-stabilizing feedback

Output and sales are close together but not equal. The difference between the two variables changes the stock of products. Due to the feedback as defined by (35) an inventory cycle emerges. Thus, the stock of products is kept close to the target level. Output and sales are now related via the predetermined sales ratio.

$$X = \rho_X O \quad |t. \tag{38}$$

This is formally similar to the definition of the sales ratio (5). However, with a sales ratio that is predetermined by (36) in each period we now have a functional relationship between the two paths. The change rate of the sales ratio is a directed random variable and given with (34). Figure 6 supplants the vacuous supply-demand-equilibrium construct.

In each period the accumulated stock of previous periods enters into the price determination. The price is not (co-)determined by period output alone but also by the numerical integral of previous changes of stock. That is, the price determination is history dependent. There is no such thing as a simultaneous equilibrium. Since simultaneity is physically infeasible it is an enigma how this conception could ever be accepted by more than a few credulous economists.

It is assumed that the business sector increases its target stock in period_{30}. Figure 6 shows the gradual adaptation of the actual stock to the new target stock. Subsequently the inventory cycle continues on the higher level. The random changes together with the feedback rules produce the trajectories of the price and the stock of products. The latter remains in the vicinity of the target values. The product market is cleared, strictly speaking, when the inventory eventually returns to zero, or alternatively formulated, when the cumulated stock changes sum up to zero. For the economy as a whole this does not happen in the normal course of events.

The household sector keeps, in analogous manner, the stock of money close to a target level. How this target is determined does not concern us here. Figure 7 compares to Figure 4. The difference between a pure random path and the slight fluctuations around the target level is striking.

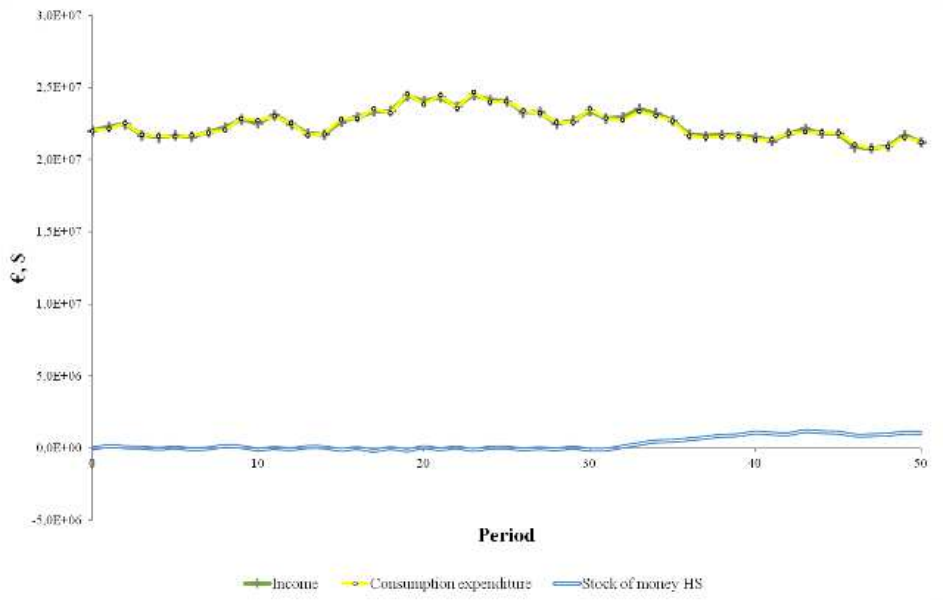

Figure 7

Income and consumption expenditures are close together but not equal. The difference between the two variables changes the stock of money. Due to the feedback as defined by (32) a cycle emerges. Thus, the stock of money is kept close to the target level which is either positive (deposits) or negative (overdrafts). Period incomes and consumption expenditures are now related via the predetermined expenditure ratio.

$$C = \rho_E Y \quad |t. \tag{39}$$

This is formally similar to the definition of the expenditure ratio (6). Since this ratio changes in each period according to (33) the relationship between income and expenditure holds only for one period and is not stable over time.

It is assumed that the household sector increases its target stock of deposits in period_{30}. Figure 7 shows the gradual adaptation of the actual stock to the new target stock. The budget is not balanced in any one period. The household sector switches between the expansion and contraction of deposits. Expansion presupposes that income is greater than consumption expenditures, in other words, that the household sector as a whole saves. However, if the household sector starts with overdrafts then saving means redemption, i.e. not an increase of deposits but a decrease of overdrafts. The meaning of saving depends on the hitherto cumulated changes of the stock of money as summarized with the following table.

		start with deposits	start with overdrafts
$\rho_E < 1$	saving	increase of deposits	decrease of overdrafts; redemption
$\rho_E > 1$	dissaving	decrease of deposits	increase of overdrafts; credit expansion
$\rho_E = 1$	balancing	no change	no change

The development pattern of profit, too, changes from purely random to a neat fluctuation around the path of distributed profit which remains a random path. Figure 8 compares to Figure 3.

The more regular pattern of profits results from the feedback between the expenditure ratio and the stock of money as determined by (32). There is at the moment no relation at all between profit and distributed profit, that is, distributed profit in period t in no way depends on profit in the previous period.

It will be remembered that we have set the target value of deposits higher in period_{30}. This effects a higher saving until the new level is reached. The prolonged saving phase disturbs the fairly regular pattern of profit variations as is clearly discernible in Figure 8.

Employment follows a random path that is independent from other variables as shown in Figure 2. There is, in particular, no interdependency between employment and profit.

In sum: the consumption economy consists of both independent and directed random variables. The latter ensure that the stock of products and the stock of

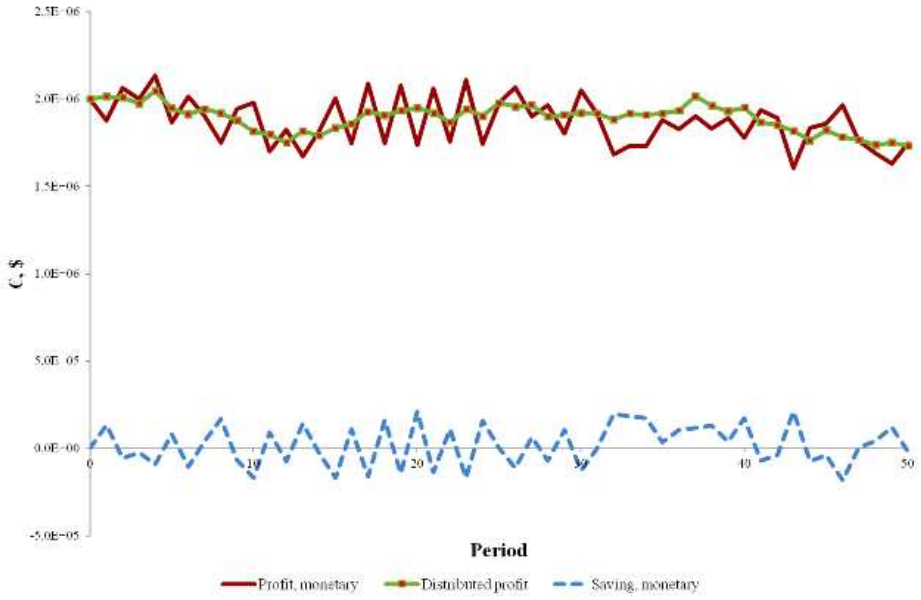

Figure 8: Profit fluctuates around the random path of distributed profit; the fluctuation is the exact mirror image of the household sector's saving/dissaving

money remains in the vicinity of their respective target values. This is done by negative feedback. Over longer stretches of time this clears the product market and balances the household sector's budget. The market clearing price depends also on cumulated stocks, in other words, conditional price flexibility is history dependent. The system adapts to changes of the target values. In the absence of external limitations it can, in principle, evolve indefinitely.

7 Positive feedback

> But, unless equilibrium theory has captured the major causes of economic phenomena, the separate science of economics can never be successful. (Hausman, 1992, p. 280)

Until now distributed profit followed its independent random path. This path in turn is composed of the symmetric random movements of dividend D and number of shares N. Distributed profit in period t is a major determinant of profit in period t according to (21). There is, however, a second link between the two variables: profit distribution in period t may be dependent on profit in period $t-1$.

Profits are fully distributed in the next period if the payout factor φ is unity. The relation is formally established by:

$$Y_{Dt+1} = \varphi_{t+1}\, Q_{mt}. \tag{40}$$

This, then, gives a circular dependency in the form of: profit higher→ distributed profit in the next period higher → profit higher → and so on. Profit in the current period is given by (see (21)):

$$Q_{mt} \equiv Y_{Dt} - S_{mt}. \tag{41}$$

Eq. (40) and (41) combined gives with a payout factor of unity:

$$Y_{Dt+1} = Y_{Dt} - S_{mt}. \tag{42}$$

To keep things simple it is assumed that the household sector dissaves in the first 25 periods, i.e. S_m is negative and therefore $Y_{Dt+1} > Y_{Dt}$. The central bank accomodates the credit expansion of the household sector which runs in parallel with an increasing stock of deposits of the business sector. As an example for a collateralized credit expansion it can be imagined that the household sector buys its family homes fully or partially on credit. Within limits this is neither risky for the households nor for the central bank as long as the classical banking rules are observed.

Beginning with period 26 the household sector saves, i.e. S_m in (42) is positive therefore $Y_{Dt+1} < Y_{Dt}$, and pays off the credits. After 50 periods the stock of overdrafts is again zero. Figure 9 shows the circular interdependence of saving/dissaving and distributed profit in action.

In the first 25 periods the expenditure ratio that is used for the simulation is set to 1,01. The household sector's overdrafts, or any variants of longer term credit, increase steadily. Profit increases as the expenditure ratio jumps from the initial value 1.0 to 1.01. With a payout ratio of 1.0 distributed profits are up in the next period. While the dissaving remains constant over the subsequent periods, profits and distributed profits spiral higher in a virtuous cycle. In period_{26} the expenditure ratio switches from 1,01 to 0,99 and this starts the vicious cycle. Total income falls with reduced distributed profits and consumption expenditures fall even more due to the lower expenditure ratio. The expansion goes into reverse.

Employment has hitherto been treated as an independent random path. Under the assumption that the direction of the random rate of change of employment depends on the direction of the rate of change of profit, employment increases in the phase of credit expansion and decreases in the phase of credit contraction. Employment follows under this plausible assumption, which implies the absence of any external obstacles, the tent pattern of profits in Figure 9. Variations of employment do not feed back on profit.

Since profit can only be known at the end of the period under consideration it is logically impossible to fully distribute it in the *same* period. The period length is

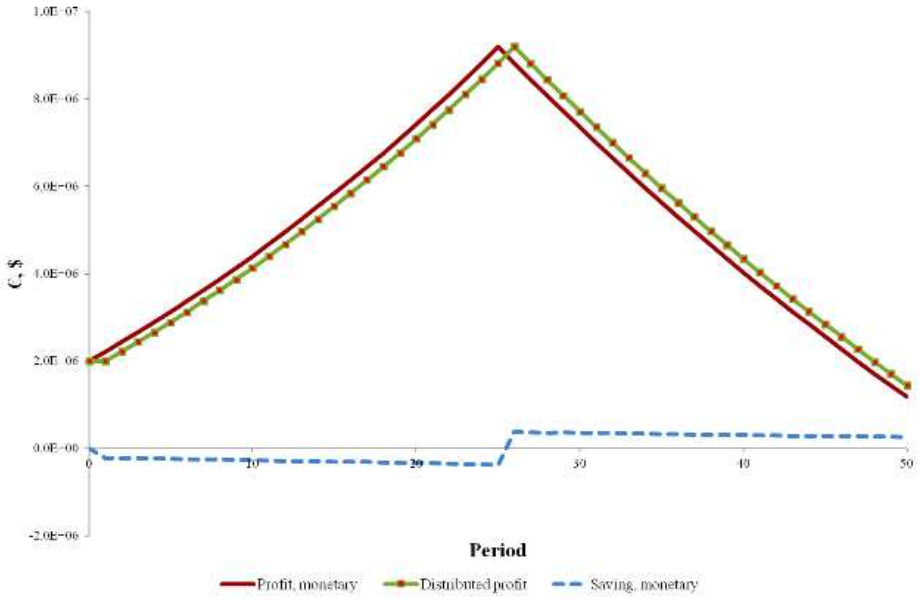

Figure 9: A 25 period phase of dissaving (credit expansion) followed by a 25 period phase of saving (redemption, credit contraction) with self-reinforcing full profit distribution

in principle immaterial, it must only be greater than zero. Let us assume for the sake of argument that the business sector guesses the period-end profit correctly and starts to distribute it during the period under consideration. This, though, would have an effect on profit under the condition of budget balancing. Therefore, the guess cannot have been correct. The business sector is caught in Morgenstern's Holmes-Moriarty paradox. It is therefore impossible that profit in period t is exactly equal to distributed profit. Yet this is what general equilibrium theory presupposes (Debreu, 1959, p. 43). Formally it is, of course, no problem to write down $Q_t = Y_{Dt}$ as an equilibrium condition. As a practical matter this involves simultaneity, which is impossible as a practical matter and inconsistent with a period length greater than zero. Logically, the equilibrium condition involves indeterminacy, that is, profit and distributed profit may assume any value between zero and infinity. This contradicts the very idea of an economic equilibrium. The formal fact that profit and distributed profit are connected via (12) makes the notion of a definite general equilibrium inconsistent. The underlying conception of simultaneity has always been illegitimate and thoroughly misleading. The structural axiomatic refutation of general equilibrium rests on the fact that the latter misrepresents the relations between profit and distributed profit. These relations, no doubt, are crucial for the understanding of how the monetary economy works. Its not a question of realism/unrealism but of true/false. General equilibrium theory is false (cf. Arrow, 1988, pp. 278-279).

The positive feedback between profit and distributed profit depends on a payout factor of unity. What happens if it is less than unity, as it certainly is in the

real world? For the simulation it is assumed that 75 percent of current profit are distributed in the next period. That is:

$$Y_{Dt+1} = 0.75 * Q_{mt}. \tag{43}$$

The simulation's outcome is graphically resumed in Figure 10.

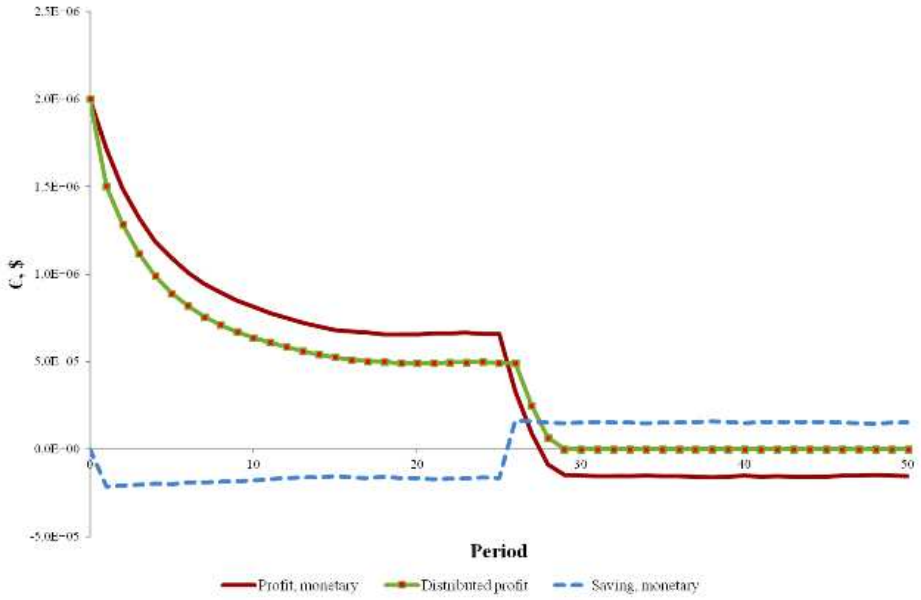

Figure 10: With a payout factor less than unity profit turns to loss if the household sectors turns from credit expansion to redemption

Profit, as to be expected, declines because of partial profit distribution although dissaving remains constant. The expenditure ratio is fixed at 1.01 for 25 periods. When the household sector switches from dissaving to saving, profit turns into a loss. In this case distributed profit is zero and loss is equal to saving/redemption.

The economy thrives on credit expansion. If credit expansion ends profit becomes, at first, equal to distributed profit and then approaches zero if the payout factor is less than unity. Saving must be zero in this limiting case, otherwise the business sector makes a loss. The ideal state of a market system is not equilibrium but expansion. The consumption economy does not necessarily break down if the credit expansion stops. It is indefinitely reproducible at the actual level provided the payout factor is unity and saving is zero. In other words, redemption has to be avoided. The household sector must maintain the actual stock of overdrafts, or other forms of credit, indefinitely.

Redemption means losses for the business sector as a whole if distributed profit is zero. Firms go bankrupt, employment precipitates, the economy plunges into a depression. The consumption economy reaches a reproducible limiting state at the

then actual employment level if saving is exactly zero and the payout factor is exactly unity. This is a very improbable configuration. To get out of a depression requires, in the pure consumption economy, a credit expansion. It makes no difference from where the expansion comes. The household sector may be replaced by the government sector, this does not alter the systemic relations between dissaving/credit expansion/deficit and profit.

The pure consumption economy is the simplest possible case. However, the fundamental relations that we have identified do not alter under more complex circumstances.

8 Monetary profit in the investment economy

We proceed now from the pure consumption economy briefly to the investment economy (for more details see 2011b). Based on the differentiated formalism it is assumed that the investment goods industry, which consists of one firm, produces $O_I = X_I$ units of an investment good, which is bought by the consumption goods industry to be used for the production of consumption goods in future periods. The households buy but the output of the consumption goods industry. From (10) then follows for the monetary profit of the consumption and investment goods industry, respectively:

$$\begin{aligned} Q_{m\mathbf{C}} &\equiv C - Y_{W\mathbf{C}} \\ & \qquad |t. \\ Q_{m\mathbf{I}} &\equiv I - Y_{W\mathbf{I}} \end{aligned} \tag{44}$$

Total monetary profit, defined as the sum of both industries, is then given by the sum of consumption expenditure and investment expenditure minus wage income which is here expressed, using (1), as the difference of total income minus distributed profit:

$$\begin{aligned} Q_m &\equiv C + I - (Y - Y_D) \\ \text{with} \quad Y_W &\equiv Y_{W\mathbf{C}} + Y_{W\mathbf{I}} \quad |t. \end{aligned} \tag{45}$$

From this and the definition of monetary saving (16) follows:

$$Q_m \equiv Y_D + I - S_m \quad |t. \tag{46}$$

This compares to (21), which is the special case for $I = 0$. Higher total monetary profits on the one side demand as a corollary, i.e. as a logical implication of the definition itself, higher investment expenditures and distributed profits and lower saving on the other side.

If profit and distributed profit happen to be equal in (46), then, as a corollary, investment expenditure and household saving must be equal too. Vice versa, if it happens that household saving is equal to investment expenditure then, as a corollary, profit and distributed profit must be equal too. In reality, though, profit and distributed profit are *never* equal and correspondingly household saving and business investment are not equal either. The fact that profit is different from distributed profit in the real world can be taken as an *empirical proof* of the logically equivalent inequality of household saving and business investment. The economists of the 1930s, including Keynes, got the relation between saving and investment badly wrong. The persistence of this blunder invalidates the larger part of Post Keynesianism (for details see 2013b).

Eq. (42) now becomes:

$$Y_{Dt+1} = \varphi_{t+1}\left(Y_{Dt} + I_t - S_{mt}\right). \tag{47}$$

Investment expenditure has the same effect as dissaving in the circular interaction between profit and distributed profit. If investment expenditure is not a completely independent random path but depends on profit like employment then it intensifies both the upturn and the downturn. With declining profits, I goes down and by consequence profit declines further, and with it distributed profit in the next period.

In the investment economy there need not be any dissaving of households. A positive contribution to profit presupposes only that investment expenditures are greater than saving. In this case, the household sector accumulates deposits and becomes the collective creditor. The business sector finances investment partly with retained profit, partly with credit and becomes the collective debtor. During a depression firms usually do two things: reduce investment expenditures and redeem credit (cf. Koo, 2009). Redemption is, for the business sector as a whole, equal to retained profit (15). For a single firm it seems in analogy sensible to curtail profit distribution in order to increase retained profit. The effect on the whole is counterproductive.

If the household or the government sector increases saving/redemption the already stagnating economy goes from bad to worse. Seen from the economy *as a whole* the first rule to keep things going in difficult circumstances says: do not redeem any debt now. Whether the debt is private or public makes not much of a difference for the profit of the business sector.

The monetary economy thrives on credit expansion. Redemption is bad for the wealth of nations. Because of built-in positive feedback between profit and distributed profit the economy either expands or shrinks but cannot ever be in some kind of equilibrium. The most improbable state in the real world is the most discussed state in the standard economic textbooks.

> ... it is clear that the public's lack of faith in the scientific nature of economic knowledge is a fact, past and present. (Benetti and Cartelier, 1997, pp. 211-212)

9 Conclusion

The behavioral axioms of standard economics have to be discarded and replaced. Not because they are unrealistic, but because they are false. The present paper builds on structural axioms. The main results of the structural axiomatic inquiry of the interdependencies of profit, credit and growth are:

- The general structural axiomatic law of supply and demand supplants the vacuous supply-function–demand-function–equilibrium construct.
- The received profit theories are formally unacceptable and practically unusable. Total profit in the consumption economy depends on the expenditure and distributed profit ratio.
- There is positive feedback at the core of the economy.
- Equilibrium theory rests on indefensible premises. The structural axiomatic refutation refers to the fact that it misrepresents the relations between profit and distributed profit.
- The consumption economy thrives on an expenditure ratio greater unity and a payout factor close to unity. An expenditure ratio greater unity means credit expansion of the household sector.
- The investment economy thrives on investment expenditures greater saving and a payout factor close to unity. Investment expenditure greater retained profit means credit expansion of the business sector.
- Redemption of the household sector (or government sector) means losses for the business sector as a whole if distributed profit is zero and falling profit if distributed profit is greater zero.
- Seen from the economy *as a whole* the first rule to keep things going in difficult circumstances says: do not redeem any debt now.

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