The Ideal Economy: A Prototype

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Abstract

Standard economics starts with behavioral assumptions that are formally expressed as axioms. This approach met with little scientific success but still enjoys some popularity for lack of a convincing alternative. To replace the subjective formal foundations by objective structural axioms is the first task of this paper. To give a correct account of how the monetary economy works is the second. This entails an explanation of the continuous clearing of both the product and the labor market in the random consumption economy, that is, of how the economy could establish ongoing full employment and price stability in principle.

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Keywords new framework of concepts; structure-centric; axiom set; consumption economy; Profit Law; directed random changes; complexity; simulation; market clearing; budget balancing; product market; labor market

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1 Real progress

> For as I said at the outset, the citadel is not at all secure and the fact that it is safe from a bombardment of soap bubbles does not mean that it is safe. (Hahn, 1984, p. 78)
>
> ... real progress involves radically revising or even abandoning that starting point. (Keen, 2011, p. 35)

Standard economics starts with behavioral assumptions that are formally expressed as axioms (McKenzie, 2008, p. 4). This approach met with little scientific success but still enjoys some popularity for lack of a convincing alternative. The heterodox reservations against everything that looks formalistic did, on the other side, not positively stimulate the quest for superior formal foundations. Lacking these, there is not much to choose. The result is factual stagnation beneath a lively exchange of argumentative soap bubbles on the surface (cf. Quiggin, 2010). There is much opinion but little knowledge about how the monetary economy works. This holds for both Orthodoxy and Heterodoxy.

Conceptual consequence demands, first of all, to discard the subjective-behavioral axioms and to take objective-structural axioms as the formal point of departure. This is an imperative of theory design. The requisite methodological transition presupposes a positive valuation of the prospects of theoretical economics and, by the same token, a refusal of political economics as we know it. Political economics is defined as either not to understand, not to accept or not to live up to the standards of material and formal consistency.

The present paper provides, on a highly decomplexified level, an explanation of the continuous clearing of both the product and labor market in the monetary economy, that is, of how the economy could establish ongoing full employment and price stability in principle. No claim is made that the market economy has an innate tendency towards this ideal state.

The following Section provides the formal foundations with the set of three structural axioms. These represent the pure consumption economy as the most elementary economic configuration. In Section 3 the straightforward implications about the market clearing price and monetary profit are made explicit. This, *uno actu*, resolves the long-standing profit puzzle. Section 4 determines the minimum number of formal elements of the simulation that replaces the ineffective analytical tools of static equilibrium analysis. In Section 5 the nominal stocks of money, credit and the real stock of products are derived as numerical integrals of directed random changes. With all necessary elements in their proper places it is then possible, in Section 6, to simulate market clearing and budget balancing in the evolving consumption economy. In Section 7 the co-evolution of full employment and price stability is established as the ideal state of the monetary economy in a random environment. Thus, the structural-axiomatic approach formally realizes what general equilibrium theory announced but failed to achieve. Section 8 concludes.

2 Elementary

> Is it not a fact, which stares at us from the histories of all sciences, that it is much more difficult for the human mind to forge the most elementary conceptual schemes than it is to elaborate the most complicated superstructure when those elements are well in hand? (Schumpeter, 1994, p. 602)

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. Nothing is implied at this stage about who owns the shares.

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

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.

3 Implications

> Besides, nothing can be derived from an analytical model that is not logically contained in its axiomatic basis. (Georgescu-Roegen, 1979, p. 321)

3.1 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:

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

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 and L, demand by ρ_E and indirectly by the income distribution as determined by W, L, D, N. In a nutshell, the price equation states that the market clearing price is determined by the expenditure ratio, unit wage costs, and the income distribution. Note that the quantity of money is *not* among the determinants. The structural-axiomatic law of supply and demand is testable in principle.

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

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

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. 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 equality of price and unit wage costs in (9) is an objective systemic property. The question, whether such a thing as the equality of price and marginal utility also exists, is left to those who have already solved the angels-on-a-pinpoint problem.

3.2 Monetary profit

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).

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:

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

or, using the definitions (5) and (6),

$$Q_m \equiv \left(\rho_E - \frac{1}{1+\rho_D}\right) Y \quad |t. \tag{13}$$

The four equations are formally equivalent and show profit under different perspectives. Eq. (13) tells us that total monetary profit is zero if $\rho_E = 1$ and $\rho_D = 0$. This corresponds to the equality of price and unit wage costs in (9). Profit or loss depends on the expenditure and distributed profit ratio and nothing else. Whether the agents maximize profit or not is irrelevant. Eq. (13) is the shortest possible answer to the pivotal question:

> The understanding of capitalism as an economic system hinges on the correct answer to one question: How are profits made? (Kirkenfeld, 1948, p. 35)

Until this day, neither orthodox nor heterodox economics has answered this question correctly. Eq.(13) – let us call it the Profit Law – is testable in principle, hence there is not much need for an argument about it. The Profit Law holds, independently of the definition of property rights, in a capitalist as well as in a communist economy. There is nothing subjective, psychological, or political in it.

3.3 Individual monetary profits

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

$$Q_{mA} \equiv P_A R_A L_A \left(1 - \frac{W_A}{P_A R_A}\right) \quad \text{if} \quad \rho_{XA} = 1 \quad |t. \tag{14}$$

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:

$$P_A = \frac{W_A}{R_A} \quad |t. \tag{15}$$

The price of product A is, in the simplest case, 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 for the most elementary case. This case is the structural-axiomatic counterpart to Walras's 'ni bénifice, ni perte' general equilibrium. In the non-zero profit economy the derivation of the price vector is a bit more involved.

3.4 Retained profit and saving

Once profit has come into existence for the first time (that is: logically – a historical account is an entirely 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:

$$Q_{re} \equiv Q_m - Y_D \quad \Rightarrow \quad Q_{re} \equiv C - Y \quad |t. \tag{16}$$

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:

$$S_m \equiv Y - C \quad |t. \tag{17}$$

In combination with (16) follows:

$$Q_{re} \equiv -S_m \quad |t. \tag{18}$$

Monetary saving and retained profit always move in opposite directions. This is the Special Complementarity. It says that the complementary notion to saving is negative retained profit; positive retained profit is the complementary of dissaving. There is no such thing as an equality of saving and investment in the consumption economy, nor, for that matter, in the investment economy (for details see 2013c).

4 Change and chance in the pure consumption economy

> Why is it that in a shower the drops of rain appear to us to be distributed by chance? It is again because of the complexity of the causes which determine their formation. (Poincaré, 2007, p. 73)

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:

$$Z_t = Z_{t-1}\left(1+\ddot{Z}_t\right). \tag{19}$$

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

$$Z_t = Z_0\,(1+\ddot{Z}_1)\,(1+\ddot{Z}_2)\ldots(1+\ddot{Z}_t) = Z_0\prod_{t=1}^{t}(1+\ddot{Z}_t). \tag{20}$$

Eq. (20) describes the path of a variable with the *rates of change* as unknowns. These unknowns are in need of determination and explanation. Without going deeper into any concrete details we can say that the rates are subject to what J. S. Mill called the 'plurality of causes and the intermixture of effects' (2006, Ch. X) and what Poincaré called complexity. The observer sees at first pure chance at work. This, however, leaves the possibility open that one may find regularities at a deeper level. To use a physical analogy: the flight of a feather is an intractable complex random path but the underlying deterministic law of the falling bodies is quite simple. The latter possibility has always to be kept at the back of one's mind. Complexity or randomness may turn out to be superficial explanations. However, the chief merits of the random hypothesis are simplicity and testability, therefore it has to be applied first (Kreuzenkamp and McAleer, 1995).

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:

$$\begin{array}{c} Pr(\{-3\%* \leq W \leq 3\%\}) \\ Pr(\{-3\%* \leq P \leq 3\%\}) \\ Pr(\{-3\%* \leq R \leq 3\%\}) \\ Pr(\{-3\%* \leq X \leq 3\%\}) \\ Pr(\{-3\%* \leq L \leq 3\%\}) \\ Pr(\{-3\%* \leq D \leq 3\%\}) \\ Pr(\{-3\%* \leq N \leq 3\%\}) \\ *\text{adapted to symmetry} \end{array} \Bigg| t. \tag{21}$$

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. There is, though, no need at this early stage to discus the merits and demerits of different probability distributions.

The four axioms combined with (21) formally constitute a simulation that produces at every run an outcome like that shown in Figure 1.

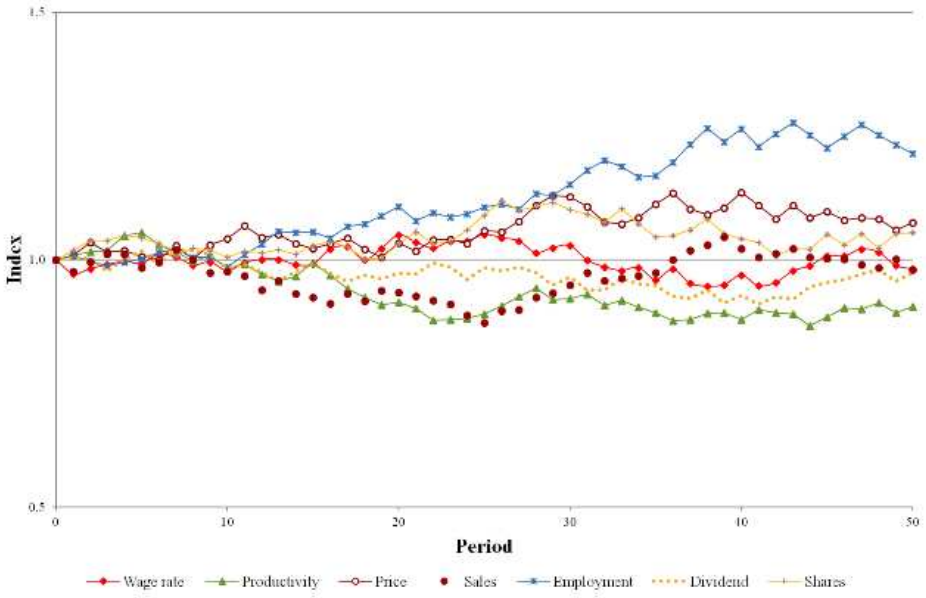

Figure 1: The evolving consumption economy consists initially of entirely independent random paths of the seven elementary axiomatic variables (selected here) and the paths of composed variables (shown later)

A simulation is a mathematical object just like a system of equations – with the decisive advantage that change and chance can be formally represented in a quite natural manner (cf. Wolfram, 2002, p. 5). To run a stochastic simulation is different from solving a set of equations. The difference is obvious: the stochastic simulation is the right tool, a set of equations is the wrong tool. Why? Because the latter presupposes functions with properties that cannot be justified by any stretch of the imagination. Worse, a set of equations inescapably leads into the simultaneous equilibrium impasse.

> Walras first formulated the state of the economic system at any point of time as the solution of a system of simultaneous equations representing the demand for goods by consumers, the supply of goods by producers, and the equilibrium condition that supply equal demand on every market. (Arrow and Debreu, 1954, p. 265)

> Although this classic notion of equilibrium is well defined and amounts to no more than finding a solution of a set of equations, it is neither uncontroversial nor very satisfactory. (Kirman, 1997, p. 95)

Simultaneous equilibrium, to be sure, is a nonentity like ether, absolute space, or epicycles. It is methodologically inadmissible to include this notion into the premises. Apart from this, to put any faith in the applicability of this notion in economics has always been an indicator of a lack of sound analytical instincts. In the meantime, all know better:

> Not much is left, therefore, of the original hopes for general equilibrium. (Ackerman, 2004, p. 18)

Given the paths of the elementary variables, the development of the composed variables is also determined as exemplified in Figure 2. From the random paths of employment L and wage rate W follows the path of wage income Y_W according to (4). Likewise follows from the paths of dividend D and number of shares N the path of distributed profit Y_D. From the 1st axiom then follows the path of total income Y.

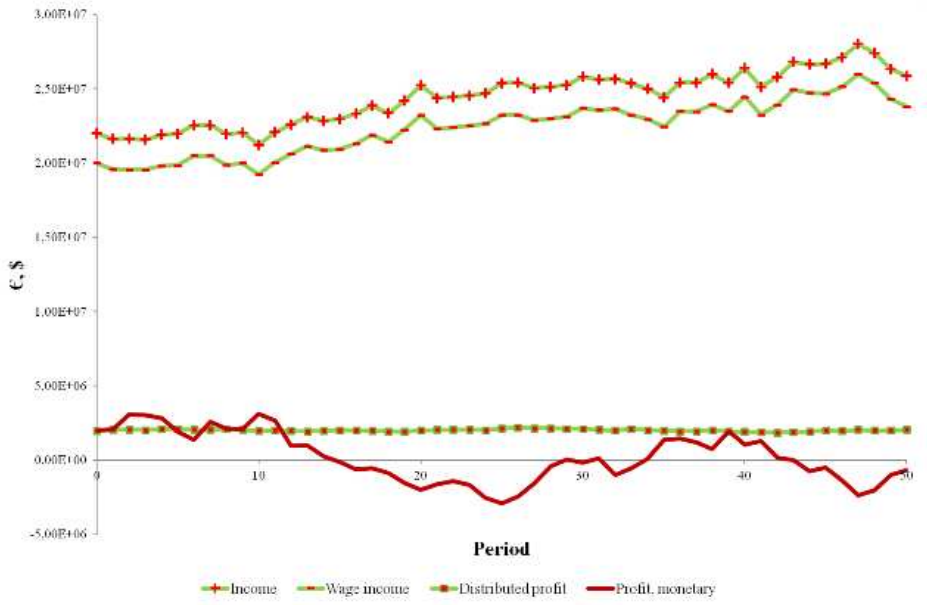

Figure 2: The relation between the composed variables total income, i.e. the sum of wage income and distributed profit, and the path of monetary profit/loss which is composed of four elementary variables (refers to Figure 1)

The path of monetary profit is *uno actu* determined. Profit depends on price P, sales X, wage rate W and employment L as defined with (11). The profit path follows from the random variations of four independent elementary variables and the structure of the pure consumption economy which is given with the axiom set.

It is decisive that the central bank accommodates all transactions between the household and the business sector. More specifically, that it expands credit when the households or firms apply for it. Otherwise the expansion and contraction of credit on the one side and money on the other cannot follow a pure random path. This condition keeps the central bank as an independent agent for a while out of the picture (for details see 2011a; 2011b).

The four structural axioms and the assumed probability distributions (21) constitute the *minimum* of premises. Given the essentials, the simulation delivers the concrete values of all variables for all future periods under the condition that no unpredictable external events interfere. There are no interdependencies between the paths; the evolution of the economy is open and only subject to statistical laws. If there are interdependencies they have to be explicitly added to the formal core. The structural-axiomatic premises are absolutely transparent.

5 Change of stocks

> ... equilibrium tells you where the model will never be. (Keen, 2011, p. 192)

When the market is cleared in one period the stock of products does not change, when the budget is balanced the household and business sector's stock of money does not change. Since these real and monetary stocks change permanently we can be quite sure that market clearing and budget balancing never has happened and never will happen in any one period. Economic models that ignore this fact cannot solve the coordination problem which is central for the explanation of how the market system works.

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:

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

Formally, the expenditure ratio takes the role of the first derivative.

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.

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 $t = 1$ 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 perfectly neutral in this sense.

5.2 Stock of products

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:

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

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

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

The development of the stock of products depends ultimately on the sales ratio in each period. If it is zero the stock stays at its current level.

Figure 3 gives an impression of the uncoordinated product market.

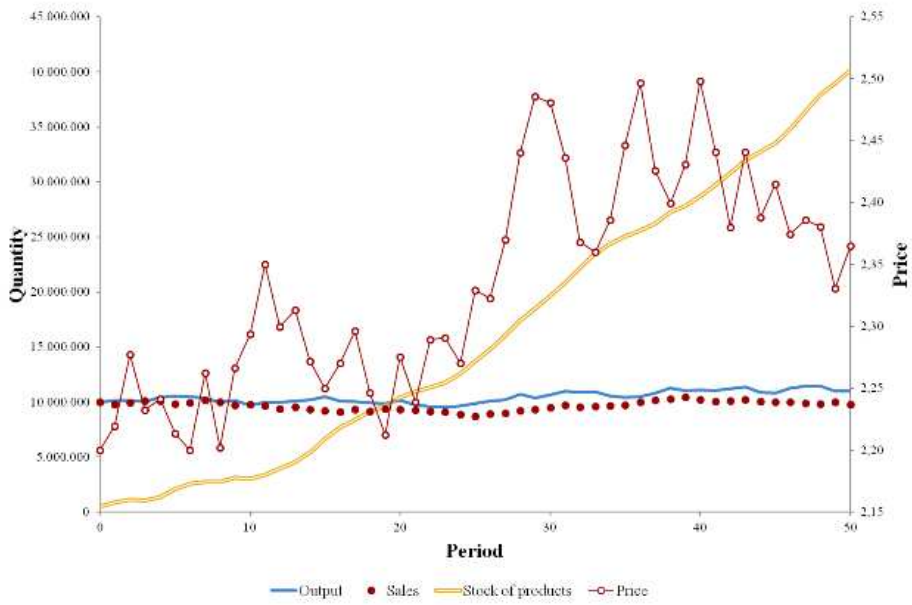

Figure 3: The pure random product market (refers to Figure 1)

Price and sales follow independent random paths. Output depends on labor input and productivity which in turn follow their own random paths. The cumulated

differences between output and sales determine the stock of products as given by (30). The rising stock indicates that the market has not been cleared over a longer time span.

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 same holds for negative stocks which are at the moment not explicitly excluded. If they appear in a simulation they have, at first, to be regarded as virtual.

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. Time for a visible hand to stabilize the pure random market.

6 The stability of markets in a random environment

> A good explanation of price determination, whether in a particular market or in a whole economy, requires a well-articulated theory of how markets determine prices. No such theory exists. (Hausman, 1992, p. 49)

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 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 of 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:

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

This new expenditure ratio is then fed into the simulation. The changing nominal demand in combination with the quantitative supply affects the price. Figure 4 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:

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

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:

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

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 limiting case the stocks of money and products remain unaltered.

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 4.

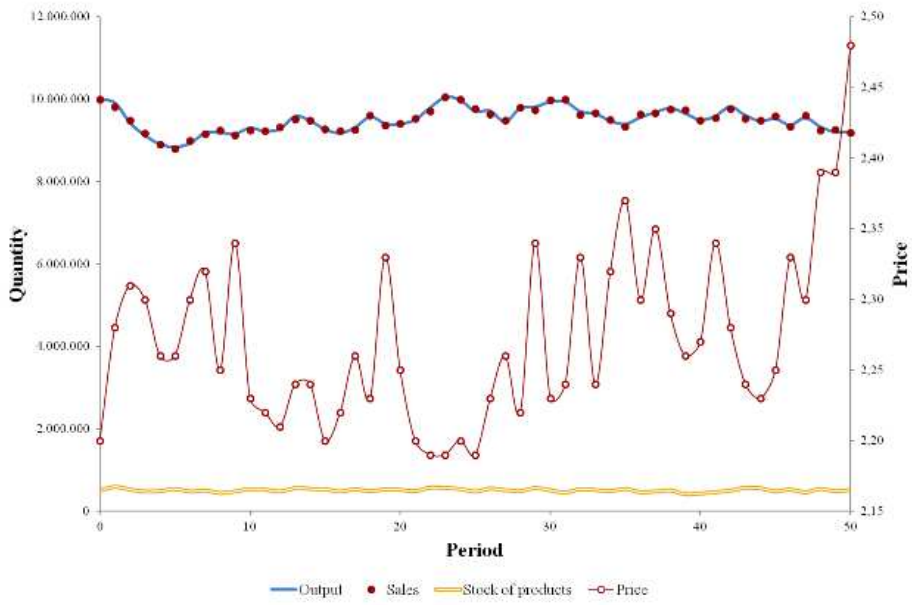

Figure 4: Price determination in the three-dimensional (price, quantity, time) product market with cumulative market clearing (compares to the pure random market of Figure 3)

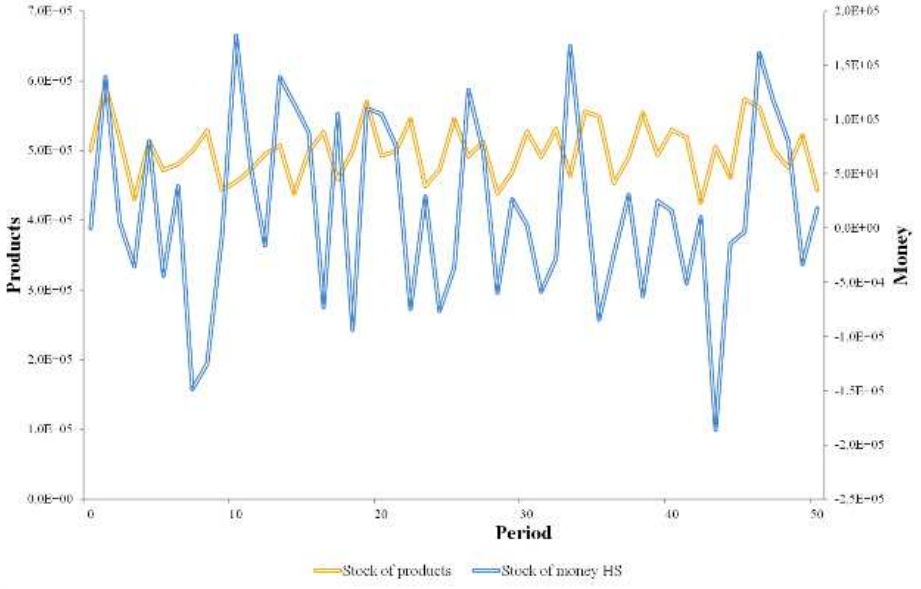

Figure 5: The business sector's stock of products and the household sector's stock of money keep close to the respective target values (the inventory cycle is identical with Figure 4)

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 linear functional relationship between the two paths. The change rate of the sales ratio is a directed random variable and given with (34). Figure 4 supplants the vacuous supply-demand-equilibrium construct.

In each period, the accumulated stock of previous periods enters into the price determination. That is, the price determination is history dependent. There is no such thing as a simultaneous equilibrium.

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. In Figure 5 the respective movements of the real and the monetary stock are contrasted. Both stocks are kept in the vicinity of their target values.

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 household sector's 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. Note that real supply (38) and nominal demand (39) are not independent because labor input L appears in both equations as determinant.

The stability of the product market ultimately hinges on (32) and (35) which provide the negative feedback. All other variables vary at random.

A change of the respective target values is possible at any time. This leads to a smooth adaptation of the system. This follows from the constituents that define the simulation. Thus the product market realizes over time cumulative market clearing and budget balancing in a random environment. There is stability but no such things as equilibrium or disequilibrium, just like in the real world.

6.3 The labor market

We have only two markets. However, from the fact that the product markets is cleared by no means follows that the labor market is cleared. Hence, something must be wrong with the interpretation of Walras's law (for details see 2013b).

Until now labor input L has varied at random. The labor supply L^θ, too, is at first treated as an random variable that ultimately depends on population growth and on the degree of voluntary participation under the concrete conditions of the period under consideration. The current wage rate is one element in the heterogeneous bundle of concrete conditions. At the moment, there is no differentiation between firms and various jobs and qualifications within the firm. The theoretical task is, in the first approximation, to get total undifferentiated labor input L as close as possible to the moving target L^θ, in other words, to establish full employment in principle.

We know that the familiar answer supply-curve–demand-curve–equilibrium is wrong because the real wage is not determined in the labor market but follows from the condition of product market clearing (8) as:

$$\begin{gathered} \frac{W}{P} = \frac{R}{\rho_E\,(1+\rho_D)} \\ \text{if} \quad \rho_X = 1 \quad \text{and with} \quad \rho_D \equiv \frac{DN}{WL} \quad |t. \end{gathered} \tag{40}$$

The real wage depends on the productivity, the expenditure ratio and the income distribution, i.e. the relation of distributed profit and wage income, and has nothing at all to do with some ill-defined equilibrium in the labor market. Therefore, the real wage cannot possibly play any role in the coordination of the labor market. Whether the real wage is equal to the marginal disutility of work is itself a question of maximum disutility. The conventional claim that the real wage is determined by supply and demand in the labor market is on one level with the claim that human destiny is determined by the stars.

Let us assume that the household sector's supply L^θ increases due to exogenous population growth. What is now needed is a drive to expand L on the side of the business sector, otherwise we are left with growing unemployment. It is certainly a good thing if there are innovative agents who try to make profit with new products. They expand production and absorb part of the additional labor supply. This works under the crucial condition that the incumbent firms continue production at the current level. Imagine that enough innovative entrepreneurs are successful in a hitherto zero profit economy. The profit of newcomers then implies a loss of equal magnitude for the incumbent firms. A part of these firms drop out and therefore the net employment increase is somewhere around zero. The animal spirits of entrepreneurs are not enough. What is needed in addition is a growth of profit

opportunities. These objective condition must be provided by the structure. The business sector, taken as a whole, cannot create profit – no matter how innovative or greedy entrepreneurs are. Profit is determined by the Profit Law (13).

It is now assumed that labor input increases if the actual profit ratio is above a preset target value. How the target value is determined is left open for the moment. The actual profit ratio is defined as:

$$\rho_Q \equiv \frac{Q_m}{Y_W} \quad |t. \tag{41}$$

The profit ratio in the consumption economy is given by the relation of monetary profit to wage income. Profit cannot be related to capital in the form of a profit rate because capital does not exist in the pure consumption economy. There is no such thing as a natural association between profit and capital.

In the general form the adaptation rule now states that the change of labor input is positive if the profit ratio is greater than the given reference value and negative in the opposite case:

$$1_t = sgn_L \left(sgn \left(\rho_{Qt-1} - \rho^{\theta}_{Qt-1} \right) \right). \tag{42}$$

The concrete rate of change depends on a plausible probability distribution:

$$\ddot{\dot{L}} = \underbrace{\{-1,0,1\}}_{\text{direction}} \underbrace{Pr(\{0 \leq \ddot{\dot{L}} \leq x\%\})}_{\text{magnitude}} \quad |t. \tag{43}$$

Eqs. (42) and (43) produce the directed random change for each period.

From (41) in combination with (12) and the definitions (5) and (6) follows:

$$\begin{gathered} \rho_Q \equiv \rho_E \left(1 + \frac{DN}{WL} \right) - 1 \\ \text{if} \quad \rho_X = 1 \quad |t. \end{gathered} \tag{44}$$

The profit ratio depends on the expenditure ratio and the distributed profit ratio. For the case of budget balancing, i.e. $\rho_E = 1$, this yields:

$$\begin{gathered} \rho_Q = \rho_D \\ \text{if} \quad \rho_E = 1, \rho_X = 1 \quad \text{and with} \quad \rho_D \equiv \frac{DN}{WL} \quad |t. \end{gathered} \tag{45}$$

Under the condition of budget balancing and market clearing, the profit ratio is equal to the distributed profit ratio. The profit ratio increases if dividend and number of shares increase, and decreases if the wage rate and employment increase.

One special case is of immediate interest. If the wage rate W is reduced and labor input L is expanded, such that wage income remains constant, then the profit ratio remains also constant. Put differently, a hyperbolic wage cut and employment increase leaves the profit ratio unaffected and is therefore indifferent for the business sector. There is, however, an effect on the market clearing price according to (8). This, in turn, leaves the real wage unaffected according to (40). In this respect, the hyperbolic employment expansion is indifferent for the household sector. If both sides behave as the indifference principle demands any level of employment can be realized with a strictly proportional reduction of wage rate and price and a hyperbolic expansion of labor input. The obvious drawback of this course of action is that it violates the principle of price stability. According to this principle, deflation is as unacceptable as inflation. Note well that hyperbolic adaptation does not work at all in the (Walrasian) zero profit economy.

A hyperbolic wage rate reduction keeps the profit ratio unaffected but disturbs the dividend ratio ρ_V and the share ratio ρ_N which are defined, respectively, as:

$$\rho_{Vt} \equiv \frac{D_t}{W_t} \qquad \rho_{Nt} \equiv \frac{N_t}{L_t}. \tag{46}$$

The number of shares is a proxy for the size of the firm that at the moment constitutes the business sector. Hence the share ratio should, in the pure consumption economy at least, be more or less constant. It is assumed now that both ratios are constant at their initial values ρ_{V0} and ρ_{N0}. With this the initial income distribution, which is represented by the distributed profit ratio ρ_D, remains constant irrespective of whether total income increases or shrinks.

This assumption is now translated into a linear relation between labor supply and the number of shares:

$$N_t^\theta = \rho_{N0} L_t^\theta. \tag{47}$$

Together with (44) this yields:

$$\rho_Q \equiv \rho_E \left(1 + \rho_{V0}\rho_{N0}\frac{L^\theta}{L}\right) \quad |t. \tag{48}$$

This gives us a plausible mechanism of employment adaptation. It works as follows: labor supply L^θ up, number of shares N^θ up, profit ratio ρ_Q up. Then, according to (42) labor input L up which brings the profit ratio eventually down to the initial level. The higher employment now corresponds to a greater number of shares. The

dividend ratio ρ_V is kept constant. Employment depends on the profit ratio which must take the lead. The business sector initiates growth expressed by the proxy N. Note that the possibility of credit expansion taking the lead with $\rho_E > 1$ is here not taken into consideration (for details see 2013a). For a random path of labor supply the development of labor input over 1.000 periods is shown in Figure 6.

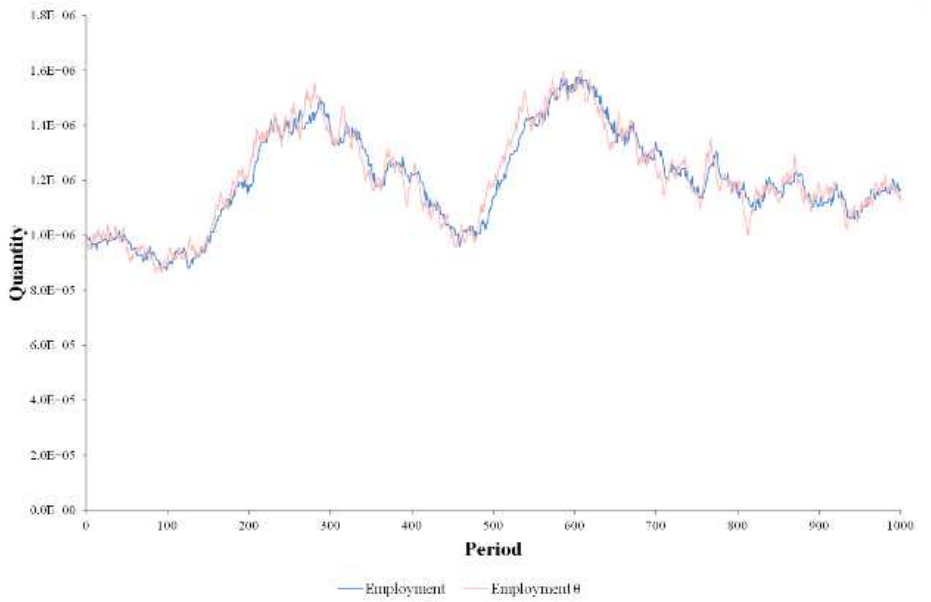

Figure 6: Labor input depends on changes of the profit ratio and fluctuates around the independent random path of labor supply

The path of labor input tracks the random path of labor supply quite satisfactorily. The difference between the paths indicates temporary under- or over-employment. The un(over)employment rate in this simulation seldom exceeds 5 percent and reaches at maximum 10 percent.

The simulation consists of the symmetric random movements of wage rate W and productivity R, and the reference values L^θ, $\bar{O}^\theta$, $\bar{\mathrm{M}}^\theta_{\mathbf{H}}$ and ρ^θ_Q. Both, the former and the latter have been treated as exogenous. Let the superscript θ indicate tastes, R represent technology, and W represent the arbitrary nominal numéraire, then it can be said with the familiar slogan that the evolution of the economy is ultimately determined by tastes and technology. The exact numerical details are given with the structural-axiomatic simulation over an arbitrary number of periods which enables a real world comparison. We have three rules for directed random changes: (32), (35), and (42). The simulation clears the product market as shown in Figure 4 and the labor market as shown in Figure 6.

It is worth emphasizing that the wage rate has, according to (37), a direct influence on the price but not on employment which depends on the combination of (42) and (43), that is, ultimately on the profit ratio. A changing profit ratio initiates a

change of employment and with increasing employment the profit ratio returns to the original value. The process stops as soon as $L = L^{\theta}$ in (48). The adaptation of the employment level does not alter the initially given income distribution. Apart from temporary fluctuations the income distribution and the profit ratio is equal on all levels of employment. The principle of indifference holds for both the business and the household sector with regard to the profit ratio and the real wage if the productivity remains constant over the range of realized labor inputs. With regard to the number of beneficiaries the full employment economy is always preferable. There is no structural trade-off between full employment and price stability.

The adaptation of labor input depends on the difference between the actual profit ratio and the preset ratio ρ_Q^{θ} in (42). The preset ratio is determined by the structural relations of dividend, wage rate, number of shares and employment. The concrete value of this structural relationship is a systemic property and not known to the agents. For our simulations it has been assumed to be constant. This is quite realistic under a medium range perspective but certainly not for each period and perhaps not under the secular perspective. Different economies may be characterized by different average profit ratios.

Let us assume that the underlying profit ratio is fairly stable but only approximately known through longer experience. Then we have two possible configurations: (a) the business sector's target value ρ_Q^{θ} is systematically below the structurally given value, or (b), just the opposite. According to our rules of employment adaptation, in case (a) we will observe a tendency for over-employment and in case (b) chronic underemployment. The target profit ratio in the latter case is too high. This bias can be speedily corrected by a reduction of the target profit ratio. Economists who have not done their theoretical homework will propose in this situation a wage rate reduction as they have mindlessly done for the last two hundred years (cf. Keen, 2011, p. 210).

In sum: the consumption economy formally consists of both independent and directed random variables. The latter ensure that the stock of products and the stock of money remains in the vicinity of their respective target values. This is done by negative feedback. Over longer stretches of time this cumulatively clears the product market and balances the household sector's budget. The determination of the market clearing price depends also on cumulated stocks, in other words, conditional price flexibility is history dependent. Employment, on the other hand, is determined by the difference between the actual profit ratio and the preset target value. Full employment is possible but not necessary. The system adapts with directed random changes smoothly to changes of the target values. In the absence of external limitations, the pure consumption economy can, in principle, evolve indefinitely.

7 Full employment and perfect price stability

> It is good to have [the technically best study of equilibria], but perhaps the time has now come to see whether it can serve in an analysis of how economies behave. The most intellectually exciting question of our subject remains: is it true that the pursuit of private interest produces not chaos but coherence, and if so, how is it done? (Hahn, 1984, p. 102)

The study of equilibria in no way serves in an analysis of how economies behave. This question is settled; what remains after the clarification of much neoclassical confusion is the original question. So, how can it be really done?

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

$$P = \frac{\rho_E}{\rho_X}\,\frac{W}{R}\left(1+\frac{DN}{WL}\right) \qquad |t. \tag{49}$$

The equation states that the market clearing price will remain perfectly stable if the configuration of magnitudes on the right hand side produces a constant numerical outcome. We have three different kinds of determinants on the right hand side: the income distribution, unit wage costs, and the symmetry of the expenditure and the sales ratio.

The income distribution remains constant if any expansion or contraction of the household sector's voluntary labor supply runs in parallel with an increase or decrease of the number of shares, as defined with (47) and (48), and if the development of the dividend runs in parallel with the wage rate. Changes of the wage rate have no effect on employment. The quantitative adaptation of employment is not dependent on a price signal but on the profit signal.

Unit wage costs are kept constant if the wage rate moves perfectly in step with the productivity. The wage rate in turn determines the dividend under the condition of a fixed dividend ratio. The wage rate has to be determined with an eye on production conditions and not with an eye on the clearing of the labor market. Neither the nominal nor the real wage is determined according to the rather awkward supply-function–demand-function–equilibrium. This inept construct contributes nothing to the understanding of the working of the actual economy.

Finally, the expenditure ratio and the sales ratio must always move in step. This means: if the household sector's expenditure ratio is greater than unity the sales ratio must also be greater than unity, which implies that an additional demand is met out of the stock of products without affecting the price in the least. Vice versa, if the household sector's expenditure ratio is below unity. In this case the falling nominal demand increases the stock of products. A rising and falling expenditure ratio thus leads to a falling and rising inventory. For very practical reasons there is, trivially,

a upper and lower ceiling for the oscillations of the inventory cycle that, however, need not disturb us at the moment. Over a longer time span there is a good chance that the demand variations and the stock variations cancel out. In this ideal case, the household sector's stock of money and the business sector's stock of products return to their respective target values. The price remains in any case constant over all periods, it does *not* react on changing supply or demand.

In the ideal economy, the price mechanism is switched off and the quantity mechanism is switched on. Formally this is incorporated in the symmetry condition $\frac{\rho_E}{\rho_X} = 1$. The one-sided reliance of conventional economics on the price mechanism is misplaced and at odds with the principle of price stability. In the obsolete language of the equilibrium metaphor eq. (49) determines the eternal price for the economy as a whole. This price is neither affected by rising or falling employment nor by rising or falling nominal demand. Analytically, this price is the fulfillment of Ricardo's dream of a perfect standard of economic value.

8 Conclusion

> Since abstract general equilibrium theories seem to have no explanatory or predictive implications, many have wondered what good they are. (Hausman, 1992, p. 99)

Equilibrium theories never have been any good and with hindsight it may appear astonishing how much time it took to realize the obvious. This, tough, is a normal effect in the scientific trial-and-error process. After having achieved a consensus about the ineffectiveness of standard analysis the question is how to proceed?

In the present paper the behavioral axioms of standard economics are replaced by structural axioms. Any alternative to the standard approach must itself articulate by means of a consistent set of foundational statements. Debunking the results of equilibrium theory as unrealistic and useless is necessary but not sufficient. The decision between theories is always a decision between the basic postulates. The basic postulates of standard economics are unacceptable on all methodological counts.

The immediate yield of the change to objective structural axioms is the correct profit theory.

After establishing the new formal foundation an explanation of the continuous clearing of both the product and the labor market in the random monetary economy is given, that is, of how the economy could establish ongoing full employment and price stability in principle. The adaptation in the structural-axiomatic consumption economy is accomplished by directed random changes.

Additional yields of the structural-axiomatic inquiry are:

- a stochastic simulation is the right tool, a set of equations is the wrong tool of analysis,
- there is stability in the pure consumption economy but no such things as equilibrium or disequilibrium,
- full employment and price stability are feasible, there is no trade-off,
- full employment through hyperbolic wage rate reduction is possible at any time if the distributed profit ratio is greater than zero but contradicts the principle of price stability,
- price stability requires stable unit wage costs, a constant income distribution, and an unchanging relation of the expenditure and the sales ratio of unity,
- in the ideal economy, the price mechanism is switched off and the quantity mechanism is switched on.

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