Economics for Economists

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Abstract

The characteristic capability of science – to turn whatever it might touch into knowledge – seems to have eluded economics. Currently, economists do not understand how the economy works. To get out of the cul-de-sac requires a paradigm shift. It consists in replacing behavioral axioms by structural axioms. The subject matter of theoretical economics is not human behavior but systemic behavior. From the structural analysis follows a new Law of Supply and Demand and a new Profit Law for the economy as a whole. The conventional supply-demand-equilibrium approach is refuted. This implies that the reliance on the spontaneous order metaphor is unfounded.

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Keywords new framework of concepts; structure-centric; axiom set; Profit Law; Law of Supply and Demand; self-adjustment

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1 Lacking the Midas touch of science

> Thousands upon thousands of scholars, as well as thousands of statesmen and men of affairs, have contributed their efforts to the attempt to understand the course of events of the economic world. And today this field of investigation is being cultivated more extensively, than ever before. How is it, then, that in all these years, and with all the undoubted talent that has been lavished upon it, the subject of economics has advanced so little? (Schoeffler, 1955, p. 2)
>
> Could it be that there is something deeply wrong with mainstream economics . . . ? (Blaug, 1984, p. 973)

J. S. Mill excused economics in the inescapable benchmark comparison with physics as separate and inexact science. Indeed, when one compares the respective starting points – Newton and Smith – and the actual state of the fields then one is driven to the conclusion that in the course of time economics has fallen behind even farther. The characteristic of science, to turn whatever it might touch into knowledge, seems to have eluded economics.

Historians of economic thought will certainly explain some day in greater detail how this could happen. The working hypothesis of the present paper is that economic analysis started off on the wrong foot. Conventional economics rests on behavioral assumptions that are formally expressed as axioms (McKenzie, 2008). Axioms are indispensable to build up a theory that epitomizes formal and material consistency. The fatal flaw of the standard approach is that human behavior does not yield to axiomatization.

Orthodox approaches, but the heterodox alternatives also, lack this crucial intuition: the subject matter of theoretical economics is not human behavior but the behavior of the economic system. It is quite commonsensical to focus first on human behavior and to second-guess motives, expectations, and plans but ultimately this leads to nowhere. Common sense has always been a bad guide in scientific matters.

The conceptual consequence of the present paper is to discard the subjective-behavioral axioms and to take objective-structural axioms as the formal point of departure. This is the first step to get out of the cul-de-sac.

Section 2 provides the new formal foundations with the set of four structural axioms. From these minimalistic premises follows in Section 3 the purely structural Law of Supply and Demand. In Section 4 human behavior is formalized and applied to price setting. In Section 5 the Profit Law is derived. In Section 6 full employment is formally established. In Section 7 the condition of budget balancing is repealed and it is shown that despite flexible markets the system is not self-adjusting. What has been overlooked hitherto is that the profit mechanism, not the price mechanism, is of primary importance for the functioning of the market system. Section 8 concludes.

2 The paradigm shift

> The problem is not just to say that something might be wrong, but to replace it by something – and that is not so easy. (Feynman, 1992, p. 161)

We now advance from behavioral axioms to objective structural axioms as formal incarnation of the evolving economic system. Human beings are thereby moved from the center to the analytical periphery. The paradigm shift is necessary because any proposition about human behavior is vague and uncertain, therefore no solid theory can be built upon it.

2.1 Abstraction and idealization

A theory is an articulated mental representation of the real thing. A theory and the real thing are different but correspond at crucial touch points. It has been aptly remarked that they are related like map and landscape. One of the silly arguments against theory is that it is unrealistic. It always is, yet there are different kinds of unrealism.

The economy is without doubt a complex entity and everybody knows only a tiny part from personal experience. When we talk of the economy we always talk about a mental construct, a highly simplified abstraction. The economy a practitioner has on his mind is an abstraction no less than the supply and demand curves of the armchair economist. But commonsensical abstraction is usually of limited scope. The goal of theoretical economics is to find out "how the economy works." This goal, however, is far away from the starting point, which consists of the most extreme abstraction, one that must get rid of almost all complexities of the real thing. And this abstraction has to be articulated as a consistent set of foundational propositions.

> Since, therefore, it is vain to hope that truth can be arrived at, either in Political Economy or in any other department of the social science, while we look at the facts in the concrete, clothed in all the complexity with which nature has surrounded them, and endeavour to elicit a general law by a process of induction from a comparison of details; there remains no other method than the *à priori* one, or that of "abstract speculation." (Mill, 1874, V.55)

Abstract speculation, though, must eventually arrive with the highest precision at concrete facts, that is, at the crucial touch points of theory and the real thing.

Theoretical economics is different from political economics. The goal of political economics is to push an agenda, the goal of theoretical economics is to explain how the actual economy works. This cannot be achieved by observing and interpreting what the agents do. For this reason theoretical economics is also fundamentally different from both psychology and sociology.

2.2 Axioms

The new formal foundations of theoretical economics define the interdependencies of the real and nominal variables that constitute 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.

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.

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

The period counter t runs from 0, the initial period, to ∞. An anchoring in historical time is possible but not necessary at the very beginning of the analysis.

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. Geometrically the 2nd axiom is a ray from the coordinate origin that tracks underlying discontinuous non-linearities; it does not contain any implicit assumption about increasing or decreasing returns.

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 period values of the axiomatic variables are formally connected by the familiar growth equation, which is added as the 4th axiom.

$$Z_t = Z_{t-1}\left(1 + \dddot{Z}_t\right)$$
$$\text{or}$$
$$Z_t = Z_0\left(1 + \dddot{Z}_1\right)\left(1 + \dddot{Z}_2\right)\ldots\left(1 + \dddot{Z}_t\right) = Z_0\prod_{t=1}^{t}\left(1 + \dddot{Z}_t\right). \tag{4}$$
$$\text{with}$$
$$Z \leftarrow W, L, D, N, R, P, X, \ldots$$

The path of the representative variable Z_t is determined by the initial value Z_0 and the rates of change $\ddot{Z}_t$ for each period. Each path has three segments past, present, future. The past rates of change are known and can be inserted in (4). The axioms contain the minimum number of variables. Seven of the variables are elementary, three are composed. Figure 1 is the graphical representation of the first four axioms.

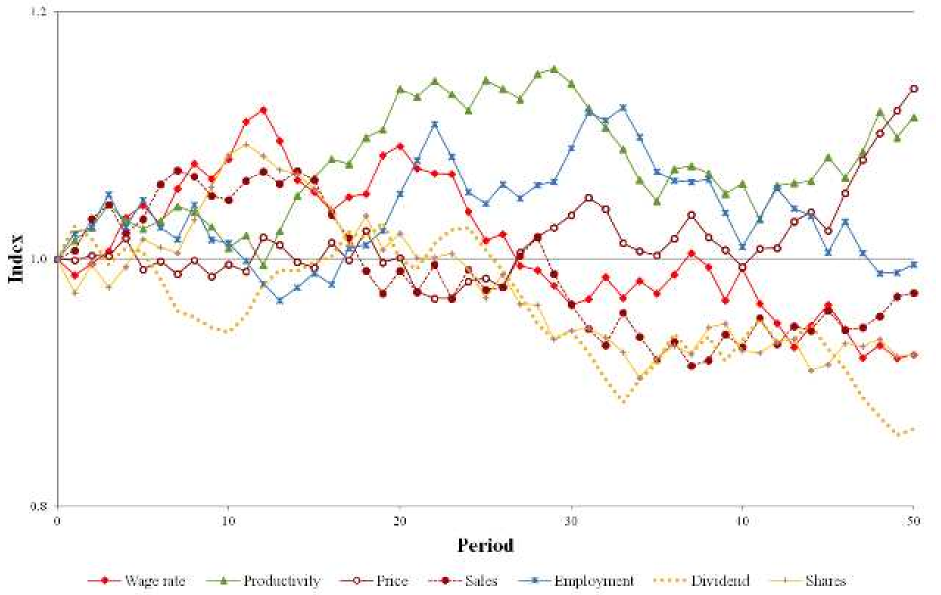

Figure 1: Paths of the seven elementary axiomatic variables W, L, D, N, R, P, X from the initial period $t = 0$ until period $t = 50$ as defined by independent symmetrical random rates of change. All paths are numerically expressed in terms of their respective initial values, therefore they start collectively at the index point 1.

2.3 Definitions

Income categories

Definitions are supplemented by connecting variables on the right-hand side of the identity sign that have already been introduced by the axioms. With (5) wage income Y_W and distributed profit Y_D is defined:

$$Y_W \equiv WL \qquad Y_D \equiv DN \quad |t. \tag{5}$$

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

Given the paths of the elementary variables, the development of the composed variables is also determined.

Key ratios

We define the sales ratio as:

$$\rho_X \equiv \frac{X}{O} \quad |t. \tag{6}$$

A sales ratio $\rho_X = 1$ indicates that the quantity bought/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:

$$\rho_E \equiv \frac{C}{Y} \quad |t. \tag{7}$$

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.

We define the factor cost ratio as:

$$\rho_F \equiv \frac{W}{PR} \quad |t. \tag{8}$$

A factor cost ratio $\rho_F = 1$ indicates that the nominal value of one hour's labor input W is equal to the value of output PR which implies that profit per hour, respectively per unit of output, is zero.

We define the distributed profit ratio as:

$$\rho_D \equiv \frac{DN}{WL} \quad |t. \tag{9}$$

The distributed profit ratio may, for instance, assume a value between zero and 10 percent.

2.4 Assumptions

> When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect. (Solow, 1956, p. 65)

Assumptions are a necessary ingredient of any theory. Their justification or, as the case may be, their futility materializes in the course of the analysis. What has to be avoided for compelling methodological reasons is assumptionism. It should be obvious that it is illegitimate to take assumptions like equilibrium, perfect competition, well-behaved production functions, optimization, etc. into the premises.

Assumptionism introduces physical or psychological nonentities and thereby creates a parallel world with no connection to the economy we happen to live in.

However, the specific difficulty with nonentities is sometimes that they cannot be readily recognized or disproved. It is simple with the Easter Bunny and has been rather demanding with the concept of absolute space. Identifying nonentities is one of the defining activities of science. In took the physicists about eighteen centuries to find out that epicycles are nonentities.

Sociology and psychology are based on behavioral assumptions. Economics has created its own brand with constrained optimization. These attempts did not lead to much more than a gossip model of the world.

> ...there has been no progress in developing laws of human behavior for the last twenty-five hundred years. (Hausman, 1992, p. 320), (Rosenberg, 1980, p. 2)

From this follows that economics should distance itself as far as possible from the social sciences. There is a low probability that any participation in the discussion about human behavior could ever lead to new, reliable, or valuable insights. It is alone the systemic aspect of the economy that yields itself to the scientific method.

Methodology cannot tell the researcher how best to proceed but it can identify rather common mistakes like petitio principii or the fallacy of composition. Most generalizations of microeconomic models fall into the latter category. It was J. S. Mill who has compiled a comprehensive list of methodological pitfalls for his fellow economists (Mill, 2006).

From logic and historical experience follows that the premises of standard economics have to be rejected. Not because they are all wrong but because they are not suitable as foundations of a comprehensive theoretical superstructure. Weintraub has neatly summarized these premises.

> ... the program is organized around the following propositions: HC1 *economic agents have preferences over outcomes*; HC2 *agents individually optimize subject to constraints*; HC3 *agent choice is manifest in interrelated markets*; HC4 *agents have full relevant knowledge*; HC5 *observable outcomes are coordinated, and must be discussed with reference to equilibrium states.* (Weintraub, 1985, p. 147)

The structural axiomatic paradigm leaves these behavioral premises behind. Equilibrium is, as a matter of principle, unacceptable as a premise. HC2 and HC5 are the fatal methodological blunders of conventional economics.

The set of objective structural axioms constitutes the *minimum* of premises. The economic content of the four axioms is perfectly transparent. The point to emphasize is that total income in (1) is the sum of wage income and *distributed profit* and not of wage income and profit.

For a start it is assumed that the elementary axiomatic variables vary at random. This produces an evolving economy. The respective probability distributions of the change rates are given in general form by:

$$\begin{array}{cc} Pr\left(l_W \leq \ddot{W} \leq u_W\right) & Pr\left(l_R \leq \ddot{R} \leq u_R\right) \\ Pr\left(l_L \leq \ddot{L} \leq u_L\right) & Pr\left(l_P \leq \ddot{P} \leq u_P\right) \\ Pr\left(l_D \leq \ddot{D} \leq u_D\right) & Pr\left(l_X \leq \ddot{X} \leq u_X\right) \\ Pr\left(l_N \leq \ddot{N} \leq u_N\right) & |t. \end{array} \tag{10}$$

The four axioms, including (10), constitute a stochastic simulation.

It is, of course, also possible to switch to a completely deterministic rate of change for any variable and any period. The structural formalism does not require a preliminary decision between determinism and indeterminism.

Before the formalism can be applied concrete assumptions about the initial conditions and the upper (u) and lower (l) bounds of the probability distributions have to be made. This is the point where input from experience is needed. We know from observation for instance that productivity changes lie normally between, say, 5 percent and 0 percent per period. But it may happen that the rate of change is -100 percent in case a plant burns down or is cut off from the power supply or is paralyzed by a software bug or something else of this sort. In order to bring the simulation as close as possible to reality, we take the probability distribution from experience, and in order to make it simple, we first exclude all kinds of accidents.

We know that probability distributions may change over time and that accidents do happen. What we do not know is the exact date and extent of a possible accident in the future. For a start these features of reality are excluded from the analysis. They may be taken in as soon as the elementary relationships have been clarified.

A simulation yields a scenario and not a prediction. Each scenario is fully determined, explicit, and traceable in every detail. A simulation as defined by the four structural axioms and the probability distributions is a well-defined mathematical object just like a system of equations. While they are formally on the same footing both mathematical objects yield different kinds of outputs: the system of equations yields a solution vector, a simulation yields a bundle of paths. This bundle has a counterpart in reality.

The upper (u) and lower (l) bounds of the respective probability distributions are, for a start, taken to be symmetrical around zero. This produces a drifting or stationary economy as a limiting case of the growing economy. There is no need at this early stage to discuss the merits and demerits of different probability distributions. Eq. (10) represents the general stochastic case which in the limit $u - l \rightarrow 0$ shades into determinism. The evolving consumption economy is a well-defined mathematical object that contains no subjective elements.

3 The Law of Supply and Demand

> Supply and demand are at the heart of how market economies work. (Mankiw, 1998, p. 519)

In this general form the statement is certainly acceptable. The problems begin with concretion. The actual fact is that economists do not know how the market system works. General equilibrium theory as the quasi-canonical analytical framework is now generally regarded as failure and an alternative is not available. The task ahead is – not to waste any time with an explanation of where things went wrong, but – to develop the correct theory of the elementary market interdependencies. This theory is based on objective structural axioms and not on subjective behavioral assumptions.

3.1 The elementary product market

From (3) and the other axioms and the definitions follows the price as dependent variable:

$$P = \frac{\rho_E}{\rho_X}\frac{W}{R}\left(1+\frac{DN}{WL}\right) \quad |t. \tag{11}$$

This is the general structural axiomatic Law of Supply and Demand for the pure consumption economy with one firm (for the generalization see 2014a). In brief, the price equation states that the price is equal to the product of the expenditure ratio ρ_E, the inverse of the sales ratio ρ_X, unit wage costs $\frac{W}{R}$, and the distributional factor $1+\rho_D$. The structural axiomatic price formula is testable in principle and fully replaces supply-function–demand-function–equilibrium.

Under the condition of market clearing one gets:

$$P = \rho_E\frac{W}{R}\left(1+\frac{DN}{WL}\right) \quad \text{if} \quad \rho_X = 1 \quad |t. \tag{12}$$

Conditional price flexibility is, clearly, an algebraic concept. Nothing is said about the behavior of the firm. Price setting behavior is dealt with in more detail in Section 4.3.

If, in addition, the household sector's budget is balanced then we have:

$$P = \frac{W}{R}\left(1+\frac{DN}{WL}\right) \quad \text{if} \quad \rho_E = 1, \rho_X = 1 \quad |t. \tag{13}$$

In the standard case with budget balancing and market clearing the price is equal to the product of unit wage costs and the distributional factor. Changes of the wage rate, the productivity, distributed profit, and employment all act upon the market clearing price. Budget balancing, too, is algebraic and not behavioral.

If, again in addition, distributed profit is set to zero then:

$$P = \frac{W}{R} \qquad \text{if} \quad \rho_D = 0,\, \rho_E = 1,\, \rho_X = 1 \quad |t. \tag{14}$$

The market clearing price is equal to unit wage costs. That is, independent of the employment level profit per unit is zero and therefore overall profit is zero.

Starting with the axiom set, we now have three independent variables left: W, R, L. It is assumed that they vary at random, more specifically that the random rates of change are distributed symmetrically around zero. With this all variables are formally determined and the concrete outcome on the product market is summarized in Figure 2.

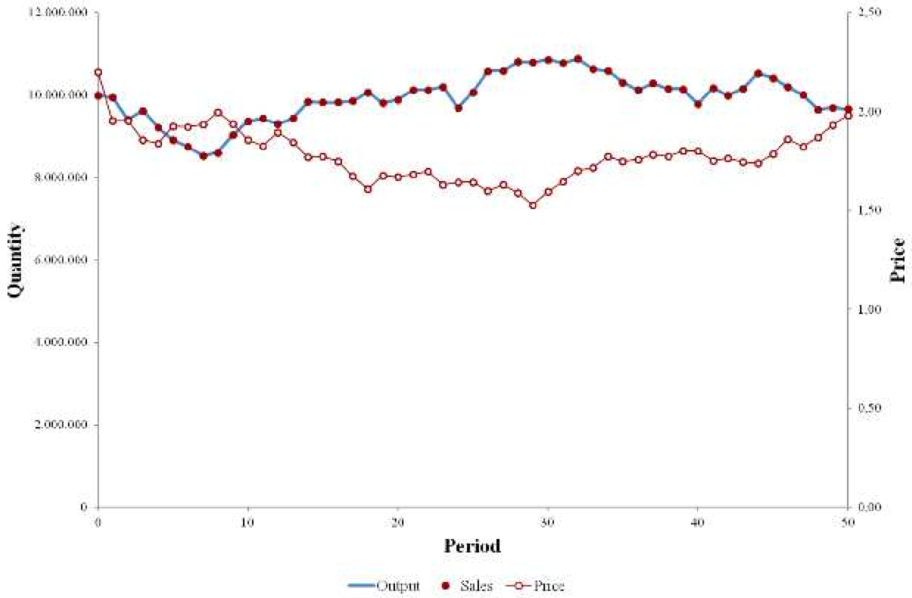

Figure 2: The three dimensional product market: supply and demand quantities (left axis), market clearing price (right axis), time (horizontal axis). The congruent paths of output O and quantity sold/bought X indicate market clearing over the whole time span of observation. The price is throughout the market clearing price. This representation replaces the obsolete two dimensional supply-function–demand-function cross.

Due to the market clearing condition $\rho_X = 1$ the paths of real supply O and demand X are congruent over the whole time span of observation. With wage rate and productivity given by random changes in each period the market clearing price is uniquely determined. The random changes of employment play no role for the price. In pre-structural-axiomatic thinking this price was regarded as equilibrium price. It is therefore important to note that the concept of equilibrium is not applied here. The reason is simple: it is a metaphor that always had been inapplicable in economics. The talk of market forces that push or pull towards equilibrium is pure animism, i.e. the redundant verbal interpretation of a mathematical operation.

> Generally speaking, "equilibrium" is simply the solution of a system of equations. (Ingrao and Israel, 1990, p. 263)

The price path in Figure 2 has only one correct interpretation: it satisfies all objective systemic requirements. All equilibrium talk is strictly forbidden in the structural axiomatic context. This loose verbiage always has been and still is the defining characteristic of proto-science.

3.2 The elementary labor market

From (14) follows

$$\frac{W}{P} = R \qquad \text{if} \quad \rho_D = 0,\, \rho_E = 1,\, \rho_X = 1 \quad |t, \tag{15}$$

that is, the real wage is equal to the productivity.

The first point to notice is that the real wage is *not* determined by supply-demand-equilibrium in the labor market. Only the *nominal* wage rate is. The wage rate W may go up or down by an arbitrary percentage rate, this has, due to conditional price flexibility, no effect on the real wage.

The crucial systemic fact to point out against the conventional approach is: if the product price is determined in the elementary economy by 'supply and demand' in the product market then the real wage cannot be determined by 'supply and demand' in the labor market. Let us call this the structural axiomatic impossibility theorem.

The real wage is determined by the systemic and the production conditions. What is not determined at the moment is the labor input L. Hence, it may well be the case that the actual labor input is below the full employment level. We take up this issue in Section 6.

From (12) follows the general formula for the real wage under the condition of product market clearing:

$$\frac{W}{P} = \frac{R}{\rho_E \left(1 + \frac{DN}{WL}\right)} \qquad (16)$$

$$\text{if} \quad \rho_X = 1 \quad |t.$$

If the expenditure ratio is unity and the distributed profit ratio is zero, that is $\rho_E = 1$, $\rho_D = 0$, then the real wage is equal to the productivity R. In distributional terms: in this case the employees get exactly the hourly product. If $\rho_E > 1$, $\rho_D > 0$ then the real wage is below the productivity. Ultimately, it is the real wage that determines the living standard; and the basic determinant of the real wage is productivity. If the denominator is exactly unity, i.e. $\rho_E < 1$, $\rho_D > 0$, the effect of profit distribution is neutralized. The real wage is in this case again equal to the productivity.

Eq. (16) determines the real distribution of the hourly product. Note that marginal productivity of labor or capital does not play any role whatsoever. These are entirely redundant subjective concepts with no counterpart in reality. Here we are alone concerned with *objective* systemic relationships.

3.3 Disqualifying

The conditional market clearing price is determined by (12) in the general case and by (15) under the condition of budget balancing and zero distributed profit. In both cases Figure 2 is the correct graphical representation of the product market. By implication the usual representation, i.e. Figure 3, has to be discarded for compelling reasons.

First of all, time is not an explicit element of the graph but is verbally added in order to explain adaptation processes. From general equilibrium theory it is known that this is illegitimate.

> Let us assume for a moment that we define some such process, which adjusts prices when they are not in equilibrium. This would not help us at all, because the fundamental problem is that the conditions which are known to guarantee the stability of such a process cannot be obtained from assumptions on the behaviour of the individuals. (Kirman, 2010, p. 508)

The missing time axis implies simultaneity and this is a concept that is irreparably at odds with real world adaptation processes.

Second: there is no such thing as a supply function because there is no such thing as a well-behaved production function. The physically impossible production function has been introduced in order to make the optimizing assumption applicable. This

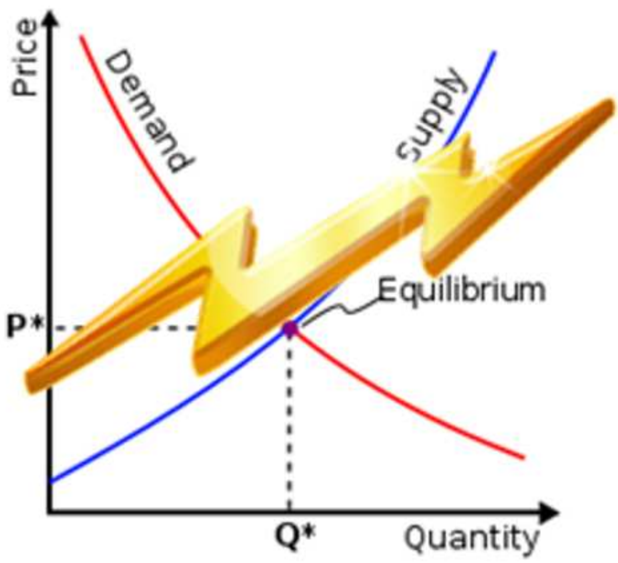

Figure 3: To be discarded: obsolete market representation with – methodologically illegitimate – supply function, demand function, and equilibrium. Source: Wikipedia http://en.wikipedia.org/wiki/File:Supply-demand-equilibrium.svg

is methodologically illegitimate. Behavioral assumptions cannot predetermine the formal representation of the production process.

Third: there is no such thing as an independent demand function. Let us assume for the moment that the firm moves along a hypothetical supply curve. This presupposes a change of labor input and by consequence of income which in turn is a major component of nominal demand. In the case of budget balancing nominal demand moves exactly in step with income.

Figure 3 has to be discarded because supply and demand functions are figments of the imagination that violate a couple of methodological rules. Neither the functioning of one market nor the interdependence of qualitatively different markets like the product and the labor market (not to speak of other types, see 2011a) can be illumined with the help of Figure 3. What follows from this depiction is either trivial or false. To accept it as an explanation of how the market systems works is an almost infallible indicator of scientific incompetence.

4 The logic of behavior

> Is there something about human behavior that makes the formulation of laws impossible? (Hausman, 1992, p. 320)

4.1 Target-orientation

Having determined the market clearing price and the real wage by objective conditions, the next task is to consistently integrate economic agents into the structural axiomatic framework. The most general proposition about agents is certainly not that they maximize utility but that their actions are target-oriented. This is the point to start with.

Formally, for every variable of the structural axiomatic formalism there exists a reference or target variable. The realized values of the variables are superimposed by desired values. In a sense, the real world is duplicated by a desired world:

$$Z \rightarrow Z^{\theta}. \tag{17}$$

Let Z stand for the stock of money then Z^{θ} stands for the desired stock. Or, let Z stand for profit then Z^{θ} stands for the profit target. This may or may not be the profit maximum. The question how different economic agents set their respective targets must be left open for the moment. To assume that agents maximize utility or profit would be premature. We simply have no certain knowledge about behavior at the moment.

What we can say with certainty is that there are three logical configurations for the relation between the actual value of a variable and the target value:

$$Z - Z^{\theta} \gtreqless 0. \tag{18}$$

The actual value of a variable may be greater than, equal to, or less than the target value. This is the economic situation. The agent's action depends alone on whether the deviation from the target value is positive, zero, or negative. There is no need for the agent to measure the deviation precisely, what is needed is only the sign.

$$sgn\left(Z - Z^{\theta}\right) \rightarrow +, 0, - \;\text{ resp. }\; 1, 0, -1. \tag{19}$$

What is needed next is an instrument variable $\mathbb{Z}$. If, for example, the actual stock of products is higher than the target stock, then it is plausible that the firm lowers the price in order to sell off. In this case, the price is taken as instrument variable. The general formal relationship is given by:

$$\underbrace{(-1, 0, 1)_{\mathbb{Z}t}}_{\text{Direction}} = sgn\left(Z_{t-1} - Z^{\theta}_{t-1}\right). \tag{20}$$

If the deviation of the actual value from the target value yields a $+$ sign then the sign of the instrument variable $\mathbb{Z}$ in the current period is here negative, i.e. -1. If the actual value is on target, the signum function yields 0, i.e. the instrument variable does not change. Should this happens for all variables simultaneously in period t then we could speak of a steady state because if all instrument variables are kept constant and there are no exogenous disturbances the economy simply reproduces itself with an unchanged intake from the physical environment. If the actual variable is below target, then the sign of the instrument variable is positive, i.e. 1.

In brief, the signum function delivers the direction of change of the instrument variable. There are only two directions: up and down. Eq. (20) is the general expression of the intentionality of human action. It does not demand any sophisticated calculations from the agent.

In the example above it holds: if the sign of the deviation is positive then the sign of the direction of change is negative, and vice versa. This is not an immutable law but a plausible behavioral assumption. There is no such thing as a behavioral law. For other instrument variables the combination of signs may be alternatively $(1,0,-1)$.

The determination of the target value involves expectations. This means that target values can change fast and that they are generally more volatile than the actual values. Most important, target values may change simultaneously for a greater number of agents. For our present purposes it is not necessary to occupy ourselves with the determination of targets, hence they are without further explanation taken as given. It is important to keep in mind that (20) is the formal expression of a behavioral assumption that is based on more or less reliable observation and second-guessing the agents. It is at the moment not based on behavioral experiments or established certain knowledge. Eq. (20) is general and covers more specific assumptions like profit maximization. It is therefore possible to integrate Walrasian, Keynesian and other approaches as limiting cases into the overarching structural axiomatic framework.

The magnitude of the change of the instrument variable is a random variable. With this we overcome the initial lack of exact knowledge. Thus, the directed random change of the instrument variable consists of two elements: (i) direction, which depends on the deviation of the actual value from the target value, and (ii), magnitude, which depends on a plausible set of discrete random rates of change. For our simulations the concrete numbers are taken from the worksheet random number generator and adapted. The stochastic change vector is given by:

$$\dddot{\mathbb{Z}} = \underbrace{(-1,0,1)}_{\text{Direction}}\underbrace{Pr(0 \leq \dddot{\mathbb{Z}} \leq x)}_{\text{Magnitude}} \quad |t. \tag{21}$$

This equation – the propensity function – delivers the rates of change of the elementary variables of the structural axiomatic set. The development of an economy with a defined structure depends on human action and randomness. The agents determine the paths within the structural axiomatic framework. In this way economic history unfolds (see also 2014b).

4.2 Product market clearing in the course of time

Market clearing in the period under consideration is an analytical limiting case. In the general case markets are not cleared. This has some obvious consequences, the first one is that the firm's stock of hitherto unsold products grows and shrinks in the course of time. The second is that nonmometary profit/loss emerges (2011a).

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

$$\Delta\bar{O} \equiv O - X \equiv O\left(1 - \rho_X\right) \quad |t. \tag{22}$$

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:

$$\bar{O}_t \equiv \sum_{t=1}^{t} \Delta\bar{O}_t + \bar{O}_0. \tag{23}$$

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

$$\bar{O}_t \equiv \sum_{t=1}^{t} O_t\left(1 - \rho_{Xt}\right) \quad \text{if} \quad \bar{O}_0 = 0. \tag{24}$$

Seen from the firm's perspective, the stock at the end of period $\bar{t}$ is either too large, too small, or just right. This depends on the firm's target stock which is denoted by $\bar{O}^\theta$. The firm's objective is not to clear the market in the period under consideration, that is, to sell exactly the current output O, but to bring the actual stock as close as possible to the target stock, i.e.

$$\bar{O}_t - \bar{O}_t^\theta \to 0. \tag{25}$$

Only if the actual stock is exactly equal to the target stock the task in the subsequent periods reduces to market clearing in the narrow sense, i.e. to

$$O_t - X_t = 0 \quad \text{or} \quad \rho_{Xt} = 1. \tag{26}$$

It is assumed that the firm chooses the price as instrument variable in order to adapt the actual stock to the target stock. That is, the price is no longer determined by systemic conditions but set by the agents. The firm is not a price taker but a price setter.

4.3 First approximation: directed price setting

The price setting behavior is formalized by the propensity function which is given by:

$$
\begin{aligned}
(-1,0,1)_{Pt} &= sgn\left(\bar{O}_{t-1} - \bar{O}^{\theta}_{t-1}\right) \\
\ddot{P}_t &= (-1,0,1)\, Pr\,(0 \leq \ddot{P}_t \leq x)
\end{aligned}
\tag{27}
$$

The upper part says that the firm lowers the price if the actual stock is above the target stock and vice versa. The lower part combines the direction of change with a random rate of change. Figure 2, the representation of the at all times cleared product market, now changes to Figure 4.

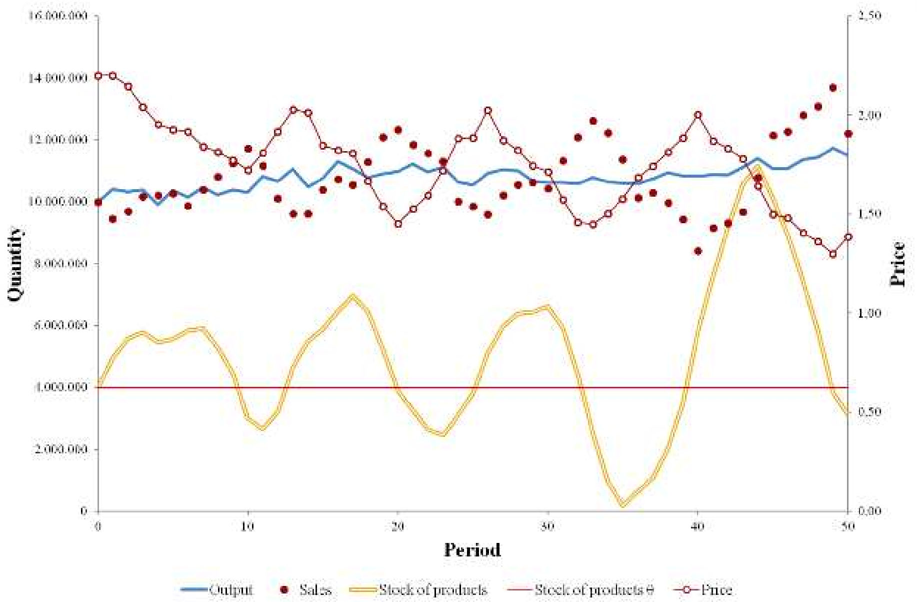

Figure 4: The three dimensional product market: directed price setting in dependence of the deviation $\gtreqless 0$ of the actual stock from the target stock

As above, the three independent variables W, R, L vary with random rates of change that are symmetrically distributed around zero.

The product market is now cleared at the recurring intersections of the inventory curve with the target line, i.e. at $\bar{O}_t - \bar{O}^{\theta}_t = 0$. It can immediately be seen that the price falls if the actual stock is above the target stock and vice versa. Over the whole time span of observation the price falls. While the output path is relatively stable the sales path runs counter to the price movements.

The propensity function (27) embodies a rather simple behavioral rule. Clearly, it is possible to formulate a more sophisticated rule that reduces the swings of the inventory cycle. For the moment, the simple rule is good enough to make the decisive point, i.e. that the market representation of Figure 4 fully replaces the untenable supply-demand cross of Figure 3. Figure 4 is the true icon of the market.

The familiar supply-demand cross implies the behavioral assumption of price taking. This assumption is only acceptable as an analytical limiting case. In general, each firm sets its price. Formally this means that eq. (11) changes directionality to:

$$\rho_X = \rho_E \frac{W}{PR}\left(1 + \frac{DN}{WL}\right) \quad |t. \tag{28}$$

The price setting now co-determines the sales ratio ρ_X which in turn changes the stock of products according to (22). Via the behavioral link (27) there is a feedback on (28) which quite naturally explains the inventory cycle. Because of the random changes of the independent variables this cycle cannot be completely eliminated because it is impossible for the firm to know the current market clearing price. Whatever the market does, it does not signal to the world what the market clearing price is going to be.

While the propensity function ensures that the product market is periodically cleared it may turn out that this is not enough. Practically speaking, it may turn out that the firm either lacks space, or time, or credit to keep an inventory of a certain size until the next intersection of the inventory curve with the target line. From the fact that it can be shown that the product market clears in principle does not follow that it clears 'in time.' That there can be a problem is immediately obvious from the swings in Figure 4 but not at all from Figure 3. For compelling methodological reasons, equilibrium models and all conclusions that are derived from them are unacceptable.

5 The Profit Law

> What are the sources of profit for all business enterprises in a society taken together, or what are the conditions under which aggregate profit arises? (Murad, 1953, p. 6)

Total profit consists of monetary and nonmonetary profit. Here we are at first concerned with monetary profit. Nonmonetary profit is treated at length in (2011a).

The business sector's monetary profit/loss in period t is defined with (29) 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:

$$Q_m \equiv C - Y_W \quad |t. \tag{29}$$

Because of (3) and (5) this is identical with:

$$Q_m \equiv PX - WL \quad |t. \tag{30}$$

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

From (29) and (1) follows:

$$Q_m \equiv C - Y + Y_D \quad |t \tag{31}$$

or, using the definitions (7) and (9),

$$Q_m \equiv \left(\rho_E - \frac{1}{1+\rho_D}\right) Y \quad |t. \tag{32}$$

The four equations (29) to (32) are formally equivalent and show profit under different perspectives. The Profit Law (32) tells us that total monetary profit is zero if $\rho_E = 1$ and $\rho_D = 0$. Profit or loss for the business sector as a whole depends on the expenditure and distributed profit ratio and nothing else (for details see 2013). Total income Y is the scale factor.

It is a unique fact of the history of economic thought that neither Classicals, nor Walrasians, nor Marshallians, nor Keynesians, nor Marxians, nor Institutionialists, nor Monetary Economists, nor Austrians, nor Sraffaians, nor Evolutionists, nor Game theorists, nor Econophysicists, nor New Keynesians, nor New Classicals ever came to grips with profit (cf. Desai, 2008).

Most economists have no true conception of the two central phenomena in the economic universe: profit and income. Such an economist, busily stepping forward and explaining how to fix a crisis or how to make the world a better place, has not done his scientific homework and is in the state of self-delusion (2013).

6 First approximation: full employment in the zero profit economy

We have seen above that the real wage is determined by systemic conditions and not by supply-demand-equilibrium in the labor market. By consequence, the real wage has nothing to do with the determination of employment. Since profit is zero independently of employment according to the Profit Law (32) it cannot – at this stage at least – have anything to do with the determination of employment either.

In the first approximation it is therefore assumed that the business sector increases employment at the going wage rate W whenever there is underemployment and reduces employment whenever there is over-employment. Thus, the propensity function reads:

$$
\begin{aligned}
(-1,0,1)_{Lt} &= sgn\left(L_{t-1} - L^{\theta}_{t-1}\right) \\
\ddot{L}_t &= (-1,0,1)\,Pr\left(0 \le \ddot{L}_t \le x\right)
\end{aligned} \tag{33}
$$

The employment is at first entirely supply driven. The labor supply follows a random walk that is defined by:

$$
Pr\left(l_L \le \ddot{L}^{\theta} \le u_L\right) \quad |t. \tag{34}
$$

The upper and lower bound of the probability distribution is symmetrical around zero. The wage rate, too, follows a random path and co-determines the market clearing price according to (14). The labor market develops as shown in Figure 5.

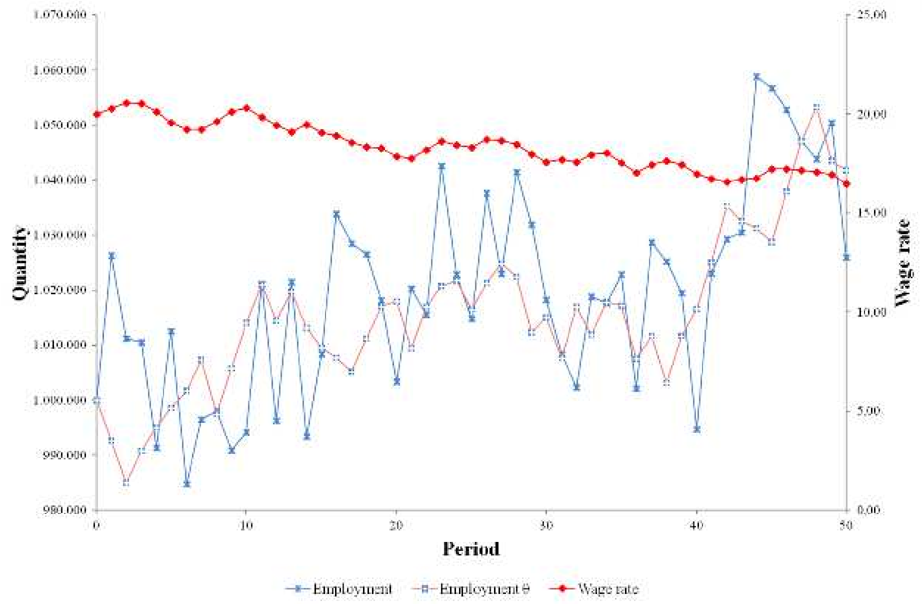

Figure 5: Labor market clearing independently from both the nominal wage rate and the real wage (interdependent with the product market clearing of Figure 4)

The actual labor input L follows the random path of labor supply L^{θ}. The vertical difference between the two paths measures actual under- or over-employment. An increasing labor supply therefore increases employment, income, and consumption expenditures under the condition of budget balancing. As Say had it: supply creates its own demand. The propensity function (33) in combination with the condition $\rho_E = 1$ is the formal representation of Say's law in the zero profit economy with conditional market clearing, i.e. $\rho_X = 1$. If the business sector acts as price setter things are different (see 2014c, Sec. 5).

In sum: Figure 5 fully replaces the conventional supply-function–demand-function–equilibrium representation of the labor market. These functions are derived from untenable assumptions like optimizing behavior or a well-behaved production function. Almost needless to add that equilibrium is a nonentity. The assertion that employment and real wage are determined 'by supply and demand' in the labor market in untenable.

7 The non-balanced budget

There exists no such thing as an immutable law of budget balancing in the same period. Logically, we have three possible cases $\rho_E < 1$, $\rho_E = 1$, $\rho_E > 1$. For the market clearing price follows from (12) under the condition of zero profit distribution:

$$P = \rho_E \frac{W}{R} \qquad \text{if} \quad \rho_X = 1, \rho_D = 0 \quad |t. \tag{35}$$

With given unit wage costs, the market clearing price moves in parallel with nominal demand which is determined by the expenditure ratio and total period income. Loosely speaking, the price rises and falls with demand. The expenditure ratio follows a random walk that is defined by:

$$\rho_{Et} = 1 + \ddot{\rho}_E \quad \text{with} \quad Pr\left(l_\rho \leq \ddot{\rho}_E \leq u_\rho\right) \quad |t. \tag{36}$$

The random rates of change of the expenditure ratio are symmetrically distributed around zero, that is, the expenditure ratio varies symmetrically around unity. This is a plausible behavioral assumption to start with, not an economic law.

Eq. (35) says that the market clearing price variations are dependent on the expenditure ratio, the wage rate, and the productivity. These independent variables in turn vary at random with the possible rates of change distributed symmetrically around zero. The random changes of employment have no effect on the price. Accordingly, the market clearing price follows a well-defined random path as shown in Figure 6.

Market clearing shows up in the flat inventory curve which follows from the congruent paths of output and sales. From outer appearances Figure 6 is not different from Figure 2. However, because the former has three price determinants it is more general. For full generality profit distribution has to be included with the next analytical step. This, though, does not change the 3D representation of the product market.

The household sector's monetary saving/dissaving is given as the difference of income and consumption expenditures (for nonmonetary saving see 2011a):

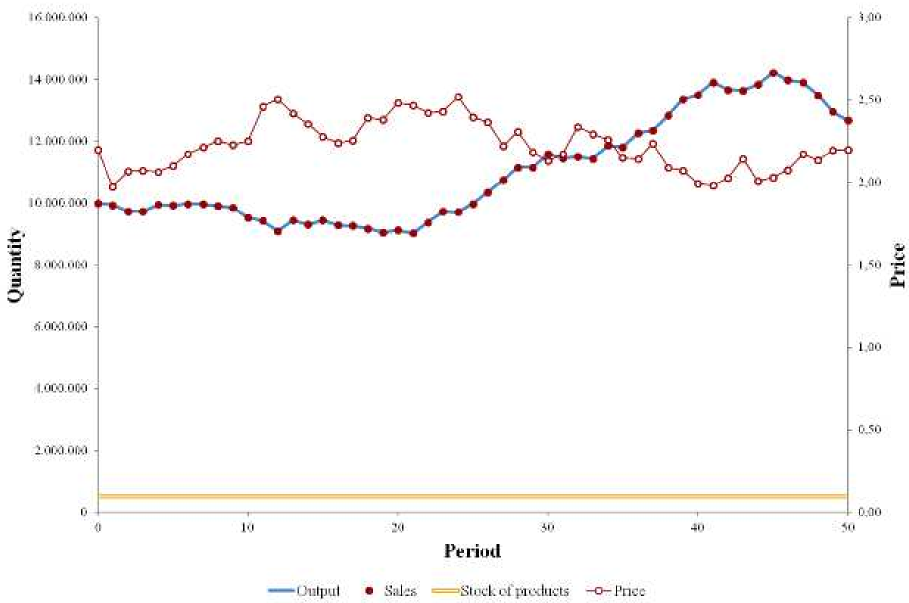

Figure 6: The three dimensional product market: the conditional market clearing price is here dependent on the random paths of the expenditure ratio, the wage rate, and the productivity. The random employment variations have no effect on the price.

$$S_m \equiv Y - C \equiv (1 - \rho_E)Y \quad |t. \tag{37}$$

Saving varies inversely with the expenditure ratio. The two statements: the household sector saves or the expenditure ratio is less than unity, are interchangeable; likewise: the household sector dissaves or the expenditure ratio is greater than unity.

7.1 Money and credit

If income is higher than consumption expenditures the household sector's stock of money increases. The change in period t is defined as:

$$\Delta\bar{\mathsf{M}}_{\mathbf{H}} := Y - C := Y(1 - \rho_E) \quad |t. \tag{38}$$

The alternative identity sign := 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:

$$\bar{\mathsf{M}}_{\mathbf{H}t} \equiv \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_{\mathbf{H}t} + \bar{\mathsf{M}}_{\mathbf{H}0}. \tag{39}$$

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

$$\bar{\mathsf{M}}_{\mathbf{H}t} \equiv \sum_{t=1}^{t} Y_t \left(1-\rho_{Et}\right) \quad \text{if} \quad \bar{\mathsf{M}}_{\mathbf{H}0} = 0. \tag{40}$$

The household sector's actual stock of money ultimately depends on the preceding sequence of expenditure ratios.

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

$$\Delta\bar{\mathsf{M}}_{\mathbf{B}} := C - Y \quad |t. \tag{41}$$

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

$$\bar{\mathsf{M}}_{\mathbf{B}t} \equiv \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_{\mathbf{B}t} + \bar{\mathsf{M}}_{\mathbf{B}0}. \tag{42}$$

The development of the household or business sector's stock of money follows without further assumptions formally directly from the axioms.

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 (40) the current overdrafts of the business sector are of equal amount according to (42) 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 (40) or (42):

$$\bar{\mathsf{M}}_t \equiv \left| \sum_{t=1}^{t} \Delta\bar{\mathsf{M}}_t \right| \quad \text{if} \quad \bar{\mathsf{M}}_0 = 0. \tag{43}$$

The development of the household sector's stock of money is shown in Figure 7. The business sector's stock is symmetrical. Therefore it could also be said that the quantitative demand for loanable funds is necessarily equal to the the supply.

In Figure 7 the household sector saves in the first periods and this effects the initial increase of their money stock. This corresponds to the decline of the market clearing price in Figure 6 which also depends on the expenditure ratio. The price path, however, is in addition co-determined by wage rate and productivity changes, therefore there is no one-to-one correspondence with the stock of money path.

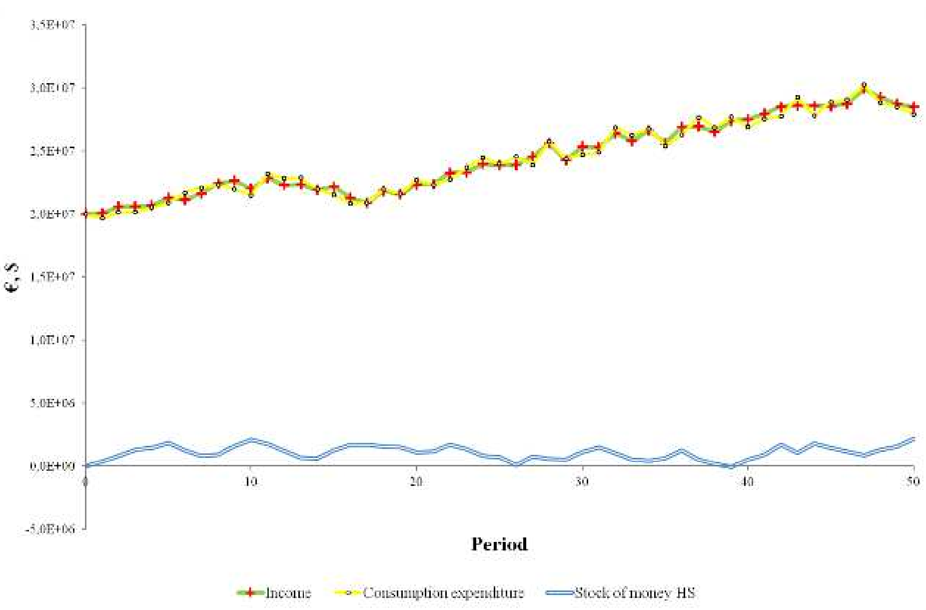

Figure 7: Household sector's stock of money as derived from the paths of total income and consumption expenditure which are interconnected by the randomly varying expenditure ratio (refers to Figure 6)

7.2 Profit and loss in the course of time

From the definition of monetary profit (31) and the definition of saving (37) follows:

$$Q_m \equiv Y_D - S_m \quad \rightarrow \quad Q_m \equiv -S_m \qquad \text{if} \quad Y_D = 0 \quad |t. \tag{44}$$

Under the condition of zero distributed profit, monetary profit and monetary saving always move in opposite directions. That is, the complementary notion to saving is loss; profit is the complementary of dissaving. Figure 8 makes this systemic relationship palpable.

We now have perfect market clearing in the product market over time as shown in Figure 6 and roughly full employment in the labor market analogous to Figure 5. That is, the two main markets in our elementary consumption economy function quite satisfactorily. The central bank provides money and credit. Despite of all this, there is a problem. The variations of the expenditure ratio, which are assumed to reflect the households' optimal consumption pattern over time, produce profits and losses which may not cancel out fast enough.

To repeat, there is no market failure, no stickiness, and the households act in full accordance with their time preferences. Nevertheless, with losses the system is in distress. The business sector's overdrafts mount in tandem with the household

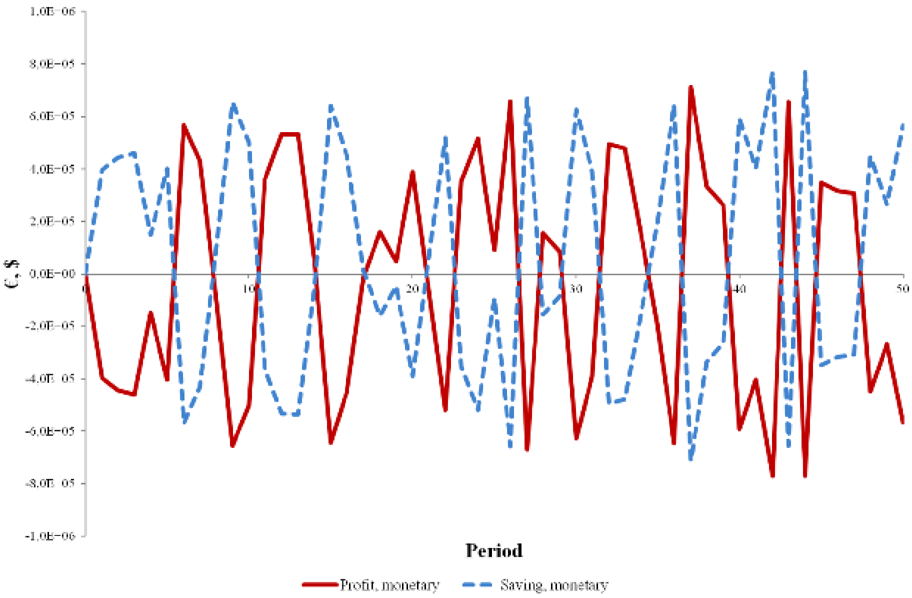

Figure 8: The complementary relationship of profit/loss and dissaving/saving under the condition of zero profit distribution (refers to Figure 7)

sector's deposits. Under this conditions the business sector probably resorts first to wage cuts. These can reduce the absolute amount of loss but do not eliminate it because profit and loss are determined by the expenditure ratio which in turn reflects the household sector's time preference. Eq. (44) can be rewritten as:

$$Q_m \equiv (\rho_E - 1)Y \quad \text{and} \quad \rho_E < 1 \quad |t. \tag{45}$$

With falling income, loss is reduced but not eliminated. The relation of loss to income remains constant. The wage cut does not alter the real situation of the household sector as long as employment and productivity remain unchanged. The wage rate falls and the market clearing price falls, but loss does not turn into profit.

The next reflex is to cut down employment. This means that our simple employment rule (33) no longer holds. It can indeed only hold under the condition that overall profit is greater or equal zero. This condition is violated because of (45).

Falling employment reduces income and absolute loss according to (45) but loss becomes zero not before employment becomes zero. Neither perfect markets nor flexible adaptation can stop the self-dissolution of the economy.

It is obvious that we are now just in the middle of a time-honored riddle.

> As Joan Robinson said, our essential object in economics is "to understand how the economic system works"; or, putting the emphasis differently, as did Keynes, "Is the economic system self-adjusting?"

> Sadly, we economists have so far done little to address, much less provide satisfying answers to the issues posed by Newcomb, Robinson, and Keynes. ... we know little more now about "how the economy works," or about the *modus operandi* of the invisible hand than we knew in 1790, after Adam Smith completed the last revision of *The Wealth of Nations*. (Clower, 1999, p. 401)

Based on the structural axiomatic analysis the answer to Keynes's question can now be given: the system is, even under the condition of perfect adaptive flexibility, not self-adjusting. What economists have constantly overlooked is the profit mechanism. Market flexibility is not sufficient. The indispensable condition for the functioning of the economy is that overall profit is positive. The heterogeneity of firms even requires that it is above a structurally determined minimum amount (see 2011b, Sec. 8). In the pure consumption economy this requires $\rho_E > 1$ and/or $\rho_D > 0$. This essential requirement is never mentioned in the familiar supply-demand-equilibrium story of spontaneous order. As Clower correctly observed, since Adam Smith economists do not know "how the economy works."

It is the profit mechanism that is crucial – it provides the fuel and keeps the market machine going. The market system is not an information processor but a profit processor. The supply-demand-equilibrium mechanism as embodied in Figure 3, which is since the textbook initiation at the back of the mind of every economist, is good enough for political economics but not for theoretical economics. It simply explains nothing.

> What is now taught as standard economic theory will eventually disappear, no trace of it will remain in the universities or boardrooms because it simply doesn't work: were it engineering, the bridge would collapse. (McCauley, 2006, p. 17)

7.3 Extensions

In the pure consumption economy monetary profit is given by:

$$Q_m \equiv Y_D - S_m \qquad |t. \tag{46}$$

The formula indicates that a lot of stress is taken out of the system through profit distribution. In Figure 8 distributed profit Y_D shifts the whole curve upwards. Instead of losses we then have lower profits under the condition that saving does not increase by the same amount as distributed profit.

In the investment economy profit is given by (see 2014c, Sec. 4):

$$Q_m \equiv Y_D + I - S_m. \tag{47}$$

Growth pushes profit. The formula is one essential ingredient in the explanation of the expansion of the industrial system. Higher monetary profit on the one side demands as a corollary, i.e. as a logical implication of the definition itself, higher investment expenditure and distributed profit and lower saving on the other side. For the limiting case $I = 0$ eq. (47) reduces to (46).

The profit formula gets again more complex when foreign trade and the government budget is taken into the picture.

All models that do not explicitly contain the Profit Law are useless. This applies first and foremost to the supply-demand-equilibrium model.

8 Conclusion

The standard approach is based on indefensible subjective-behavioral axioms. They are in the present paper replaced by objective-structural axioms. The main result of the systemic analysis of the structural-behavioral interdependence of markets is:

- It is true that supply and demand are at the heart of how market economies work but with supply-demand-equilibrium standard economics got the formal representation wrong.
- The structural axiomatic Law of Supply and Demand for the pure consumption economy with one firm states that the market clearing price is equal to the product of the expenditure ratio, unit wage costs, and the distributional factor. The price formula is testable and fully replaces supply-demand-equilibrium.
- The crucial systemic fact is: if the price is determined by 'supply and demand' in the product market then the real wage cannot be determined by 'supply and demand' in the labor market.
- From the fact that it can be shown that the product market clears in principle does not follow that it clears 'in time.' Equilibrium models and all conclusions that are derived from them are unacceptable.
- Most economists have no true conception of the two central phenomena in the economic universe: profit and income.
- All models that do not explicitly contain the structural axiomatic Profit Law are useless.
- In the pure consumption economy with an expenditure ratio below unity neither perfect markets nor flexible adaptation can stop the self-dissolution of the economy. At the most elementary level the system is not self-adjusting. The spontaneous order metaphor is unfounded.

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