Towards Full Employment Through Applied Algebra and Counter-Intuitive Behavior

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Abstract

It is common knowledge that neither Walrasians nor Keynesians nor Marxians nor Institutionialists nor Austrians nor Sraffaians came to grips with profit. The reason is a defective formal basis. In the present paper the formal foundations are first renewed. When the profit theory is false the rest of an approach is questionable. What is reexamined next because of its vital practical implications is the theory of employment. One remarkable result is that the popular recipe to eliminate unemployment, viz. downward wage rate flexibility, is self-defeating because it does not take the objective systemic properties of the monetary economy into account.

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1 Pareto's way – an agonizing detour

> The foundation of political economy and, in general, of every social science, is evidently psychology. A day will come when we shall be able to deduce the laws of social science from the principles of psychology ... (Pareto, 2014, p. 20)
>
> The failure of microeconomic theory to uncover laws of human behavior is due to its wrongly assuming that these laws will trade in desires, beliefs or their cognates. And the system of propositions about markets and economies that economist have constructed on the basis of its assumptions about human behavior is deprived of improving explanatory and predictive power ... (Rosenberg, 1994, p. 224)

The actual state of economics shows that Pareto's program has failed. The reason is evident, there is no such thing as a law of human or social behavior. The day when we shall be able to deduce the laws of social science from the principles of psychology will never come.

Standard economics rests on behavioral assumptions that are formally expressed as axioms (Debreu, 1959; Arrow and Hahn, 1991; 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 and axiomatization are disjunct (for details see 2014b).

Orthodoxy has a strong formal basis which, however, is unacceptable. Heterodoxy has not yet agreed upon any axiomatic foundation at all and is therefore formally at a great disadvantage, to say the least. Both approaches lack the crucial intuition: the subject matter of theoretical economics is not human behavior but the behavior of the economic system. To take psychology, or, for that matter, sociology or any other of the so-called social sciences as the foundation of political economy is the Paretian blunder. It is commonsensical, after all economics is about human wants and needs, but it is a blunder nonetheless.

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 overcome the indigenous agony of economics.

In the following, Section 2 first provides the new formal foundations with the set of four structural axioms. These minimalistic premises represent the evolving consumption economy. In Section 3 the Profit Law is derived. Then, with all requisite elements in their proper places, the labor market theory is reconstructed with stepwise increasing complexity in Sections 4 to 7. It is shown that full employment cannot be derived from optimizing behavior and that wage cutting is a theoretically ill-founded strategy to achieve full employment. Section 8 concludes.

2 Bits and pieces

> We are lost in a swamp, the morass of our ignorance. ... We have to find the roots and get ourselves out! ... Braids or bootstraps are necessary for two purposes: to pull ourselves out of the swamp and, afterwards, to keep our bits an pieces together in an orderly fashion. (Schmiechen, 2009, p. 11)

We now advance from behavioral axioms as formal incarnation of homo oeconomicus to structural axioms as formal incarnation of the evolving economic system. Human beings are thereby moved to the analytical periphery. This amounts to a *decoupling* of behavioral assumptions and the axiomatic method. The formal foundations of theoretical economics define the interdependence of the real and nominal variables that constitutes the monetary economy.

2.1 Axioms

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.

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

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

$$\begin{gathered} Z_t = Z_{t-1}\left(1+\dddot{Z}_t\right) \\ \text{with} \quad Z \leftarrow W, L, D, N, R, P, X, \ldots \end{gathered} \tag{4}$$

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

$$Z_t = Z_0\,(1+\dddot{Z}_1)\,(1+\dddot{Z}_2)\ldots(1+\dddot{Z}_t) = Z_0\prod_{t=1}^{t}(1+\dddot{Z}_t)\,. \tag{5}$$

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:

$$\begin{array}{cc} Pr\left(l_W \leq \dddot{W} \leq u_W\right) & Pr\left(l_R \leq \dddot{R} \leq u_R\right) \\ Pr\left(l_L \leq \dddot{L} \leq u_L\right) & Pr\left(l_P \leq \dddot{P} \leq u_P\right) \\ Pr\left(l_D \leq \dddot{D} \leq u_D\right) & Pr\left(l_X \leq \dddot{X} \leq u_X\right) \\ Pr\left(l_N \leq \dddot{N} \leq u_N\right) & |t. \end{array} \tag{6}$$

The four axioms, including (6), constitute a 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.

The upper (u) and lower (l) bounds of the respective intervals are, for a start, 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. (6) represents the general stochastic case which in the limit $u-l \to 0$ shades into determinism. The four axioms generate at every run an outcome like that shown in Figure 1 which is the archetype of the evolving monetary economy. The evolution is not distorted by any external restrictions or hindrances. These have to be dealt with separately.

What has to be avoided for good methodological reasons is the bad analytical habit of assumptionism. It should be obvious that it is illegitimate to take assumptions like equilibrium, perfect competition, decreasing returns, optimization, etc. into the premises. The set of axioms including (6) constitutes the *minimum* of premises. The paths in Figure 1 are, for the beginning, entirely independent. If we suspect that there are indeed relations between the path variables either over time or across variables or both then the respective hypotheses have to be explicitly introduced and consistently integrated into the formal frame. The structural axiom set lends itself to further concretion.

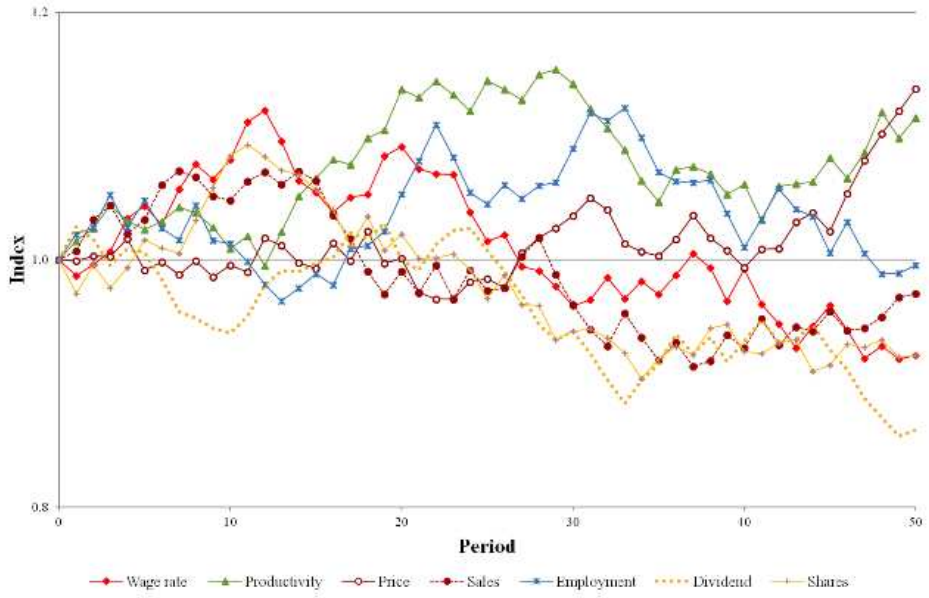

Figure 1: The evolving consumption economy consists initially of entirely independent random paths of the seven elementary axiomatic variables (shown here) and the paths of composed variables

The economic content of the four axioms is transparent. One 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. The familiar approaches come to grief at this first axiomatic step.

2.2 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 (7) wage income Y_W and distributed profit Y_D is defined:

$$Y_W \equiv WL \qquad Y_D \equiv DN \quad |t. \tag{7}$$

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. From the random paths of employment L and wage rate W follows the path of wage income Y_W. 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 random path of total income Y as a compound of four random paths.

Key ratio quaternity

We define the sales ratio as:

$$\rho_X \equiv \frac{X}{O} \quad |t. \tag{8}$$

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:

$$\rho_E \equiv \frac{C}{Y} \quad |t. \tag{9}$$

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:

$$\rho_F \equiv \frac{W}{PR} \quad |t \tag{10}$$

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:

$$\rho_D \equiv \frac{DN}{WL} \quad |t \tag{11}$$

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

Cores

With the help of the ratios, the first three axioms are now consolidated to one single equation:

$$\rho_F \frac{\rho_E}{\rho_X} (1 + \rho_D) = 1 \quad |t \tag{12}$$

The Period Core (12) determines the interdependencies of the measurable structural key ratios for each period. The factor cost ratio ρ_F summarizes the internal conditions of the firm. A value of $\rho_F < 1$ signifies that the real wage is lower than the productivity or, in other words, that unit wage costs are lower than the price, or in

still other words, that the value of output exceeds the value of input. In this case the profit per unit is positive. Then we have the conditions in the product market. An expenditure ratio $\rho_E < 1$ indicates that consumption expenditures are lower than income in the period under consideration and a value of $\rho_X < 1$ of the sales ratio means that the quantity sold is less than the quantity produced or, in other words, that the product market is not cleared. One case is special, that is, with $\rho_E = 1$ *and* $\rho_X = 1$ the budget is balanced and the product market is cleared in period t. This case is analytically most convenient but rarely, if ever, to be found in the real world. Nevertheless, it is the standard textbooks' favorite case and this is one reason why they are of so little use. The Period Core is general and fundamental. It covers the key ratios about the firm, the market, and the income distribution and determines their mutual interdependencies.

The paths are given in a convenient form as abbreviation of (5):

$$Z_t = Z_0 \Pi_{Zt}. \tag{13}$$

The period value of each variable is now replaced by its development until period t. From the period core (12) and (13) then follows:

$$\rho_{F0}\Pi_{Ft}\,\frac{\rho_{E0}\Pi_{Et}}{\rho_{X0}\Pi_{Xt}}\,(1+\rho_{D0}\Pi_{Dt}) = 1. \tag{14}$$

The Path Core (14) describes the evolution of the whole system from the initial period to $\to \infty$ as a combination of the paths of the four key ratios. All path operators Π have the value 1 for $t = 0$. Equation (14) thus boils down to:

$$\underbrace{\Pi_{Ft}}_{\text{Firm}}\;\underbrace{\frac{\Pi_{Et}}{\Pi_{Xt}}}_{\text{Market}}\;\underbrace{\frac{1+\rho_{D0}\Pi_{Dt}}{1+\rho_{D0}}}_{\text{Distribution}} = 1. \tag{15}$$

When the initial value ρ_{D0} in (15) is conveniently determined nothing but the *rates of change* for each elementary variable remain as explananda. Structural axiomatization thus directly leads to a theory of change. The Path Core is the most economical expression of the first four axioms. As a purely formal relationship it must always be satisfied independently of the actual formulation of any particular economic model. Given the structural axiom set as an agreed upon formal starting point, different approaches can only differ in the *explanation* of the rates of change. The preliminary explanation consists of straightforward randomness and is formally embodied in (6). The at any time possible refutation of randomness then points the way to an underlying non-random relationship. If there is a behavioral law we will find it. The preliminary explanation has the methodological advantage that it is self-correcting. If randomness cannot be refuted then we are already at the end of the analytical flagpole and (6) has to be accepted as an irreducible property of the economic system.

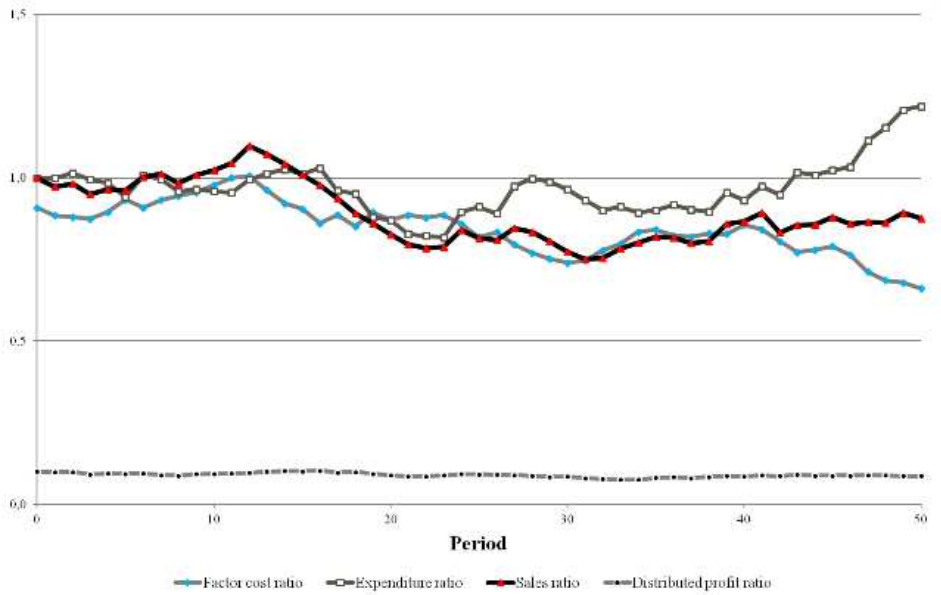

Figure 2: The Path Core as shortest possible formal description of the evolving consumption economy is composed of four unit-free paths which in turn are composed of the random paths of elementary variables

Figure 2 shows the Path Core as a summary of Figure 1. Note the the product of the four period values is, according to (15), equal to unity, which means that the paths are not independent.

The characteristic of the Path Core is that it is neither real nor nominal but unit-free.

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

The methodological mantra that money is a veil and that economic analysis therefore has to run in real terms points roughly in the right direction. In fact, fundamental analysis must run in unit-free terms.

The first four axioms including (6) formally represent the entirety of possible paths of the consumption economy. One of the possibilities is realized as the actual history of the economic system. There is no denser formal description of the evolving consumption economy. All ratios are measurable in principle and it will turn out that their product is unity from the initial period to $\rightarrow \infty$. This characterizes a law in the proper sense. Otherwise, the structural axiom set is refuted. It is as simple as that, except for the fact that real economies are a bit more complex. In order to cover the greater part of real world phenomena the structural axiomatic framework

therefore has to be differentiated and extended. We first turn to the phenomenon of profit.

3 Monetary profit

> Most theoretical economists are used to living amid a welter of diversified and contradictory profit theories. (Bernstein, 1953, p. 407)

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 (16) 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:

$$Q_m \equiv C - Y_W \quad |t. \tag{16}$$

Because of (3) and (7) this is identical with:

$$Q_m \equiv PX - WL \quad |t. \tag{17}$$

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

The Profit Law

From (16) and (1) follows:

$$Q_m \equiv C - Y + Y_D \quad |t \tag{18}$$

or, using the definitions (9) and (11),

$$Q_m \equiv \left(\rho_E - \frac{1}{1+\rho_D}\right) Y \quad |t. \tag{19}$$

The four equations (16) to (19) are formally equivalent and show profit under different perspectives. The Profit Law (19) 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 2013a). Total income Y is the scale factor.

Retained profit

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 (18) but it is invisible in (16). 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:

$$Q_{re} \equiv Q_m - Y_D \quad \Rightarrow \quad Q_{re} \equiv C - Y \quad |t. \tag{20}$$

Retained profit is, due to (18), equal to the difference of consumption expenditures and total income.

Saving

The household sector's monetary saving is given as the difference of income and consumption expenditures (for nonmonetary saving see 2012):

$$S_m \equiv Y - C \quad |t. \tag{21}$$

In combination with (20) follows:

$$Q_{re} \equiv -S_m \quad |t. \tag{22}$$

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 2013d).

For the special case of zero distributed profit it follows as a corollary of the definition (22):

$$\begin{array}{c} Q_{re} = Q_m = -S \\ \text{if} \quad Y_D = 0 \\ \text{i.e.} \\ Q_{re} \doteq Q_m \doteq -S \end{array} \tag{23}$$

The alternative equal sign $\doteq$ is introduced to make it clear that (23) is neither an axiom nor a definition but a corollary, that is, a logical implication of a definition.

It is common knowledge that neither Walrasians nor Keynesians nor Marxians nor Institutionialists, not to speak of Austrians or Sraffaians, ever came to grips with profit (Desai, 2008), (Tómasson and Bezemer, 2010), (Kakarot-Handtke, 2013a).

> Rather surprisingly, therefore, the nature of profits remains something of a mystery in contemporary economics; indeed, in the realm of "advanced" theory – namely the perfectly competitive general equilibrium models – profits have disappeared altogether. This is clearly an unsatisfactory situation. (Obrinsky, 1981, p. 491)

With the new formal foundations of the structural axiomatic approach this scientifically unacceptable situation ends and theoretical economics moves at long last above the proto-scientific level. The Profit Law (19) fully replaces orthodox as well as heterodox profit theories.

When the profit theory is false the rest of an theoretical edifice cannot be relied upon. What has to be reexamined next because of its vital practical implications is the theory of employment.

4 The indifference of employment and the futility of wage–price flexibility

> A rise in the rate of money wages will necessarily diminish employment and raise real wages. (Hicks, 1937, p. 150)

From (3), (2), (1), (8) and (9) follows the price as dependent variable:

$$P = \frac{\rho_E}{\rho_X}\frac{W}{R}\left(1+\frac{DN}{WL}\right) \quad |t. \tag{24}$$

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 W/R, and the income distribution $1+\rho_D$. The structural axiomatic price formula is testable in principle and fully replaces supply-function–demand-function–equilibrium.

Under the condition of market clearing we get:

$$\begin{gathered} P = \rho_E \frac{W}{R}\left(1+\frac{DN}{WL}\right) \\ \text{if} \quad \rho_X = 1 \quad |t. \end{gathered} \tag{25}$$

Conditional price flexibility is, clearly, an algebraic concept. Nothing is said about the behavior of the firm or how the firm manages to set exactly the market clearing price. For our present purposes there is no need to discuss price setting behavior of the firm (for details see 2013b, Sec. 11)

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

$$P = \frac{W}{R}\left(1 + \frac{DN}{WL}\right) \qquad \text{if} \quad \rho_E = 1, \rho_X = 1 \quad |t. \tag{26}$$

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.

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

$$P = \frac{W}{R} \quad \rightarrow \quad \frac{W}{P} = R \qquad \text{if} \quad \rho_D = 0, \rho_E = 1, \rho_X = 1 \quad |t. \tag{27}$$

The market clearing price is equal to unit wage costs or, what amounts to the same, 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. The wage rate W may go up and down by an arbitrary percentage rate, this is, due to conditional price flexibility, of no effect to the real wage.

The real wage is determined by the systemic and the production conditions. What is not determined is the labor input L. Therefore, it may well be the case that the actual labor input is below the full employment level, i.e. $L < L^{\theta}$. How to achieve full employment?

From the Profit Law (19) and the conditions of (27) follows $Q_m = 0$. Profit is zero on all levels of employment. The firm that represents the business sector can be completely indifferent with regard to employment. There is no profit incentive to move from a lower to a higher employment level. Because of indifference the firm may as well stay where it is. Let us call this implication the principle of behavioral inertia. Hence, persistent unemployment is not due to a lack of price or wage rate flexibility. The problem goes deeper: for lack of a convincing behavioral motive the price mechanism cannot spontaneously bring about full employment. The assumption of profit maximization does not work, neither does wage rate flexibility. The assertion that – as a matter of principle – the unhindered working of the price mechanism clears all markets is unfounded. With this the argument of market failure as an explanation for unemployment falls flat. Unemployment persists because all employment levels are indifferent with regard to profit.

It is well known that the conditions of market clearing, budget balancing and zero profit apply to Walras's original model. The sole difference to the structural axiomatic approach is that Walras argues with demand and supply functions. In

his model the labor market is not much different from the product market. This is an analytical blunder (for details see 2013c). Let us put it thus: in the economic system the qualitatively differentiated labor markets are not on the same plane with the qualitatively differentiated product markets but orthogonal to them. Hence the economy does not consist of n markets in total with n' product markets and $n-n'$ labor markets which function similar, but of m product markets and o labor markets which function differently in the systemic context. The real wage is determined by (27) and not by crossing vacuous demand and supply functions.

What is needed is a behavioral drive on the side of the business sector to expand labor input L, otherwise we are left with unemployment. This drive cannot depend on profit, which is zero throughout, it can only refer to the actual state of the labor market itself. Roughly speaking employment must increase as long as there is unemployment, i.e. if $L < L^{\theta}$. This behavioral assumption establishes a self-referential feedback loop. This feedback works, of course, but because there are no profit incentives it is implausible that it will occur spontaneously. The bootstrap mechanism is trivial but agents will not set it in motion because of profit indifference and inertia.

To formalize the logically required behavior the propensity function is introduced. The directed random changes which increase or reduce labor input are made, in a rather straightforward way, dependent on the situation in the labor market itself:

$$\begin{aligned} &\text{(i)} \quad \underbrace{(-1,0,1)_t}_{\text{direction}} = sgn\left(L_{t-1} - L^{\theta}_{t-1}\right) \\ &\text{(ii)} \quad \dddot{L}_t = \underbrace{(-1,0,1)_t}_{\text{direction}} \underbrace{Pr(0 \leq \dddot{L} \leq x)_t}_{\text{magnitude}}. \end{aligned} \tag{28}$$

The upper part of (28) says that the sign, i.e. the direction of change in period t, depends on whether there was over- or under-employment in the previous period. In the case of over-employment, i.e. $L_{t-1} - L^{\theta}_{t-1}$>0, the sign is negative, that is, the business sector reduces labor input, and vice versa in the case of under-employment, i.e. if $L_{t-1} - L^{\theta}_{t-1} < 0$. Part (ii) combines the direction with a random rate of change. This random rate assumes values between 0 and x, which is the symmetrical upper or lower bound depending on the positive or negative sign of the direction of the change vector (ii). In combination, the two parts of (28) define an elementary behavioral dependency which says: if you see unemployment in the economy increase employment by a random percentage rate, and likewise for all other possible states of the world. It is assumed for the moment that no exogenous factors restrict this bootstrap process. This directed random process works reliably but it is obviously no part of standard deterministic equilibrium economics. Standard economics never has defined a market clearing process in a formally acceptable way – the propensity function (28) does this in full generality.

Figure 3 shows the unhindered evolution of the consumption economy with product market clearing, budget balancing, and a tendency towards full employment in an environment with randomly changing labor supply, wage rate, and productivity.

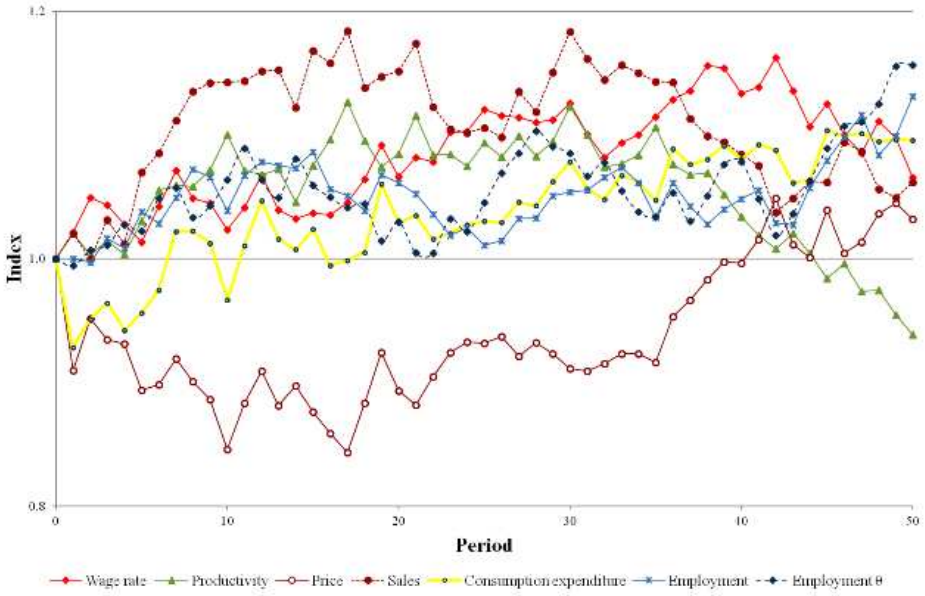

Figure 3: Product market clearing, budget balancing and bootstrap full employment in the zero profit consumption economy

Note that the employment path L follows the random full employment path L^{θ}. The difference between the two paths measures under- or over-employment. The product market is always cleared because of conditional price flexibility. The paths of output O and quantity bought X fall here into one because of $\rho_X = 1$; and the paths of consumption expenditures C and total income Y fall here into one because of $\rho_E = 1$. This conditions can be relaxed without affecting the main conclusion. The real wage falls here into one with the path of productivity which varies randomly. This elementary consumption economy can evolve for an indefinite time. It represents the structural axiomatic version of what is known as Say's Law and shows that Say's Law cannot be derived from optimizing behavior.

Full employment is – approximately – feasible in the stochastic consumption economy with budget balancing and zero distributed profit but it will not spontaneously emerge from the behavior that is usually attributed to the agents, i.e. utility and profit maximization. Unemployment is not attributable to sticky wages but rather to the indifference of profit with regard to employment. Any reduction of the wage rate leads to a fall of the market clearing price but not to an increase of profit. The worker with rational expectations and the true model at the back of his mind will not resist wage cuts because these do not affect the real wage which is invariably equal to the productivity. Since profit for the business sector as a whole is zero at unemployment and at full employment it is not in the self-interest of the business

sector to realize full employment. The principle of profit maximization is inoperative if profit is indifferent with regard to different employment levels. It is a matter of indifference what the production function looks like and whether returns are decreasing or increasing.

The natural state of a consumption economy with $\rho_D = 0$, $\rho_E = 1$, $\rho_X = 1$ and growing labor supply is unemployment. From the systemic perspective full employment would be possible in principle. It is not a lack of flexibility in the price mechanism that causes the problem, it is the peculiarity of the profit mechanism. The peculiarity consists in the independence of overall monetary profit from employment, wage rate, price and productivity. This crucial systemic property remains outside the view field of standard approaches because these lack a correct profit theory.

5 Hyperbolic employment expansion and deflation

> For example, it is of little use and comfort to know that after 10 years of deflation, full employment would be restored. (Beker, 2012, p. 106)

In order to generalize we now lift the condition that distributed profit is zero. Total income is given with the 1st axiom, i.e.:

$$Y = WL + \underbrace{DN}_{c} \quad |t. \tag{29}$$

Distributed profit is kept constant. It is algebraically obvious that total income does not change if the wage rate goes down and employment goes up such that the product WL remains constant, i.e.

$$\dddot{L}_t = \frac{1}{1 - \dddot{W}_t} - 1. \tag{30}$$

This is the formula for a hyperbolic employment expansion. Since total income does not change consumption expenditures remain also constant because of $\rho_E = 1$.

From (18) follows that profit is constant under the condition of budget balancing:

$$\begin{gathered} Q_m = DN \\ \text{if} \quad \rho_E = 1 \quad |t. \end{gathered} \tag{31}$$

The nominal amounts in national accounting do not change while employment, output, wage rate and price change. The stationary nominal surface screens the underlying real changes.

From (24) follows the market clearing price under the condition of budget balancing as:

$$P = \frac{W}{R}\left(1+\frac{DN}{WL}\right) \quad \rightarrow \quad \frac{W}{P} = \frac{R}{1+\frac{DN}{WL}} \tag{32}$$

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

The market clearing price is equal to the product of unit wage costs and the distributional factor. The real wage is now lower than the productivity but in no way affected by the hyperbolic employment expansion. The distributed profit ratio ρ_D remains constant. From (32) follows that the market clearing price falls in parallel with the wage rate, i.e. $-\ddot{P} = -\dddot{W}$. The hyperbolic move from unemployment to full employment is deflationary.

The algebraic argument clarifies the systemic feasibility of full employment, what has to be shown next is whether the agents' behavior conforms to the systemic necessities. The propensity function for the wage earners reads:

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

Wages are flexible, the upper part of the propensity function says that the wage rate is reduced until full employment obtains. It is raised in the case of over-employment. The lower part determines the random rate of change in each period.

The hyperbolic mechanism requires two behavioral assumptions for the business sector. First, business expands and contracts employment mechanically according to (30) in dependence of wage rate changes. Profit plays no role. Second, conditional price flexibility obtains. All in all, business acts rather Pavlovian. This, of course, is no description but a characterization of what hyperbolic adaptation implies in behavioral terms.

The problem is again indifference. The business sector's profit remains constant on the way from unemployment to full employment according to (31). For lack of a profit incentive it is therefore not to be expected that full employment is spontaneously established. Wage and price flexibility do not suffice.

The assumption that employment reacts mechanically to wage rate changes is no part of the standard behavioral repertoire. So we drop it here also.

If the wage rate is reduced without immediate employment increase according to (30) total income falls according to (29). Under the balanced budget condition consumption expenditures decline and under the market clearing condition the price

falls according to (32). Profit remains unaltered according to (31). The real wage declines according to (32).

While profit remains unaltered the profit ratio increases; it is defined as quotient of profit and costs (and is different from the profit rate which is defined as quotient of profit and capital):

$$\rho_Q \equiv \frac{Q_m}{WL} \quad |t. \tag{34}$$

Using (18) and the definitions (9) and (11) this boils for the general case down to:

$$\rho_Q \equiv \rho_E (1+\rho_D) - 1 \quad |t. \tag{35}$$

Like absolute profit the profit ratio depends on the expenditure and the distributed profit ratio. Under the condition of budget balancing the corollary holds:

$$\begin{gathered} \rho_Q \doteq \rho_D \equiv \frac{DN}{WL} \\ \text{if} \quad \rho_E = 1 \quad |t. \end{gathered} \tag{36}$$

With the wage rate down according to (33) the profit ratio goes up because absolute profit in the numerator remains unaltered. Now, employment changes are made dependent on the profit ratio. If the actual ratio is above the target ratio ρ_Q^θ then the business sector expands employment. The propensity function reads:

$$\begin{gathered} (1,0,-1)_t = sgn\left(\rho_{Qt-1} - \rho^\theta_{Qt-1}\right) \\ \ddot{\dot{L}}_t = (1,0,-1)_t \, Pr\,(0 \leq \ddot{\dot{L}} \leq x)_t. \end{gathered} \tag{37}$$

Let ρ_Q^θ be the initial profit ratio then W and L in (36) vary hyperbolically until full employment is reached. In the process wage rate and price decline. Deflation is a necessary but not very attractive feature of the hyperbolic employment expansion. The positive aspect is that no additional transaction balances are needed because income and consumption expenditures remain constant in the process.

If the firm, which stands here for the whole business sector, is fixated on the profit ratio and reacts according to (37) then the consumption economy moves towards full employment. However, if the firm overlooks the whole process it will realize that the profit ratio eventually returns to its initial level and is the same at unemployment before the wage rate reduction sets in and at full employment. The propensity function therefore implies myopic behavior. The firm that overlooks the whole process will not react with an employment expansion after a wage rate reduction because this only brings the profit ratio back to the initial level.

Under the assumption of rational expectations and knowledge of the correct model, indifference prevents that the firm moves towards full employment. Myopia is beneficial, rational expectations would be self-inhibiting. If it were true, this hypothesis could only be used to explain why a flexible price system keeps the labor market at current unemployment.

In the zero profit consumption economy with $\rho_D = 0$, $\rho_E = 1$ the wage rate mechanism is inoperative because both absolute profit and the profit ratio are always zero. If overall profit is greater than zero because distributed profits are greater zero (and constant for the time span of observation) the wage rate mechanism could work spontaneously because a lower wage rate translates with constant absolute profit into a higher profit ratio which in turn could motivate an increase of employment. The hyperbolic employment expansion can be underpinned with a behavioral assumption that is reasonably plausible. Note in passing that the firm's behavior must be made dependent on the profit ratio and not on absolute profit, otherwise profit ratio equalization, which is a logical implication of perfect competition, could not work.

A deflationary full employment expansion is incompatible with the ideal of a properly functioning price mechanism. Deflation is as unacceptable as inflation. The standard recipe of standard economics, i.e. in case of unemployment cut the wage rate, is not worth much. Not because it could not work, but because the outcome is unacceptable if it works. The deflationary implication makes one wonder whether there are alternative routes to full employment that avoid this drawback.

6 Absolute and relative profit: a difference that makes a difference

> We economists have all learned, and many of us teach, that the remedy for excess supply in any market is a reduction in price. ... Applied to economy-wide unemployment, this doctrine places the blame on trade unions and governments, not on any failure of competitive markets. (Tobin, 1997, p. 11)

The key to employment expansion is the firm's propensity function which says that employment increases if the actual profit ratio is above the target ratio:

$$\begin{aligned} (1,0,-1)_t &= sgn\left(\rho_{Qt-1} - \rho^{\theta}_{Qt-1}\right) \\ \dddot{L}_t &= (1,0,-1)_t \, Pr\,(0 \leq \dddot{L} \leq x)_t. \end{aligned} \tag{38}$$

Hitherto, the target ratio has been given and the general question how targets are determined has been left open. Whether the target ratio is equal to a calculable maximum or not is no issue in the present context. It is obvious that target setting

involves a lot of questions about individual and collective psychology, information, and expectations about which much can be speculated without ever reaching firm ground. In order not to entrap ourselves in filibuster economics, all these issues are put aside and and it is simply postulated that the firm lowers its target profit ratio. According to (38) this initiates an employment expansion. Target setting is formally captured with a second order propensity function which says:

$$\begin{aligned} (1,0,-1)_t &= sgn\left(L_{t-1} - L^{\theta}_{t-1}\right) \\ \dddot{\rho}^{\theta}_{Qt} &= (1,0,-1)_t \, Pr\left(0 \leq \dddot{\rho}^{\theta}_{Qt} \leq x\right)_t \end{aligned} \tag{39}$$

that is, if there is unemployment, i.e. $L_{t-1} - L^{\theta}_{t-1} < 0$, then lower the target profit ratio and vice versa if there is over-employment; in case of full employment do nothing. The employees are supposed to keep quiet in the situation, hence the wage rate remains unchanged. With increasing employment total income increases according to the 1st axiom:

$$Y = \underbrace{W}_{c} L + \underbrace{DN}_{c} \quad |t. \tag{40}$$

The employment expansion requires higher average transaction balances. It is assumed, without going deeper into the theory of money here, that the central bank accommodates the expansion.

Under the condition of budget balancing consumption expenditures rise and this results in a market clearing price that is lower compared to the initial situation because output increases also:

$$\begin{aligned} P = \frac{W}{R}\left(1 + \frac{DN}{WL}\right) \quad \rightarrow \quad \frac{W}{P} = \frac{R}{1 + \dfrac{DN}{WL}} \\ \text{if} \quad \rho_E = 1, \rho_X = 1 \quad |t. \end{aligned} \tag{41}$$

By implication, the real wage increases compared to the initial situation. Remarkably, higher average transaction balances because of (40) come along with a lower market clearing price. Absolute profit remains unchanged in the process according to (31), however, the profit ratio ρ_Q falls because wage income increases while distributed profit remains constant throughout:

$$\begin{aligned} \rho_Q \doteq \rho_D \equiv \frac{DN}{WL} \\ \text{if} \quad \rho_E = 1 \quad |t. \end{aligned} \tag{42}$$

This process brings the profit ratio closer to the lower target ratio of (39). If both are equal the employment expansion stops; if there is still unemployment the target ratio has to be reduced further. The clearing of the product market is guaranteed by conditional price flexibility which is formally incorporated in (41).

The behavioral assumptions for the business sector eventually bring about full employment. Wage flexibility is not required and this means that sticky wages are no part of the problem and that wage flexibility is, by consequence, no necessary ingredient of the solution. Conditional price flexibility is sufficient. The whole process is still deflationary but not as deflationary as the hyperbolic adaptation of Section 5. In sum, the move towards full employment involves L up, P down, Q_m constant and ρ_Q down.

The wage rate remains constant, the required adaptations are all carried out by the business sector. Note that absolute profit does not change on the way from unemployment to full employment. Both situations are indifferent from the perspective of the business sector. It is the profit ratio that is lower at full employment. Therefore, the adaptation process presupposes that the firm lowers its target ratio. For this reason, profit ratio stickiness may become the cause of market failure. With regard to both real wage and employment the move to full employment is beneficial for the household sector. With regard to absolute profit the move is Pareto-optimal, with regard to the profit ratio it is not.

Since the adaptation process is still deflationary we can go one step further and combine the reduction of the profit ratio with an increase of the wage rate. Under the condition that the price remains constant we get from (41) for the relation between employment and wage rate:

$$\begin{gathered} L = \frac{DN}{PR - W} \quad \text{or} \quad W^\theta = PR - \frac{DN}{L^\theta} \\ \text{if} \quad \rho_E = 1, \rho_X = 1 \quad |t. \end{gathered} \tag{43}$$

The higher the full employment level L^θ the higher the full employment wage rate W^θ at constant price, productivity and distributed profit. This is a simple axiom-based algebraic relationship for the economy as a whole, which, unsurprisingly, is not immediately self-evident from the perspective of the individual firm. The eagle and the worm see different things.

7 Reconciling perspectives

> And thus we arrive at Mr. Ricardo's principle, that profits depend upon wages; rising as wages fall, and falling as wages rise. (Mill, 1874, IV.12)

Mr. Ricardo's principle depends on a false profit theory and does not apply to the economy as a whole. However, it has not been plucked out of thin air but applies to a single firm. Ricardo's profit theory is a paradigmatic case of the fallacy of composition which is to this day the prevailing mode of economic thinking. Because of this, the micro- and the macro-perspective do not fit together since Keynes's *General Theory*. Consistent differentiation of the structural axiom set forecloses Mr. Ricardo's blunder.

The business sector now consists of two firms that produce different consumption goods. To simplify matters profit distribution is excluded; the 1st axiom (1) then turns to:

$$Y = W_1 L_1 + W_2 L_2 + \underbrace{D_1 N_1}_{Y_{D1}=0} + \underbrace{D_2 N_2}_{Y_{D2}=0} \quad |t. \tag{44}$$

With (3), (8), and (9) the market clearing price of firm 1 is given by:

$$P_1 = \frac{\rho_{E1}\left(W_1 + W_2 \dfrac{L_2}{L_1}\right)}{R_1} \tag{45}$$

$$\text{if} \quad \rho_{X1} = 1, \rho_D = 0 \quad |t.$$

The first thing to notice is that the market clearing price of firm 1 is not independent from what happens in firm 2. In the general case, the markets are entangled. Analogously we have for the market clearing price of firm 2:

$$P_2 = \frac{\rho_{E2}\left(W_2 + W_1 \dfrac{L_1}{L_2}\right)}{R_2} \tag{46}$$

$$\text{if} \quad \rho_{X2} = 1, \rho_D = 0 \quad |t.$$

Let us now assume that firm 1 lowers the wage rate W_1 by half. From (45) and (46) then follows that the market clearing prices in *both* firms decline if all other variables are unchanged. Firm 2 is affected because total income falls and with it the nominal demand C_2. The respective expenditure ratios remain unchanged.

From (16) and (9) follows for the profit of firm 1:

$$Q_{m1} \equiv \rho_{E1} Y - W_1 L_1 \quad |t. \tag{47}$$

In more detail this gives after substitution of (1) and rearrangement

$$Q_{m1} \equiv \rho_{E1} W_2 L_2 - (1 - \rho_{E1}) W_1 L_1 \quad |t \tag{48}$$

and analogous for firm 2

$$Q_{m2} \equiv \rho_{E2} W_1 L_1 - (1 - \rho_{E2}) W_2 L_2 \quad |t. \tag{49}$$

According to (48), the reduction of the wage rate W_1 increases the profit of firm 1 and according to (49) it decreases the profit of firm 2. When we look alone at firm 1 we see what everybody has seen before, to wit, wages down – profit up. Mr. Ricardo's principle holds.

However, this situation cannot last for long if profit has been zero in the initial period. In this limiting case firm 2 makes a loss as a consequence of the wage rate reduction in firm 1. This loss is given by (49) and exactly equal to firm 1's profit. If nothing else changes the bankruptcy of firm 2 and a drop of employment is only a question of time. An obvious remedy is a cut of W_2 that restores the initial zero profit configuration. Both firms then end up with lower wage rates and lower market clearing prices and again zero profits.

An alternative route consists of employment adaptations. From 'wage down, profit up' follows employment up. This is good news from firm 1. However, in firm 2 we have profit down and employment down. Both employment adaptations cancel out and the net effect is close to nil. The result is the same as in Section 4. Wage rate reductions – partial or general – are not the best way to increase overall employment.

The myopic agents are blind to these interdependencies and therefore prone to the fallacy of composition. The generalization of partial effects has the irrefutable empirical evidence of firm 1 on its side. What Mr. Ricardo and standard economics say about the relation of wage rate, profit, and employment is all true from the worm's perspective and all false from the eagle's perspective. Needless to emphasize that the eagle's perspective is the correct one in theoretical economics.

8 Conclusion

> Ptolemaic astronomers were able to mathematize models of a solar system revolving around the earth rather than the sun. The phlogiston theory of combustion was logical and even internally consistent, as is astrology, former queen of the medieval sciences. But these theories no longer are taught, because they were seen to be built on erroneous assumptions. Why strive to be logically consistent if one's working hypotheses and axioms are misleading in the first place? (Hudson, 2010, p. 14)

Logical consistency is a *sine qua non* and correct axioms too. From the fact that axioms are visibly defective does not follow that consistency is dispensable, it only follows that the search for correct axioms has to be intensified.

The standard approach is based on indefensible subjective-behavioral axioms which are in the present paper replaced by objective-structural axioms. The set of four structural axioms constitutes the most elementary case of an evolving consumption economy. The formalism is absolutely transparent, the logical implications are testable in principle.

The main result of the structural axiomatic analysis of the labor market is: The familiar supply-demand-equilibrium approach implies a logically defective profit theory. The long held view that overall unemployment can be cured by lowering the wage rate is a fallacy of composition. It holds for a single firm but not for the business sector as a whole. Under the condition of price stability the move from unemployment to full employment presupposes an increasing wage rate. Standard economics is a flat earth approach that has only common sense on its side. Common sense, though, is the worst guide in scientific matters. Lacking correct axioms and logic, standard employment theory is beyond hope.

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