The Structural Price Mechanism

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Abstract

Standard economics rests on behavioral assumptions that are formally expressed as axioms. With the help of additional assumptions like perfect competition and equilibrium a price vector is established that displays a host of desired properties. This approach is tightly stuck in a cul-de-sac. Conceptual rigor demands to discard the subjective-behavioral axioms and to take objective-structural axioms as the point of departure. The present paper reconstructs the price system in structural axiomatic terms for the most elementary economic configuration. The generalization of the structural price mechanism supplants the collapsed Walrasian and Keynesian attempts to formulate a consistent price and value theory.

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1 From behavior to structure

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

Standard economics rests on behavioral assumptions that are formally expressed as axioms (Debreu, 1959; Arrow and Hahn, 1991). With the help of additional assumptions like perfect competition and equilibrium a price vector is established that displays a host of desired properties. This approach is tightly stuck in a cul-de-sac (Ackerman and Nadal, 2004). Therefore, psychologism has to be replaced – not by other behavioral assumptions – but by something fundamentally different.

The main methodological point in the critique of standard economics is that it is not the axioms that determine what the conclusion shall be, but that the desired result determines what the fundamental propositions shall be (cf. Peirce, 1931, 1.57).

Conceptual rigor demands, first, to discard the subjective-behavioral axioms and to take objective-structural axioms as the formal point of departure and, secondly, to clarify the interrelations of the fundamental concepts income and profit. Standard economics has never managed to define these concepts properly and this explains the unsatisfactory state of price theory.

The present paper reconstructs the price system in structural axiomatic terms for the most elementary economic configuration.

Section 2 provides the formal point of departure with the set of three structural axioms. These represent the pure consumption economy. In Section 3 the harmonic structure is defined and the structural value theorem is derived. It states for the simplest case that the exchange ratio is inverse to the transformation ratio. In Section 4 the market mechanisms are analyzed in greater detail by relying exclusively on objective structural conditions. Finally the determinants of the resulting vectors of wage rates and prices are established. Section 5 concludes.

2 First principles

> In short, there is no escape from the need of a critical examination of
> "first principles." (Peirce, 1931, 1.129)

2.1 Axioms

The behavioral assumptions of standard economics are unacceptable as first principles. The formal foundations of theoretical economics must be nonbehavioral and epitomize the interdependence of real and nominal variables that constitutes the monetary economy.

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

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

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

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

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

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

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

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

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

The economic content of the structural axioms is plain. The sole point to mention is that total income in (1) is the sum of wage income and *distributed profit* and not of wage income and profit. It is an imperative of rigorous analysis to keep profit and distributed profit apart. This makes the very difference between good or bad theory.

2.2 Definitions

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

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

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

We define the sales ratio as:

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

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

We define the expenditure ratio as:

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

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

3 The harmonic structure

> There is little or nothing in existing micro- or macroeconomics texts that is of value for understanding real markets. (McCauley, 2006, p. 16)

3.1 One firm

From (3), (5), and (6) follows the price as dependent variable under the condition of zero distributed profit:

$$P = \frac{\rho_E}{\rho_X}\frac{W}{R} \quad \text{if} \quad Y_D = 0 \quad |t. \tag{7}$$

Under the additional conditions of market clearing and budget balancing then follows:

$$P = \frac{W}{R} \quad \text{if} \quad \rho_X = 1,\, \rho_E = 1,\, Y_D = 0 \quad |t. \tag{8}$$

The market clearing price is equal to unit wage costs if the expenditure ratio is unity and distributed profit is zero. By consequence, profit per unit is zero. All changes of the wage rate and the productivity affect the market clearing price in the period under consideration. Let us refer to this formal property as *conditional* price flexibility because (8) involves no assumption about human behavior. No matter how wage rate and productivity develop, with conditional price flexibility profit per unit is invariably zero. The purchasing power is determined by the productivity. With given productivity, the wage rate determines the price level.

Since with (8) the real wage $\frac{W}{P}$ is *uno actu* given independently of employment it cannot possibly determine the level of employment. The real wage is under the given conditions always equal to the hourly output R, that is, labor gets the whole product. The elementary consumption economy with market clearing and budget balancing is reproducible at any level of employment. It is assumed for a start that the economy operates at full employment L_0. Total income is then given by:

$$Y = WL_0 \quad \text{if} \quad Y_D = 0 \quad |t. \tag{9}$$

With this our elementary consumption economy is completely specified. It displays a host of desirable properties (market clearing, budget balancing, conditional product price flexibility) and is reproducible for an indefinite time span at any level of employment, provided no external hindrances occur. The structural axioms and the conditions of market clearing and budget balancing render the most elementary formal description of a reproducible consumption economy. It is worth emphasizing that the market clearing price is unequivocally determined by axioms and conditions. In order to avoid over-determination it is therefore *inadmissible* to add supply and demand functions. That is, as a matter of principle neither the product price nor the real wage can be determined by supply-demand-equilibrium. Hence it is the right place and time to get rid of an ineffective analytical tool (see also 2013a).

3.2 Two firms

The axioms and definitions have first to be differentiated. Period income changes from (1) to:

$$Y = W_A L_A + W_B L_B + \underbrace{D_A N_A + D_B N_B}_{Y_D = 0} \quad |t. \tag{10}$$

The full employment labor input is now allocated between two firms:

$$L_0 \equiv L_A + L_B \quad |t. \tag{11}$$

Since distributed profits are set to zero in order to keep things simple for the beginning and the wage rates of the two firms are assumed to be identical $W_A = W_B = W$, total income does not change with a reallocation of labor input between firms. Full employment L_0 is maintained by assumption. Only the composition of the business sector's output changes with a reallocation of labor input between the two firms. This presupposes, of course, that there is no hindrance to the free movement of labor between the firms.

The partitioning of the consumption expenditures (3) is given by:

$$\begin{aligned} C_A &= P_A X_A \\ C_B &= P_B X_B \end{aligned} \quad |t. \tag{12}$$

For the relative prices of two products then follows directly from (12) in combination with the differentiated sales ratio (5):

$$\frac{P_A}{P_B} = \frac{R_B}{R_A}\frac{L_B}{L_A}\frac{C_A}{C_B} = \frac{X_B\rho_{EA}}{X_A\rho_{EB}} \quad \text{if} \quad \rho_{XA} = 1, \rho_{XB} = 1 \quad |t. \tag{13}$$

If the markets for both products are cleared the relation of prices is inversely proportional to the relation of productivities and the relation of labor inputs and directly proportional to the relation of consumption expenditures for the two products. A straightforward result materializes if the labor inputs of the two firms stand in the same proportion as the expenditures for both products:

$$\begin{gathered} \frac{P_A}{P_B} = \frac{R_B}{R_A} \\ \text{if} \quad \frac{L_A}{L_B} = \frac{C_A}{C_B} = \frac{\rho_{EA}}{\rho_{EB}} \quad \text{and} \quad \rho_{XA} = 1, \rho_{XB} = 1 \quad |t. \end{gathered} \tag{14}$$

If labor input is allocated according to the consumers' preferences, which are revealed by their expenditure ratios, then relative prices are inversely proportional to the productivities in the two lines of production. The productivities are measurable in principle.

The subjective partitioning of consumption expenditures has no effect whatever on relative prices if the partitioning corresponds exactly to the allocation of total labor input between the different lines of production. We refer to this unique configuration of expenditure ratios and labor inputs as the *harmonic* structure.

The elementary version of the structural value theorem (14) follows directly from the axioms. In real terms it states that the exchange ratio is inverse to the transformation ratio. Loosely speaking, the value of produced goods is independent of subjective factors like demand or preferences but depends alone on objective production conditions. By and large, this is what the classicals said and what the neoclassicals denied. As a matter of fact, the subjective factors determine the allocation of labor but not the real value of products. The harmonic structure resolves the apparent contradiction between classical and neoclassical tenets.

From (14) in combination with (11) follows under the condition of budget balancing:

$$\begin{gathered} \frac{L_A}{L_0 - L_A} = \frac{\rho_{EA}}{1-\rho_{EA}} \quad \Rightarrow \quad L_A = \rho_{EA}\, L_0 \\ \text{if} \quad \rho_{EA} + \rho_{EB} = 1 \quad |t. \end{gathered} \tag{15}$$

The employment of firm A is determined by that part of total income that the households spend on product A. Under the condition of full employment (11) the labor input of firm B is then also known. The respective expenditure ratios are an objective expression of the household sector's preferences.

3.3 Overall profit

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:[1]

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

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

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

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

From (16) and (1) finally follows:

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

The three equations are formally equivalent and show profit under different perspectives. Eq. (18) tells us that overall profit is zero if $\rho_E = 1$ and $Y_D = 0$. It is important to recall that we discuss at the moment the simplified case with zero distributed profit. Hence profit for the business sector as a whole depends solely on the relation of consumption expenditures C and income Y, i.e. on the expenditure ratio ρ_E. Then, with an expenditure ratio of unity profit of the business sector as a whole is zero.

3.4 Individual profit

For firm A eq. (17) reads in the case of market clearing:

$$Q_{mA} \equiv P_A R_A L_A \left(1 - \frac{W_A}{P_A R_A}\right) \quad \text{if} \quad \rho_{XA} = 1 \quad |t. \tag{19}$$

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

$$P_A = \frac{W_A}{R_A} \quad |t. \tag{20}$$

The price of product A is equal to unit wage costs. In the same way we get the price P_B. Taken together, the zero profit conditions for each firm – Walras's 'ni bénéfice

[1] Nonmonetary profit is treated at length in (2012).

ni perte' – gives for relative prices again (14) under the condition of equal wage rates:

$$\frac{P_A}{P_B} = \frac{\frac{W_A}{R_A}}{\frac{W_B}{R_B}} = \frac{\frac{W}{R_A}}{\frac{W}{R_B}} = \frac{R_B}{R_A} \qquad (21)$$

$$\text{if} \quad Q_{mA} = 0,\, Q_{mB} = 0,\, \rho_{EA} + \rho_{EB} = 1,\, W_A = W_B = W$$

The elementary structural value theorem follows either from the harmonic structure or from the zero profit condition provided the wage rates are equal. With unequal wage rates the elementary theorem still holds, but one firm makes a profit and the other a loss of equal magnitude because overall profit (18) is zero due to ρ_E=1 and $Y_D = 0$.

3.5 The general value theorem

The allocation rule that satisfies both the harmonic structure and the zero profit condition in the general case of given unequal wage rates reads:

$$\frac{L_A}{L_B} = \frac{\frac{\rho_{EA}}{W_A}}{\frac{\rho_{EB}}{W_B}} = \frac{\rho_{EA} W_B}{\rho_{EB} W_A} \qquad (22)$$

The allocation of the labor input depends, roughly speaking, on the respective demands and costs in both firms. With different wage rates, total income (10) changes when labor moves between the firms.

Inserted into (13) the general allocation rule (22) yields for relative prices:

$$\frac{P_A}{P_B} = \frac{\frac{W_A}{R_A}}{\frac{W_B}{R_B}} \qquad (23)$$

$$\text{if} \quad \frac{L_A}{L_B} = \frac{\rho_{EA} W_B}{\rho_{EB} W_A} \quad \text{and} \quad \rho_{XA} = 1, \rho_{XB} = 1 \quad |t.$$

In the harmonic structure with different wage rates relative prices stand, under the zero profit condition, in direct proportion to unit wage costs.

From (22) and (11) follows for the labor input of firm A:

$$L_A = \frac{L_0}{\left(\frac{1}{\rho_{EA}} - 1\right)\frac{W_A}{W_B} + 1} \tag{24}$$

This reduces to (15) if wage rates are equal. We get analogous for the labor input of firm B:

$$L_B = \frac{L_0}{\left(\frac{1}{\rho_{EB}} - 1\right)\frac{W_B}{W_A} + 1} \tag{25}$$

In general, then, labor input in one firm depends on the expenditure ratio and *relative* wage rates. With given relative wage rates, if demand ρ_{EA} goes up, employment increases in firm A and decreases in firm B, due to the balanced budget link $\rho_{EA} + \rho_{EB} = 1$. The respective labor inputs L_A, L_B sum up to overall full employment L_0. In the zero profit harmonic structure, allocation depends on final demand, value on the production conditions.

Note that labor can move at the moment freely between the firms, although the wage rates are different. Full employment is defined with regard to the economy as a whole. The alternative is to define full employment with regard to each line of production separately, that is, the free movement of labor is then restricted (see Section 4.5).

4 The market mechanisms

> The primitive apparatus of the theory of supply and demand is scientific. But the scientific achievement is so modest, and common sense and scientific knowledge are logically such close neighbors in this case, that any assertion about the precise point at which the one turned into the other must of necessity remain arbitrary. (Schumpeter, 1994, p. 9)

4.1 Initial period

The simple and transparent model to start with is perfectly symmetric. The households split their consumption expenditures equally between two products, i.e. $\rho_{EA} = \rho_{EB} = 0.5$. The full employment labor input of 200 units [hours per period] is allocated equally to the two lines of production, i.e. $L_A = L_B = 100$. Wage rates are equal, i.e. $W_A = W_B = 10$ [€ per hour]. The production conditions determine the productivities as $R_A = 4$ and $R_B = 1$ [units per hour]. Under the condition of market clearing the respective prices then are $P_A = 2.50$ and $P_B = 10.00$ [€ per unit].

4.2 Change of preferences

Our point of departure is the initial period as described in Section 4.1 with the harmonic structure at full employment. It is assumed now that well before the beginning of period_1 the firms poll the households and learn that that the expenditure ratio for the product of firm A, i.e. ρ_{EA1}, will be up and correspondingly ρ_{EB1} will be down, such that the overall expenditure ratio is still unity. The household sector's budget is balanced in all periods.

The firms decide to adapt output accordingly and to maintain the demand-determined harmonic structure. By consequence, L_{A1} is larger and L_{B1} is lesser in strict proportion to the new expenditure ratios. There is no further change. Relative prices (23) remain unchanged since productivities and wage rates stay where they are. Loosely speaking, it is not the case that prices rise and fall with demand. The adaptation to shifting demand is here purely quantitative.

Total income is not affected by the reallocation of labor input and with an overall expenditure ratio of unity total consumption expenditures are equal to those in the initial period. The households want more of product A and less of B and the firms produce exactly what the households signal with the shift of expenditures. Demand and supply move in step at given prices. There is *no* such thing as *independent* supply and demand functions. Conventional price theory rests on wrong premises.

The firms do not act on any price signals but on information about changing expenditure ratios. A change of preferences affects only the allocation of labor input. Relative prices play no role for the reallocation. Hence, what the firms really need is accurate prior information about shifts of the expenditure ratios. Then the respective labor inputs can be calculated with (15) under the premise that total full employment input is known. The adaptation of the labor inputs implies that the workers are, with equal wage rates, indifferent between the firms and move freely between them. This, of course, is an idealization that helps to focus here on the question of price-quantity adaptations. Since the wage rates are by assumption uniform they cannot assume the role of a signal. The prior knowledge of a demand shift sets the quantity mechanism in the product and labor market in motion, the price mechanism remains idle.

As an alternative scenario imagine now that the firms have no prior information about the demand shift and therefore cannot even attempt a well-timed reallocation of labor input. By consequence, the structure in period_1 is no longer harmonic. In order to clear the product market the prices adapt. From (3) in combination with (5), (6), and (10) follows for the general case:

$$P_A = \rho_{EA}\frac{W_A}{R_A}\left(1+\frac{W_B}{W_A}\left(\frac{L_0}{L_A}-1\right)\right) \qquad \text{if} \quad \rho_{XA}=1, Y_D=0 \quad |t. \tag{26}$$

The price of product A depends under the condition of market clearing on demand, expressed by the expenditure ratio, unit wage costs, and the structure of wage costs in both firms. Mutatis mutandis for firm B. If wage rates are equal in both firms (26) reduces to:

$$\begin{aligned} P_A &= \rho_{EA} \frac{W}{R_A} \frac{L_0}{L_A} \\ \text{if} \quad & \rho_{XA} = 1, Y_D = 0, W_A = W_B = W \quad |t. \end{aligned} \tag{27}$$

It holds that $P_{A1} > P_{A0}$ because $\rho_{EA1} > \rho_{EA0}$ with unchanged production conditions. Correspondingly, the market clearing price of firm B falls. Thus, relative prices do not any longer stand in inverse proportion to the unaltered productivities as in (14).

The profit of firm A is now greater than zero because the price is higher while wage costs do not change. As a mirror image firm B makes a loss of equal magnitude. Total profit of the business sector is zero as it was in the initial period. This is a situation than cannot last for long. With accumulating losses firm B drops eventually out and the structure of the business sector changes. Product B vanishes and employment may fall below full employment. The conditional adaptation of prices clears the markets but disturbs the initial equality of zero profits. Logically this implies that one firm may get lost in the process. This aspect of price adaptation is usually overlooked or spirited off with the help of the auctioneer.

The only action that leads to a reproducible outcome consists of the reallocation of labor input. An appropriate increase of L_A in (27) counteracts the increase of the expenditure ratio and brings the price back to the former level. The move of labor input from firm B to A is in accordance with the profit situation, however, firm A is not forced in any way to increase employment. In stark contrast, firm B is under pressure to reduce employment. If firm A is in no hurry to increase labor input unemployment occurs, at least temporarily. To keep focus, likewise feasible wage adaptations are ignored.

It is assumed here that labor takes vacancies respectively planned redundancies as signal and moves smoothly at equal and constant wage rates from firm B to A. Vacancies and redundancies in turn are made dependent on profit and loss. The reallocation of labor increases the output of product A and reduces the output of B and brings prices back to their initial levels according to (27). The final result is the same as it was without the detour of price changes except for the indirect redistribution of money between the firms that takes the form of profits and losses (for details about the monetary side see 2011).

In sum: If the households' preferences between the products A and B change then a purely quantitative adaptation of labor input is sufficient. All prices and the uniform wage rate can be held constant. An adaption of product prices to demand shifts would destabilize the economy and has strong distributive side effects. To answer a shift of preferences, the quantity mechanism is obviously more appropriate than the price mechanism. To make the quantity mechanism workable the firms need other information than price signals. The exclusive reliance on the price mechanism is, clearly, an analytical and practical mistake of conventional economics.

4.3 Change of productivity

Our point of departure is again the initial period of Section 4.1 with the harmonic structure at full employment. It is assumed now that firm A knows at the beginning of period$_1$ that the productivity increases, i.e. that $R_{A1} > R_{A0}$. In order to maintain the harmonic structure relative prices should therefore change according to (14). In the simplest case firm A reduces the price and everything else is left unchanged. The lower market clearing price follows from (27). At this price the additional output is, as a first step, fully absorbed by the household sector with unchanged consumption expenditures. The lower price is not only a signal but de facto enables the households to buy the increased quantity. In other words, with unchanged total nominal income (10) real income increases.

The simple price-quantity adaptation, which fits the accustomed idea of supply-up–price-down, changes the quantitative relation of consumption goods. This may initiate further changes. The new relation of quantities bought, which indicates an improvement, is given by:

$$\frac{X_{A1}}{X_{B0}} > \frac{X_{A0}}{X_{B0}}. \tag{28}$$

The new quantitative relation corresponds to the new price relation. It is assumed now, however, that the households wish to return to the previous relation:

$$\frac{X_{A2}}{X_{B2}} = \frac{X_{A0}}{X_{B0}}. \tag{29}$$

In order to restore the initial relation in period$_2$ the expenditure ratio for product A has to be lowered and that for product B has to be increased. This demand shift leaves relative prices (14) unchanged.

From (13) follows in combination with (14) under the condition that the relation of quantities X_A and X_B remains constant:

$$\frac{\rho_{EA}}{\rho_{EB}} = \rho_{\kappa}\frac{R_B}{R_A} \quad |t. \tag{30}$$

With a constant ratio ρ_{κ} of the quantities bought the expenditure ratio ρ_{EA} decreases if the productivity R_A increases. As a consequence labor input is reallocated from firm A to B and the households buy in the second round more of product B and less of A. This restoration of the initial relation of the quantities bought happens at constant prices. In the final analysis the productivity push in firm *A* increases the quantities bought of *both* products. Taking the two steps together, the price elasticity for product *A* is less than unity. Without the second step it is always unity. This is a systemic property that follows from conditional price flexibility.

If the elasticity is different from unity the rest of the economy is affected because of the budget link. That is, the *ceteris paribus* clause no longer holds. This prohibits generalizations from the analysis of a single market and herein lies the fatal weakness of Marshall's approach.

The properties of the harmonic structure suggest that a price reduction is the correct first round answer to a productivity increase. The firm, however, has no idea of the systemic interrelations and may decide to sell the same quantity at the same price as before and to reduce labor input instead. If the firm succeeds with cost cutting total income diminishes and with constant expenditure ratios consumption expenditures in both lines of production diminish, thus causing a loss in firm *B* that is exactly equal to the profit in firm *A*. This is not a reproducible situation in the longer run. From the perspective of the economy as a whole the purely quantitative adaption of labor input is possible but certainly not advisable. Because in this case the individual pursuit of profit unintentionally causes losses in the rest of the economy. That is neither what the invisible hand is supposed to do nor what Pareto could justify.

If supply increases due to a productivity push then, in the first round of adaptations, the market clearing price falls in the harmonic structure. By consequence, the price level as a weighted average of all prices falls. To compensate for the deflationary effect of a partial increase of productivity, all wage rates have to be increased by the same percentage rate.

4.4 Change of the employment level

Our point of departure is again the initial period of Section 4.1. Now the overall supply of labor increases and the full employment level reaches a new height, i.e. $L_1 > L_0$.

It is assumed first that both firms act in accordance with (15), that is, both increase labor input at the going wage rate in proportion to the given expenditure ratios. This presupposes that the firms know, at the beginning of period_1, the exact amount of the new full employment labor input L_1 and the respective expenditure ratios.

It would be the wrong course of action to reduce the given uniform wage rate because this would, as we know from Section 3.1, only translate into a fall of the market clearing prices. For the labor market as a whole the accustomed idea of labor-supply-up–wage-rate-down is inapplicable, because of the interdependence with the product market as a whole. The interdependence is established by the balanced budget condition which is expressed by an overall expenditure ratio of unity.

Total income increases as both firms move in step by applying (15) and increase labor input to L_{A1}, respectively L_{B1}. Output grows in both firms according to (2). The relation of expenditures, expressed by the respective expenditure ratios, remains the same. Absolute prices stay where they are and the price relation (14) remains unchanged. With constant wage rates a proportional increase of labor supply creates proportional demand in both lines of production. By and large this is what Say's law asserts.

It nearly goes without saying that the employment expansion requires a larger average stock of transaction money (for details see 2011, Sec. 3). Otherwise the monetary side becomes a hindrance to growth.

In sum: a proportional increase of labor input at constant uniform wage rates leaves all market clearing prices in the harmonic structure unchanged. This implies, of course, that the new workers apportion their consumption expenditures in the same manner as the incumbents. Otherwise the expenditure ratios change. This case has been dealt with in Section 4.2.

4.5 Partial changes of employment

Our point of departure is again the initial period with the harmonic structure at full employment and an equal wage rate W in both firms.

It is assumed now that the wage rates in both lines of production are the dependent variables and that the labor supply changes from L_{B0} to L_{B1}. Full employment is now defined for each line of production separately. From (22) then follows:

$$\frac{W_{A0}}{W_{B1}} = \frac{\rho_{EA}}{\rho_{EB}}\frac{L_{B1}}{L_{A0}} \quad |t. \tag{31}$$

The relation of full employment wage rates depends on the given relation of expenditure ratios and inversely on the increased labor supply in firm B. An increase of supply L_{B1} translates into a decline of the wage rate W_{B1} (alternatively, but intuitively not immediately plausible, into an increase of W_{A0}, or a mixture of both).

From (23) follows for relative prices:

$$\frac{P_{A0}}{P_{B1}} = \frac{\frac{W_{A0}}{R_A}}{\frac{W_{B1}}{R_B}} \tag{32}$$

$$\text{if} \quad \frac{W_{A0}}{W_{B1}} = \frac{\rho_{EA}L_{B1}}{\rho_{EB}L_{A0}} \quad \text{and} \quad \rho_{XA} = 1, \rho_{XB} = 1 \quad |t.$$

All other variables held constant, the lower wage rate leads to lower unit wage costs and in turn to a lower market clearing price. At this price the higher output, which is due to the larger labor input, can be absorbed. The relation between wage rate and employment in (31) is hyperbolic, that is, the product of wage rate and labor input remains constant. By consequence, total income and the respective consumption expenditures do not change either. The relation between price and increased quantity is also hyperbolic. This is a systemic property.

To compensate the deflationary effect of a partial increase of labor supply, all wage rates have in a separate step to be increased by the same percentage rate.

A partial increase of the labor supply effects a fall of the market clearing price in the respective line of production. This first round adaptation is accompanied by an increase of the quantity bought. If the household sector wants to restore the original ratio of quantities this could only be accomplished with a reallocation of labor. In this case, the increased labor supply in one line of production indirectly affects the rest of the economy.

4.6 Determinants of the wage and price structure

With the differentiated axiom set and the conditions of the zero profit harmonic structure relative wage rates and relative prices are determined as:

$$\text{(i)}\,\frac{W_A}{W_B}=\frac{\rho_{EA}L_B}{\rho_{EB}L_A}\quad\text{and}\quad\text{(ii)}\,\frac{P_A}{P_B}=\frac{\rho_{EA}L_BR_B}{\rho_{EB}L_AR_A}\quad|t. \tag{33}$$

The determinants of relative wage rates (i) are: the given endowments of the labor supply in the different lines of production and the respective expenditure ratios. The latter reflect tastes. There is not much use to go behind the measurable expenditure ratios and to speculate about maximizing agents. Each configuration of expenditure ratios can be explained as the outcome of maximizing some target function. This exercise is pointless. Tastes are exogenous and vary at random.

One can imagine that in the course of time workers get successively out of the low-wage line of production and into the high-wage line. This would eventually result in an equalization of wage rates between the different lines of production. For all practical purposes this configuration can be ignored; it is, however, a useful theoretical benchmark. Under the secular perspective the differentiated labor endowments are endogenous. Since W_A, W_B are averages their eventual equality does not prevent differentiation of the individual wage rates *within* each line of production (for details see 2013b, Sec. 17.3).

The determinants of relative prices (ii) are in the first part the same as of relative wage rates. In contradistinction they are in the second part augmented with relative productivities which reflect technology. Hence, ultimately, the wage and price structure is determined by taste, technology, and the endowment of resources.

To arrive at absolute values, one of the wage rates has to be taken as nominal numéraire. If, for example, W_B is fixed the other wage rate is determined in (33) by the exogenous variables. With given wage rates and the exogenous labor supply in both lines of production total income is determined according to (10). Then, with exogenous expenditure ratios the respective consumption expenditures are determined. The demand side together with the supply side, which depends on the exogenous productivities, finally yields the market clearing prices. With this, the whole system is determined in real and nominal terms. The solution consists in a vector of wage rates and a vector of product prices.

In sum: the generalized harmonic structure satisfies the conditions of market clearing, budget balancing, zero profit, and full employment in both lines of production. This combination of desired properties is rarely found in reality but it is significant as a benchmark. The harmonic consumption economy is fully determined by objective conditions; all variables of (33) are measurable in principle. The structural price determination has nothing in common with supply-function–demand-function–equilibrium. There is no use for this figment of a confused imagination.

The pure consumption economy is the most elementary configuration. Extensions suggest themselves. The first is an economy with overall profit greater zero, the second is the formal generalization for an arbitrary number of products. This generalization fully replaces the inoperative general equilibrium construct.

5 Conclusion

> It may be distasteful for recently trained economists to admit that there is a lot of silly philosophy underlying ordinary neoclassical economics, but I think such is the case. (Boland, 1992, p. 203)

To change a theory means to change the axiomatic foundations. This has been done in the present paper with the introduction of structural axioms. The new approach yields:

- the general value theorem for the harmonic structure,
- the wage rate vector and the price vector that in combination satisfy the objective conditions for a reproducible consumption economy and ultimately depend on taste, technology, and the endowments of labor supply.

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