Taxes, profits, and employment: a structural axiomatic analysis

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Taxes, Profits, and Employment: A Structural Axiomatic Analysis

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Abstract

Standard economics is regarded as the theory of the market system. Profit is the pivotal phenomenon of this system. Contrary to expectations, though, profit is neither well defined not fully understood. The frailty of the theoretical core is passed on to the subfields. This paper provides a consistent definition of profit and applies it to the analysis of the effects of the government sector's budget on employment and the profitability of the business sector. Since the formal point of departure is different from the standard approach it is quite natural that we arrive at new conclusions in some fundamental issues.

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> It is certainly not at all clear how a *scientist* can enjoy a "pacified professional conscience" while basing his procedure on a marginal utility curve drawn up on the assumption that "other people have much the same psychology as himself", for which proposition no conceivable method of testing is given except "blind faith". (Hutchison, 1960, p. 138), original emphasis

Critique of the standard economic research program relates to its theoretical, empirical, methodological, and political aspects. Part of the pleas amounts to not much more than 'a bombardment of soap bubbles' (Hahn, 1984, p. 78). If it is acknowledged, however, that the serious scholars' central objections are valid, and if it is acknowledged on the other hand that the conclusions of standard economics are formally correct, unsatisfactory results must – modus tollens – ultimately be due to the basic assumptions.

Standard economics rests on a set of behavioral axioms (Arrow and Hahn, 1991, p. v). This paper's general thesis says that human behavior does not yield to the axiomatic method (cf. Hudík, 2011; Rosenberg, 1980), yet the axiomatization of the money economy's fundamental structure is feasible. In the following, three general non-behavioral axioms are put forward as formal foundation. The structural axiom set is then directly applied to the special topic of taxation and government spending. Since the formal point of departure is different from the standard approach it is quite natural that we arrive at new conclusions in some fundamental issues.

The case for structural axiomatization has been made at length elsewhere (e.g. 2011e; 2011g). We therefore skip the discussion of methodological pros and cons and proceed to practical application. The formal frame that constitutes the pure consumption economy is set up in Section 1. In Section 2 profit as the pivotal concept for the analysis of the money economy is derived from the axiom set. In Sections 3 and 4 the income tax and a public good is introduced first in the pure consumption economy with zero profits and then in an economy with positive profits and profit distribution. Section 5 is devoted to the analysis of allocative changes that are effected by taxation and government spending. The provisional assumption of a fixed total labor input in then suspended. The determinants of employment are at first established in Section 6.1 for an economy without government. The effects of balanced and unbalanced government budgets on employment and profits are then made explicit in Sections 6.2 and 6.3. It turns out that budget deficits are a crucial precondition for growth and an economically successful private sector. Section 7 concludes.

1 Axioms

> A sharply and clearly defined system of concepts enables sharp and clear answers to be obtained from empirical investigation. (Hutchison, 1960, p. 35)

The first three structural axioms relate to income, production, and expenditures in a period of arbitrary length. For the remainder of this inquiry the period length is conveniently assumed to be the calendar year. Simplicity demands that we have at first one world economy, one firm, and one product.

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 conditions. 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 expenditures, no foreign trade, and no taxes or any other government activity. It has to be emphasized that all axiomatic variables are measurable in principle.

2 Profit and overall profit ratio

Profit is the pivotal concept for the analysis of the market system. The business sector's financial profit Q_{fi} in period t is defined with (4) as the difference between the sales revenues – for the economy as a whole identical with consumption expenditures C – and costs – here identical with wage income Y_W:[1]

$$Q_{fi} \equiv C - Y_W \equiv PX - WL \quad \leftarrow \quad Y_W \equiv WL \quad |t. \tag{4}$$

For the business sector as a whole to make a profit consumption expenditures C have in the simplest case to be greater than wage income Y_W. So that profit comes into existence in the *pure consumption economy* the *household* sector must run a deficit at least in one period.[2] This in turn makes the inclusion of the financial sector mandatory. An economic theory that does not include at least one bank that supports

[1] Profits from changes in the value of financial and nonfinancial assets are excluded here to streamline the analysis. For details see (2011f).

[2] It needs hardly emphasis that in the investment economy the process of profit generation appears more complex. For details see (2011h).

the concomitant credit expansion cannot capture the essential features of the market economy (for details see 2011e, Sec. 7-8).

From (4) and (1) follows for the relation of profit and distributed profit:

$$Q_{fi} \equiv C - Y + Y_D \quad \leftarrow \quad Y_D \equiv DN \quad |t. \tag{5}$$

Definitions are supplemented by connecting variables on the right-hand side of the identity sign that have already been introduced by the axioms. To the definitions in (4) and (5) three structural ratios are added now. With (6) the expenditure ratio ρ_E, the sales ratio ρ_X, and the distributed profit ratio ρ_D is defined:

$$\rho_E \equiv \frac{C}{Y} \qquad \rho_X \equiv \frac{X}{O} \qquad \rho_D \equiv \frac{DN}{WL} \equiv \frac{Y_D}{Y_W} \quad |t. \tag{6}$$

From (5), the first axiom (1), and the definitions (6) one gets for total profit that it depends on the key ratios ρ_E and ρ_D and the absolute amount of total income:

$$Q_{fi} \equiv \left(\rho_E - \frac{1}{1+\rho_D} \right) Y \quad |t. \tag{7}$$

To get rid of all absolute magnitudes the profit ratio ρ_Q is defined with (8) and this gives a succinct summary of the *structural* interrelations of the profit ratio, the expenditure ratio, and the distributed profit ratio for the business sector as a whole:

$$\rho_Q \equiv \frac{Q_{fi}}{WL} \quad \Rightarrow \quad \rho_Q \equiv \rho_E (1+\rho_D) - 1 \quad |t. \tag{8}$$

The overall profit ratio ρ_Q is positive if the expenditure ratio ρ_E is > 1 or the distributed profit ratio ρ_D is > 0, or both.[3]

3 Income tax in the zero profit economy

3.1 Initial conditions

The business sector consists of two firms and the given total labor input L is allocated between them:

$$L \equiv L_A + L_B \quad |t. \tag{9}$$

The 1st axiom (1) is differentiated and at the same time simplified by equalizing the wage rates and by setting distributed profits to zero:

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

[3] The full implications of the profit definition are far-reaching; for details see (2011e, Sec. 12). Mention should be made that neither neoclassicals nor Keynesians ever came to grips with profit (Desai, 2008, p. 10), (Tómasson and Bezemer, 2010).

Total income consists only of wage income. The household sector apportions consumption expenditures between the two firms. The 3rd axiom (3) in combination with (6) now reads:

$$\begin{aligned} C &= P_A X_A + P_B X_B = C_A + C_B \\ \frac{C}{Y} \quad &\Rightarrow \quad \rho_E = \rho_{EA} + \rho_{EB} \quad |t. \end{aligned} \tag{11}$$

From the 2nd axiom (2) follows under the condition of market clearing $X = O$ respectively $\rho_X = 1$:

$$\begin{array}{ll} P_A R_A L_A = \rho_{EA} Y & \text{if} \quad \rho_{XA} = 1,\, \rho_{EA} \,\text{now independent} \\ P_B R_B L_B = \rho_{EB} Y & \text{if} \quad \rho_{XB} = 1,\, \rho_{EB} \,\text{now independent} \end{array} \quad |t. \tag{12}$$

Accordingly, the market clearing prices of both firms are given by:

$$\begin{array}{ll} P_A = \rho_{EA} \dfrac{W}{R_A} \dfrac{L}{L_A} & \text{if} \quad \rho_{XA} = 1,\, \rho_{EA} \,\text{indep.} \\ P_B = \rho_{EB} \dfrac{W}{R_B} \dfrac{L}{L_B} & \text{if} \quad \rho_{XB} = 1,\, \rho_{EB} \,\text{indep.} \end{array} \quad |t. \tag{13}$$

The market clearing prices are determined by the respective expenditure ratios, unit wage costs and the relative size of the firms measured in labor input.

From (4) and the condition of market clearing follows for financial profits:

$$\begin{array}{ll} Q_{fiA} = L_A \underbrace{(P_A R_A - W)}_{0} & \text{if} \quad \rho_{XA} = 1 \\ Q_{fiB} = L_B \underbrace{(P_B R_B - W)}_{0} & \text{if} \quad \rho_{XB} = 1 \end{array} \quad |t. \tag{14}$$

Profits are zero if the respective values of the outputs per hour are equal to the respective wage rates, which are in this simplified case equal for both firms.

From (12) in combination with the zero profit condition of (14) follows:

$$\begin{array}{l} W L_A = \rho_{EA} Y \\ W L_B = \rho_{EB} Y \end{array} \quad |t. \tag{15}$$

In combination with (10) this yields the labor input of each firm:

$$\begin{array}{l} L_A = \rho_{EA} L \\ L_B = \rho_{EB} L \end{array} \quad |t. \tag{16}$$

And this in turn gives for the relation of labor inputs:

$$\frac{L_A}{L_B} = \frac{\rho_{EA}}{\rho_{EB}} \qquad \varpi \equiv \frac{\rho_{EA}}{\rho_{EB}} \quad |t. \tag{17}$$

Labor input is under the given conditions allocated in exact proportion to the expenditure ratios. The proportion ϖ represents the consumer optimum.

Since we have from the standard theory of consumer demand the marginalistic behavioral condition that the marginal rate of substitution MRS be equal to the price ratio we are in the position to synthesize the structural formalism and the marginalistic behavioral assumption. From the definition of the expenditure ratio (6) follows:

$$\frac{\rho_{EA}}{\rho_{EB}} = \frac{\frac{C_A}{Y}}{\frac{C_B}{Y}} = \frac{P_A X_A}{P_B X_B} \quad |t. \tag{18}$$

When, by applying the rule $MRS = \frac{P_A}{P_B}$, the optimal quantities X_A, X_B are determined in the usual way as coordinates of the tangential point of budget constraint and indifference map then the optimal partitioning of consumption expenditures ρ_{EA}, ρ_{EB} is also determined. Any configuration of expenditure ratios can be formalized as a consumer optimum.

The zero profit condition of (14) entails budget balancing for the household sector as a whole:

$$\begin{array}{l} C_A - WL_A = 0 \\ C_B - WL_B = 0 \\ \hline C \;\; - \;\; Y \quad\; = 0 \end{array} \tag{19}$$

Total consumption expenditures are equal to total income, i.e. the overall expenditure ratio ρ_E in (11) is unity. In sum we then have for the initial situation: equal wage rates in both firms, market clearing, zero profit, budget balancing, an optimal partitioning of consumption expenditures, and the allocation of the given labor input exactly in proportion to the households' demand for the two products. The business sector is structured according to the preferences of the households. Since no agent has the possibility to improve her situation an overall economic optimum is realized in period t. This initial configuration serves as clear-cut point of reference.

3.2 Switch to government production and taxation

Now we substitute a government agency for firm B. Firm B's output O_B becomes $O_{\mathbf{G}}$ but it is qualitatively the same. If government would sell the product the partitioning of consumption expenditures (11) would read:

$$\check{C} = P_A X_A + \check{P}_{\mathbf{G}} X_{\mathbf{G}} \quad |t. \tag{20}$$

The former household purchases from firm B, however, are now virtual. The former market price P_B becomes the imputed price $\check{P}_{\mathbf{G}}$. The market transaction volume and consumption expenditures decline:

$$C = \breve{C} - \breve{P}_{\mathbf{G}} X_{\mathbf{G}} = C_A \quad |t. \tag{21}$$

It is assumed at first that the same agents that formerly bought X_B now absorb $X_{\mathbf{G}}$. To achieve this restriction may prove difficult in the concrete case. If we take, as an example, the replacement of private security services by a local police department no great problems arise and we can shelve the question of how the distribution of government output is organized beyond the market.

The former total income (10) now changes to:

$$Y = WL_A + WL_{\mathbf{G}} - \underbrace{T_Y + Y_{\mathbf{G}}}_{0} \quad |t. \tag{22}$$

The total amount of income tax payments is denoted T_Y. This amount is exactly offset by government income $Y_{\mathbf{G}}$. Thus total income remains unaltered and includes private and public households. The household sector's disposable income is given by:

$$Y_{\mathbf{H}} \equiv Y - Y_{\mathbf{G}} \equiv WL_A + WL_{\mathbf{G}} - T_Y \quad |t. \tag{23}$$

Disposable income is lower than total income in the initial situation (10). As a counterpart households' consumption expenditures in (21) are lower, too.

The income tax payments T_Y are calculated by applying the income tax ratio ρ_T to total wage income:

$$T_Y = \rho_T \left(WL_A + WL_{\mathbf{G}}\right) \quad \text{if} \quad \rho_T \,\text{indep.} \quad |t. \tag{24}$$

The balanced budget condition demands that the income tax covers the wages of the public sector:

$$T_Y = WL_{\mathbf{G}} \quad |t. \tag{25}$$

With the help of (9) this reduces to:

$$\rho_T = \frac{L_{\mathbf{G}}}{L} \quad |t. \tag{26}$$

The income tax ratio ρ_T is under the given conditions determined by the relative size of the public sector measured in labor input. The ratio is, in a sense, the equivalent to the imputed price $\breve{P}_{\mathbf{G}}$ for the former private and now public good. The relative labor input is still determined by the optimal partitioning of consumption expenditures. The relative size of the public sector is ultimately determined by the households' preferences for the output $X_{\mathbf{G}} = X_B$.

For both the household and the business sector the situation does not change in real terms. The same output is produced with the given labor input and absorbed by the household sector. Although they are taxed, the wage income receivers' real income remains unchanged. When the income tax ratio ρ_T is translated into the imputed price $\breve{P}_G$ the household sector's distribution of imputed consumption

expenditures is as optimal as before. Profits are zero before and after the substitution of firm B by a government agency. The switch from private to public and from buying to tax paying may be neutral in real terms, however, it seems improbable that it is neutral in behavioral terms for myopic agents. It is a rare bird that is indifferent between a seller and a tax collector. From the methodological point of view it is worthwhile to note:

> It is a characteristic of the Anglo-Saxon tradition in public finance that the entire question was discussed solely in terms of taxation, totally ignoring the expenditure side. (Blaug, 1998, p. 322)

In is important to recall that the household sector is at the moment not differentiated and this implies that the redistribution among households that occurs when the sets of taxpayers on the one hand and receivers of the output X_B on the other differ is not considered further at this juncture.

In the zero profit economy the relative size of public production can be analytically traced back to the optimal split-up of the household sector's balanced budget between different consumption goods. The partitioning of expenditures determines the allocation of labor input. The relative size of the public sector in turn determines the income tax ratio. In the zero profit economy the switching between private and public production and vice versa is neutral in real terms. This changes when profits are taken into the picture.

4 Positive profits

4.1 Initial conditions

Total income increases compared to (10) because both firms now distribute profits. To simplify matters, the dividend D is set equal for both firms. Accordingly, the 1st axiom (1) reads:

$$\begin{gathered} Y = \underbrace{W_A}_{W} L_A + \underbrace{W_B}_{W} L_B + \underbrace{D_A}_{D} N_A + \underbrace{D_B}_{D} N_B \\ Y = WL + DN \\ \text{with} \quad L \equiv L_A + L_B, N \equiv N_A + N_B \quad |t. \end{gathered} \tag{27}$$

Compared to (12) the expenditure ratios remain unchanged:

$$\begin{array}{ll} C_A = \rho_{EA} Y & \text{if} \quad \rho_{EA} \text{ indep.} \\ C_B = \rho_{EB} Y & \text{if} \quad \rho_{EB} \text{ indep.} \end{array} \quad |t. \tag{28}$$

By consequence, consumption expenditures for both products increase in proportion to income.

Compared to (13) the new market clearing prices are higher:

$$
\begin{aligned}
P_A &= \underbrace{\rho_{EA}\frac{W}{R_A}\frac{L}{L_A}}_{\text{unaltered}} + \rho_{EA}\frac{DN}{R_A L_A} \quad \text{if} \quad \rho_{XA}=1,\ \rho_{EA}\,\text{indep.} \\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad |t. \qquad (29)\\
P_B &= \underbrace{\rho_{EB}\frac{W}{R_B}\frac{L}{L_B}}_{\text{unaltered}} + \rho_{EB}\frac{DN}{R_B L_B} \quad \text{if} \quad \rho_{XB}=1,\ \rho_{EB}\,\text{indep.}
\end{aligned}
$$

Under the condition of market clearing profit distribution raises the prices of products A and B. Since labor input, costs and output remain unchanged profits increase. The price increase effects a redistribution of output within the household sector. The unchanged wage income translates at higher prices into a smaller part of total output. The complementary part is absorbed by the receivers and spenders of distributed profits (for details see 2011b, Sec. 9).

For the pure consumption economy as a whole profit is equal to distributed profit:

$$
\begin{gathered}
Q_{fiA} = \rho_{EA}Y - WL_A \\
\underline{Q_{fiB} = \rho_{EB}Y - WL_B} \\
Q_{fi} = Y - WL \\
\text{if} \quad \rho_{EA}+\rho_{EB}=1 \quad \rho_{EA},\ \rho_{EB}\,\text{indep.} \\
Q_{fi} = DN \quad |t.
\end{gathered} \qquad (30)
$$

This configuration, which compares to that of Section 3.1, is reproducible for an indefinite time. The interrelation of profit and distributed profit is self-sustaining (for details see 2011a). This, of course, is a theoretical limiting case.

The profit ratio for each firm is, in formal analogy to the overall profit ratio (8), given by:

$$
\begin{aligned}
\rho_{QA} &\equiv \frac{\rho_{EA}Y}{WL_A} - 1 \\
&\qquad\qquad |t. \qquad (31)\\
\rho_{QB} &\equiv \frac{\rho_{EB}Y}{WL_B} - 1
\end{aligned}
$$

The partitioning of the consumption expenditures is the same as in as in the zero profit case (17) :

$$
\varpi \equiv \frac{\rho_{EA}}{\rho_{EB}} \quad |t. \qquad (32)
$$

From the condition of profit ratio equalization then follows:

$$
\rho_{QA} = \rho_{QB} \quad \Rightarrow \quad \varpi = \frac{L_A}{L_B} \quad |t. \qquad (33)
$$

Since the allocation of the labor input remains by assumption unchanged compared to the zero profit case, the profit ratios in the two lines of production are

equal by implication. The absolute profits of both firms are positive and of different magnitude, yet the profit ratios are equal.

Taken as a whole, the household sector's situation is unchanged in real terms but the distribution of output *within* the household sector has changed compared to the zero profit economy. The partitioning of expenditures and the allocation of labor input is still optimal. This holds, of course, under the condition that the expenditure ratios of both income groups remain unchanged. Changes of the partitioning of expenditures are interesting in their own right and have to be kept apart. Compared to the zero profit economy the business sector is better off with positive profits and the wage income receivers are worse off in real terms. The receivers and spenders of distributed profits are better off in real terms. This new configuration is now no longer compared to the zero profit case but serves as a benchmark for the analysis of the structural effects of the government's budget.

4.2 Switch to government production and taxation

Again, we substitute government for firm B. Firm B's output O_B becomes $O_{\mathbf{G}}$. If government would sell the product for the former price, i.e. $\check{P}_{\mathbf{G}} = P_B$, the partitioning of consumption expenditures (11) would remain unchanged:

$$\check{C} = P_A X_A + \check{P}_{\mathbf{G}} X_{\mathbf{G}} \quad |t. \tag{34}$$

This, though, is not the case. The composition of total income (27), which remains constant, changes to

$$Y = WL_A + WL_{\mathbf{G}} + DN - \underbrace{T_Y + Y_{\mathbf{G}}}_{0} \tag{35}$$

and the household sector's disposable income is given by:

$$Y_{\mathbf{H}} \equiv Y - Y_{\mathbf{G}} \equiv WL_A + WL_{\mathbf{G}} + DN - T_Y \quad |t. \tag{36}$$

The government's budget is balanced by assumption, that is, income tax revenues T_Y are equal to wage income $WL_{\mathbf{G}}$. With a unchanged expenditure ratio ρ_{EA} a lower disposable income entails lower expenditures for product A:

$$C_A = \rho_{EA} Y_{\mathbf{H}} \quad \rho_{EA} \text{ indep.} \quad |t. \tag{37}$$

Under the condition that the allocation of labor input, and by consequence the output of both firms, remains unaltered the market clearing price P_A must fall. Since wage costs WL_A stay put firm A's profit shrinks with declining consumption expenditures:

$$Q_{fiA} \equiv C_A - WL_A \quad |t. \tag{38}$$

The output of the former firm B is not sold but distributed according to the criteria of the government agency. The condition that profit and distributed profit are

equal for the economy as a whole applies now to firm A alone since firm B has been replaced by a government agency that makes no profit. Hence $Q_{fiA} = DN$. Equation (38) together with (37) and (36) then yields the result that profit and distributed profit are zero under the given conditions. We are back at the zero profit economy and this entails that the income tax ratio is given by (26).

The rule of profit ratio equalization applies now to the limiting case of zero profits. The household sector taken as a whole again absorbs to whole output. The allocation of labor input remains the same. Without profit distribution the wage earners are better off compared to the benchmark of Section 4.1 because they can buy the whole output with their unchanged income at a lower price. The former share of the receivers of distributed profit vanishes. The switch from private to public production disrupts the self-sustaining interaction between profit and distributed profit. Although profit is not taxed at all it reduces to zero. In contradistinction to the zero profit economy the switch from private to public production is not neutral in real terms.

5 Reallocation of output and input

5.1 Neutral redistribution of output

Now we consider the case that government is no longer involved in producing a public good but buys a certain fraction of the firms' outputs. The initial situation is derived from the 1st axiom and is the same as in Section 4.1, that is, total income is given by:

$$Y = \underbrace{W_A}_{W} L_A + \underbrace{W_B}_{W} L_B + \underbrace{D_A}_{D} N_A + \underbrace{D_B}_{D} N_B \quad |t. \tag{39}$$

The income tax revenues are given by (24):

$$Y = WL + DN - \underbrace{\rho_T (WL + DN) + Y_{\mathbf{G}}}_{0} \quad |t. \tag{40}$$

The household sector's disposable income is by consequence lower than total income:

$$Y_{\mathbf{H}} \equiv Y - Y_{\mathbf{G}} \quad |t. \tag{41}$$

Consumption expenditures are again set in relation to disposable income and therefore they decrease compared to (28) if the expenditure ratios remain unchanged:

$$\begin{array}{ll} C_{A\mathbf{H}} = \rho_{EA} Y_{\mathbf{H}} & \rho_{EA} \text{ indep.} \\ C_{B\mathbf{H}} = \rho_{EB} Y_{\mathbf{H}} & \rho_{EB} \text{ indep.} \end{array} \quad |t. \tag{42}$$

It is assumed that the reduced demand of the private sector is compensated for by the public sector. The expenditure ratios of both sectors are at first identical.

$$\begin{array}{ll} C_{A\mathbf{G}} = \rho_{EA} Y_{\mathbf{G}} & \rho_{EA} \text{ indep.} \\ C_{B\mathbf{G}} = \rho_{EB} Y_{\mathbf{G}} & \rho_{EB} \text{ indep.} \end{array} \quad |t. \tag{43}$$

By consequence, the consumption expenditures for product A are the same as in (28) when private and public households are taken together:

$$\begin{array}{l} C_{A\mathbf{H}} = \rho_{EA} Y_{\mathbf{H}} \\ \underline{C_{A\mathbf{G}} = \rho_{EA} Y_{\mathbf{G}}} \quad |t. \\ C_A = \rho_{EA} Y \end{array} \tag{44}$$

Likewise for product B. Thus, the government in part replaces the households with regard to consumption expenditures. Prices, labor inputs and product outputs remain unchanged. Relative prices by consequence stay put. The optimal partitioning of consumption expenditures is maintained because government perfectly mimics the preferences of the households. For the business sector only the customers' faces change. The declining demand of the household sector due to the reduction of disposable income is fully compensated for by public demand for the output of the two firms. Final output is redistributed without repercussions to production.

The household sector's share of output diminishes in proportion to the lower disposable income. Government distributes its share of output. Let us at first divide the population into mutually exclusive sets: employees in the business and government sector on the one hand, and a not further specified complementary set on the other. Government staff consists of salaried civil staff that produces the civil public goods and, for simplicity, of a non-salaried military staff that is supplied with all necessities in kind. The remaining part of the population is referred to the complementary set. Government then distributes its share of product A, e.g. foodstuff, and product B, e.g. small arms weaponry, directly among its military staff. In real terms the households trade a part of output against the public good security. If this trade is regarded as satisfactory the wage income and distributed profit income receivers are neither worse nor better off. The redistribution of output does not violate the household sector's preferences.

Alternatively, government may distribute product A, e.g. foodstuff, and product B, now clothing, among the not further specified complementary set of the population. In this case it is not as clear as in the foregoing in what the public good consists of, or if there is any trade at all of output against a public good. This path leads to transfers and we do not follow it further here.

The share of output of wage income and distributed profit income receivers shrinks as they trade direct output for an indirect public good that does not violate their preferences. Under ideal conditions taxation and the redistribution of output is neutral with regard to the optimal partitioning of overall consumption expenditures and the allocation of labor input.

5.2 Changing the structure of demand and production

Government, though, may as well change the initial spending pattern. It is assumed now that government does not buy product A but spends all tax revenues on product B. Therefore households' consumption expenditures $C_{A\mathbf{H}}$ are reduced as before but the reduction is not made good by government spending. Likewise consumption expenditures $C_{B\mathbf{H}}$ adapt in proportion to lower disposable income but this decline is overcompensated by government spending $C_{B\mathbf{G}}$.

Compared to (42) households' spending pattern remains unchanged.

$$\begin{array}{ll} C_{A\mathbf{H}} = \rho_{EA} Y_{\mathbf{H}} & \rho_{EA} \text{ indep.} \\ C_{B\mathbf{H}} = \rho_{EB} Y_{\mathbf{H}} & \rho_{EB} \text{ indep.} \end{array} \quad |t. \tag{45}$$

Compared to (43) government's new spending pattern is given by:

$$\begin{array}{ll} C_{A\mathbf{G}} = 0 & \\ C_{B\mathbf{G}} = \rho_{EA} Y_{\mathbf{G}} + \rho_{E\mathbf{B}} Y_{\mathbf{G}} & \rho_{EA}, \rho_{EB} \text{ indep.} \end{array} \quad |t. \tag{46}$$

Total consumption expenditures are equal to total income:

$$\begin{array}{ll} C_A \equiv C_{A\mathbf{H}} + C_{A\mathbf{G}} = \rho^{\circ}_{EA} Y & \rho^{\circ}_{EA} \text{ indep.} \\ \underline{C_B \equiv C_{B\mathbf{H}} + C_{B\mathbf{G}} = \rho^{\circ}_{EB} Y} & \underline{\rho^{\circ}_{EB} \text{ indep.}} \\ C = Y \quad |t. & \end{array} \tag{47}$$

While the overall expenditure ratio ρ_E is still unity the expenditure ratios for the two lines of production change: ρ°_{EA} is smaller than ρ_{EA} in (44), ρ°_{EB} is larger than ρ_{EB}.

Labor input is adapted to the new structure of consumption expenditures to the effect that:

$$\frac{L_A}{L_B} = \frac{\rho^{\circ}_{EA}}{\rho^{\circ}_{EB}} \tag{48}$$

This entails that labor input migrates from firm A to firm B without any change in wage rates. Hence total income is not affected by the reallocation. Prices, P_A and P_B respectively, remain constant because the changes of labor inputs L_A and L_B in (29) are proportional to the changes of the expenditure ratios according to (48). Absolute profit falls in firm A with decreasing output and labor input, and increases in firm B with increasing output and labor input. The profit ratios, however, are again equal. This follows from conditions (32) and (33). If the firms are free of size-illusion and geared exclusively to the profit ratio nothing changes. The reallocation of labor inputs is neutral for the business sector. If, on the other hand, the firms take the absolute amounts of profits into account firm A is worse off and firm B is better off. A rational firm, though, is not allowed to see it in this mode. Only the profit ratio counts. The household sector, too, is not affected in real terms by the new composition of final output and the reallocation of labor input. The receivers of wage income and distributed profit income trade a part of output against a public good. Whether less of product A and more of B is consumed in the making

of the public good or vice versa is a question analogous to the factor combination in production. Under the additional condition that government has realized an optimal combination the household sector is not affected by the changed spending pattern of government.

6 Budget effects

Up to this point total labor input L has been taken as constant. We were chiefly concerned with the optimal partitioning of consumption expenditures and the corresponding allocation of labor input among firms and government in the pure consumption economy. In the following the differentiation between firms is suspended. The business sector produces one consumption good. We are now at first interested in the determination of the volume of employment and how it is affected by the government's budget. Subsequently we turn to profits.

6.1 Initial conditions

The structural employment equation follows from the axioms (1) to (3) and the definitions (6) as:

$$L = \frac{Y_D}{PR\dfrac{\rho_X}{\rho_E} - W} \quad |t. \tag{49}$$

In this form the axioms now imply the *additional* assumption that employment as dependent variable is determined by the rest of the system. This is an assumption about the direction of dependency in a system with complex and mutual interrelations and this *add-on* assumption is no constituent of the axiom set which is clearly open to various dependency interpretations. Dependency is conceptually different from causality.

The employment equation states – with the other variables unaltered in each case (for details see 2012, Sec. 6):

(i) An increase of the wage rate leads to *higher* employment, i.e. to a lower unemployment rate.

(ii) A price increase is conductive to *lower* employment.

(iii) Provided that wage rate, price and distributed profit all change with the same rate there is no effect on employment.

(iv) If the configuration of price and wage rate changes is such that the denominator remains unchanged then employment stays where it is, no matter how large wage rate and price changes are. In this case perfect wage–price flexibility has no impact on employment.

(v) An increase of the expenditure ratio ρ_E leads to higher employment. An expenditure ratio $\rho_E > 1$ presupposes the existence of at least one bank.

(vi) A productivity increase leads to lower employment.

(vii) As the difference in the denominator approaches zero employment goes (formally) off to infinity. This singularity is an implicit property of the economy as given by the structural axiom set. When this point of discontinuity is approached the system's behavior changes in unpredictable ways.

(viii) Profit distribution exerts a positive influence on employment.

Statements (i) to (viii) follow without regress to any behavioral assumptions from the axiom set and the 'laws of algebra' (Shaik, 1980, p. 83). If the axioms capture reality the logical implications of (49) are observable (for details see 2011i).

With regard to the process of adaptation of employment to changes of the independent variables the employment equation (49) implies that the independent variables have to be fixed at the beginning of the period under consideration. Since the period length is arbitrary no great distortions arise from this idealization if the length is conveniently chosen (for details see 2011c).

The standard key variable for the establishment of full employment is the real wage $\frac{W}{P}$ which has to fall. There seems to be a rare unanimity among economists of all shades on this point (Prychitko, 1998, p. 2). In marked contrast, the structural axiomatic approach asserts that in the consumption economy employment is determined by the expenditure ratio ρ_E and the factor cost ratio ρ_F of which the real wage is a constituent. This follows from (49) under the conditions that the product market is cleared, i.e. $\rho_X = 1$, and that the relation of dividend to wage rate ρ_V is held constant. After the supplementation of the two definitions

$$\rho_F \equiv \frac{W}{PR} \qquad \rho_V \equiv \frac{D}{W} \tag{50}$$

the employment equation reduces to its simplest form:

$$L = \frac{\frac{DN}{PR}}{\frac{\rho_X}{\rho_E} - \frac{W}{PR}} = \frac{\rho_V N}{\frac{\rho_X}{\rho_E \rho_F} - 1} = \frac{\rho_V N}{\frac{1}{\rho_E \rho_F} - 1} \quad \text{if} \quad \rho_X = 1 \quad |t. \tag{51}$$

Employment depends in the pure consumption economy on ρ_E, i.e. the structural axiomatic expression of Keynes's effective demand (Keynes, 1973, pp. 23-24), and the outcome of the market price formation ρ_F.

Under the conditions that the product market is cleared, i.e. $\rho_X = 1$, and the household sector's budget is balanced, i.e. $\rho_E = 1$, a higher factor cost ratio ρ_F means higher employment as shown in Figure 1.

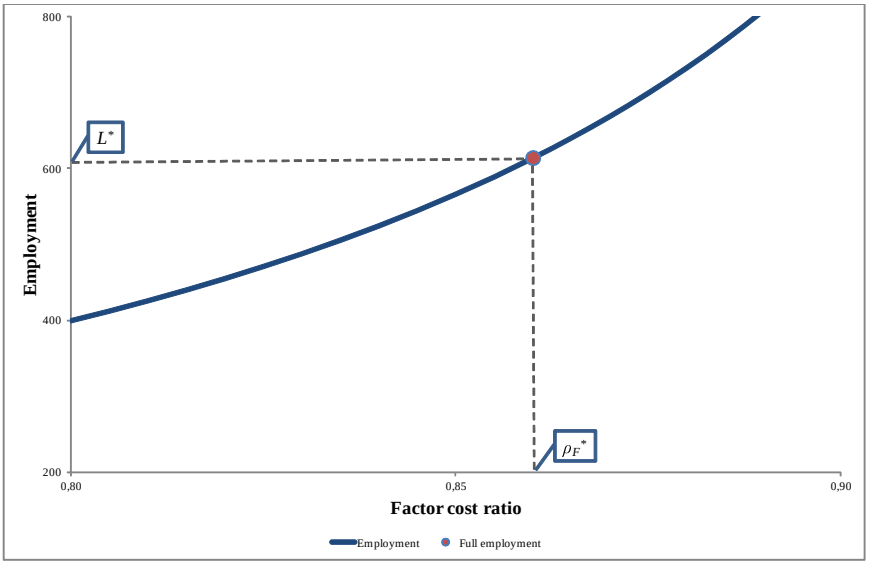

Figure 1: Structural relationship between factor cost ratio and employment ($\rho_E = 1$)

If, vice versa, the factor cost ratio is fixed, then the curve has a similar shape for an increasing expenditure ratio ρ_E. The two variables of (51) are interchangeable with regard to their effect on employment. The curve goes off to infinity and this entails that there is no such thing as a natural rate of unemployment or some kind of unemployment equilibrium.[4] Any level of employment can be realized *in principle,* that is, when the fullness of microeconomic mismatches and frictions is excluded for the moment.

In sum, full employment can be achieved in the pure consumption economy by any suitable combination of the expenditure ratio and the factor cost ratio. Full employment is possible in principle but there exist no 'forces' that swiftly bring about the right combination of ρ_X, ρ_E and ρ_F. The structural axiomatic approach is methodologically free of equilibrium-occultism.

6.2 Budget effects on employment

The government's role is restricted to the purchase of the business sector's undifferentiated output. There is no separate salaried government employment.

From the 1st axiom disposable income has already been derived as:

$$Y_{\mathbf{H}} = WL + DN - T_Y \quad |t. \tag{52}$$

Total consumption expenditures (3) are now given by:

$$C \equiv C_{\mathbf{H}} + C_{\mathbf{G}} \quad |t. \tag{53}$$

[4] "It is not news that NAIRU theory is a failure." (Hall, 2011, p. 446)

Government expenditures are autonomous, households' expenditures are formally brought in relation to disposable income via the expenditure ratio $\rho_{E\mathbf{H}}$:

$$C = \rho_{E\mathbf{H}} Y_{\mathbf{H}} + C_{\mathbf{G}} \quad \rho_{E\mathbf{H}} \text{ indep.} \quad |t. \tag{54}$$

Solving (52) to (54) for L and inserting (50) one arrives at

$$L = \frac{\rho_V N + \overbrace{\frac{1}{W}\left(\frac{C_{\mathbf{G}}}{\rho_{E\mathbf{H}}} - T_Y\right)}^{\text{budget effect}}}{\frac{1}{\rho_{E\mathbf{H}}\rho_F} - 1} \quad \text{if} \quad \rho_X = 1 \quad |t \tag{55}$$

which compares to (51). In order to bring the budget effect sharper into focus, the budget expenditure ratio is introduced in analogy to the household sector's expenditure ratio:

$$\rho_{E\mathbf{G}} \equiv \frac{C_{\mathbf{G}}}{T_Y} \quad |t. \tag{56}$$

A budget expenditure ratio $\rho_{E\mathbf{G}} > 1$ indicates that government spending exceeds income tax revenues, in other words, it indicates a budget deficit. The alternative version of (55) then reads:

$$L = \frac{\rho_V N + \overbrace{\frac{C_{\mathbf{G}}}{W}\left(\frac{1}{\rho_{E\mathbf{H}}} - \frac{1}{\rho_{E\mathbf{G}}}\right)}^{\text{budget effect}}}{\frac{1}{\rho_{E\mathbf{H}}\rho_F} - 1} \tag{57}$$

$$\text{if} \quad \rho_X = 1 \quad \rho_{E\mathbf{H}}, \rho_{E\mathbf{G}} \text{ indep.} \quad |t.$$

The first thing to note is that the government's budget is of no consequence for employment if both the household sector's and the government sector's expenditure ratios are unity. If $\rho_{E\mathbf{H}} = 1$ and $\rho_{E\mathbf{G}} = 1$ the budget effect is zero and then we are back at the initial employment equation (51). This holds also if the expenditure ratios are different from unity but numerically equal. The government sector makes a difference for employment only if its expenditure ratio is *different* from that of the household sector. Taken in isolation, a balanced government budget is not neutral.

If the household sector's expenditure ratio is different from unity, i.e. $\rho_{E\mathbf{H}} \neq 1$, and the government's budget is balanced, i.e. $C_{\mathbf{G}} = T_Y$ respectively $\rho_{E\mathbf{G}} = 1$, then the budget effect depends on the budget's volume which is expressed by the autonomous expenditures $C_{\mathbf{G}}$:

$$\text{balanced budget effect} = \frac{C_{\mathbf{G}}}{W}\left(\frac{1}{\rho_{E\mathbf{H}}} - 1\right) \quad |t. \tag{58}$$

If the household sector's expenditure ratio is greater than unity then employment expands but the balanced budget effect on employment is negative. Parts of income are taken away from households, which spend in the current period in excess of their income, and are transferred to government with an expenditure ratio of unity. In this case a balanced budget dampens an employment expansion. Vice versa, if the household sector's expenditure ratio is below unity. In this case a balanced budget softens a employment contraction.

Figure 2 shows that if $\rho_{E\mathbf{H}} > 1$ there is a dampening effect on the right hand side of the intersection of the initial curve (51) and (57). On the left hand side of the intersection the balanced budget employment curve lies above the initial employment curve. Thus, the balanced budget dampens both the employment expansion or contraction that is brought about by the household sector's varying expenditure ratio. The magnitude of the dampening effect in both directions depends on the budget's volume. With a small volume the curves in Figure 2 almost coincide and the employment effects of the government's budget are negligible. The balanced budget operates as a built-in stabilizer that tends to keep employment close to the actual level. That is, it stabilizes full employment as well as unemployment. Expression (58) in combination with (57) is a generalization of the Haavelmo-Theorem.

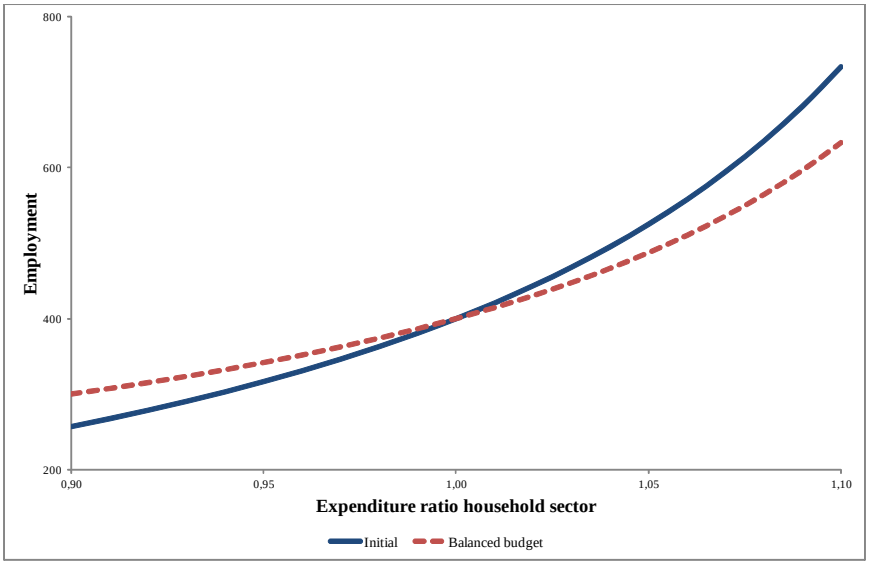

Figure 2: Balanced budget effect ($\rho_F = 0.8$)

It is well worth remarking that all budget effects may be counteracted by a simultaneous change of the factor cost ratio. The positive balanced budget effect on the left hand side of $\rho_{E\mathbf{H}}$=1 in Figure 2 for example may be annihilated by a price increase that lowers the numerical value of the factor cost ratio ρ_F in (57). A productivity increase works in the same manner (for details see 2011d). All this is quite obvious and the diverse employment effects have been enumerated in

Section 6.1. Supporting or counteracting variations of the other variables of (57) on employment are therefore not explicitly mentioned in the following.

If the household sector's expenditure ratio is unity, i.e. $\rho_{E\mathbf{H}} = 1$, a budget deficit, i.e. $\rho_{E\mathbf{B}} > 1$, boosts employment according to:

$$\text{deficit/surplus effect (i)} = \frac{1}{W}\left(C_{\mathbf{G}} - T_Y\right) \quad |t. \tag{59}$$

This effect is commonsensical.

Hitherto both sides of the government's budget have been assumed to be autonomous. Next, the income tax revenues T_Y are coupled to income via the income tax ratio ρ_T:

$$\begin{gathered} T_Y = \rho_T\left(WL + DN\right) = \rho_T W\left(L + \rho_V N\right) = \rho_T WL\left(1 + \rho_D\right) \\ \rho_T \text{ indep.} \quad |t. \end{gathered} \tag{60}$$

The budget effect in (55) then takes a new form:

$$\text{deficit/surplus effect (ii)} = \frac{C_{\mathbf{G}}}{W\rho_{E\mathbf{H}}} - \rho_T\left(L + \rho_V N\right) \quad |t. \tag{61}$$

When we start with an income tax ratio ρ_T that reduces the difference in (61) to zero then a subsequent increase of the tax ratio has a negative effect on employment. This, too, is commonsensical.

With (61) employment appears also on the right hand side of the employment equation (55). After solving for L it reads:

$$L = \frac{\overbrace{\rho_V N\left(1-\rho_T\right)}^{\text{budget effect}} + \overbrace{\dfrac{C_{\mathbf{G}}}{W\rho_{E\mathbf{H}}}}^{\text{budget effect}}}{\dfrac{1}{\rho_{E\mathbf{H}}\rho_F} - 1 + \underbrace{\rho_T}_{\text{budget effect}}} \quad \text{if} \quad \rho_X = 1 \quad |t. \tag{62}$$

The budget effect is no longer as plain as in (57). Equation (62) states, roughly speaking, that an isolated increase of the income tax ratio ρ_T reduces employment and that an isolated increase of autonomous government expenditures $C_{\mathbf{G}}$ boosts employment.

The household sector's expenditure ratio has been assumed to be equal for both the receivers of wage income and of distributed profit income. And the income tax ratio has been taken to be equal for both income categories. In the general case they need not be equal. The inclusion of these additional details makes the employment equation quite naturally more intricate. Here we are content with the structural axiomatic formalization of the basic effects.

6.3 Budget effects on profits

From the business sector's perspective the profit effects of the government's budget are clearly more important than the employment effects.

Profit has been defined with (4):

$$Q_{fi} \equiv C - WL = (PR - W)\,L \quad \text{if} \quad \rho_X = 1 \quad |t. \tag{63}$$

Together with (55) this yields for the simplest case, i.e. $\rho_{E\mathbf{H}} = 1$:

$$Q_{fi} = DN + (C_{\mathbf{G}} - T_Y) \quad |t. \tag{64}$$

Total profit of the business sector is equal to distributed profit if the budget is balanced. In this limiting case there is no difference to the pure consumption economy without government as given by (5). Total profit increases with a budget deficit and diminishes with a budget surplus. With steadily growing deficits in the mature economies (for an example see Samuelson and Nordhaus, 1998, p. 283, Fig. 16-1) the government sector has become a major source of profits from the 1970s onwards. The business sector therefore cannot have a genuine interest in budget balancing, not to speak of a reduction of public debt (for details see 2011a). The crucial question in this context is whether the business sector is viable at all without the deficit spending of the public sector. This depends also on the relation of investment and household sector saving (for details see 2011h) and on the relation of exports to imports. If both relations are unfavorable the government's deficit may become the sole source of profits. Equation (64) has some obvious consequences for the laissez-faire doctrine.

In the pure consumption economy with a household expenditure ratio different from unity one has as the general case:

$$\begin{aligned} Q_{fi} &\equiv \left(DN + \frac{C_{\mathbf{G}}}{\rho_{E\mathbf{H}}} - T_Y \right) \Phi \\ \text{with} \quad \Phi &\equiv \frac{\rho_{E\mathbf{H}} - 1}{\dfrac{1}{\rho_{E\mathbf{H}}\rho_F} - 1} + \rho_{E\mathbf{H}} \quad |t. \end{aligned} \tag{65}$$

The expression Φ brings about a profit increase if the household sector's expenditure ratio is greater that unity, i.e. $\rho_{E\mathbf{H}} > 1$, and vice versa, if it is below unity. This effect is somewhat counteracted by the budget effect that is given by the fraction of autonomous government expenditures $C_{\mathbf{G}}$ and the ratio $\rho_{E\mathbf{H}}$.

The business sector's overall profit ratio is finally given by:

$$\rho_Q \equiv \rho_{E\mathbf{H}}\,(1 + \rho_D) + \overbrace{\frac{C_{\mathbf{G}}}{WL}\left(1 - \frac{\rho_{E\mathbf{H}}}{\rho_{E\mathbf{G}}}\right)}^{\text{budget effect}} - 1 \quad |t. \tag{66}$$

If both the household sector's and the business sector's expenditure ratios are symmetrical we are back to (8) and there is no budget effect on the overall profit ratio. Given $\rho_{E\mathbf{H}} = 1$, the budget effect on profitability is positive if $\rho_{E\mathbf{G}} > 1$ and negative if $\rho_{E\mathbf{G}} < 1$, with the magnitude of the effect depending on the magnitude of autonomous government spending. Higher employment and a higher wage rate lessen the budget effect on the overall profit ratio. It is worth emphasizing that profit is not taxed at all. According to (60) only wages and distributed profits are taxed.

7 Conclusions

Behavioral assumptions, rational or otherwise, are not solid enough to be eligible as first principles of theoretical economics. Hence all endeavors to lay the formal foundation on a new site and at a deeper level actually need no further vindication. The present paper suggests three non-behavioral axioms as groundwork for the formal analysis of the effects of taxation and government spending.

The main results of the structural axiomatic inquiry are:

- In the pure consumption economy the overall profit ratio is positive if the expenditure ratio is > 1 or the distributed profit ratio is > 0, or both.
- In the zero profit economy the relative size of public production can be analytically traced back to the optimal split-up of the household sector's balanced budget between different consumption goods. The partitioning of expenditures determines the allocation of labor input. The relative size of the public sector in turn determines the income tax ratio. In the zero profit economy the switching between private and public production and vice versa is neutral in real terms.
- In an economy with positive profits and full profit distribution the switch from private to public production disrupts the self-sustaining interaction between profit and distributed profit. Although profit is not taxed at all it reduces to zero. In contradistinction to the zero profit economy the switch from private to public production is not neutral in real terms.
- The balanced budget operates as a built-in stabilizer that tends to keep employment at the actual level. That is, it stabilizes full employment as well as unemployment. The structural axiomatic approach provides a generalization of the Haavelmo-Theorem.
- Total profit of the business sector is equal to distributed profit if the private and public budget is balanced. In this limiting case there is no difference to the pure consumption economy without government. Total profit increases with a budget deficit and diminishes with a budget surplus. With steadily growing deficits in the mature economies the government sector has become a major source of profits.

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