

DISTRIBUTION AND GROWTH IN A MULTI-SECTOR OPEN ECONOMY WITH EXCESS CAPACITY

1. INTRODUCTION

As is well known, one of the key findings of post-Keynesian theory (à la Kalecki-Steindl) is that a redistribution of income from capitalists to workers (who have a higher propensity to consume) *may* imply a rise in the level of consumption, in effective demand, in the degree of capacity utilization, and by inducing firms to invest more, in the rate of capital accumulation and the rate of profits. Thus, first, the long-period relationship between the real wage rate and the growth (profit) rate is not always inverse and, second, a ‘bad income distribution’ can be a cause of stagnation (see e.g., Dutt, 1984, and 1987; see Commendatore *et al.*, 2003, for a survey on Keynesian theories of growth).

On the other hand, as is also well known, in systems of ‘production of commodities by means of commodities’ the traditional neoclassical statements concerning the relationships between the distribution of income, long-period commodity prices and technical conditions of production cease to be of general validity (Sraffa, 1960; see also Kurz and Salvadori, 1995, ch. 14). Thus a change in the real wage rate has ambiguous effects on the aggregate capital-capacity ratio.

This paper deals with a multi-sector open economy in which the desired rate of accumulation is an increasing function of both the degree of capacity utilization and the aggregate profit share¹. Thus the aggregate capital-capacity ratio enters into the determination of the equilibrium between investment and savings, and therefore the effects of a redistribution of income on the degree of capacity utilization, the profit rate and the growth rate are neither known *a priori* nor independent of the initial state of the economy.

¹ This specification of investment function is from to Marglin and Bhaduri, 1990, pp. 160-71. See also Bhaduri and Marglin, 1990, and Kurz, 1990, pp. 218-21.

Evidently this finding casts doubt on the reliability of income redistribution (from capitalists to workers *or vice versa*) as a macroeconomic policy concerned with removing stagnation.

The paper is organized as follows. Section 2 presents a basic model for a multi-sector open economy with generalized excess capacity of capital. In order to focus attention on the role of heterogeneous capital goods we employ certain extremely restrictive assumptions. Thus the exposition is more in the nature of an exercise, rather than the formulation of a complete framework. *Ceteris paribus*, Section 3 takes account of foreign capital and related interest flows. Section 4 concludes.

2. THE BASIC MODEL

Consider an open economy with excess capacity of *capital*, which produces many commodities by linear processes of single production. Labour is the only primary input and capital goods do not depreciate. All the commodities are dual purpose commodities in that they may be consumed or utilized as means of production. The economy may obtain dual purpose imported commodities from other countries; there are no competitive imports. The foreign currency prices of the imported commodities are independent of the volume of the economy's imports, whilst the economy's exports are exogenously given². There are only two classes, workers (employed in proportion to the level of production) and capitalists. All wages are spent on consumption, whilst a given and constant fraction of profits, $s(0 < s \leq 1)$, is saved. The growth of the economy is not constrained by the availability of labour. Both within each sector and between the sectors there is a *uniform* degree of capacity utilization, $u(0 < u \leq 1)$, which gives the ratio of actual output to potential output, where the latter is taken to be proportional to the capital stocks in existence³. Competitive conditions are taken to be close to free competition. This allows us to interpret the underutilization of productive capacity as caused essentially by an insufficient effective

² This assumption is overly strong. It may be assumed that the volume of exports is a decreasing function of their foreign currency prices. Nevertheless, the inclusion of demand functions for exports in the model would complicate the analysis without substantially changing its conclusion.

³ It goes without saying that modifications of this 'heroic' assumption would not alter the conclusion of our analysis.

demand (Kurz, 1995, pp. 96-7; see also Kurz, 1994, Sections 3 and 6). Finally, the desired rate of accumulation is an increasing function of both the degree of capacity utilization and the aggregate profit share. Finally, we ignore entirely questions of technical progress and questions of government expenditure and taxation⁴.

On the basis of these assumptions, we can write the following system of relations⁵:

$$p = (pA + efM)(r/u) + w\ell \quad (1)$$

$$pz_1 + efz_2 = 1 \quad (2)$$

$$X = AX(g^s/u) + cLz_1 + E, \quad L \equiv \ell X \quad (3)$$

$$\text{Im} = MX(g^s/u) + cLz_2 \quad (4)$$

$$B \equiv pE - ef\text{Im} \quad (5)$$

$$g^s = sr - b, \quad b \equiv B/K, \quad K \equiv (pA + efM)(X/u) \quad (6)$$

$$g^I = a_0 + a_1u + a_2h \quad (7)$$

$$h \equiv 1 - (wL/pX) = (vr)/u, \quad v \equiv (pA + efM)X/pX \quad (8)$$

$$g^I = g^s = g^* \quad (9)$$

$$(sh/v) > a_1 \quad (10)$$

where p denotes the price vector of domestically produced commodities, A, ℓ the input matrix and direct labour input vector for domestically produced commodities, M the input-output matrix of the imports (for a pure consumption import the corresponding row of M is null), e the nominal exchange rate, f the given vector of 'gold' import prices, r the uniform profit rate, w the uniform money wage rate, $z^T \equiv [z_1, z_2]$ a given vector representing the uniform consumption pattern (T is the sign for transpose), X the activity level vector, g^s the actual rate of capital accumulation, determined by the amount of savings, c the index of consumption per worker employed, L the volume of total employment, E (Im) the given vector (the vector) of commodities exported (imported), B the trade balance (measured in numeraire), K the value of capital stocks, g^I the desired rate of

⁴ See Kurz, 1990, pp. 226-35, and You and Dutt, 1996, respectively, for one-commodity models of a closed economy. See Dutt, 1984, pp. 37-8, and 1995, Taylor, 1985, and Blecker, 1989, for open economy considerations.

⁵ It is clear that this is a hybrid model which combines the main features of the Metcalfe and Steedman, 1981, and Kurz, 1994, models.

accumulation, h the aggregate profit share, v the aggregate capital-capacity ratio, and g^* the equilibrium rate of accumulation. Equation (2) fixes the numeraire. Hence w and e also symbolize the level of the real wage rate and the real exchange rate (i.e., the number of bundles of the numeraire which exchange for a unit of gold), respectively. Equation (7) defines a linear investment function (a_0, a_1, a_2 are given and positive constants). Equation (9) defines the commodities market equilibrium. Finally, relation (10) gives the short-run Keynesian stability condition for the $g^I - g^s$ equilibria (i.e., the total saving must increase by more than investment demand when u rises).

It is quite clear that the system has three degrees of freedom. From (1) and (2) we obtain

$$p = wa + e\beta \quad (11)$$

$$waz_1 + e(\beta z_1 + fz_2) = 1 \quad (12)$$

where

$$a \equiv \ell C(u, r), \quad C(u, r) \equiv [I - A(r/u)]^{-1} \quad (11a)$$

$$\beta \equiv (r/u)f MC(u, r) \quad (11b)$$

I is the identity matrix, the function $C(u, r)$ is homogeneous of degree zero, and each element in a and b is positive and increase with r/u , tending to infinity as r/u approaches its maximum feasible value, $r/u = 1/\lambda$ (λ is the Perron-Frobenius eigenvalue of A). Thus equation (12) defines a ' $w-e-(r/u)$ frontier' for this open economy, in which each variable is inversely related to each of the others⁶.

Furthermore, from equations (1) – (6) we obtain⁷

$$X = [I - A((sr - b)/u) - z_1\gamma]^{-1} E$$

or

$$X = M^x E \quad (13)$$

and

$$L = m^L E \quad (14)$$

where $M^x(m^L)$ is a matrix (vector) of 'super-multipliers' linking exports to gross output (to total employment), and

$$\gamma = w\delta + e\varepsilon \quad (13a)$$

⁶ See Metcalfe and Steedman, 1981, pp. 4-11 (where $u=1$ holds by construction), for a detailed examination of the equilibrium price structure of this open economy.

⁷ See also Metcalfe and Steedman, 1981, pp. 13-4, where $u=1$ and s denotes the uniform savings ratio.

$$\delta \equiv \ell + (1-s)a A(r/u) \quad (13b)$$

$$\varepsilon \equiv (1-s)(\beta A + f M)(r/u) \quad (13c)$$

Consequently, the aggregate capital-capacity ratio (see (8)) is a complicated expression involving w, e, b, u, r and technical conditions.

Finally, equations (6) – (9) yield the following relation between u, b and r :

$$r[s - (a_2 v/u)] = A_0 + a_1 u \quad (15)$$

where $A_0 \equiv a_0 + b \left(\begin{smallmatrix} \geq \\ < \end{smallmatrix} 0 \right)$.

Given w and e from outside the system, (11) and (12) determine a unique economically significant solution for $(p, r/u)$. Furthermore, if b is also given, (8), (13) and (15) yield a *multi-valued* (in the general case) function $r = r(u)$. Thus, given w, e and b , (8), (11) – (13) and (15) determine the equilibrium values of u and r . Nevertheless, nothing useful can be said, *a priori*, about, first, the shape of this multi-valued function and, second, the directions of change in v when w, e or b change. Therefore a complete analysis of this system is complex.

The point can be illustrated in terms of a *special* case of the present model. Assume that z_1 is the Perron-Frobenius eigenvector of A , normalized in such a way that $\ell z_1 = 1$, $E = z$ and $z_1 = 0$. Then⁸

$$w = 1 - (\lambda + ef M z_1)(r/u) = 1 - h \quad (16)$$

$$v = v_0 \equiv \lambda + ef M z_1 \quad (17)$$

$$L = u / (sref M z_1 + \lambda b), \quad (18)$$

whilst equation (15) takes the following form

$$r = u(A_0 + a_1 u) / (us - a_2 v_0) \quad (19)$$

Consequently, the equilibrium values of u and r are

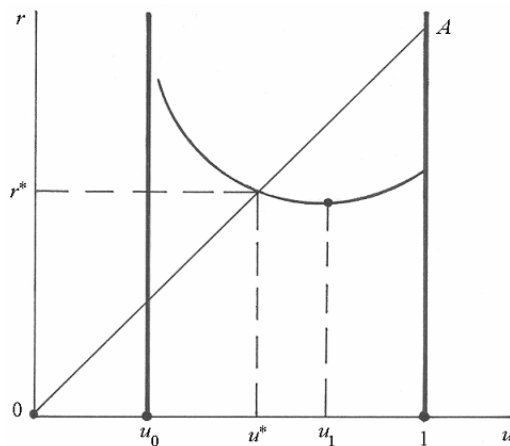
$$u^* = v_0 (A_0 + a_2 h) / (sh - a_1 v_0) \quad (20)$$

$$r^* = u^* h / v_0 \quad (21)$$

⁸ In this case the system is a quasi-one-commodity economy (i.e., a Charasoff – Sraffa quasi-Standard system; see Kurz and Salvadori, 1995, pp. 387-90) in the sense that the output, the domestically produced means of production and the real wages have the same composition. Therefore v depends only on technical conditions, e and f .

As is well known, according to the shape of the relationship between the equilibrium values of w , v and r we may determine certain sets of steady-state equilibria or 'growth regimes' (Kurz, 1990, pp. 213 and 222-6; see also Commendatore *et al.*, 2003, pp. 121-2). From (10), (16), (18), (20) and (21) it follows that there are three growth regimes: When $A_0 s > -a_1 a_2 v_0$, a rise in r implies a rise in u^* but has an ambiguous effect on r^* (See, e.g., Figure 1, where it is assumed that $A_0 \geq 0$). The straight line OA represents (16), the curve represents (19), $u_0 \equiv a_2 v_0 / s$ and u_1 denotes the positive root of the first derivative of the function (19). Finally, although $u_0 < u_1$ always holds, it is assumed that⁹ $u_1 < 1$. Thus, a rise in w , i.e., a clockwise rotation of the line OA, may involve a shift between different growth regimes). Moreover, if $b \geq (<) 0$, then a rise in w implies a rise in (has an ambiguous effect on) the equilibrium value of the total employment, L^* . Finally, when $A_0 s < -a_1 a_2 v_0$, a rise in w implies a fall in u^* , a fall in r^* and a rise in¹⁰ L^* .

FIGURE 1



⁹ It may be noted that u_1 is a strictly increasing (decreasing) function of A_0, a_2 and v_0 (of a_1 and v).

¹⁰ From $A_0 s = -a_1 a_2 v_0$, (8) and (19) it follows that $sh = a_1 v_0$ which contradicts condition (10). Thus there is a critical value of b at which the relation between w and u^* switches from being positive to being negative. Note that Blecker, 1989, p. 400, determines a critical value (of the ratio of trade balance to national income) at which the relation between w and r^* switches from being positive to being negative. Blecker's model includes a linear investment function à la Steindl-Rowthorn, i.e., $g^I = a_0 + a_1 u + a_2 r$, and therefore there is *not* a growth regime in which a rise in w implies a rise in u^* and a fall in r^* .

Now return to the *general* case. Equation (12) continues to be represented in the (u, r) plane by a straight line. Also, a rise in w (or in e) continues to imply a clockwise rotation of the said line. Furthermore, given w, e and b , it is not possible to make any *a priori* prediction concerning the shape of the curve which represents (15). Finally, a change in w (or in e) has ambiguous effects on this curve¹¹. Consequently, nothing rules out, first, the existence of multiple equilibria and, second, the ‘reswitching’ of growth regimes. Therefore, no generally valid statement about the consequences a changing w (or e) has for the equilibrium values of u , r , g and L can be made. Clearly, the complexity of a multi-sector system is due, in the final analysis, to the fact that the aggregate capital-capacity ratio is not given independent of, and prior to, the determination of prices, distribution and growth¹².

3. TRADE BALANCE, FOREIGN LENDING, DISTRIBUTION AND GROWTH

In the previous analysis we ignored the fact that a non-zero trade surplus corresponds to changes in the stock of net external wealth owned by domestic residents and hence to changes in the flow of profit income related to external assets.

Ceteris paribus, assume that, first, the domestic and ‘world’ rates of inflation are equal to zero, second, the ‘basic balance’ (i.e., the trade balance plus the net inflow of interest income on net external assets minus the net outflow of foreign lending) is zero, third, the savings ratio out of profits, s , applies to domestically generated profits plus net foreign income, and, fourth, the desired rate of accumulation depends positively on the ratio of inflow of income on net holdings of foreign assets (bonds) to value of the domestic

¹¹ *Ceteris paribus*, a linear investment function à la Steindl-Rowthorn implies that v does not enter into the determination of u^* and r^* . Thus a rise in w has either positive or negative effects on u^* and r^* , i.e., the system behaves as a one-commodity economy à la Blecker, 1989, p. 400.

¹² *Ceteris paribus*, consider a closed economy. Then, first, v depends on technical conditions and r/u , whilst $v = v(r/u)$ is a *single-valued* function, second, a change in r/u has ambiguous effects on v , third, h is a strictly increasing function of r/u (see Franke, 1999, pp. 46-9, where $u=1$) and, fourth, equation (15) yields a multi-valued (in the general case) function $r = r(u)$ (see Mariolis, 2004, pp. 170-7, for a detailed examination). Consequently, although the existence of multiple equilibria is impossible, the main point of our argument continues to be valid.

capital stocks¹³. Then (6) and (7) become

$$g^s = sr - b - iz(1 - s) \quad (6a)$$

$$g^l = a_0 + a_1u + a_2h + a_3iz, \quad g^l > 0 \text{ for } r > i \quad (7a)$$

where $z \equiv Z/K$, $z > -1$, Z denotes the net foreign bond holdings (assets minus liabilities), i the given rate of interest and a_3 a given and positive constant.

The short-run equilibrium is defined as one in which z is exogenously given. In the first instance consider a quasi-one-commodity economy (see (16) and (17)). Setting g^s equal to g^l yields

$$u = v_0 (A_0 + a_2h + A_3iz) / (sh - a_1v_0) \quad (22)$$

where $A_3 \equiv a_3 + 1 - s$. Consequently, a rise in i has either positive (when $z > 0$) or negative (when $z < 0$) effects on u, r and g^s . Nevertheless, in a multi-sector system the aggregate capital-capacity ratio depends on u, r and g^s , whilst g^s is related to r and to i by (6a). Hence the effects of a change in i (or in w) are unknown *a priori*.

Finally, the long-run equilibrium is defined as one in which z remains constant over time.

Let a dot indicate the first derivative with respect to time. Since $\dot{Z} = B + iZ$, it follows that

$$\dot{z} = b - (g^s - i)z \quad (23)$$

In the first instance consider a quasi-one-commodity economy. From (7a), (22) and (23) we obtain the equation of motion for z :

$$\dot{z} = b + C_1z + C_2z^2 \quad (24)$$

where

$$C_1 \equiv i - a_0 - a_2h - [a_1v_0 (A_0 + a_2h) / (sh - a_1v_0)] \quad (24a)$$

and

$$C_2 \equiv -a_3i - [v_0A_3a_1i / (sh - a_1v_0)] \quad (24b)$$

When $b > 0$, the solutions of the equation $\dot{z} = 0$ have opposite signs. The positive solution, z^* , is the unique stable fixed point.

¹³ See Metcalfe and Steedman, 1979, for a detailed examination of these assumptions.

However, even if this is the case, the effects of a variation in w (i or b) on¹⁴ z^* and therefore on u^*, r^*, g^* and L^* are vague.

In a world of heterogeneous capital, a redistribution of income influences C_1 and C_2 by changing not only r/u but also the aggregate capital-capacity ratio. Hence there is a further source of ambiguity.

4. CONCLUSION

It has been shown that in a simple model for a multi-sector open economy with excess capacity the interaction between distribution and growth of income is a particularly complex phenomenon. The reason for this is that the aggregate capital-capacity ratio cannot be treated as a datum.

To the extent that the ‘different political ideologies regarding the management of the capitalist economy’ (Bhaduri and Marglin, 1990) are based, explicitly or otherwise, on one-commodity models, their suggestions cannot generally be sustained.

THEODORE MARIOLIS

Panteion University and Social and Political Sciences, Department of Public Administration, Athens, Greece

REFERENCES

- Bhaduri, A. and S. Marglin (1990), “Unemployment and the Real Wage Rate: The Economic Basis for Contesting Political Ideologies”, *Cambridge Journal of Economics*, vol. 14, 375-393.
- Blecker, R.A. (1989), “International Competition, Income Distribution and Economic Growth”, *Cambridge Journal of Economics*, vol. 13, 395-412.
- Commendatore, P., S. D’Acunto, C. Panico and A. Pinto (2003), “Keynesian Theories of Growth”, pp. 103-138 in N. Salvadori (ed.), *The Theory of Economic Growth*, A ‘Classical’ Perspective, Cheltenham, Edward Elgar.

¹⁴ It can be seen that z^* is positively related to b, C_1 and C_2 . Moreover, from (24) we get

$$\begin{aligned} dz^*/dw &> 0 \text{ if } a_2 h(sh - 2a_1 v_0) > a_1 v_0 (A_0 + A_3 i z^*) \\ dz^*/di &> 0 \text{ if } (sh/a_1 v_0)(1 - a_3 z^*) > 1 + z^*(1 - s) \\ dz^*/db &> 0 \text{ if } (sh/a_1 v_0) > 1 + z^* \end{aligned}$$

- Dutt, A.K. (1984), "Stagnation, Income Distribution and Monopoly Power", *Cambridge Journal of Economics*, vol. 8, 25-40.
- Dutt, A.K. (1987), "Alternative Closures Again: A Comment on 'Growth, Distribution And Inflation' ", *Cambridge Journal of Economics*, vol. 11, 75-82.
- Dutt, A.K. (1995), "Interest Rate Policy, Growth and Distribution in an Open Less-Developed Economy: A Theoretical Analysis", pp. 3-26 in P. Arestis and V. Chich (eds), *Finance, Development and Structural Change*, Aldershot, Edward Elgar.
- Franke, R. (1999), "Technical Change and a Falling Wage Share if Profits are Maintained", *Metroeconomica*, vol. 50, 35-53.
- Kurz, H.D. (1990), "Technical Change, Growth and Distribution: A Steady-State Approach to 'Unsteady' Growth", pp. 211-239 in H.D. Kurz, *Capital, Distribution and Effective Demand. Studies in the 'Classical' Approach to Economic Theory*, Cambridge, Polity Press.
- Kurz, H.D. (1994), "Growth and Distribution", *Review of Political Economy*, vol. 6, 393-420.
- Kurz, H.D. (1995), "The Keynesian Project: Tom Asimakopoulos and the 'Other Point of View'", pp. 83-110 in G.C. Harcourt, A. Roncaglia and R. Rowley (eds), *Income and Employment in Theory and Practice: Essays in memory of Athanasios Asimakopoulos*, New York, St. Martin's Press.
- Kurz, H.D. and N. Salvadori (1995), *Theory of Production: A Long-Period Analysis*, Cambridge, Cambridge University Press.
- Marglin, S.A. and A. Bhaduri (1990), "Profit Squeeze and Keynesian Theory", pp. 152-186 in S.A. Marglin and J.B. Schor (eds), *The Golden Age of Capitalism: Reinterpreting the Postwar Experience*, Oxford, Clarendon Press.
- Mariolis, T. (2004), "Distribution, Accumulation and Interest Rates in a Post-Keynesian Model: A Sraffian note", pp. 164-195 in K. Sham Bhat (ed.), *Issues in Financial Development*, New Delhi, Serials Publications.
- Metcalf, J.S. and I. Steedman (1979), "Growth and Distribution in an Open Economy", pp. 201-227 in I. Steedman (ed.), *Fundamental Issues in Trade Theory*, London, Macmillan.
- Metcalf, J.S. and I. Steedman (1981), "Some Long-Run Theory of Employment, Income Distribution and the Exchange Rate", *The Manchester School*, vol. 49, 1-20.
- Sraffa, P. (1960), *Production of Commodities by Means of Commodities*, Cambridge, Cambridge University Press.
- Taylor, L. (1985), "A Stagnationist Model of Economic Growth", *Cambridge Journal of Economics*, vol. 9, 383-403.
- You, J.-I. and A.K. Dutt (1996), "Government Debt, Income Distribution and Growth", *Cambridge Journal of Economics*, vol. 20, 335-351.

ABSTRACT

This paper deals with a multi-sector open economy in which the desired rate of accumulation is an increasing function of both the degree of capacity utilization and the aggregate profit share. It is shown that nothing can be said *a priori* about the long-period relationship between the real wage rate (or the real exchange rate), the degree of capacity utilization, the profit rate and the growth rate. In the final analysis this is due to the fact that, in a world of heterogeneous capital goods, the aggregate capital-capacity ratio can change in an apparently complicated way as the real wage changes.

Keywords: Aggregate capital-capacity ratio, Capacity utilization, Investment demand function, Post-Keynesian theory, Sraffian theory

JEL Classification: D57, E11, E12, F43

RIASSUNTO

*Distribuzione e crescita in un modello di economia aperta
caratterizzato da molti settori con eccesso di capacità*

Questo lavoro tratta di un'economia aperta con molti settori in cui il tasso desiderato di accumulazione del capitale è una funzione crescente sia del grado di utilizzazione del capitale sia dei profitti. Si dimostra come non si possa dire nulla *a priori* sulla relazione di lungo periodo tra il tasso salariale reale (o il tasso di cambio reale), il grado di utilizzazione della capacità, il tasso di profitti e il tasso di crescita. Nell'analisi finale ciò è dovuto al fatto che, in un mondo caratterizzato da beni capitali eterogenei, il rapporto tra il capitale e la capacità può modificarsi in modo estremamente complicato al cambiare del tasso salariale reale.