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Procrustean Beds for Adam Smith

by

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Elsewhere we constructed a Smithian balanced growth model to explain that the ratio of the natural, not market, wage to the subsistence wage is equal to the rate of growth of the labor population, which is equal to the rate of growth of output, and that an increase in the rate of saving increases the rate of growth but decreases the natural rate of profit (Negishi, 1988, 1989, pp. 83-89). We believe it is useful to translate what great economists in the past grasped intuitively into formal models to confirm their conclusions logically. Translation is, however, treason. There always exist a danger to cut or stretch a past theory in a Procrustean bed of modern theory. We have to admit that our model may be a Procrustean bed for Smith. The aim of this note is to compare our bed with other beds prepared for Smith by other modern economists to show that it is not necessarily a less uncomfortable bed for Smith than other beds and to modify and adjust it so that it becomes more comfortable for Smith.

Perhaps it should be emphasized that we are interested in Smith's system of natural, not market, prices in a growing economy. Natural prices are equilibrium prices which are realized when suppliers (or demanders) expect demands (supplies) correctly so that ex ante supplies are equal to ex ante demands, while unequal ex ante demands and supplies are

equalized ex post by some changes in market prices. Our general impression is that the distinction between natural and market prices is not well recognized in the recent literature on Adam Smith, as will be seen in the below.

In section (2) our Smithian growth model is sketched. Section (3) is devoted to Hicks's model of Adam Smith, which we critically discuss in section (4). Eltis's model is commented in section (5), while approaches of Samuelson and Reid are reviewed in section (6). Finally, in section (7), we shall modify our model of section (2) so that the effect of the division of labor on labor productivity is taken into consideration.

Let us sketch our Smithian growth model. Suppose that the period necessary for the reproduction of labor (power) in laborers' households is identical to the period of production of labor products and that a unit of labor must be expended one period before to produce one unit of product and one unit of labor product must be consumed in households one period before to produce one unit of labor. Capitalists are assumed to use e of their stock of products to employ labor in the production and consume (1 - e) of the stock of products in their households. In other words, the rate of (gross) saving of capitalists is e while laborers are assumed not to save, and the existence of unproductive labor is assumed away.

Denote the capitalists' aggregate stock of the product at time t by X(t) and the labor population at time t by L(t). Then, from definitions of coefficients a and e, we have

(1) $eX(t) = L(t+1)$

and

(2) $L(t) = aX(t+1).$

To consider a balanced growth solution of our model (1) and (2) in which both X(t) and L(t) grow at the common rate of g, substitute $X(t+1) = (1+g)X(t)$ and $L(t+1) = (1+g)L(t)$ into (1) and (2). It can be easily seen that the rate of growth g and the given coefficients must satisfy the condition

(3) $a(1+g)^2 = e$

Particularly, the given coefficients must satisfy the condition $e > a$ to assure the positive rate of growth. The rate of growth

g is higher, if the rate of saving e and the labor productivity 1/a are higher.

Since equilibrium relative prices remain unchanged through time on such a balanced growth path of the economy, let us denote the natural price of the product by p and the natural rate of wage by w. According to Smith, then,

(4) $p = (1+r)aw$

and

(5) $w = (1+s)p$

where r is the natural rate of profit, and r and s are assumed to be positive if g is positive. In other words, the natural price of the product is the sum of the wage $\underline{aw}$ and profit $\underline{raw}$ at their natural rates, since we assumed away the land rent, and in a growing economy the natural rate of wage is higher than the subsistence wage $\underline{p}$, which is the wage at the natural rate in a stationary economy. From (4) and (5), it can be easily seen that

(6) $1 = (1+s)(1+r)a$

must be satisfied by s and r.

From the definition of e,

(7) $wL(t) = epX(t).$

By substituting $L(t+1) = (1+g)L(t)$ and (7) into (1), we have

(8) $w = (1+g)p$

Smith's assumption that s is positive when g is positive is justified, therefore, in the balanced growth path of our model, since $s = g$ from (5) and (8). Similarly, by substituting $X(t+1) = (1+g)X(t)$ and (7) into (2), we have

(9) $ep = (1+g)aw.$

As Smith assumed, therefore, r is higher if g is higher (with

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unchanged e), since (4) and (9) imply that

$$(10) \qquad e(1+r) = (1+g).$$

In view of the fact that s = g, then, both s and r can be higher, if g is higher, provided that the rate of saving e remains constant. In other words, the coexistence of high profit and high real wage is possible, if the labor productivity 1/a is high so that the rate of growth is high.

If the rate of saving e is increased, there is an increase in the rate of growth g, as is seen in (3). This increases s and real wage w/p in (5), since s = g as we saw in the above. The increased s implies that the rate of profit r decreases from (6). As far as the balanced growth path is concerned, therefore, the analysis of our Smithian growth model confirms Smith's theory of the falling rate of profit caused by the capital accumulation, which, unlike Ricardo's, does not require the falling productivity of labor through diminishing returns to scale.

Let us start with Hicks's " formal Smith model " (Hicks, 1965, pp. 36-42).

Let X_{t-1} be last year's output of corn ; let w be the given wage ; the number of labourers employed will then equal X_{t-1}/w. If p is labour productivity, this year's output will be pX_{t-1}/w ; so that $X_t = (p/w)x_{t-1}$ (Hicks, 1965, p.37).

One of the troubles that we create for ourselves if we insist on interpretation as a regularly progressive economy relates to the real wage w. - - - - the employment of labour must continuously expand ; but where is the additional labour to come from ? Smith was writing before Malthus ; though he often writes in such a way as to lead one to attribute to him some foretaste of a Malthusian theory, it is dangerous to press that interpretation too far. It was, however, usual among eighteen-century writers to assume the existence of a reserve of labour which could be called into employment if there was a demand for its services ; - - - - But the amount of labour that would be available in this way would always be limited. There are plenty of passages in which Smith makes it clear that accumulation of capital (expansion of the wage fund) is taken to increase the real wage of labour ; presumably because it creates a labour shortage. It follows from the model that this rise in wages will diminish the rate of growth. I do not think that Smith would, or could, have rejected this conclusion ; if he does not stress it, there is a clear

reason for that. This is his conviction that it is not only w that would rise, if the force of the expansion were strong enough, but also p ; the productivity of labour would increase in the course of expansion, since the division of labour would call forth increasing returns (Hicks, 1965, pp. 39-40).

There is of course no difficulty if we are assuming a regularly progressive economy. The initial position is then taken to be adjusted to the needs of the economy, and the final position must be the same as the initial proportion. But if data are changing from period to period, then the choice of final proportions must depend, even in a circulating capital model, upon the conditions that are expected to rule in the future periods, or at least in the next period. Expectations which may be wrong, or right! (Hicks, 1965, p.41).

From our point of view, there are three problems, i.e., (1) the supply of labor, (2) divisions of labor, and (3) natural and market prices, to be considered with respect to Hicks's arguments cited in section (3).

With his view on the supply of labor shown in the second quotation in section (3), it is evident that he had the market rate of wage in mind rather than the natural rate of wage. To defend our own view on the supply of labor, which is given in our model shown in section (2), it is sufficient to see the following quotations from Smith.

The most decisive mark of the prosperity of any country is the increase of the number of its inhabitants. - - - - In the British colonies in North America, it has been found, that they double in twenty or five-and-twenty years. Nor in the present times is this increase principally owing to the continual importation of new inhabitants, but to the great multiplication of the species. - - - - Labour is there so well rewarded that a numerous family of children, instead of being a burden is a source of opulence and prosperity to the parents. - - - The value of children is the greatest of all encouragements to marriage (Smith, 1776, pp. 87-88).

If this demand is continually increasing, the reward of labour must necessarily encourage in such a manner the marriage and multiplication of labourers, as may enable them to supply that

continually increasing demand by a continually increasing population. - - - - - The market would be so much under-stocked with labour in the one case, and so much over-stocked in the other, as wood soon force back its price to that proper rate which the circumstances of the society required. It is in this manner that the demand for men, like that for any other commodity, necessarily regulates the production of men; quickens it when it goes on too slowly, and stops it when it advances too fast (Smith, 1776, p.98).

The natural rate of the wage is "that proper rate." Clearly Smith argued that high natural wage in a growing economy makes the production and supply of labor large enough so that supply can be equalized to the increased demand. This is a different story from the high market wage in "a labor shortage" caused by "expansion of the wage fund."

Hicks seems to admit the possibility of a balanced growth with the natural prices in the third quotation in section (3) but insisted that expectations may be wrong when " data are changing from period to period." Certainly, a balanced growth may not be possible when "date are changing from period to period," owing to the effect of the division of labor on productivity. Is it still possible to have a system of natural prices ? We shall consider this problem in section (7) below.

Eltis (1975) discussed " - - - the assumptions about - - - - wages that are appropriate to a modern restatement of Smith's theory of growth" (p. 440). He pointed out that "Smith has Malthus-type arguments, - - - , to show that population will expand with the demand for labour " (p. 437) and quoted from Smith the last part of the second quotation we made in section (4). He showed Smith's theory of wages in his figure " where the wage at different rates of growth of circulating capital is shown by the [upward sloping] schedule WW. Where there is no growth of capital, the wage is oW_s, Malthus's 'natural' or 'subsistence' wage, and it will exceed this if capital is growing - - - , and fall short of it if capital is declining - - - " (p. 437).

It is not clear whether Eltis recognized that Smith's natural, not market, rate of wage is higher in a growing than the subsistence wage, since he continued as follows.

However, the view that wages will reach the level appropriate to the rate of accumulation and then rise no further is only correct if - - - qualification are made. - - - it must be possible for employment and population to grow fast enough to prevent a continuous rise in wages. This is evidently not always possible (Eltis, 1975, p. 438).

Then he made following quotation from Smith.

Notwithstanding the great increasing occasioned by such early marriages, there is a continual complaint of the scarcity of hands in North America. The demand for labourers, the funds destined for maintaining them, increase, it seems, still faster than they can find labourers to employ (Smith, 1776, p. 88).

It is evident that the market, not the natural, wage which rises in this situation of excess demand for labor. It seems that for Eltis there is no distinction made between natural and market rates of wage, since no mention was made of Smith's natural wage while only Malthus's natural wage was mentioned.

Eltis then proceeded to consider "the long-term rates of growth."

Then the rate of growth of circulating capital determines the rates of growth of output, population, and wage and raw material costs per head, and a faster rate of capital accumulation will produce faster long-term rates of growth of each of these. - - - - - - To complete the model, what determines k_c, the rate of growth of circulating capital, must be set out. This has been worked out for a circulating capital model of the kind outlined here by Sir John Hicks, and his equation - - - shows that the rate of growth of circulating capital depends on q. the proportion of the labour force employed productively, and on the ratio of output per productive worker, Y/L_p to W, the cost of employing a worker, and this clearly corresponds to Smith's own argument (Eltis, 1975, p. 443).

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It is, however, impossible " to complete the model," since the value of W is not given. What we can know from Adam Smith's assumptions (Eltis, p. 428) is that it is higher than the subsistence level if k_0 is positive. No further relation between them (e.g., the relation like s = g in section (2)) is not yet obtained in Eltis's model. As a matter of fact, what Eltis could was only to argue that "the rate of capital accumulation will grow if (Y/L_p)/W grows " (Eltis, 1975, p. 444). He could not "determines k_0." He could only determine the rate of change of k_0. Since Eltis emphasized the importance of increasing returns due to the division of labor, furthermore, generally it is impossible to have a balanced growth of outputs and labor, nor is it possible to have "long-term rates of growth " remain unchanged over time, as was pointed out by Reid (1987). Nevertheless, Eltis was right to point out that "Smith has Malthus-type arguments " against Hicks and that the level, not the rate of change, of wage depends on the rate of accumulation of capital. As for the increasing returns due to the division of labor, we shall consider in section (7) below.

Samuelson, who was very critical in his mathematical reformulation of economics of Ricardo and Marx, vindicated Adam Smith strongly in a similar reformulation (1977) of economics of The Wealth of Nations. According to Samuelson, Smith is vindicated as less guilty than Ricardo and Marx of believing in a rigid subsistence wage in the short-run and Smith's transient rise in wage rates is a credit to his models of realism. In Samuelson's mathematical model, this is considered as Smith's Malthusian relation in which the market wage deviates from the subsistence level. As for the market wage, however, even Ricardo did acknowledge it clearly (Ricardo, 1818, pp. 94-95). What distinguishes Smith from Ricardo and Marx is that Smith considers not the market rate but the natural rate of wage as well as natural rate of profit higher in a growing economy than in the stationary economy. Unfortunately, this important fact was not recognized by Samuelson.

Samuelson emphasized the role of scarce land and considered natural prices only in the case of a long-run stationary equilibrium where the real wage is at the subsistence level and the rate of profit is exogenously given at such a low rate that there is no accumulation of capital. In other words, von Neumann balanced growth is considered with respect only to an economy where land is still redundant. It is called Smith's cheerful transient state of growth, which soon begins to decelerate since the land fills up and the law of diminishing returns on fixed land operates.

We might argue against this as follows (Negishi, 1989, p. 88). The labor productivity (i.e., 1/a in (2) in section (2) above) may remain unchanged in economic growth even if land is scarce, since diminishing productivity due to land is counterbalanced with increasing productivity due to the division of labor which is conditioned by an enlarging extent of the market. In this case, X(t) in our model explained in section (2) is defined as the stock of goods owned by capitalists, and land owners are assumed to consume all the rent income. In the figure, the labor population L(t) is measured horizontally, and its marginal productivity MPL is, vertically. When the labor population L(t) is OH, the relevant MPL curve is AB. A part of output OEFH is distributed to capitalists who advanced wages to labor, i.e., OEFH = X(t+1) = (1/a)(OH) and the rest of output AEF is distributed to landowners. When the labor population grows to 01, MPL curve is shifted to CD, since division of labor is furthered by the enlarged extent of the market. A part of output OEGI is distributed to capitalists as X(t+1), i.e., OEGI = (1/a)(01) and the rest of output CEG is distributed to landowners. Diminishing returns and increasing returns are balanced so that the marginal productivity 1/a remains unchanged at OE.

Perhaps most ambitious approach to Smith is that of Reid who insists that

an essential aspect of growth as analyzed by Smith, is that it progresses at a rate which is neither uniform over time nor uniform across sectors of the economy. Smith's is a

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disequilibrium form of growth, deriven by the increasing returns which are consequential on the division of labor (Reid, 1987, p. 87).

In the sort of disequilibrium situations that are being contemplated in this article, markets may not be cleared, actual and desired levels of inventories may not coincide, and short-period expectations may not be fulfilled (Reid, 1987, p. 88).

It is evident that Reid is concerned with the disequilibrium process in which market prices fluctuate so as to bear the consequences of unfilled expectations. Being the last to deny the importance of such studies, however, we would still like to stick to an equilibrium process governed by natural prices, even though it is only a small part of Smith's system of economics where growth is " deriven by the increasing returns which are consequential on the division of labor. " Certainly, as Hicks argued, expectations " may be wrong, or right " (1965, p. 41). Like modern rational expectationists, then, Smith is perfectly entitled to assume that expectations, are fulfilled and to consider the system of natural prices of economic growth caused by the division of labor.

Let us modify our model given in section (2), by assuming that the labor productivity 1/a is an increasing function of the level of output X(t) so that the rate of growth of output and that of labor population are no longer identical each other and each changes over time. Let us, however, assume that expectations are fulfilled and consider the system of natural prices.

While (1) in section (2) remains unchanged,

(1)   eX(t) = L(t+1)

(2) should be replaced by

(11)   L(t) = a[X(t)] X(t+1),

where a is a decreasing function of X(t), since the division of labor which increases the labor productivity is limited by the extent of the market (Smith, 1776, p. 31). The rate of growth of output g and the rate of growth of population h are respectively defined by

(12)   X(t+1) = [1+g(t)]X(t)

(13)   L(t+1) = [1+h(t)]L(t).

By the substitution of (12) and (13) into (1) and (11), we have

(14)   a[X(t)][1+g(t)][(1+h(t))] = e

instead of (3) in section (2).

    Instead of (4) and (5) in section (2), we now have

(15)   p(t+1) = [1 + r(t)][a[X(t)] w(t)]

(16)   w(t)   = [1+s(t)]p(t)

as the price cost equation and the wage equation. The rate of
inflation m is defined by

(17)   p(t+1) = [1 + m(t)] p(t).

If we define the real natural rate of profit R(t) as

(18)   1+R(t) = [1+r(t)]/[1+m(t)]

and the real natural wage W(t) as

(19)   W(t) = w(t)/p(t),

(15) and (16) are rewritten as

(20)   1 = [1+R(t)]a[X(t)]W(t)

(21)   W(t) = [1+s(t)]

in view of (17).

    From the definition of e,

(22) $p(t)eX(t) = w(t)L(t)$

instead of (7) in section (2). By substituting (11) and (12) into (22), we have

(23) $e = [1+g(t)]a[X(t)]W(t)$

from which we can see that

(24) $e[1+R(t)] = [1+g(t)]$

in view of (20), as in (10) in section (2) above. Similarly, by the substitution of (1) and (13) into (22), we have

(25) $W(t) = [1+h(t)]$

from which we see that $s(t) = h(t)$ in view of (21).

The model is completed since we are given $X(t)$ and $L(t)$ to determine seven unknowns $X(t+1)$, $L(t+1)$, $g(t)$, $h(t)$, $W(t)$, $R(t)$ and $s(t)$ from the seven equations (1), (11), (12), (13), (20), (21) and (22).

Unlike as in section (2), we cannot have $g(t) = h(t)$, though we have $e[1+R(t)] = [1+g(t)]$ and $h(t) = s(t)$ as was seen in the above. Since expectations are realized in the system of natural prices, however, we have also

(22)' $p(t+1)eX(t+1) = w(t+1)L(t+1)$

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(25)' $w(t+1) = [1+h(t+1)]$

from which we have $g(t) = h(t+1)$, in view of (1).

Even though the growth is not balanced, and the rates of growth are not unchanged over time, still we can say that the ratio of real natural wage over the subsistence wage is equal to the rate of growth of labor population and the real rate of profit is higher if the rate of growth of output is higher (with unchanged rate of saving e).

As for the effect of changes in e, given $X(t)$ and $L(t)$, an increase in e increases $W(t)$ from (22). It also increases $h(t)$, since otherwise $W(t)$ is reduced from (21) through the reduction of $s(t) = h(t)$. Then, in view of (20) and (21), $R(t)$ is reduced. Even if the growth is not balanced, therefore, the analysis of our modified, Smithian growth model confirms Smith's theory of the falling rate of profit caused by the capital accumulation.

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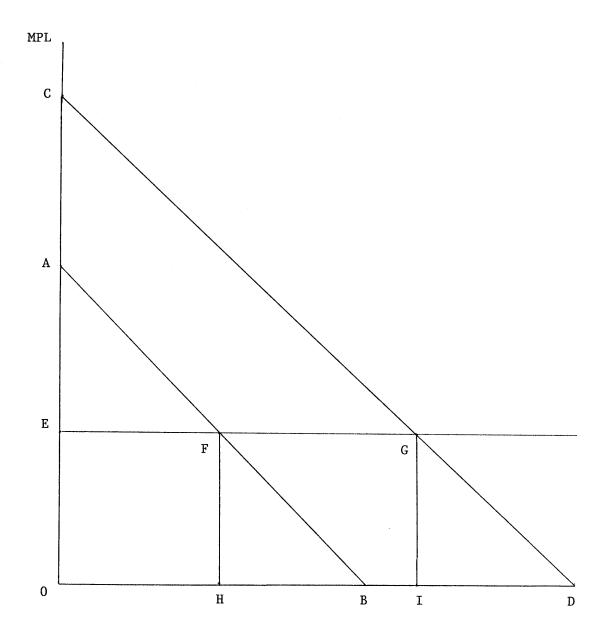
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