

Marxism and Post-Keynesian Economics

Joseph Halevi*

Introduction

The thesis presented here runs as follows: Post-Keynesian economics has contributed to identify within the framework of the theory of effective demand, the conditions of sectoral disproportionalities on which a significant part of Marxian theories of accumulation and crisis are based. This happened not as a result of an explicit dialogue with the Marxian debates about sectoral proportions, but as a consequence of the analytical evolution of Post-Keynesian theories. In order to evince the connection between the Post-Keynesian theory of growth and distribution and the Marxian approach to the question of disproportionalities, it is necessary to accept the basic Kaldorian hypothesis concerning the level of development of the stock of capital relatively to total population, then it is necessary to reject the Kaldorian adjustment mechanism in favour of Hicks's disequilibrium Traverse (Hicks, 1965, 1985; Kaldor, 1956, 1957). From the above it follows that I view Kaldor's and Hicks's contributions to growth theory as the central analytical core of Post-Keynesian economics. In fact, it will become apparent that the conceptual range of validity of Hicks's structural disequilibrium falls within Kaldor's hypothesis about the level of development of the stock of capital in a mature economy.

The guiding concept underlying this paper is the Marxian notion of *degree of development of the productive forces*. This notion refers to the technical and material basis characterising production in different modes of production (eg. capitalism as opposed to feudalism), as well as in the different phases within a given mode of production. In this context, Kaldor's characterisation of the level of development of the stock of capital in a mature, hence Keynesian, economy represents an expansion of the Marxian concept applicable to a particular stage of the evolution of the capitalist system, not necessarily envisaged by Marx.

The Marxian Story: Marx

In Marx there are a number of theories of cycles and crises. For the purposes of this paper I will single out two of them: cyclical accumulation, and sectoral imbalances.

The first is very well known and needs only a brief summary. Capitalist accumulation is driven by the creation of surplus value under competitive conditions, the latter means that the system tends, through periodic fluctuations, to move towards a uniform rate of profit. For Marx, the technical basis of capitalist production is such that its capacity to accumulate will invariably expand at a greater rate than the natural increase in the supply of labour. Hence, accumulation requires an endogenous creation of a reserve army of workers, even when the possibilities to draw labour from non fully capitalistic sectors have run out. Consequently, the mechanism which regulates accumulation and, with it, the formation of the labour force, has to be found in the link between variations in the rate of accumulation and in the distribution of income. It is easier at this point to assume that no wages and all profits are saved. Under full capacity conditions, a one to one relation is established between changes in the rate of profit (= to the rate of growth) and changes in the share of profits over total output for any given set of techniques of production. Whenever the rate of accumulation is high and sustained enough as to lead to an exhaustion of the reserve army, real wages will rise reducing the rate of profit, the rate of accumulation and the share of profit (= to the share of investment) over total output.

In these circumstances capitalists, because of classical competition, will attempt to change the technical basis of production through labour saving investment, which Marx assumed also to be capital augmenting. In the short run, labour saving investment in a situation of a much reduced rate of profit, will cause an increase in the reserve army and a downward pressure on the real wage. The share of profits rises again setting the stage for a recovery in the rate of profit. In fact all the surplus is automatically invested, which leads - after a certain amount of time - to a recovery in accumulation on an enlarged technical basis. It is precisely in the interim period that the crisis manifests itself in full through the bankruptcies of those firms which were unable to reduce their costs of production, which, in Marx, means that they were unable to pay their debts. Yet this crisis contains the seeds for its solution, since widespread bankruptcies imply the creation of a large mass of unemployed people with negative impact on real wages and a positive one on the rate of profit. In the longer period however, the system is bound to experience, from cycle to cycle, a secular rise in the organic composition of capital and therefore to undergo a secular decline in the rate of profit.

Marx's achievement lies in having eliminated all the naturalistic elements which marked the theory of population of the Classical economists. The factors governing the movements of the economically relevant component of population are made to depend on the process of accumulation itself. It must be noticed that Marx in developing his cycle cum crisis theory in Volume One of *Capital* (Chapter 25), worked with the classical one sector *corn* model which has been correctly described by Hicks (1965) as a primitive growth model. For Hicks the primitiveness of the Classical growth model consists in that its one sector nature makes it difficult to take into account an undesired accumulation of inventories. If we were to apply Marx's analysis of the cycle conducted in Volume One to the two sector scheme of reproduction developed in Volume Two of *Capital*, we would have to conclude that - during the crisis - mass unemployment and the ensuing fall in the effective demand for consumption goods could act as signals for the capitalists in the capital goods

industries that the time is ripe for an expansion of their own investments. Mass unemployment while leading to a fall in consumption demand causes a decline in the real wage thereby lifting the potential rate of profit, which can be transformed into an actual increase only if investment expands. Given that the consumption goods industries are in a depressed state, the expansion in investment activity should come - initially at least - from the capital goods sector. But, from the scheme of reproduction presented in Volume Two, another scenario is equally possible: the fall in the purchasing power of workers by creating unwanted unused capacity in the consumption goods sector will also reduce the demand for capital goods with a negative impact on the rate of capacity utilisation in the capital goods sector.

In my view, Marx, although aware of the role of wages as a component of effective demand, did not integrate it in his long run theory of growth and cycles. The basic reason for this is to be seen in three factors: firstly, in the strait-jacket imposed by the Classical corn model which he used in Volume One to which Hicks's critical remarks fully apply; secondly, in his belief in the classical view of competition; thirdly, in the incomplete character of Volume Two given his untimely death. This last factor explains why so many of his insights into the issue of sectoral proportions have remained isolated in relation to the main corpus of his work.

The Marxian Story: The Marxists and Tugan Baranovsky

Volume Two of *Capital* had a very profound impact on the economic thought of the Social Democrats, in particular in Germany, Austria, and Tsarist Russia virtually until the First World War. The analytical structure of their thought was grouped around the reproduction schemes out of which sprang two debates: the breakdown controversy (Sweezy, 1942), and the controversy over capitalist development in Russia (Lenin, 1903). In my opinion it would be impossible to appreciate the influence of Marx's reproduction schemes on the pre 1914 Social Democracy without mentioning that for European Marxists the model economy was no longer Marx's Britain, but Germany. Capitalist accumulation in this country was seen as based on a tight integration between banks and industries, on cartels and on the formation of a very large capital goods (heavy industry) sector. In this historical context Marx's two sector model became the analytical instrument for debating whether or not the expansion of the capital goods sector ahead of the consumption goods one could lead to sustained growth or to a crisis of overproduction / underconsumption. The disproportionality approach stemmed precisely from this kind of preoccupations.

Tugan Baranovsky (1905) - a non Marxist Ukrainian, yet an admirer of Marx's logic - was the main theorist of the disproportionality strand. On the logical plane his approach was superior to that of the partisans of the theory of crisis due to underconsumption (Kautsky) or to that of Rosa Luxemburg, who stressed the role of imperialism as a means to create a market for surpluses which would otherwise go unsold.

Tugan understood very well the connexion between profits and accumulation in a two sector model. Today, after Von Neumann, these links seem to be self evident, yet it must be borne in mind that the full analytical dissection of two sector models dates only from the 1960s. Before the end of the 19th Century, Tugan realised that in a Marxian model of expanded reproduction total profits are equal to the value of

total capital goods output. The larger the ratio of this output relatively to the output of consumption goods the higher the share of profits over the value of total production. Furthermore, he also argued that the rate of profits need not fall even if the degree of mechanisation (the Marxian organic composition of capital) were to rise indefinitely.

In substance, Tugan Baranovsky, working solely with Marx's schemes which are expressed in terms of labour values, understood that the Marxian framework contains two polar cases: a pure labour theory of value when the rate of profit is zero; and a pure capital theory of value when the wage rate is zero. All this is very well known today (Pasinetti, 1977; Sraffa, 1960) but in those years even the necessary theorems in matrix analysis did not exist. The second case means that if the labour vector could be reduced to zero, which is the same thing as setting the wage rate equal to zero, total production would be equal to total profits at the maximal rate of profit. By groping towards the case of a pure capital theory of value Tugan argued that capitalism could theoretically achieve through automatization a stage in which virtually all output would coincide with that of the capital goods sector, without entering into any kind of crises. The condition for the smooth transition to a pure capital theory of value is that to every decline in employment, and therefore in the socially necessary output of consumption goods, there should correspond a shift in investment towards the capital goods sector by the amount that would otherwise have gone to the consumption goods sector. In other words, if mechanisation reduces the quantity of labour needed to produce a given amount of output, a compensatory mechanism should take place in the capital goods sector. The role of the compensatory mechanism is not to provide employment but to create the necessary sectoral shift for capital to be fully utilized.

This is what Tugan called sectoral proportionalities. It is interesting to see that in Tugan Baranovsky, balanced proportions are not those yielding a steady state rate of growth. Quite the contrary. The balancing condition refers only to the size of the shift towards the capital goods sector, while the growth rate will actually be rising. Tugan Baranovsky concluded that even if the system were to end up activated by only one worker, no crisis should occur from the side of consumption demand as long as the shrinkage of the consumption goods sector is perfectly offset by an expansion of the capital goods sector. From his analysis Tugan Baranovsky deduced that crises and industrial fluctuations are due to sectoral disproportionalities, since in reality conditions for smooth shifts to the capital goods sector are never obtained. In Harrodian terminology, we could say that for Tugan the warranted rate of growth can be as high as labour saving technical progress allows the internal rate of accumulation of the capital goods sector to be. Yet, there is no reason to assume that the multitude of capitalists will actually move their investment to that sector in the required proportions. His book *Theory and History of Commercial Crises in England* (1901) interpreted the whole business cycle in those terms.

If Volume Two of *Capital* attracted the attention of the bulk of the Social Democratic movement in Europe, Tugan's utilisation of the reproduction schemes had a further effect on European social thought, especially in the German and Russian speaking areas of the continent. Tugan's approach influenced Lenin's critique of the Populists, Hilferding's analysis of disproportionalities in a regime of cartels and, via Hilferding, Schumpeter's view that a trustified capitalist system can be more stable

than a competitive one (Schumpeter, 1928). Tugan Baranovsky, condensed in his work two strands of European social and scientific thought, namely, the role of consumption under conditions of accumulation and the question of automation. These two aspects have been dealt with separately, and with much greater analytical precision, by Von Neumann. The latter's contribution to growth theory is well known to economists. By reducing labour to the status of means of production - like oxen in an agricultural economy - Von Neumann showed that a maximal growth rate can exist and it yields a steady state. The second aspect links up with Von Neumann's research on the theory of automata, where he showed, as early as in 1948, that it is possible to design a self reproducing machine (Von Neumann, 1965).

While Tugan Baranovsky's logic is impeccable his argument implies a questionable theoretical approach concerning the social character of capitalism. Capital, is in Marx a social not a technical relation, namely, the existence of capital requires the existence of wage labour. In the Marxist framework, means of production and money are not in themselves capital; they will constitute capital only if they are confronted with a set of people whose livelihood is derived from selling their labour power. It is the purchase of labour power by the capitalist which allows means of production and money to function as capital. This is why for Marx the formation of a market of free labourers - free to sell their labour power and free from the ownership of the means of production - plays such an important role in his theory of accumulation. It is the existence of wage labour which permits the objective determination of wage rates relatively to productivity rates which, in turn, gives to the rate of profit a very precise function in the working of capitalism as a socio-economic system.

In Tugan Baranovsky, by contrast, the labour market disappears completely, since with full automation only one worker will push the button with which automata will just reproduce themselves. True, the rate of profit will be at its maximum, since labour inputs will no longer exist, but it will have no social meaning, unless a full institutional theory is provided to show how humankind can coexist alongside such a technical system. Tugan not only did not provide us with the required theory but he kept treating his own system of machines producing machines as if it were socially and institutionally comparable to Marx's capitalism. Thus Tugan Baranovsky succeeded in eliminating consumption demand from the theory of cycles and crises by eliminating the labour force from the picture. The absence of an appropriate institutional and juridical theory - which should have taken, at this point, centre stage - regarding the social organisation of such a system, implies that his "economy" is outside the orbit of the capitalist system with nothing to replace it in its stead.

The critical remarks made in the foregoing paragraph should not be taken to mean that the form of the capital-labour relation put forward by Marx is immutable over time. In other words, within the framework of a society based on wage labour there can be a transformation of the dynamic process which determines the distribution of income and the rate of accumulation. A possible source of this transformation is the development over time of the stock of capital in relation to the employable labour force induced by increases in the productivity of labour. In Marxian terms, modifications in the role of wage labour could, ultimately, be caused by the development of the forces of production engendered by accumulation. It is

at this point that Kaldor's contribution may be brought in. This will enable us to recapture - via Hicks - the issue of disproportionalities in a manner consistent with the problem of effective demand.

Kaldor's Story: The Evolution of Capitalism

Kaldor's most quoted essay on the theory of income distribution is the famous 1956 *Economica* paper titled "Alternative Theories of Distribution". For my purposes, however I will refer to a subsequent paper which, because of the context in which it was delivered, tackled head on Marx's cyclical theory as expounded in Volume One of *Capital* and summarized in the second section of this paper. In a lecture given at the University of Peking (Beijing) in 1956, Kaldor presented a typology of capitalist transformation in which the Marxian stage appears as belonging to the initial phase of industrialisation (Kaldor, 1957). According to Kaldor the Marxian phase of accumulation pertains to an epoch in which growth is conditioned by three factors: (i) by moderate increases in productivity, (ii) by the gravitation of wage rates around subsistence through oscillations due to the periodic exhaustion and replenishment of the reserve army of labour, (iii) by a tendency of the capital output ratio to rise so as to counter the tendency of the share of profit to rise. The third factor is nothing but a reformulation of Marx's view about the long term fall in the rate of profit. In this historical period investment is not governed by any form of stock adjustment principle, since the amount invested will be what the surplus (i.e. profits defined as $Y-W$) allows it to be. If the surplus rises relatively to output so will investment and vice versa. Changes in the share of the surplus go hand in hand with the cycle of the reserve army. Consequently, the existence of a surplus population relatively to the stock of capital is, in the long run, a prerequisite for this mechanism to operate as a law. That is, as a permanent phenomenon in the process of growth. Unused capacity plays no analytical role in this context, although during the trough of the cycle less efficient firms will close down. Yet the ensuing spare capacity has no persistent impact of the tendency toward recovery which, in turn, results from the effect of mass unemployment on the wage rate.

The Marxian (Volume One) phase will end when the reserve army will cease to act as a regulator of the share of investment over national income, and therefore as a regulator of the trade cycle based on variations in the distribution of income. The dynamics of real wages is now determined by the growth of the productivity of labour while investment decisions in the aggregate are determined by the need to adjust the stock of capital relatively to effective demand. Thus, given a stable difference between productivity rates and real wages, accumulation and growth can continue unperturbed along a given warranted path up to the point where the accumulated stock of capital can employ the whole of the working population. If, in the neighbourhood of full employment, money wages begin to rise, instead of a fall in the share of profits the economy will experience a rise in the price of wage goods. Kaldor's reasoning is entirely in terms of a one sector model, but here he implicitly uses in a Kaleckian manner Marx's equilibrium condition of effective demand for the wage goods sector stated in Volume Two of *Capital*. Translated in price and quantity relations, Marx's condition for the wage goods sector is as follows:

$$p_w a_w E_w = wE$$

Where p_w is the price of wage goods, a_w the productivity of labour in the wage goods sector and E_w is the sector's level of employment, while E is total employment and w is the money wage rate.

At any given moment of time there is a division of the product between profits and wages where total demand for wage goods must be equal to total supply. If money wages are below what this distribution would require, prices would fall leading to an increase in effective demand for consumption goods; whereas if money wages were higher prices would rise. For any given a_w/w ratio, the price of wage goods will depend on the ratio between total employment and the employment in the wage goods sector. In turn the employment ratio is determined by the relative movements in the degree of capacity utilisation (Halevi, 1985; Halevi and Kriesler, 1991). But Kaldor never analysed this side of the problem because he clung to the representative firm model which implies one sector only (Harcourt, 1963).

To the Peking audience, Kaldor explained the difference between Marx's approach and his own by using also the labour theory of value. In the Marxian case, if the socially necessary labour time to produce the basket of wage goods is 60% of the total amount of time bestowed in production, capitalists cannot undertake an amount of investment exceeding 40% of national income. The share of wages cannot be below 60% because workers's incomes are assumed to be at subsistence. By contrast, if productivity increases reduce the socially necessary labour time for the production of the wage goods basket 40%, while the share of profits is 50%, the price mechanism will increase the share of wages to 50% as well. In the former case profits are determined as residuals after fixing the share of wages, while in the second it is the wage rate that is determined as a residual. Any further increase in wages above 50% will be met by a price inflation rather than by a fall in the share of profits. Analytically, the difference between the two cases lies in that in Marx the share of investment and the share of profits are taken to be virtually identical; whereas in Kaldor the share of investment is equal to the share of profit multiplied by the propensity to save out of profits. The propensity to save out of profit is given, that is, it is fixed independently of variations in the distribution of income. It is this factor, formally simple but conceptually quite profound since it changes the *modus operandi* of capitalist investment, which allows for real wages to increase along with labour productivity.

Capital accumulation breaks, at this point, free from the constraint of the reserve army of labour, so that the stock of capital can grow until it meets the labour constraint. For Marx, the reserve army of labour represents the population law internal to the capitalist system thereby allowing it to expand by means of regular cycles. For Kaldor, the reserve army sets a limit to the growth rate of the stock of capital relatively to total population. It must be pointed out that these sort of ideas, aiming at identifying a maturity phase in capitalism's historical evolution, were not exclusively Kaldor's. Sweezy (1953) and Kalecki (1954) also produced an interpretation of the maturity of capitalism basing it on the degree of development of capital equipment relatively to total population, coupled with assumptions concerning the oligopolistically induced rigidity in the distribution of income. This led them to conclude that in its maturity phase the economy, if left to itself, was likely to be subjected to a persistent tendency towards stagnation. Kaldor, however, did not

take the stagnationist approach. Instead he suggested an adjustment mechanism based on variations in the distribution of income around the full employment zone. Given the propensity to save out of profits and given the capital output ratio, the share of profits will fall, through a decline in prices relatively to wages, whenever the initial share of profits tends to be higher than what is required by the Harroddian full employment growth rate. Conversely prices will rise and the share of wages will fall if the actual share of profits is below the level required by the Harroddian full employment rate.

In this context all the discussions between Kaldor's approach and the MIT approach to growth can be left aside. The important point here is that Kaldor's theory represents simultaneously an alternative to Marx (Volume One) - while retaining the capitalistic character of investment and accumulation - and an answer to the instability hypothesis contained in Harrod. Yet, up to what point is the adjustment mechanism plausible? The answer to this question may, in fact, be found in Hicks's *Capital and Growth*.

Hicks: The Problem of Disproportionalities Restated

Hicks's *Capital and Growth* (1965) was, in my opinion, the product of the capital theoretic debates seen in the light of growth theory and of Joan Robinson's contribution in particular (1956). No single element of *Capital and Growth* was new, just like *Value and Capital* whose components were taken from Marshall and Lindahl.¹

The capital theoretic debates showed that in a two sector model the postulated monotonic inverse relation between the capital labour ratio and the rate of interest will exist only if the capital labour ratio in the consumption goods sector is higher than that in the capital goods sector. In parallel with, but independently from, the capital controversy, the writings of a number of Japanese economists such as Shinkai, Uzawa, Inada, showed that the dynamic stability condition of the quantity side of a two sector model depends on the same assumption about the relative capital labour ratios. Hence, if the Neoclassical relation between aggregate capital intensity and the rate of interest could be criticised because of its special assumption about relative sectoral intensities, the same critique could be levelled against the economic meaningfulness of the dynamic stability conditions of growth models. This is exactly what Hicks has accomplished in *Capital and Growth*, a book which culminates in the Traverse. Yet, instead of limiting himself to purely formal observations, Hicks used the fact that the capital intensity condition was not in general valid, in order to bring out the shortcomings of the political economy implied in one sector growth models, be their nature Kaldorian or Solovian.

The Traverse of *Capital and Growth* is about structural disequilibrium, that is, about the fundamental reasons why the system is unlikely to adjust to a full employment growth path in the case of a discrepancy between the growth of the stock of capital and that of population. Hicks derived the inspiration to look into the complexities of structural relations from the Austrian School, from Von Hayek in particular as well as from a little known Neo Austrian monograph published well before *Capital and Growth* (Lachmann, 1956). With hindsight it appears normal that an essay which begins with a critique of Classical "corn" type models, would reach

its peak in the discussion of whether an appropriate capital structure can be attained. In this respect also the reference to the Austrian School seems natural, given that in *Prices and Production* (1932) Von Hayek did stress the specificity of each form of equipment. Yet there is more to it than the insights that can be gotten from a particular school of thought. *Capital and Growth* and its sequel *Methods of Dynamic Economics* (1985), testify to Hicks's long march away from the Temporary Equilibrium method developed in *Value and Capital*. The latter method is seen as too restrictive since it requires that markets be in equilibrium also in the very short period. However:

even in a very competitive economy such very short-run equilibration is hard to swallow; in relation to modern manufacturing industry, it is hard to swallow indeed. It was inevitable that the time should come when it had to be dropped (Hicks, 1985, p. 81).

Hicks's first step was to adopt the assumption that prices have only to be such as to cover costs of production at a given rate of profit. The system thereby becomes a fixprice economy and once applied to a long term equilibrium, it becomes a Harrod type growth model. Under fixprices all quantities are treated as homogeneous since they are aggregated by volume indices. But, Hicks points out that:

of course we know that in fact these things are not homogeneous; each of them is a collection of different things, which at least for some purposes need to be distinguished. From that point of view the fixprice assumption has made things too easy. It has left out the *structure* of the productive system (Hicks, 1985, p. 132).

The emphasis on structure serves the purposes of highlighting the flimsy character of the adjustment mechanism proposed by the two competing one sector growth models whenever a change occurs in the equilibrium growth rate. As already mentioned, in Kaldor the adjustment takes place through a change in the aggregate propensity to save via a change in the distribution of income. In Solow, by contrast, it takes place via a change in the capital output ratio for any given aggregate propensity to save. Hicks's scepticism is not primarily motivated by the need for formal completeness. Instead it stems from a critical perspective on the political economy of applied Keynesianism, or, better still, from a critique of the Keynesian ideology:

But let us now suppose that the Harrod difficulty has been got over: that a suitable change in the propensity to save, for whatever reason, has occurred - will that be the end of the trouble? The magic that used to be attributed to a Keynesian fiscal policy assumed that it would; but there is a school of economists, whose voices were for long almost drowned among the fanfare of the Keynesian orchestra, who have been maintaining all along, that it is not. (Hicks, 1985, p. 131).

The structural model with which Hicks analysed the Traverse is the standard single technology fixed coefficients one. It is heterogeneous only in relation to the physical distinction between capital goods and consumption goods. Quite apart from the Austrian ideas that stimulated Hicks to study the implications for growth theory of structural relations, the model can be perfectly assimilated to Marx's schemes of reproduction. Indeed, there is hardly any difference between Hicks's

construction and the Marx inspired mathematical growth model put forward by Gregorii Feldman (1928) in the U.S.S.R. Their main difference lies in the initial conditions depicting the degree of development of the economy. For Feldman the capital stock corresponds to an economy with a low degree of industrialisation, implying an ample reservoir of labour as well as a low share of the capital stock installed in the capital goods sector over the total stock. In Hicks the stock of capital is initially in equilibrium with the employable labour force. The economy is therefore a mature one in the sense of Kaldor.

The problem of the Traverse arises whenever the growth rate of capital stock, call it G and the growth rate of population, call it g , begin to differ for whatever reason. Clearly, from a mathematical point of view convergence or nonconvergence conditions can be analysed by looking at both $G > g$ and $G < g$. Yet if we accept Kaldor's political economy it is $G > g$ that matters. More precisely, Kaldor's definition of the Keynesian phase consists in that the stock of capital can, at full capacity, employ the available population. In these circumstances a modern economy can be assumed to possess the technical capacity to expand the output of capital goods faster than population growth. This state of affairs is also reflected in Harrod's preoccupation with the warranted rate being persistently higher than the natural rate. Harrod even went on to specify that such a preoccupation applied only to developed economies. Thus, contrary to Hicks' procedure, which focussed on the case $G < g$, I will concentrate on $G > g$. Analytically the results are the same in both cases, since we are dealing with a symmetrical construction. Yet, the case $G > g$ will allow us to link the issue of disproportionalities with the problem of effective demand for capital goods.

The special case character of a monotonic inverse relation between the aggregate capital labour ratio and the rate of interest is shown by the value of the determinant of the coefficient matrix of rank 2 characterising the price equations of the two sector model. The value of the determinant should be such that the capital labour ratio in the consumption goods sector, call it n , be greater than that of the capital good sector, call it m . The matrix of the quantity equations is the same as that of the price equations. Hence $n > m$ is a necessary condition for convergence of G toward g for a given $G > g$. However, if $n > m$ is a special case solution for the relation between capital intensity and the rate of interest, it is also a special case as far as convergence is concerned. If we were to follow Hicks we are left only with the opposite case of $n < m$. In this instance, if $G > g$ a new full employment full capacity equilibrium can be found but with a still higher share of capital goods replowed into the capital goods sector. It follows that G will grow even more, thereby widening the discrepancy vis a vis g . Eventually this process will lead to an explosion of the capital goods sector and to an implosion of the consumption goods sector. It is a case of cumulative disproportionality, in which the problem of effective demand does not manifest itself immediately but only at some later state and in a very weird manner. The implosion of the consumption goods sector under fixed coefficients of production is as arbitrary as Tugan Baranovsky's result in which both the labour force and the consumption goods sector are eliminated by means of automation.

The cumulative divergence solution is, from a theoretical point of view, as bad as the convergence solution, if not worse. Why should the economic system continue to invest until one sector implodes and the other explodes? This kind of formally driven extremism can be found neither in Marx, nor in Keynes nor in Harrod. In

Harrod, for example, whenever the warranted rate of growth exceeds the natural one investment will fall without any disappearance of the consumption goods sector. Now, if we want to find *within a two sector model* a solution more akin to Harrod's result than to the extravagant case of cumulative explosion, we would have to consider the case of a vanishing determinant. This means that $n=m$. We can call this case the Marxian case because uniform sectoral capital labour ratios are equivalent to uniform organic compositions of capital. In these circumstances, if $G>g$ and the system starts from a situation of full employment and full capacity, an overproduction of capital goods will immediately appear. In fact, no matter where they are allocated, no equilibrium can be found between machines and labour. The ensuing excess capacity can be met only by cutting down on investment demand with full Keynesian consequences. The disproportionality between the production of capital goods and that of consumption goods is nothing but the mirror image of the disproportionality between the stock of capital and the available labour force. Furthermore the problem of overproduction of capital goods emerges already in the short run, that is as soon as the new capital goods come into being without entailing a destruction of the consumption goods sector. The decline in investment activity due to overproduction of capital goods will reduce the level of consumption demand thereby generating excess capacity in the consumption goods sector as well, which is something quite different from an implosion.

I have come to these conclusions by looking appreciatively at Hicks's endeavour while modifying his approach to the Traverse problem. I have been struck by the fact that a truly one commodity model allows for an immediate absorption of any excess supply. If corn is both consumable and investible and if the amount of corn set aside for replowing is too large in relation to the number of agricultural workers operating at a given productivity of labour, then the excess corn can be ipso facto transformed into consumption, at least in principle. By contrast a two sector model with uniform organic composition of capital - $n=m$ - remains physically a heterogeneous system although in value terms it is equivalent to a pure corn model. There is therefore a difference, in my opinion, between Volume One of *Capital*, where in Chapter 25 accumulation is portrayed as being carried out apparently on the basis of a uniform organic composition of capital, but in reality on the basis of a one commodity economy, and Volume Two, where uniformity in the organic composition does not impede the analysis of disproportionalities and of overproduction.

As a final note I should mention that Hicks did not look at the case of a vanishing determinant. Perhaps he thought that uniform capital labour ratios are unrealistic, so to speak. But all the three cases are unrealistic. The problem lies with the nature of the two sector model itself, whether it is Marxian, or Neoclassical. Each case is a special one because the model admits only one technological configuration at a time. With two sectors only we will have either $m>n$, or $m<n$, or $n=m$; but we cannot have all of them at once. In this paper the link between Marx, Tugan Baranovsky, Kaldor and finally Hicks, is given precisely by the fact that their discourses run from a one to a two sector model. In this context it is epistemologically correct to take into full account the reciprocal impact of the different assumptions made within virtually the same model. Thus one should only try to see what are the insights, relatively to the theoretical questions discussed, that may be obtained by looking at each of the three cases, while being aware that those insights are purchased at the price of some atrocious assumptions.

In more general terms the task in growth theory should be to get out as quickly as possible from the limitations imposed by the narrowness of models which while performing an important clarifying role have run out of time. It seems to me that the multi commodity growth theory based on the notion of vertically integrated sectors is a step in the right direction (Pasinetti, 1981).

* Department of Economics, University of Sydney, NSW 2006, Australia. This paper is the synthesis of 4 seminars given at: the Institut de Sciences Economiques et Mathematiques Appliquees, in Paris in September 1990, at the University of the Philippines in Manila in February 1991, at the University of New South Wales and at the University of Sydney in April 1991. Acknowledgments for financial assistance, hospitality and support are extended to the above mentioned institutions.

Note

1. The main achievement of *Value and Capital* was the incorporation of Lindahl's Temporary Equilibrium theory (TE) into a Walrasian framework. TE theory portrays dynamic movements as a sequence of short run equilibria. Hicks's adaptation of Lindahl's method enabled him to get around a crucial aspect of Walras's General Equilibrium, namely, the need to have uniform rates of return (Halevi, 1988).

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