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TAKING INVENTORY OF CONTEMPORARY ECONOMIC THEORY

A Book Review Article :

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The Book Reviewed :

"CAPITAL AND GROWTH"
by JOHN HICKS,
Oxford University Press, New York (1965)

«The task on which we have been engaged is not closed at this point; it is far from being closed. It is only a part of much larger enterprise, in which economists all over the world ... are busily concerned. All I have tried to do is to draw some of these threads together.»

Hicks: "CAPITAL AND GROWTH", pp. 305-306».

I.—1. Hicks style and approach cannot be considered helpful to the non-professional. On the other hand it can be stated that Hicks pulled together the wires of what we might call contemporary theory. He shows, for those who can detect it, how the economic theoretician «grows» in the study of his subject. Looking for specific objectives we may find many but I find as his most important contribution the presentation of an overall picture of contemporary theoretical analysis. I am of the opinion that Hicks did for what we call «Economic Dynamics» the same thing that Samuelson did for «The National Income Approach»; He prepared the road for the revision of the Economic Principles.

Hicks doubts the existence of The Theory of Economic Growth; instead of a theory he talks about approaches, methods, to the handling of the complex problems of a developing economy. One of these approaches is the method of growth theory which uses as its central concept «the equilibrium of an expanding economy.» (VI). The growth theory

is that part of economic theory which is concerned with long term trends and deals with both trends and fluctuations. It is a branch of economic dynamics. To find out where economic theory stands we must undertake «a survey of the methods of Economic Dynamics as a whole.» ([5]). «Dynamic theory is the analysis of the processes by which (variables) change.» ([6]).

Welfare economics have been static: it has assumed constancy of wants and resources and has investigated their optimum organization. But welfare problems must be thought in terms of a changing economy and therefore in this case statics is preliminary to dynamics.*

In welfare economics we compare the desirable optimum with the would be position if the economy was organized on some given principle.

In positive economics, on the other hand, we must distinguish between a «pure» and an «applied» branch. A considerable part of economic theory is pure, independent of time and place.

Econometrics do not satisfy our needs because an important question is not how the economy worked over a certain period but how if built on certain lines, it would work. In the case of econometrics we can find out what will happen if the same forces operating now continue to operate in the future. They do not give the answer «what will happen if a new force of organization ... is introduced.» ([10]). But since such an alternative does not exist we may perceive of one through what Hicks calls «Pure Positive Economics».

2. In economics the meaning of equilibrium as a balance of forces cannot be understood, because, there is no such balance of forces. In a static economic equilibrium we establish the absence of reason for choosing other alternatives ([15]). We take it for granted that a static economy is at equilibrium but as Hicks puts it, it is one thing to need an assumption and another to have a right to it.

In welfare economics it is «the equilibrium choice which is the optimum choice» while in pure positive economics equilibrium is not inevitable but we must have a tendency towards equilibrium which it may take long time before it reaches it.

In reality instead of concentrating on the average performance of the economy during n periods (a static performance) «we face up to the variations that occur in the course of those n periods.» ([22]).

* This paper was presented and discussed in two meetings of the Regional Economic Association on March 27, 1966 at Georgetown University and May 8, 1966 at the Catholic University of America.

Miss Barbara Lindsey did the typing and also inside valuable suggestions.

There are two kinds of equilibrium we may be looking for: first, equilibrium at a point of time which is reached if individuals achieve a preferred position in respect to their expectations at that point, and second, equilibrium over a period of time which in order to achieve we must have equilibrium at every point of the period. Point equilibrium must be based on its own expectations and expectations referring to different points must be consistent with one another and consistent with what happens within the period. «Period equilibrium is essential in dynamic theory, as a standard of reference.» ([24]).

3. Hicks is interested in the dynamic character of economic models which handle time and change. While both classical and neo-classical economists were interested in dynamic problems, they, nevertheless, were dealing with them with tools of static theory which were inadequate. Today we have several dynamic methods of dealing with models all of which have weaknesses and strengths.

In the search for equilibrium, equilibrium at a point of time becomes equilibrium of a single period while equilibrium over a period becomes sequense of single period equilibria. Thus «static theory is used as the single-period theory of the dynamic process.» ([31]).

Since it is the essence of dynamics that present and future are not identical, for this reason what goes on within the period is not only a matter of tastes and resources but also «of plans and expectations». Since in statics we do not need planning because of repetition this is not the case in dynamics.

4. Adam Smith turned his attention to capital accumulation; for Smith the only form of capital that matters is circulating capital; there is no fixed capital in his model; In Smith's system productive labor plays the same role as gross investment plays in Hicks' system. His unproductive labor corresponds to Hicks' consumption sector. Employment is determined by the size of the capital stock which in this model is a «wage fund.» ([37]). Smith's model is a static model because it confines itself to circulating capital and to a single capital good. The period in his model becomes self contained. It is not like the contemporary growth models where the growth rate is kept constant. In the Smith model the data change from period to period and the final proportions of factor should be chosen on the basis of expectations. But Smith did not pay any attention to plans and expectations and meglected uncertainly and liquidity and to this extent the Smith model is anti-Keynsian ([42]).

Smith assumed the agricultural sector of the economy to be representative of the whole. Ricardo's model of the agricultural sector is

similar to Smith's but he tooke land to be a svarce factor and attempted to show how land's shortage «would set a limit upon the expansion of agriculture» (44) and by implication of the economy in general. For Smith it was shortage of labor that would limit expansion. But in Ricardo trouble begins outside the agricultural sector. In an industrialized economy it cannot be assumed that all capital is circulating.

Smith found a way to apply the static method to dynamic problems. Ricardo outgrew the Smith method but failed to find another. Marshall did find another but it was a special case. It works only under *caeteris paribus*. The crucial assumption in Marshall's method is that industry in the short period, can be treated as if we were in static equilibrium (51). This method becomes similar to the agricultural sector of Ricardo. The short period was dealt by Marshall as the single period which was also the case of Smith and Ricardo. In dynamic there would be change in the capital stock from period to period but Marshall did not link these periods; he did not take under consideration «user cost» which is determined outside the short-period and he also omitted stocks or inventories the values of which cannot be determined within the period.

5. The Marshallian assumption of supply equals demands refers to the very short period when supply is taken as given. The static determination of the price by equilibrium of demand and supply will give a fair approximation of what is likely to happen in practice (54). Something similar was supposed by Marshall for the short period proper. Since the market is competitive and the firms are not price makers, prices can be determined by demand and supply, by market bargaining.

Marshall's method can be regarded «as a last stage in the evolution of static method ... it gets very near to dynamics.» (57).

6. The basis of the work of the Swedes was Wicksell's stationary state where «relative prices remain constant over time» and the natural rate of interest is determined as a part of this system of relative prices. Wicksell's assumption was that real economy is stationary because «market rate is equal to the natural rate». If this equality is destroyed then we are led to dynamic questions and here is where Eric Lindahl comes in with his temporary equilibrium method. He reduces the process into single periods; within each period change could be neglected and quantities and prices within such period could be determined in a static manner. Lindahl introduces expectations as an independent variable in the «determination of the single period equilibrium.» (60). For Lindahl, unlike Wicksell, the single period is not self contained.

In the Lindahl method it is assumed that the zero period is the

old stationary equilibrium where the market rate of interest is equal to the natural rate. Expected and current prices are equal. As long as the market rate of interest in later periods is smaller than the natural rate of interest, this will create higher price expectations. This cumulative process will continue as long as the inequality between the market rate and the natural rate is maintained under the assumption that the market rate is smaller than the natural rate ([63]).

The dynamic character of Hick's and Keyne's theories rests on the fact that «their temporary equilibrium is governed by expectations» which are used in a different way from the way they are used in Lindahl. In the Lindahl case the single periods are linked which is not the case with the Hicks and Keynes models. For Lindahl current expectations are bassed on past experience and they are not influenced by what happens now in the market while Hicks and Keynes allowed their expectations to be influenced by current experience ([66]). For Hicks, expectations are formed on the basis of information acquired during the trading period. Changing prices lead to adjustments in expectations.

To be at a temporary equilibrium supply must be equal to demand. The determinants of supply, demand and prices are a. real available resources; b. tastes of individuals; c. formed expectations; and d. the rate of interest. Production, consumption and capital equipment to be handed over to the next period are determined in period zero. With these given data the behavior in period one is determined and the same happens in later periods.

Over a number of periods the Lindahl process is in temporary equilibrium with respect to its own data: if the data change, the temporary equilibrium method shows serious defetes, the combined effects of which make questionable the validity of temporary equilibrium as the only dynamic method.

These defects are: uncertainty not only in production and consumption, which are the outcome of the most expected prices, but also to the confidence with which these values are expected ([70]). When we are faced with uncertainty of expectations, we cannot talk about a single rate of interes. There will be no unified rate of interest and the amount that can be borrowed «at any fixed rate of interest» is limited by the credit of the borrower. At the temporary equilibrium method the rate of interest is under the control of the monetary authority, but when this authority is faced with a multiplicity of interest rates it has not overall control.

In the Lindahl and Hicks methods it is assumed that prices remain

unchanged throughout the single period, and supply is equal to demand.

7. At this point is dropped the Marshallian assumption of equality of supply and demand. In the temporary equilibrium method the system is in equilibrium in any single period and prices are determined by this equilibrium. In the new method, which Hicks calls the fix-price method, price determination is not the outcome of supply and demand; prices are taken outside the model and all that is required of them is that they cover costs. If they are fixed exogenously «one naturally will begin by assuming them to be constant. The model becomes a fix-price model.» ([78]).

According to Marshall, in a single market there are no carryover stocks and the ruling price for perishable commodities is the one that equates current demand to current supply. But if the price is rigid there is no reason why we should have equality between supply and demand. An unsatisfied demand will give the signal for a rise in the output and vice versa. The economy is not deprived of a signal for adjustment.

Up to now no stocks have been introduced; the existence of stocks complicates things. But the current flow of supply and demand is not sufficient; we must also take care of the stock equilibrium which is fundamental for fix-price analysis.

8. The key to the fix-price theory is considered the stock equilibrium which is an equilibrium at a point of time and the items involved at that point are estimates.

While in temporary equilibrium we do not mention stocks and flows and there is no more than one price for the same commodity at the same time, in the case of the fix-price theory the equilibrium position is given and divergence from it measures the extent of disequilibrium at the end of the period. We have stock equilibrium when the assets and liabilities of a firm form the best of all alternative combinations, the term «best» referrring to plans and expectations.

In the fix-price theory such expectations should be demand expectations while in a temporary equilibrium such expectations are price expectations. Demand expectations involve the notion that available assets must fully satisfy expected demand which is the Marshallian assumption.

The firm is at stock equilibrium over time but stock equilibrium at the beginning and the end of the period might have been based on different expectations. To get out of this difficulty we assume that expectations remain the same during the period which allows constant

comparison of stocks at the beginning and the end of the period. This leads us to the concept of flow equilibrium; in this case a firm is at equilibrium at the beginning and the end of the period. Flow equilibrium here is flow over time and is defined as maintenance of stock equilibrium. To be at equilibrium both stock and flow conditions must be satisfied.

In a regularly progressive economy the stock equilibrium at the beginning and the end of the period will not be the same; expected demand will be greater at the end which requires expansion of the capital stock without which we cannot have equilibrium over time ([21]). Flow conditions must be adjusted in a way that production should cover expanded demand plus required investment. On the basis of this the Harrod equilibrium is a flow condition equilibrium over time and the regularly progressive economy becomes a simple case. The economy may be at equilibrium with its capital adjusted to specific expectations over time. But this is the short period equilibrium over time.

When the long period is characterized as a sequence of short periods, the long period can be at equilibrium over time when the short periods are at equilibrium. But, equilibrium over time implies consistency between expectations and realizations within the period. But expectations of the remote future are arbitrary. To maintain stock equilibrium we must have flow equilibrium: but what happens if we do not start from stock equilibrium?

9. To answer the question, Hicks, begins with a stationary market equilibrium. In a market with stationary demand no stocks are required, but because of uncertainty there will be some stocks determined by the extent of demand and these stocks are called equilibrium stocks. To maintain this stock equilibrium we must have flow equilibrium which requires that current output should equal current demand, a flow condition.

In the case of an unexpected demand, to maintain equilibrium at the new level will necessitate an increase in output which before takes place will necessitate a fall (through use) in stocks during the period. Increased production will take place if it is certain that the increase in demand will be permanent. The longer it takes to increase production the greater the fall of stocks, and equilibrium will be achieved when the stock and flow equilibrium have been restored.

This is a simple case and the restoration will be easy. But in a general case we must determine the future course of demand and correct the positive or negative errors in stocks which result from past mistakes. Gradual induced investment spread thinly over a long period will be

required to establish a smooth convergence to equilibrium. «the flow of induced investment being dependent upon the state of stock.» (99). Even though it is better to have induced investment depend «upon changes in the stock» or upon the excess of desired stock over the actual.

10. The application of stock and flow analysis to fix-price macroeconomics is discussed in chapters X and XI. Two cases are considered : The Keynes-type model which is different from the Keynes model, a non strictly dynamic model and the Harrod-type model. In Keynes the volume of investment depends on the rate of interest which we determine from the marginal efficiency schedule. If Keynes is interpreted in a fix-price sense, the rate of interest becomes an exogenous factor and the marginal efficiency schedule becomes a given volume of investment (104). But if actual investment is given there is no room for the dynamic process to work. To introduce dynamic process we must relax the strict Keynes assumption of a given investment by distinguishing between *ex-ante* and *ex-post* investment.

According to Hicks we do not assume an exogenously given volume of investment, but we assume that, part of such investment, large or small, is given. Hicks takes as autonomous investment the whole in fixed capital.

By taking gross investment in fixed capital as given, automatically depreciation is determined as a function of output as a whole. Hicks assumes as given «net fixed capital investment.» (105). If we add to it, at the beginning of the period, working capital, we get income saved times net output : That is :

$$A_t = (K_t + 1 - K_t) = sY_t$$

If instead of actual working capital we substitute desired working capital, the latter will depend on the expected level of output, which is a stock condition but not the only one. Another necessary element of stock equilibrium is «a balance between holdings of fixed capital assets and of working capital assets;» (108). Fixed capital assets are a given magnitude of each state of the process; working capital is variable and must bear a certain relation to fixed capital assets if equilibrium is to be maintained.

For a Keynes-Type model proportionality between investment of working capital and fixed capital is a condition to be improved if we are to achieve an equilibrium path. This is an additional condition of flow equilibrium.

If the economy through a shift in autonomous investment increases more than expected, is it possible to have an adjustment to a new equi-

librium path? ([110]) A spurt in autonomous investment will lead to increased production during the production period. The outcome of this will be increase in labor employment and of the demand for consumption goods. The latter will be met from stocks if the increase in demand is not large. At the end of the period increased production will take care of the stock deficiencies and lead to equilibrium. But this presupposes a stock of raw material in the final stage which we assume that it exists. Thus, if production is divided into equal stages and response to a change is immediate all along the line, the stock equilibrium may be restored at the end of the period ([111]). But these assumptions requiring stocks to be held at regular intervals may technologically be impossible. It is unreasonable to deny lags if adjustment takes longer.

It becomes clear that the disturbance in autonomous investment leads to fall in stocks at the final or earlier stages. Rise in autonomous investment is counterbalanced by a fall in working capital (induced investment) and total output rises to something shorter than equilibrium. If output remains below equilibrium, stocks will be falling continuously below the equilibrium level. The gap must be removed by an attempt to increase output which will grow until the gap is filled ([111]).

11. In this section Hicks moves to the case where the fixed capital-investment ratio is not given autonomously as in the case of the Keynes-Type model but depends in whole or in part on changes in output. It will be advisable to understand the working of an economy as one in which all investment is induced investment. «It is a model of this kind which I shall call a Harrod-Type model.» ([114]) It is assumed that prices are fixed and there is no shortage of labor.

In the Harrod model all that is determined is the warranted rate of growth not sufficient to determine the equilibrium path. We cannot do it the way it was done in the Keynes-Type model because here no part of the capital stock is autonomously determined. We must have some other specification, we must find out what determines the initial capital. Necessary conditions for an equilibrium path are appropriate expectations and appropriate initial capital.

If the initial condition is balanced, that is we have output for which the desired stock exists, then :

$$K_0 = cY_0 \qquad ([116])$$

One way to interpret the Harrod equation is to take it as showing the equilibrium path that will be followed on the assumption of satisfied expectations. Since K_0 is given the equilibrium path under stated assumptions in unquestionably determined. This is the full employment

path. But the question is raised what happens if the initial period capital is not fully employed or fully balanced. In such as case expectations may be founded on past experience. For a true equilibrium path both stock and flow conditions must be satisfied ([118]).

The Harrod-Type model is unstable in the same way as the Wicksell-Lindahl model: «In the Harrod-Type model prices are given exogenously:» ([121]) In the Wicksellian model we introduce lags by making price expectations depend on previous output ([122]).

In the case of an overoptimistic rate of growth which is greater than the warranted rate, actual capital must be less than desired capital at the point we hit the labor ceiling. While the deficiency is made up, the economy may remain at equilibrium. The capital-output ratio will be corrected and output may increase even if no more labor is needed.

The capital-output relationship that would produce output in an optimum manner refers to a given technology with which we begin our process. If a new technology is introduced, this cannot be satisfied by what existed and therefore we do not have an equilibrium path. We have to determine what will be the desired capital under the new technology.

II. Hick's approach to growth equilibrium is covered in chapters XII to XVI. We may call it his main contribution to the growth method.

1. What has been presented, Hicks points out in growth literature as a «growth theory», cannot explain actual growth phenomena, the theory must be supplemented by other methods. Hicks is concerned with prices that will allow the establishment of equilibrium over time. Price flexibility is allowed only in this sense.

Since the activities of the economy are changing over time, the economy remains at equilibrium if we foresee future developments and make the necessary adjustments. In the process we assume given tastes, given technology and uniform expansion. Hicks points out that «it is the equilibrium of such an economy expanding at constant growth rate, which I describe as a growth equilibrium.» ([132]). This equilibrium is the Harrod-Type which before hitting the full employment ceiling is expanding uniformly at a warranted rate; but the idea of a cosntant growth is not sufficient; because, for such an equilibrium to exist very unrealistic assumptions are necessary, including linearity.

In the new method, it is assumed that consumption goods combined in constant proportions can be treated as single goods; it is also assumed that one capital good and one sort of labor are used; under these cir-

cumstances the constant proportions model becomes a macro-model. In such a model fixed and circulating capital no need to be distinguished. They are both combined in the goods bundle. If we have a positive growth rate, to maintain equilibrium we must replace wasteage.

When we compare two economies under these simplified assumptions, each of the two economies is divised in two industries the consumption goods and the investment goods industry; even if the assumption, that the capital good used in each industry is the same, is dangerous, we cannot work without such simplification and therefore it is assumed that in both industries the same capital good is used. In the comparison of the two equilibrium paths we may assume the same consumption and the same capital good in both, we also assume the same technology and the same production coefficients. What are fixed are not technical coefficients but the quantities that are needed in equilibrium.

«There is no reason why the tractor-labour ratio in farm and in factory should be the same.» ([138]). To have equilibrium in both the production of producers goods and consumers' goods industries, the stock of capital, must be expanding and the supply of labor must also increase. It is assumed that they do at the warranted rate. Since the labor supply is fully elastic at a given wage, a fall in wages will lead in labor reduction. An equilibrium condition is that the earnings of capital (tractor) must be the same in the producers' and consumers' goods industries. In this system, labor and capital needed for capital good production are given and therefore the cost and price of the new capital goods is fixed in real terms. «If we define the rate of profit as the ratio of the earnings of a tractor to the cost of the tractor, then this is also fixed.» ([139]). In this way the whole of the price system is determined before saying anything about saving or growth rate of the economy. At equilibrium the earnings of factors must be the same in both production and consumption goods industries.

But with relative prices fixed we are back in the fix-price system and we can follow Harrod by saying that the equilibrium rate of growth will be higher, the higher the propensity to save.

Since the stock of capital goods is used in the production of both, producers and consumers' goods, the stock at equilibrium must be equal to what is required for production of current output of both products. The rate of growth depends strictly on the proportion dividing the stock of capital goods between the two industries (consumers' goods and capital goods industries). This proportion is fixed. The rate of growth is determined by the proportion of income saved ([142]).

Quantity and price equations are not sufficient to determine the whole system; we must make some assumptions about saving, in order to establish a bridge between them. When we have price equations, quantity equations and some saving equation, the system is complete and the equilibrium of the economy at its given rate of real wages is completely determined. Hicks proves that the larger the equilibrium growth rate the largerwill be the saving propensity.

If the economy is to remain in constant proportions Growth Equilibrium with full employment of labor, everything must be expanding at the same rate as labor supply is increasing. If prices are fixed equilibrium can be maintained if the saving propensity is adjusted to match the requirements. If saving is less than required we may have expansion of the warranted rate of growth which will have part of the labor force unemployed. If it is more than required then we have the case of the Harrod-type economy which hits the ceiling. «With a constant saving propensity no equilibrium is possible at all.» (143).

Can prices, that can be adjusted, establish equilibrium while the saving propensity remains the same? This raises two questions : first, is it possible to have *another* equilibrium with the same production coefficients and the same propensity but different prices? Second, is there a tolerable path from one equilibrium to the other? In answer to the first question Hicks states that under such circumstances no equilibrium is possible.

If profits are zero and savings very low, then something must have gone wrong. The first thing wrong is the assumption of the Harrod-Type model that savings is proportional to the total income. Such an assumption cannot be made here because while in the Harrod-Type model no distinction is made between shares, such a distinction is made here. By making such a distinction we raise the question : will not the saving-income proportion be affected by income distribution? There will be a different propensity to save out of income and out of wages. To avoid this difficulty, Kaldor has made the assumption, which Hicks accepts, that saving is made out of profits only (146).

If the real wage is given, the rate of profits is determined from the wage equation and the rate of growth from the saving equation. The higher the real wage the lower the rate of profit and the lower the rate of growth.

If it is the rate of growth that is given, the rate of profits is determined by the saving equation and the rate of real wages by the wage

equation. «The lower the rate of growth, the lower the rate of profit and the higher the real wage.» (147).

2. The growth equilibrium analysis, up to here has been confined to a single technique, a given consumption good of given specification and a single capital good of given specification. Now, the given technique assumption is removed: in comparing equilibrium paths there is no need for the technique to remain the same. Change in technique may take two forms: change in the capital good alone and change in both the consumption good and capital good.

It is assumed a change in technique and a range of techniques from which choice will be made. First, the response of technique to price changes. It is assumed an elastic supply of labor and fixed real wage. From each technique will be derived a different rate of profit: the condition of equilibrium is that it will be chosen the technique with the higher rate of profit.

In Hick's analysis the wage equation indicates the relationship between real wage w and the rate of profit r. In the case of choice of technique there will be a wage curve for each technique; to each technique will correspond a maximum wage and a maximum rate of profit. For each alternate technique there will be an alternate curve and these curves intersect; the outer intersections of the many curves from a composite curve which is called the frontier curve. The wage frontier which Samuelson calls «factor price frontier» is the center concept of the theory of choice of techniques — along an equilibrium growth path (150).

If a technique is given and the proportion of total income saved is fixed, a change in price, especially in the rate of profit could not cause a change in the growth rate except if there was a difference in the coefficient ratios of the two industries. m is taken as the ratio of the production coefficient ratios.

If $m = l$, then the wage curve is a straight line joining w and r. The price ratio will be unchanged by a change in r and a change in r will be unable to restore equilibrium. When $m = l$ the limits within which the rate of growth must lie in order to have equilibrium for a single technique, will be $g = s/a$ for any rate of profit, where a is capital coefficient in capital goods production.

3. The oversimplified form of the theory of growth equilibrium which Hicks gives in chapters XII and XIII is based on unacceptable assumptions, namely that the same capital good is used in both production and consumption industries. Now, he removes this assumption

but maintains the assumptions of constant proportions equilibrium. Instead of one, many forms of capital are introduced and in the field of consumption, one consumption good is introduced to represent consumption in general ([161]).

It is a condition of equilibrium that for each capital good the same rate of profit should be earned throughout the system.

In the many capital goods model the curve does not move in one direction, as in the case of one capital, but it may pursue a serpentine course. The practice is always to look at the end of the curve while it would be better to investigate what happens around the point where the change takes place. When there is a fall in the rate of profits there will be a tendency to shift to techniques which give more profits.

If all savings come out of profits we shall have the saving equation $g = s_i r_i$. With the wage equation and the saving equation holding, the analysis of effect of real wages on growth will hold good as long as we can assume that all saving comes out of profits. If some savings come out of wages then «the ratio of total saving to profits depends upon the ratio of total wages to profits and this depends both upon quantity and prices.» ([168]).

In growth equilibrium the stock of each capital good must be that which is required for current production (of capital goods and consumption goods) and the labor employed must be what is required for the same production ([168]).

4. In his attempt to develop a theory of growth equilibrium Hicks indicates that such a theory is restricted in scope «it is simply a generalization of the Classical Stationary State.» ([170]). It is impossible to find actual economies in growth equilibrium; what we may find is an actual economy in transition to growth equilibrium. There are devices, however, by which we can make an actual economy look more like a growth equilibrium than it appears at first sight.

If we include in the growth of labor force with which has been identified the natural growth of an economy the labor efficiency in collaboration with capital, the whole concept becomes broader. This explains how the constancy in real wage «per unit of labour», which characterizes the equilibrium path «should imply a rise in the real wage per head.» ([170]).

Some, in addition to increased productivity, consider more general progress consistent with growth equilibrium as long as such progress is neutral, that is, it does not affect the factor shares. But this is rejected by Hicks because it involves changes in technology which implies transfer from one equilibrium path to the other.

In growth equilibrium we compare two paths along which the distribution of factors remains constant over time. The theory of distribution here does not run in terms of production functions and elasticities of substitution. In his discussion of the theory of factor distribution Hicks begins with the simplest model of one capital good. In such a model if g, the rate of growth, is given we may establish f, the factor share of profits in total income, and r, the rate of profit.

The rate of profit will tend to fall as a result of an increase in any saving propensity; this does not mean that the share or profit will necessarily fall, it may or may not. When we compare growth equilibrium paths, the propensity to save does not have any clear cut influence upon factor distribution. It may affect it but nothing else may also affect it. An increase in saving, however distributed, must tend to diminish *the rate* of profit «but its effect upon the *share* of profit is quite uncertain.» ([180]).

5. The more we try to define the equilibrium model the closer it resembles to the old static (even stationary) model. It moves more and more away from reality. The study of an expanding economy with a constant growth rate is good for aggregates; by this way we stick to a theory where prices are fixed exogenously «not as consequence of other aspects of the system.» ([183]). It is when we contemplate changes as a part of the economic mechanism that the trouble appears. In such a case we have to disaggregate and it is this which leads into trouble. Growth equilibrium outside the fix-price theory can be defined with reference to a given technology. There is no time for equilibrium in a changing technology. The problem becomes how the economy can move to a new equilibrium which is appropriate to new conditions. The problem is studied as a traverse from one equilibrium to the other.

In the Harrod-Type model it was found that adjustment to a different growth rate with full employment can be done only if the saving propensity or «the capital-output ratio is varied.» ([184]). In the one capital good model the capital-labor ratio depends upon the rate of growth only, assuming given technique. If the rate of growth changes while technique remains the same the equilibrium capital labor ratio will change. For a new equilibrium we must have an over all adjustment in the saving propensity. Hicks assumes that such an adjustment occurs.

Four cases develop : The first two cases appear when g rises or falls and the other two when m is greater or smaller than one. Whether g rises or falls «there is a full employment path to equilibrium, *provided* that m is greater than 1, if it is smaller, such full employment path does

not exist ([186]). If there is a continuous adjustment, there will be a continuous adjustment in the growth rate of capital tending to the equilibrium rate from period to period.

But reality is not like this; the situation is transformed in an actual economy as we move nearer reality. The fixity of technique is not the vital point; of importance is the abandonment of the single capital good assumption which comes before the change in techniques. We must pay attention to the change of the equilibrium growth rate which changes the equilibrium ratios not only of capital and labor but also of one capital good and the other. For different capital goods the answer will be different; this ratio for some capital goods will rise and for other will fall. In this way a more general theory will be preferable than the one capital good theory ([191]).

A change in the growth rate, which was used here, matched by a change in the saing propensity has the good quality that prices do not need to be affected by it, prices in the new equilibrium may be the same as in the old. Price flexibility may occur but it does not give guidance to planning production or the choice of path to equilibrium. What is of importance and needs study is a change in g, while prices, even if they change during the transition, at the end of the period, the old prices must be restored. If there is no price change during the transition the choice of the path depends entirely on the foresight of the producers, on their ability to forecast demand. But it is a condition of the new equilibrium that the right prices should be found because otherwise the new technique will not be selected. Getting to the equilibrium will be more difficult and the approach to it will be retarded.

In an actual situation all these problems come at once and the problem becomes one of business management.

III.—1. The actual behavior of the economy with imperfect foresight which constitutes the dynamic problem of pure positive economics becomes baffling; the corresponding problem of welfare economics is more tractable; in the case of welfare economics while we cannot determine the actual path of the economy we can say more about its optimum path which will best satisfy some social objective.

The central problem of the dynamic optimum theory is planning which will lead to the set aim in the most efficient way. The aim may be either objective, total output, or subjective, economic welfare. In the first case we look for maximization of either quantity or value; while in the latter case we aim at utility maximization and we must

have a device to compare the utilities of different individuals. We must devise a case of correspondence between utility optimizing and value optimizing. In addition we may be looking for quality optimizing, value oprimizing and quantity optimizing each of which may increase by raising the terminal capital.

Every optimization problem is one of maximization under constraints. The so called turnpike theory is concerned with optimization through maximization of the terminal capital while consumption goods have to be restrained which makes it a restricted form of optimum theory ([208]).

2. While the turnpike theory is the theory of the optimum path when «the terminal stock» at the end of a given period is the only factor to be maximized, Von Neumann, on the other hand looked for the conditions which make possible the existence of long-run optimum equilibrium path and certain of its properties. The turnpike theory shows that given sufficient time the optimum path will approach equilibrium path which means that even in the field of optimum theory there is a tendency towards equilibrium.

Hicks wants to show the relations between the turnpike theory and other methods of dynamic economics. The essential point of his analysis is that to any technique of production corresponds a critical rate of return «entirely determined by the technique.» ([209]). The top technique will be the one corresponding to the highest rate of return along the equilibrium path. The Von Neumann equilibrium is a growth equilibrium at the top rate of return. Labor does not appear in the production coefficient but as a capital coefficient ([210]). Profit is considered as the only source of savings and for a large rate of growth savings out of profits must be large. If all profits are saved then $g = r$ that is, the rate of growth is equal to the rate of profit. The technique with the highest rate of return will have the highest rate of growth ([211]).

In the Von Neumann case we have to consider a more general case including non equilibrium paths under the assumption that all production is joint production of used and new equipment which prevents the possibility of showing the existence of a non equilibrium path. To deal with the case of joint production Von Neumann used Activity-Analysis, which is the theoretical basis of linear programming ([211]).

In the Von Neumann system «products have no purpose except to serve as inputs to future production.» ([212]). But the non consumption case which the turnpike theory studies is only a limiting case. In the

Hicks model available techniques are devoted in producing bundles of consumption goods that could be substituted for one another.

Hicks questions the validity of Von Neumann's assumption that any combination of techniques is feasible: while this assumption may be acceptable in the case of a circulating capital model, for fixed capital techniques to which the Von Neumann model is extended raises questions, but if such an assumption is rejected the vital question is raised what remains of the turnpike theory?

In the case of circulating capital the equilibrium path is a balanced part. The Von Neumann path is the balanced growth path that corresponds to the best technique, the same proposition holds in the case of joint production which tends to tie proportions together.

The second Von Neumann theorem states that «The equilibrium path is an optimum path», which means that it has a higher rate of any other balanced or unbalanced path ([214]).

In the Hicks model, circulating capital model with no joint supply, the output limits will take the form of a linear frontier. At the Von Neumann equilibrium wage falls to zero and the rate of profit reaches its maximum. If we have a technique for joint production of all capital goods with fixed prices and values of inputs, fixed quantities of outputs would emerge. But in the case of choice of techniques the character of the frontier changes. The frontier is subject to change in direction in which case there will be some technique where output will be maximized at any given output prices. Thus, the second theorem a top growth rate ar the right prices is true even under joint production ([220]).

The third Von Neumann theorem states that «The equilibrium path is the only top-technique path that is continually viable.» ([221]). Under no joint-production we compare only top technique paths and we follow them for more than one period. In the case of joint production, the production possibilities frontier is not *flat*. If we start with the top proportions as inputs, the outputs of the next period will be more restricted and after a number of periods of being continuously restricted they must be approaching equilibrium: that is the path which starts from equilibrium will approach equilibrium ([223]). The turnpike theorem holds as long as the third theorem holds.

3. In the case of the turnpike theory itself we start from a non equilibrium stock and we aim, at the end of a number of periods, at a larger terminal stock of a given composition which will have the largest value at equilibrium prices. The path is backward narrowing

and the only difference between the initial terminal and the equilibrium stock is a difference of proportions.

If the initial capital stock is top-balanced, expansion will proceed along the Von Neumann equilibrium path with a growth rate greater that any other technologically possible. But in the case of a non top-balanced initial stock, in a few periods the whole stock will not be employed at the top technique and the growth rate will fall below the top. But there is a feasible path on the assumption that the composition differs only in proportions ([229]).

We may correct the non-top balanced stock into balanced by discarding the surpluses, which leads us to the top-technique method.

According to Von Neumann, the growth rate along the optimum path, cannot, in any single period, exceed the turnpike growth rate; the difference between the two from period to period is positive and the average of these differences when a great number of periods is taken «can be made as small as we like.» ([231]). Over most of its course this difference must be small. This average growth rate along the optimum path must approximate the top-growth path.

What is needed to go from the original Von Neumann theory to the turnpike theory which is based on it is the existence, optimality and viability of the balanced growth path; the first, the existence, is necessary for equilibrium; for the second, optimality, the growth rate of the equilibrium path must be as great in a certain period as that of every other alternative path; and for the third, viability, only along the equilibrium path a process of top growth rate could be carried continuously through. These three points establish the main points of the turnpike theory and would be satisfied even when the Von Neumann assumptions were not satisfied completely.

The central directive of the turnpike theory is that we must look at the utility of the terminal stock of the planning process.

4. According to Hicks what is of importance is not the terminal capital stock «but the stream of consumption outputs» ([238]). The turnpike theory also requires labor elasticity which may or may not exist; there is a possibility of labor growing at a constant rate of growth; fixed supply of land also prevents growth equilibrium.

The center of the pricture becomes the stream of consumption outputs and how this stream is distributed over time. Land and labor rigidities impose restraints but by extending the time of the plan we extend the intermediate period and the rigidity of the stock does not

matter much. A fixed supply of land and labor will prevent a growth equilibrium with constantly expanding consumption output.

An index P gives «the average growth rate of the stream of outputs. So that a *fall in the rate of interest tends to increase the average growth rate of the stream of consumption outputs.*» ([245]).

The measurement of the growth rate of a stream of consumption goods is not the same problem as the measurement of the growth rate of a capital stock; in the latter case we look at the initial and terminal stock in order to determine the growth rate. In the former case, of consumption goods, we must bring into calculation the whole flow.

The lower will be the rate of interest the higher will be the rate of real wages and the higher will be consumption output. A fall in the rate of interest reduces consumption output in the near future, causes an increased growth rate between time zero and a certain period T and causes a rise in the line of output after T. In the optimum theory the rate of interest is determined by productivity and thrift; we considered productivity, we now proceed with thrift.

5. If saving comes out of profits we have $g = sr$; but if saving is determined by utility maximization then g increases with r; we cannot conclude, however, that s increases with r. s may rise or fall or remain constant. A number of economists have attempted to use the utility function as a prescription about saving but this is not based on safe grounds. In the theory of saving, in its simplest form, we need special assumptions namely, Koopman's stationariness, that is constancy of needs over time. This is characteristic of the utility function. The second assumption is homogeneity which means that an increase in consumption inputs in the same proportion will increase utility (output) «in a proportion that depends upon the utility level (output), but is independent of the proportions in which the consumptions (inputs) are combined ([255]).

On the assumptions of stationariness and homogeneity the only optimal consumption plan, under constant rate of interest, is a plan with a constant growth rate. Under the same assumptions, a rise in the rate of interest will tend to increase the growth rate of the optimum path but will not say anything about the proportion of income saved.

The third assumption is independence where the marginal utility of consumption in each single period depends on consumption in that single period alone. Thus we see that while in homogeneity all consumptions are to increase in the same proportion when there is change in capital value and no change in the rate of interest, in dependence,

marginal utilities of consumptions «are each of them independent upon its own consumption only.» (256).

While independence is a key assumption it is accompanied by difficulties because if successive consumptions have independent utilities, this interputs future planning. The normal condition is that there is strong complementarity between successive consumptions.

6. The key relation of intertemporal optimum theory «is a relation between the rate of interest and the rate of growth». In the comparative theory all savings were coming out of profits; but saving out of wages complicated things and the factor-share ratio had to be introduced as a third variable; in optimum theory capital value is treated as the whole capitalized value of all streams of consumption goods: in such a case, we disregard the difference between profits and wages and wages appear as interest in the capitalized value of labor; then, $g = sr$ «becomes a valid equation for savings out of income as a whole.» (264).

With a given rate of profit «the equilibrium rate of growth would be higher, the higher the propensity to save.» (264). But with the rate of growth given, the equilibrium rate of profit would be lower, the higher the propensity to save.

When we compare no constant growth optimum paths, on the productivity side a rise in the real rate of interest tends to diminish the trend growth-rate of the consumption flow and on the saving side, a rise in the rate of interest tends to increase the same trend growth rate (265). Thus the rate of interest facilitates the selection of the optimum position.

The optimum rate of growth might be a position of full growth equilibrium under the following conditions: 1. The optimum rate of growth must be equal to the natural rate of growth of the economy; 2. the rate of interest should be such that would a rate of saving to support the rate of growth; 3. to this interest or profit rate would correspond an equilibrium technique; and 4. the capital stock of the economy should employ the initial labor force at the equilibrium technique and optimum growth rate.

If the initial stock corresponds to all these conditions but savings propensity is greater than equilibrium, then the trend rate of growth would be greater than equilibrium rate of growth, because of a shift in technique towards a more productive direction. This difference would disappear with the passing of time which would involve a falling rate of interest. Technical progress and time work in opposite directions and may balance one another. «On the average we shall find the optimum

point higher with optimum growth of interest above the equilibrium values.» ([272]). This is Hicks' general conclusion, which fits with classical and neo-classical models.

For Ricardo and Hicks disequilibrium growth rate and profit rate are above their equilibrium counterparts while for Von Neumann and the turnpike theory are below. In each case the discrepancy is due to imperfect adjustment of capital stock to that required along the equilibrium path. The reason for the difference is that in the Von Neumann case there is no limiting factor, everything is reproducible, «the maximum growth rate is entirely determined by technology.» ([273]). Another reason for the difference is that Von Neumann aims at the maximization of the growth rate, not a sensible economic objective; what is to be maximized is utility. Another difference is what Kaldor seems to observe that technical progress is the outcome of economic forces, Hicks points out that while economic forces constitutes part of the phenomenon, a part of progress is dominated by non economic forces but also by the advancement of science.

IV.—1. While Keynes' is a short-run model he looked in the long-run as well. Up to this point growth equilibrium and optimal growth path have been discussed without the use of money. The only way money could be introduced in the growth equilibrium was through the introduction of a commodity money, gold for instance, whose price would be determined on the basis of its cost of production and would appear as a capital good like the others.

The difference between commodity money and credit money appears in the comparison of equilibrium paths.

In the Keynesian system liquidity preference is choosing between bank money and bonds, but the role of liquidity preference is broader from what appears to be in the general theory. There is a maximum to all rates of interest «set by the expected rates of return on real investment» ([286]) and a minimum paid by the bank; all other rates must lie in between; where exactly, it will depend on liquidity considerations.

In the previous section attention has been paid to the relation between optimum growth and optimum interest under various conditions of productivity and thrift; here we are bach in pure positive economics «examining how a system that was organized in a particular way could be expected to work.» ([288]). To transfer the results from the one to the other is considered a mistake which economists often make.

Hicks makes the mistake «with his eyes open»; he assumes that

the relations between the optimum rates of the optimum theory are valid not for actual historical rates «that for the rates that would have been established if the monetary system had been working perfectly.» (288).

The main conclusion of the former analysis is that the optimum rate of profit is likely to be higher when the rate of technical progress is rapid.

Since the rate of profit is determined in real terms and the rate of interest is built in monetary terms can they effectively be confronted? If prices remain constant both money rate and real rate come to the same thing and the preceding analysis stands. But if prices are expected to rise there will be equilibrium but the money rate of profit will be higher that the real rate. Inflation will be controllable inflation and equilibrium would be maintened. But it will be unwise to rely very far on such an inflationary equilibrium and therefore it is room for smooth monetary policy.

2. The production function. Differences in productivity between two economies are due to factor endowments, technical knowledge or differences in the efficiency with which factors are applied. The production function has been investigated as a static phenomenon where gross investment is equal to depreciation. It is now assumed that an invention is made and there is not sufficient capital. To increase production to the possibilities of new invention time is required, for adjustment. A gradual adjustment to the new equilibrium level is the simplest thing but how the new and old equilibrium will be compared assuming that no saving takes place in the meantime?

Consumption has increased by the increase in technology but labor and capital remain unchanged; during the period of adjustment technology is changing and the production function is continuously shifting, which increases the product even if capital and labor remain the same. But if production is rising capital must be rising.

Technical improvements will result to fall of the capital stock and a good deal of consumption will be foregone in order to replace the productive power of physical instruments. The change in technology has a direct effect on the marginal products of both labor and capital: it will increase the marginal productivity of capital and will reduce the marginal productivity of labor.

The initial effect of the new technology will be to raise the rate of profit but since the higher rate of profit is to be applied to smaller capital, it does not follow that the share of profit will increase; the rate of

profit will rise on new investment and the change in relative shares will depend on the productivity of substitution ([301]).

But if capital is higher at the new equilibrium because of saving from higher profits, labor does not have to stay the same and thus we move to a new equilibrium path. Saving may be measured by the value of consumption goods given up during the process. The economy is always in a state of transition loosing capital by improvements and offsetting that loss by accumulation. Usually this form of saving is left out and we attribute less of a rise in output to capital accumulation and more to technical progress.

V. *Conclusion.* — There will be some time before all the points of the book come up for intensive and critical discussion. The mathematician will declare himself as being withing his jurisdiction; the economic theoretician, whether pro or con will also have a lot to say; the teacher of economic thought will discover that his feelings have been heart or the cause of the history of economic though has been enriched and amplified.

Since the book is not easy reading I consider as my contribution the pointing out of the main issues involved and making them approachable to a larger number of students.

It is true that my effort is not characterized by the meticulous care with which the author proceeds but it is this care which makes reading almost impossible. The book has no single purpose in the sense that a thesis has been resolved one way or another. It is an open end process, it is a picture of the processes which it tries to explain.

If I wanted to generalize to a dangerous point I might put it this way : Part I aims at the clarification of «my own former work, even to myself» (Preface p. vi). We might call this part the review of efforts on an unsolved problem.

To the continuous criticism and the indications of what is good or bad on ideas of contemporary economic theory, the second part comes as a kind of complementary effort aiming at filling the gap of the past within the framework of Positive Pure Economic Theory. But this theory leads us nowhere. The actual behavior of an economy «with imperfect foresight ... becomes so baffling.» ([201]).

But this is not reason for stopping because «Though we cannot determine the actual path which the economy ... will follow, we can say much more about its optimum path», and this leads to the discussion of Part III that of the Optimum Growth.

While the Dynamics of Aggregative Economics present no great difficulty, a search for equilibrium is made in a disaggregative system. It is here where greatest trouble is faced.

The issues discussed in part four are not new. The only thing which I want to say here is that in the case of the discussion of «the production function» Hicks has followed the traditional path of not mentioning those who prepared the foundation for the discussion of his last chapter.

Bethesda, Md. November, 1966