CHAPTER I: INTRODUCTION

1. The purpose of the present study is to look at certain analytical aspects of handling time in macroeconomic models. More specifically, we shall examine the Marshallian tradition of defining a short-run and a long-run as two qualitatively different environments for economic events to occur, where different economic variables serve as adjustment variables. Having identified some of the analytical weakpoints of such a method we shall counterpose to it a method which seems to be implicit in Keynes' General Theory, but not fully developed there. This latter method, as we will argue, does not make a qualitative distinction between a short-run and the long-run. What happens in the long-run, there, is the outcome of a succession of similar short periods - an idea which seems to correspond much more closely to our intuitive notion of a short span and a long stretch of time. We will also try to argue that this latter method is free from certain ambiguities and difficulties of the logical time construct of Marshall.

We shall try to develop this method as a viable method of analysing long period paths of capital accumulation, concentrating completely on the flow equilibrium conditions of the single short periods. The focus of this part of the study will not be as much to construct descriptive and realistic models of capital accumulation, as to examine

the methodological implications of such a procedure. In particular we shall try to contrast the notion of a steady state and its stability properties arising from this procedure of juxtaposition of similar short periods, with similar notions of the Marshallian tradition.

In the method we try to develop, the analysis proceeds from the short period to the long-period, i.e. the element of the analysis is the equilibrium of the single, representative short period. By threading these elementary periods together one gets the view of the long period. We will argue that in this respect it represents a major departure from the Marshallian method of treating time, where the long-period equilibrium is posed as the starting point of analysis. Events of disturbance of this long-period equilibrium produce problems to be studied by the tools of short-period analysis. We will argue that this is a difference of substance and proceeding from the short period to the long period may lead to much more useful and interesting dynamic analysis than can be developed within the framework of the Marshallian method. 'In this regard we will depart from the often-held view that Marshall's and Keynes' analysis are methodologically similar, both comparative static in character and the essential difference between the two
is in postulating the adjustment variables.\(^1\)

In the present introductory chapter we will look at the relevant features of Marshall's method in some detail and counterpose it to Keynes' in General Theory.

2. Most economic activities at a point of time derive from the past and/or are directed towards future. Any frame of economic analysis that deals with such activities has to develop a technique of handling time, so that this connection between economic activities at different dates is adequately captured. Investment is probably the most typical of such economic activities, and the question of handling time assumes utmost importance in models of accumulation of capital.

It appears that there are at least two dimensions to the problem. One is that time is a continuous variable flowing in one direction alone. This implies that economic activities, even if they are not causally related, have a unique sequence in real time. As a result, if real or chronological time is substituted for by some logical time construct, it becomes necessary that the sequence of events in relation to these logical periods corresponds to the sequence of events in real time. Both confusion

---

1. Examples of this widely held view are numerous. See for example, A. Leijonhufvud: Keynes and the Keynesians; A suggested Interpretation, American Economic Review, Vol. 57, No. 2: "Keynes' theory was dynamic. His model was static. The method of trying to analyse dynamic processes with comparative static apparatus Keynes borrowed from Marshall".
and invalid conclusions may follow if this sequential correspondence between logical periods and chronological periods is not maintained. The second dimension of the problem arises from the fact that economic activities are distributed over time in such a way that an on-going activity at a point of time will in general have a link with certain activities in the past and certain others in the future. The first dimension of the problem arises, so to say, from the irreversible nature of time itself, while the second dimension arises out of the nature of expectations relating specific economic activities at different points of time.

3. The first dimension of the problem, as stated above, comes out sharply in Marshall's analysis. Marshall uses the notion of a short and a long period, which are not stretches of time defined on the real time scale, but are purely analytical constructions. They are defined not with reference to chronological time that each is supposed to span, but with reference to the set of variables that remain as parameters in a particular situation. Therefore by taking the complement of this definition, the periods can also be defined in terms of the variables that are supposed to adjust in response to economic forces. The Marshallian short-run and the long-run, are thus two qualitatively different environments in which economic events occur and adjustments take place.
This logical time-period construction has the inherent problem that the sequence of events in real time and the sequence in relation to this logical time construct may not correspond. We may note some such problems to start with:  

I) It is not possible to select any definite real time period and call it the short-run or the long-run for the simple reason that in reality capacity expansion and changing the degree of capacity utilisation go on at the same time.

II) The real time period corresponding to the short-run will be different for different industries and it is conceptually difficult to extend Marshall's partial equilibrium method to a discussion involving more than one industry.

III) Because of the durability of existing equipments the short-run may be much shorter when the adjustment is an expansion than when it is a contraction. In industries with very long-lived equipments, this asymmetry will be quite pronounced.

IV) It is not inconceivable that the actual clock time corresponding to the short-run may be longer than that corresponding to the long-run. It may happen for example in a situation where installation of new equipment needs less time than increasing output from existing facilities.

---


However these are only potential sources of problems and confusion; they do not invalidate a logical scheme where the analysis is conducted completely with reference to the particular construct of logical time used. When results of such analysis are finally translated into statements about events in real time, the degree of their compatibility with empirical reality will depend on whether the particular logical time construct used is a useful abstraction, in terms of its coincidence with the properties and sequences exhibited in real time.

But there is a second and perhaps more important problem of using a logical time construct of the Marshallian type. Marshall's short and long-period, as we have pointed out describe two different states of the economy or environments. As a result, the economic phenomena, whose essence consists of the sequentiality or order through real time can not be adequately captured in such framework. Phenomena known as "Irreversibility" or "Economic Hysteresis" etc., which involve the sequence of events through real time in an essential way are in result impossible to capture in the framework of a Marshallian classificatory scheme of logical time. This point is best illustrated by Marshall's handling of the long-run equilibrium of a decreasing cost industry.

The only case of decreasing cost industry compatible with competition is one where the industry as a whole enjoys increasing returns to scale by virtue of the individual
firms enjoying economics of scale external to themselves but internal to the industry. The long-run equilibrium can be obtained, as always, by the intersection of the long-run supply curve and the demand curve for the industry. The problem, however, is to obtain the long-run supply curve.

The factors that can give rise to external economies of scale to the firms, remaining internal to the industry, are like "extensive improvements in organisation, creation of skills" etc. These factors bring about changes in costs through time and are not reversible, as Marshall himself points out. As a result if supply is diminished after it was once expanded, the costs and hence the supply price will not trace back the path through which they had earlier traversed.

In such a situation it is impossible to derive the long-run supply curve for the industry. The supply price corresponding to a particular output level in this case would depend on the sequence, through time, of the earlier output levels. So that, it is not only that the supply price becomes a non-unique function of output (which would correspondingly create problems of multiple equilibria), but more fundamentally, the status of the supply price as a function of output independent of time becomes untenable. In particular, the supply price function can

---

no longer be used for the determination of the normal long-run output of the industry because prior knowledge of all earlier output levels would be necessary for that.\footnote{1}

The basic problem here seems to be that the question examined involves a sequence in real time, while the logical time construct used does not have the relevant attributes to make it correspond to the temporal sequence of real events.

4. We can now discuss what we have termed as the second dimension of the problem of handling time, namely that of posing the relation of causation between the events of different periods. We will start by examining the way Marshall tried to handle the problem. It seems convenient to focus on the relevant issues by discussing the behaviour of firms in relation to what Marshall calls "normal" profits. Marshall starts by identifying these normal values with the static equilibrium values of the variables. The stabilising behaviour of the firms around these normal values arises in his system because in the stationary state prior to the change being studied, these values were in fact ruling. These are therefore, the "customary" values of the respective variables so to speak, to which the firms have been conditioned and accustomed. If the

\footnote{1. This illustrates how the Marshallian framework becomes unusable in handling a phenomenon that involves sequence in real time in an essential way. For an interesting discussion of this problem in its historical perspective see Krishna Bharadwaj: Marshall on Pigou's Wealth & Welfare: Economica, February, 1972.}
profit rate falls, for example, below the "customary" level, the firms react by moving their capital away.¹

Two related but distinct points should be noted in this regard:

a) To rationalise the firms behaviour regarding a certain profit rate acting as a benchmark, it has to be postulated that this rate must have ruled over some substantial time period in the past as an equilibrium rate. This implies that prior to the dynamics being studied, there has to be always a history of a sufficiently prolonged regime of the equilibrium values, which eventually shape firms' idea of a normal profit rate and bring into existence confident expectation (or perfect foresight) about it. This introduces one serious weakness of the method, namely that it can study only a disturbance off the prevailing stationary conditions or state.

b) Secondly, to allow for this history of a sufficiently prolonged regime of the equilibrium values, the system must also be provided with stability properties. Thus the normal profit hypothesis of visualising a transition from a short-run to a long-run, logically internalises

---

¹ The firm's behaviour in Marshall can of course be rationalised at one stroke by assuming perfect foresight about the equilibrium values; and that they try to maximise their gains by shifting capital away from areas where the current profit rate is less than the equilibrium rate. We are trying to list the more elementary assumptions that could justify such foresight. At any rate Marshall himself often made statements involving more elementary assumption than perfect foresight. See Alfred Marshall. Principles of Economics. Book V, Chapter III.
the stability of the system. From this viewpoint, the stability of the long-run behaviour of the industry is a built in property and is not economically interesting. If stability were not a necessary adjunct of the system, there could not arise a reasonably long history of the equilibrium values in the past to subsequently create expectations about itself.

Thus the connection between the periods in Marshall is provided by a confidently held expectation about the normal rate of profit. The transition from the short-run to the long is effected by virtue of the agent's comparing the currently prevailing values with the normal values. For this transition the presupposition of the knowledge of the "normal" or the long-run equilibrium values is essential. But this results in several weaknesses in the method. Firstly, the system has to necessarily study a disturbance from a stationary state. Secondly, the stability of this stationary state in the sense of its being able to perpetuate itself is a pre-condition of the use of the method. Thirdly, the method is incapable of studying a path which may or may not in principle admit of a stable equilibrium. And finally, the method strictly applies to a study of a perturbation of an ongoing equilibrium and not a movement towards a stable equilibrium from an arbitrary initial state through real time. Any arbitrary initial condition may not provide the agents with the
knowledge of the equilibrium values that they are to confidently expect.¹

5. Much of the above problem seems to be inherent in starting the analysis from the long-period equilibrium and then proceeding to the short-period phenomena. It is not surprising that the analysis of a path starting from any arbitrary initial conditions will be impossible in such a framework. An alternative method that can trace out the long-period path of a system without pre-supposing it, is the so-called Swedish method.² This method deserves discussion in some detail here, if only to make the contrast with what we will present as Keynes' method in the General Theory, sharper. The essence of the Swedish method can be best described in the words of Erik Lindahl.³

1. For similar observations, see Joan Robinson: History versus Equilibrium: Thames Polytechnic, 1974.
2. It seems there are at least two distinct methods of approaching the problem in the Swedish tradition. The first is that of temporary equilibrium, to be found in the original (1929-'30 version) of Erik Lindahl's work and discussed at length by Hicks in Capital and Growth. The second is a disequilibrium method to be found in Lundberg's work titled, "Economic Expansion" and in the later works of Lindahl himself. Our purpose in the present chapter is examining the techniques used in linking various periods, so that we can, for the purpose at hand, ignore the difference between the two methods and look at the common way of their approaching the interrelation between the periods.
"Starting from the plans and the external conditions valid at the initial point of time, we have first to deduce the development that will be the result of these data for a certain period forward during which no relevant changes in the plans are assumed to occur. Next we have to investigate how far the development during this first period - involving as it must various surprises for the economic subjects - will force them to revise their plans of action for the future, the principles of such a revision being assumed to be included in the data of the problem. And since on this basis the development during the second period is determined in the same manner as before, fresh deductions must be made concerning the plans for the third period and so on."

From one viewpoint this method is diametrically opposite of the Marshallian method. Nothing is prepostulated about the state of the economy in some distant future. In some suitably defined length of time, the agents' behaviour is based completely on their experience of the past, and this determines the outcome at the end of the period. The succession of such periods traces out the path through time.

The major difficulty of the method arises in defining the unit period suitably. The requirement for a suitable unit period is extremely stringent. The method has to proceed by assuming that the successive revisions of the plans and the conclusion of the economic process generated
from the plans keep coinciding in time. This implies that plans are necessarily based on the particular variable (or its expected value) which serves as the adjustment variable in the unit period process.

For example, in the temporary equilibrium models, the assumption is that the plans are based on price expectations while price is the adjustment variable. It seems natural to criticise it for not accounting for the effect of income changes during the process on the plans of the agents - i.e. for missing out what Hicks\(^1\) terms as Income Effect. Similarly in the disequilibrium models of the Swedish tradition, where output is the adjustment variable, plans are also formulated on the basis of the movement of output.\(^2\) It will be likewise fair to criticise such a model for not taking into account the effect on the agents' plans of the price changes that may accompany the process. It should be emphasised that these criticisms are not just criticisms against omission of what ought to have been included in a model for the sake of realism. Within the framework of the method, there seems to be no way of incorporating these omissions. For example, if a model of this type is set up with both price and output as adjustment variables and with plans based on both price and output changes, then the unit period can not be defined unless price and output have also the same speed of adjustment.

In thus looking at the relation between the agents' plans and the consequences following from there, the view taken of the economic process becomes to suggest that given some ex-ante expectations, their results are concluded and can be exactly identified after a regular interval of time. This surely is a drastically demanding requirement. In fact this problem led to Keynes' rejection of the method in developing his own system. To put it in his words:

"I used to speak of the period between expectation and result as "funnels of processes", but the fact that the funnels are all of different lengths and overlap one another meant that at any given time there was no aggregate realised result capable of being compared with some aggregate expectation at some earlier date."

In effect Keynes seems to be suggesting that in reality the results that follow from a certain expectation and corresponding action, would be spread over stretches of time overlapping at different points. Consequently even if one could identify ex-ante expectation one could never be sure of identifying a particular expect result to link exclusively with it. This must be true, at the least, of certain types of expectations, and especially of what Keynes terms "long-term expectation", the results of which can not be reflected in the performance of the economy.

2. General Theory: Chapter 5.
at short intervals. As Keynes writes in the General Theory:¹

"It is of the nature of long-term expectations that they can not be checked at short intervals in the light of realised results".

This objection led to Keynes' rejection of the Swedish method as well as his own distinction between the short period expectations and the long period expectations.²

Keynes' innovation so far as economic dynamics goes was to distinguish between the short-period expectation and the long-period expectation, rather than to define a short-run and a long-run like Marshall. To visualise the working of the economic forces at present (for example that of the principle of effective demand) he simply assumed that state of the long-period expectations was frozen during the period under study.

In the General Theory, the analysis that he undertakes is of the short period. But there are interwoven discussions of a method that may profitably be used for the discussion of a succession of periods. A whole series of periods can be discussed by assuming that the state of long term expectations remain unchanged through this process in time. While the day to day decisions of the agents are shaped in

2. For a similar view, see J.A. Kregel: Economic Methodology in the face of Uncertainty: Economic Journal: June 1976. See in particular his separation of three distinct models of Keynes in his writings and the role of short- and long-period expectations, in what he calls Keynes' "truly dynamic" model.
the background of this long-term expectation and with special reference to the short-term expectations, this latter may quite well be changing from one short-period to another. In Keynes' words:

"The first type is concerned with the price which a manufacturer can expect to get for his "finished" output at the time when he commits himself to starting the process which will produce it; ............ . The second type is concerned with what the entrepreneur can hope to earn in the shape of future returns if he purchases (or perhaps manufactures) "finished" output as an addition to his capital equipment. We may call the former short-term expectation and the latter long-term expectation. (Emphasis in the original)

"Thus the behaviour of each individual firm in deciding its daily output will be determined by its short-term expectations ........... , though in the case of additions to capital equipment and even of sales to distributors, the short-term expectations will largely depend on the long-term (or medium term) expectation of other parties". (Emphasis in the original)

There are several merits of posing the problem in this way. First, as long as the state of long-term expectations is not changing, it should be possible, in principle, to trace out the path of the system from any arbitrary

initial situation. It is not necessary, unlike in Marshall's method, that the path has to arise from a disturbance of an ongoing stationary or steady state.

Secondly, it is possible to look at the path in relation to some long-period equilibrium state as a benchmark. Unlike in Marshall, this benchmark remains meaningful even if the system has no tendency to stabilise at this state. It is thus a long-term view of economic events and their resulting consequences, without attributing it the characteristics of an equilibrium configuration. For, the state of long-period expectation, in this framework can enter as a datum without making it necessary that the economy has to be in such a state previously. This notion can be best described in Keynes' own words:

"If we suppose a state of expectation to continue for a sufficient length of time for the effect on employment to have worked itself out so completely that, there is, broadly speaking, no piece of employment going on which would not have taken place if the new state of expectation had always existed, the steady level of employment thus attained may be called the long period employment corresponding to the state of expectation."

Therefore a stable long period expectation does not presuppose the existence of the corresponding equilibrium state in the past.

We should note how the difficulty observed with the Swedish method is resolved here. There are certain types of plans and expectations which are revised quite frequently, while there are others that remain stable over a longer period. As a result it becomes impossible to devise a uniform unit period for analysis through which a particular economic process based on all these plans is going on with the plans themselves remaining unrevised. With the conclusion of, say, a certain phase of this economic process some plans are bound to be revised, while a few others will still remain unchanged. In a sense, Keynes seems to have defined his unit period of analysis as the longest period of real time through which the plans that are quickest to get revised would stay reasonably stable. His "principle of effective demand", is, from this viewpoint, an analytical effort at separating out the longest meaningful economic process during which the more important aggregative plans (e.g. investment plans) remain unchanged.

(Investment has been identified in the General Theory as the economic activity that remains at a given level, till the rest of the activities in the system take their time to get correspondingly adjusted. While this is by itself a very useful empirical view to take about the working of the economy, this also at the same time resolves the problem we noted with the Swedish method. In a situation where all variables and the plans of actions based on them are continuously changing, this provides a way of isolating...
an interval through which an important type of plans remains unchanged, and allows other variables to adjust, thus enabling the analysis of the process within this interval to be more tractable.

7. If we interpret the "principle of effective demand" in this way, it is natural to suggest that a method of long-period analysis can be developed by stringing together the Keynesian unit periods. In doing so one potential source of problems remains. Even if the aggregative plans underlying investment decisions are taken to remain unchanged till their impact on the economy works out fully, the method will be meaningless if this latter process of working out is a non-converging process. Firstly, investment decisions can not be taken to remain unchanged indefinitely; and secondly, since the time of convergence of this adjustment process is to define the unit time period for the long-period analysis, we can not pose the successive unit periods unless each takes a finite time.

Such problems may arise out of the peculiarities in specifying the technological or behavioral conditions of the system or the agents respectively, regarding the response to a given level of investment. There may be also certain types of expectational behaviour of the agents during their response to the given level of investment, that may likewise render the short-period adjustment process non-converging. In all such situations, we are never out of the Keynesian short period, however long may be the corresponding
length in the historical time scale. The method of long-period analysis suggested above would break down in such circumstances.

Since such cases would constitute the set of limitations of applying our suggested method to long-period analysis, we defer their discussion for a more detailed exposition in the course of the arguments developed in this study.