Chapter VI: Conclusion
The interrelation between the distribution of income and level of output is the main focus of the study. In the introductory chapters (Ch. I and Ch. II) we discussed how this interrelation has been short-circuited in the economic literature i.e., in both the classical models and the post-war Keynesian, Kaleckian models, by assuming the level of output \( (Y) \) or the distribution of income \( (h) \) to be exogenous respectively to their models. With this basic proposition that these models are short of one equation for analyzing the interrelation satisfactorily, we set out to explore systematically the link between the distribution of income and its level by specifying different models, including some characterized by increasing returns.

First in Ch.III, we set up a simple model to understand the nature of the link between distribution of income and the level of output. In this model, we showed how exogenous variations in the given level of mark-up (distribution) affects the components of aggregate demand viz., consumption and investment, in opposite directions, thus making the link between income distribution and its level ambiguous in sign (see condition III.13, p.23). Any constant mark-up \( (m) \) at a given labour productivity entails constant real wage rate (see eqn. III.5). Then the variations in the real wage rate, due to parametric variation in the mark-up, solely determine the share of profits \( (h) \). Thus an exogenous fall in the real wage rate due to higher mark-up raises the share of profits at the given labour productivity \( (\bar{x}) \). However, this model is only a preliminary step in so far as the profit margin or mark-up \( (m) \) is given exogenously, and the nature of its link to aggregate
demand is established entirely through the specification of the investment and saving function.

Whereas in Ch.IV, the distributional changes are made endogenous to the model and its interrelation with the level of output is analysed. In this model, the distribution of income (say profit share \((h)\)) is endogenously determined as labour productivity varies due to scale economies. Thus, in this case of increasing returns due to fixed overhead wage bill of the non-operative labour, as capacity utilization \((z)\) increases labour productivity increases to bring about a fall in the unit variable cost \(^{1}\) \(\left(\frac{w}{x(z)}\right)\), which in turn would increase the share of profits \((h)\).

Thus any rise in labour productivity unambiguously increases the share of profits, which by influencing both consumption and investment, establishes its link with the level of output. The nature of this link is also unambiguous in this model, as condition (IV.8) shows clearly how the negative effect of the higher profit share on consumption demand has to outweigh the positive effect of the same on investment demand to ensure a fall in the level of output or aggregate demand. Though the models in Ch.III and Ch.IV highlight the link between distribution of income and its level, they are inadequate in so far as either exogenous changes in the profit margin at given labour productivity (Ch.III) or endogenous changes in labour productivity at given profit margin (Ch.IV) is considered to provide the necessary link.

In Ch.V, the dynamics of interrelation between income distribution and the level of income is analysed in a more complex model by assuming both money wage and productivity as increasing functions of capacity utilization. It is this explicit
consideration of money wage and labour productivity as functions of capacity utilization that generates interesting dynamics capable of producing sustained non-linear oscillations in terms of limit cycles in some cases, where investment responds sufficiently strongly to profit share (i.e. the Exhilarationist regime). Nevertheless, fluctuations in the level of effective demand still remains the central point here in this model, under the assumptions of nearly fixed price and strong impact of profitability on investment (i.e. exhilarationist regime), generating in some cases oscillatory interaction between distribution of income and the level of output.

In essence, an attempt is made to show how lack of effective demand occurs, through the same two components that expand it viz. consumption demand and investment demand, to result in cyclical fluctuations in a system where there is an endogenous, self-reinforcing interaction between distribution of income and the level of output under 'time-reversible' increasing returns.

From the perspective of relation between price, money wage, mark-up, productivity and market structure, we can summarise the findings of our models as follows:

In Ch.IV model, as discussed above any constant mark-up (m) at a given labour productivity entails constant real wage rate. Then the variations in the real wage rate, due to parametric variation in the mark-up, solely determine the share of profits (h). Thus an exogenous fall in the real wage rate due to higher mark-up raises the share of profits at the given labour productivity. This could perhaps
correspond to an oligopolistic stalemate of constancy of the relevant variables in a market structure characterized by competition among a few firms.

In Ch. V, with the assumption of money wage rate being an increasing function of capacity utilization and its interaction with the labour productivity generates two contrasting cases of rising and falling profit share in the course of expansion of economic activity. This can be seen as the interplay of the extent of monopoly power of the firms as price-setters and the extent of monopsony power of the trade unions of workers as wage setters. In this model we show that the falling profit share at the peak of activity stands somewhat in contrast to the widely observed empirical fact of procyclical behaviour of profit share. It requires the percentage rise in money wage rate to be strong enough to outweigh the advantages of higher labour productivity at high capacity utilization, which in turn could correspond to a monopsonistic labour market coupled with a fairly competitive product market.

However, a major limitation in the model in Ch. V is that the feedback from price to money wage is not taken into consideration. If this is taken into account in a more complete model, the direction of change in income shares might be difficult to determine. Another limitation of a more fundamental nature, discussed more extensively in this chapter, is the absence of 'historical time' in incorporating the consequences of increasing returns. Its major features like irreversibility of time and historical path dependence raise difficult analytical problems of considerable economic relevance. However, their formal modeling remains beyond the scope of this study. Nevertheless, in this chapter an attempt is made to conceptualize
this problem in a slightly different way from that found in the literature. It’s possible consequences for the analysis of interrelation between distribution of income and its level under this time-dependent process is pointed out in the ensuing discussion in this chapter.

Increasing Returns to Scale without time-reversibility: some implications for the study.

Generally speaking, increasing returns occur when a rise in production level leads to reduced input requirement per unit of output. Classical economists believed that the process of division of labour is the main reason for technologies to exhibit increasing returns.¹ A version of their argument runs as follows:

Let A be the set of tasks to be executed in order to produce good X; a partition A₁, A₂... Aₙ is called the first stage division of labour. Each sub-task Aᵢ, i = 1, 2...n is executed by different kinds of machinery and primary factors, called as first stage intermediate goods. The set of tasks to be executed in order to produce each first stage intermediate good is also subject to division of labour. Each sub-task generated by a second-stage division of labour is executed by intermediate goods called as second-stage intermediate goods. Clearly this process can go on indefinitely. Theoretically, this process of division of labour would reach its limit at the nth stage if all the nth-stage intermediate products are reducible to primary

¹ See f.i. Smith (1776), Young (1928).
factors. Suppose, now that production processes are indivisible, i.e., when an intermediate good is utilized in the production of some other good, its quantity cannot fall short of a minimum threshold amount. This indivisibility is defined as the fixed cost of the system.

Clearly, in terms of manufacturing industry, this implies that an increase in the degree of division of labour entails increase in fixed costs. This is clearly echoed in Smith (1776, p.7) "... the invention of greater number of machines which facilitates and abridge labour and enable one man to do the work of many".

Karl Marx’s treatment of increasing returns develops Smith’s argument and includes a detailed analysis of the actual conditions of the manufacturing industry of his day. His model links the phenomenon of increasing returns to the recurrent crises of over-production in the capitalist system. However, the basic idea of the source of increasing returns is similar to that of Adam Smith’s division of labour argument i.e., the dynamic increasing returns brought about by the division of labour in the workshop. The Austrian economists denoted it as ‘roundabout ness’ in production, which is similar to Marx’s notion in this context, obtained by

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2 Here this characterization of the production process closely resembles the theory of production put forward by the Austrian school, especially in the works of Bohm-Bowerk (1889). The distinction between ‘primary’ or original factors and ‘intermediate’ or produced factors is fundamental to his theory of interest. He argues that a production process which involves these intermediate or produced factors may be more productive but at the same time more roundabout i.e., time-consuming. Precisely it is this time-consuming roundabout nature of production that the Austrian School tried to model and not the irreversibilities that arise due to the involved to time in the production process (discussed later in this chapter). See Samuelson, P (1966,pp.567) and Blaug, M (1962, p.501-509); also see Hicks (1973).
improving equipments and augmenting their size to make finer partitions of the production process possible.  

Subsequent research in economics followed this idea of increasing returns arising out of division of labour (increasing the size of machinery) and specialization, to work out static models of increasing returns in many areas including international trade theory. Renewed interest in growth theories, in particular growth driven by increasing returns, was developed following Arrow (1962). The basic idea in his model is that productivity is assumed to be an increasing function of investment whereby he argues that increasing returns arise because new knowledge is acquired through ‘learning by doing’, as investment and production takes place. Similar to these models, which use productivity as an increasing function of capital, there are also models where the gains in productivity are linked to fixed labour or overhead labour. Perhaps, the most important example of this is Kalecki’s work, where he argues this point in an indirect manner, but it plays little role in his theories of business cycles or growth except through influencing income distribution.  

Nevertheless, what is apparent in this treatment of increasing returns is the absence of time involved in the process. Note that we are not talking about the

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3 See Marx, K (1861, Vol. I, Ch. IV, Part IV)
4 In Kalecki’s theory Overheads form a part of profits. However Overheads also has a cost character in as much as a part of wages viz., salaries to technical/managerial staff. are included in it. Then this should imply that an increase in the fixed capital/labour per unit of output would lead to a rise in the ratio of overheads per unit of output. But he argues the contrary that an increase in the ratio of fixed capital/labour per unit of output may lead to a fall in the ratio of overheads per unit of output and provides empirical support to his argument. In terms of Kalecki’s categorization i.e., part of wages form overheads, this argument implies to the phenomenon of increasing returns where an increase in the fixed capital per unit of output leads to a fall in the ratio of overheads to output. See Kalecki (1971, p.56-58) and Okun, A (1983).
5 This is the line we have followed in the preceding chapters.
time lag in reaping economies of scale i.e., economies associated to one increase in the scale of production not long enough for another and larger increase. We are focusing our attention instead on economies appertaining to the time sequence of fixed cost decision, however large or small, that must happen necessarily over time. This way of looking at increasing returns is often referred to, as Path-Dependence. By emphasising time as an independent argument in the productivity function, the explanation of the process of increasing returns depends on specifying the evolution of the sequence of fixed cost decisions. This process of increasing returns through the evolution of the time sequence of fixed cost decisions as historical events placed in a definite order in time, destroys the fundamental property of reversibility with respect to time found in the simpler type of increasing returns discussed above. Before conceptualizing further this problem, let's look at a simple example to understand the property of time irreversibility. Consider the sequence of events A, B, and C happening at different points of time, say, t₀, t₁, and t₂ respectively and suppose this sequence to be the least cost one. Suppose that we move backwards in time, say from t₂ to t₁. At time t₁ we have only A and B in the sequence, which need not represent yet the least cost sequence. It is only when C joins the sequence at time t₂, the sequence ABC becomes a least cost outcome.

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6 Alfred Marshall, in his Principles, had this in mind when he discussed, particularly in Appendix H, the neglect of the 'elements of time' in the increasing returns process. See Bharadwaj (1989, p.167-170).

From the point of view of distribution theory, in the reversible type increasing returns case one could always see how the rate of change in the fixed costs at different points of time, say, \( t_0 \), and \( t_1 \) affect the distribution of income at a subsequent time period say, \( t_2 \).

But in the case of Path-Dependent process, the distribution of income at time period \( t_2 \) depends on the arrival or happening of \( C \) at \( t_2 \). Note more over that the occurrence of events at different points of time itself may be subject to probabilistic prediction. In other words the occurrence of events at different points of time might be subject to a particular type of uncertainty or even to a random process of chance events. This rules out moving backwards in time, say, from \( t_2 \) to \( t_1 \), and argue whether the arrival or occurrence of \( C \) at \( t_2 \) would improve or worsen the distribution of income of say, a particular industry, at time period \( t_2 \).  

The above example places us in a better position to conceptualize this problem of increasing returns due to historical path-dependence resulting in the time-

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\(^8\) see Robinson (1974), where she argues that movement in space which is reversible (and subject to the type of formalization we have used in this work) is different from movement in time.
irreversibility of the process. This process can be characterized as follows:

consider the following probability tree

![Probability Tree](image)

Let A, B, C₁, C₂, C₃, D₁, ..., D₄, E₁, ..., E₅ be various fixed cost decisions happening at different points of time t₀, t₁, t₂, ..., respectively (noted on the right side of the fig VI.2).

The fixed cost decision or event A happens at time t₀ and event B that follows A, happens at time t₁. Now at the time period t₁, after the occurrence of event B, stretching the previous example over time, out of the three possible fixed cost decisions viz., C₁, C₂, and C₃, C₁ happens at time period t₂; in other words, the industry or the economy takes the C₁ way. Note here that there is no exclusion of the possibility from any of the three events happening at time period t₂. However, if C₁ takes the lead in terms of, say market share of a particular industry, it is C₁ which provides the initial condition and influences the subsequent fixed cost decisions, at time period i.e., t₃. Again at time t₂, after the occurrence of event C₁, there are four possible fixed cost decisions viz., D₁, D₂, D₃, D₄ out of which the
industry or the economy might take the D2 way. By proceeding this way we have the event E4 happening at time \( t_4 \). The actual path the industry or the economy takes is represented by the double-headed arrows, which is ABC\(_1\)D\(_2\)E\(_4\) and is assumed for the sake of the argument to be the least cost sequence (at time \( t_4 \)).

We now perform a thought experiment by moving backwards in time, say from \( t_4 \) to \( t_3 \). At time \( t_3 \), after the occurrence of D\(_2\) what we know is that the possible fixed cost decisions are E\(_1\), E\(_2\), E\(_3\), E\(_4\) or E\(_5\). We have no knowledge about which one of these events or fixed cost decision might happen at time \( t_4 \). Hence when we trace back in time, i.e., at time \( t_3 \) there is no reason to suppose that the process would end up with the least cost sequence ABC\(_1\)D\(_2\)E\(_4\) at time \( t_4 \). This way of characterizing increasing returns as a path-dependent process comes in conflict with one of the most fundamental property or assumptions usually made implicitly in economic modeling, namely reversibility in time. In contrast, in the more traditional type of increasing returns where scale economies operate continuously all along the cost curve, say average cost curve (see fig.VI.3), the movement backwards from the output level \( OM_1 \) to \( OM_0 \) does not pose any problem for determining the average cost at the output level \( OM_0 \).

![Figure VI.3](image-url)
But in the path-dependent process the same movement backwards from the output level at \( t_4 \) to \( t_3 \) might put us away from the least cost sequence \( ABC_1D_2E_4 \) or the least cost curve (if we may say), since at \( t_3 \) we have no knowledge about which one of the five possibilities is going to enter the sequence.\(^9\) Only if, \( E_4 \) enters at time \( t_4 \) we are sure that we are on the curve, otherwise not, since only the occurrence of \( E_4 \) makes the sequence the least cost one. However, it should be noted that the occurrence of events at different points of time, say \( D_2 \) at time \( t_3 \) and \( E_4 \) at time \( t_4 \), need not be purely by chance.\(^10\) This would be the case when all the plausible events that exist at time \( t_3 \), after the occurrence of \( D_2 \), viz., \( E_1, E_2, E_3, E_4, \) and \( E_5 \) do not carry equal probability of occurrence. This means the probability for the event \( E_4 \) to happen at time \( t_4 \) is embedded in the preceding sequence of events i.e., \( A \) at \( t_0, B \) at \( t_1, C_1 \) at \( t_2 \) and \( D_2 \) at \( t_3 \) and this probability becomes higher for the event \( E_4 \) than the other events i.e. \( E_1, E_2, E_3 \) and \( E_5 \) in the fig.VI.2. To put it formally, the conditional probability of \( E_4 \) happening at time \( t_4 \), given that the events \( A, B, C_1, D_2 \) happened at \( t_0, t_1, t_2, t_3 \) respectively is higher than for the plausible events \( E_1, E_2, E_3 \) and \( E_5 \)

\[ P(E_4 / A, B, C_1, D_2) > P( E_1 \text{or} E_2 \text{or} E_3 \text{or} E_5 / A, B, C_1, D_2). \]

It should also be noted that the conditional probability for the event \( E_4 \) is higher only when the preceding events happen in the following sequence i.e., \( ABC_1D_2, \)

\(^9\) Note here that it is the sequence \( ABC_1D_2 \) happening in this order leads to the event \( E_4 \) at time \( t_4 \). And precisely for the same reason it could be difficult to solve this problem in the Dynamic Programming framework. Because the sequence \( ABC_1D_2 \) which provides the initial condition for the event \( E_4 \), may not provide such a condition for the other possible events viz., \( E_1, E_2, E_3 \) and \( E_5 \) or in other words \( P(E_4 \text{or} E_2 \text{or} E_3 \text{or} E_5 / A, B, C_1, D_2) \) could be equal to zero. In a way we are constraining the process of natural selection to pick up that event or firm which would reduce the average cost of the industry. In this sense we are still dealing with the traditional increasing returns to size except that here time is incorporated. See Arthur (1994)

\(^10\) Arthur, B (1992) conceives this problem in terms of Polya Urn Scheme.
and same set of events forming a different sequence might not result in the higher probability for the event $E_4$ at time $t_4$, (see the following diagram). This implies the condition that

$$P( E_4/ A,B,C_1,D_2) \neq P( E_4/ B,A,C_1,D_2)$$

Hence in the path-dependent process it is impossible to move backwards in time as we do in the other type of increasing returns. This property is known as the Irreversibility property of the path-dependent processes. Associated with this, there are also some of the other interesting properties that arise from the path-dependent process. We consider them briefly in the following:

**a. No unique initial condition:**

The cost curve in figure VI.2 involves a unique initial condition. Suppose the curve SS as some industry's average cost curve. It is formed by adding more and more fixed costs to some initial level of fixed cost, which serves as the initial
condition for the average cost curve of that industry. On the other hand in the path-dependent process there is no unique initial condition. Every time period provides the initial condition for the subsequent time period. For instance, in figure V.2, the initial condition for the fixed cost decision $E_4$ is $D_2$ at time $t_3$. Similarly the initial condition for $D_2$ is event $C_1$ at time $t_2$ and not $B$ at time $t_1$ (as shown below).

![Fig. VI.5](image)

b. Potential Inefficiency Criteria:

So far we have assumed that the sequence $ABC_1D_2E_4$, which is the actual path of the history of an industry or an economy has evolved, as the least cost one. Which implies that the fixed cost decisions viz., $C_1$ at $t_2$, $D_2$ at $t_3$ and $E_4$ at $t_4$ are the best or technologically superior outcomes happening at different points of time. Now suppose at time $t_3$, after the occurrence of event $D_2$, out of the five possible fixed cost decisions, event $E_2$ is the best or technologically superior. But the actual path the industry or the economy has taken the $E_4$ way, i.e. the sequence $ABC_1D_2E_4$ is not the least cost sequence. This implies that under increasing returns regime there is a possibility that the industry/economy could get locked-in
to some inferior growth paths and this property is called as the Potential Inefficiency criteria.  

**c. Non-Ergodicity:**

Ergodicity assumption, often used in probability theory, means that different (plausible) sequence of historical events lead to the same outcome with probability one. Outcome in the present context of increasing returns means the least cost outcome. It should be evident from the above discussion that in the path-dependent increasing returns process, this ergodicity property does not hold, since different sequences are plausible but some or many of them may not lead to the least cost outcome. Hence path-dependent process is non-ergodic.

By portraying increasing returns as a path-dependent process one is looking at the history proxied by the evolution of fixed cost decisions ordered in time. Thus chance events i.e. historical accidents in the past may influence the way the economy evolves. There are quite a few real life examples of such path-dependent processes, referred to in the literature, such as, the spatial process of concentration of US manufacturing industry in a relatively small part of North east and eastern part of Midwest or the process of the development of Silicon Valley in Santa Clara county, California or the process of evolution of VCR market world over. These are few suggestive examples of the path-dependent increasing return

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12 if there are two sets of possible historical events \{ti\} and \{ti'\}, with corresponding time paths \{xi\} and \{xi'\}, then \|x'_i - x_i\| \to 0 with p = 1 as n \to \infty. See Arthur, W.B (1989, pp. 122).
phenomenon. Some of these examples also point out that how allocation under increasing returns regime could turn out to be inefficient, by the potential inefficiency criterion discussed above, or how an economy could get locked-in to inferior growth path. In turn these examples also highlight the point that a small or apparently insignificant random events in the past or in the history, can have cumulative consequences that get magnified over time by positive feedback so as to determine the eventual outcome.

However, although attempts at formalization are recent the idea as such is not altogether new in economics. Economists like Myrdal and Kaldor did visualize path-dependent processes when they talked about 'cumulative causation' in the context of trade, development and growth or even in the social context. This process can be stated more generally: cumulative causation involves a self-reinforcing, circular interactive mechanism between economic variables, so that in the simplest case, for example an initial increase in some variable X induce changes in a second variable Y which result in a further increase in X and so on. This interaction could continue indefinitely without leading the system towards a position of equilibrium, pre defined or otherwise. Nevertheless in this simple characterization of the process of cumulative causation there is no essential

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14 Myrdal uses this principle of Cumulative Causation to understand the dynamics of the racial tensions in America. He shows how the two variables viz., 'race prejudice' on the side of the Whites, directed against the Negroes and Negro's 'plane of living' (by which he means Negro's ignorance, superstition, dirty appearance, disorderly conduct, bad odour etc.,) mutually interact in a cumulative way, where, on the one hand, the Negro's plane of living is kept down by discrimination from the side of the whites, while on the other hand, the White's race prejudice is partly dependent upon the Negro's plane of living. He argues how this cumulative process thus set in motion had its final effects quite out of proportion to the magnitude of the original or initial level. See Myrdal, G (1944, p.1065-1070). Also see Kaldor, N (1979,1981,1985) and Sutterfield, M (1994).

15 see Chapter IV where it is shown in the context of distribution theory, how lack of effective demand breaks this circularity ad infinitum (condition (IV.8)).
involvement of ordering or sequencing in time, which makes the process time-reversible.

However, the fact remains that the process of cumulative causation can be characterized as a process of change through time. But modeling explicitly such a process of cumulative causation, which also has the property of irreversibility in time, would require comprehending the range of complexities that we outlined above.

It is clear, from the above discussion, that the fundamental property, which distinguishes increasing returns due to path-dependency from more traditional and simpler increasing returns due to dimensions of scale, is the time-irreversibility property. It is this property, which renders the path-dependent systems less flexible than the other traditional increasing returns system. We conjecture that, the economic systems characterized by path-dependent process may not have automatic mechanisms that would give rise to turning points or cyclical fluctuations in a way analogous to mechanical systems. In other words, if a system gets locked, into an inferior growth path (recall potential-inefficiency criteria) then there is no easy way by which the system could restore itself automatically to a higher or superior growth path. For instance, in the context of time-reversible increasing returns system, we discussed in ch. V, how the system could swing back and forth from a high capacity utilization and profit share zone to a low capacity utilization and profit share zone. However, it is precisely this kind of mechanical movement back and forth in time that may turn out to be far more difficult due to the inflexibilities associated with time-irreversible processes.
of increasing returns. We are still not in a position to track down formally the more precise consequences of time-irreversible increasing returns that might affect income distribution, demand and output. Nevertheless, our preceding formalism should not hide the fact that 'history', in the sense of a definite time sequence of past events, may have a far more important role in influencing income distribution, output and growth performance of economies than the formal models developed in this work might suggest.