PREFACE

In the curricular structure introduced by this University for students of Post-Graduate degree programme, the opportunity to pursue Post-Graduate course in a subject is introduced by this University is equally available to all learners. Instead of being guided by any presumption about ability level, it would perhaps stand to reason if receptivity of a learner is judged in the course of the learning process. That would be entirely in keeping with the objectives of open education which does not believe in artificial differentiation. I am happy to note that the university has been recently accredited by National Assessment and Accreditation Council of India (NAAC) with grade "A".

Keeping this in view, study materials of the Post-Graduate level in different subjects are being prepared on the basis of a well laid-out syllabus. The course structure combines the best elements in the approved syllabi of Central and State Universities in respective subjects. It has been so designed as to be upgradable with the addition of new information as well as results of fresh thinking and analysis.

The accepted methodology of distance education has been followed in the preparation of these study materials. Co-operation in every form of experienced scholars is indispensable for a work of this kind. We, therefore, owe an enormous debt of gratitude to everyone whose tireless efforts went into the writing, editing, and devising of a proper lay-out of the materials. Practically speaking, their role amounts to an involvement in 'invisible teaching'. For, whoever makes use of these study materials would virtually derive the benefit of learning under their collective care without each being seen by the other.

The more a learner would seriously pursue these study materials the easier it will be for him or her to reach out to larger horizons of a subject. Care has also been taken to make the language lucid and presentation attractive so that they may be rated as quality self-learning materials. If anything remains still obscure of difficult to follow, arrangements are there to come to terms with them through the counselling sessions regularly available at the network of study centres set up the University.

Needless to add, a great deal of these efforts are still experiment—in fact, pioneering in certain areas. Naturally, there is every possibility of some lapse or deficiency here and there. However, these do admit of rectification and further improvement in due course. On the whole, therefore, these study materials are expected to evoke wider appreciation the more they receive serious attention of all concerned.

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Netaji Subhas Open University

Post Graduate Degree Programme

MA in Economics

Course: Macroeconomic Theory

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PG-Economics (PGEC)

PGEC-VIII : Macroeconomic Theory

Unit 1 ❑ Keynesian and Post-keynesian Macro Economic models

Structure

1.1 Objectives

After going through this unit you will be able

- To Know about the difference between Keynes vs Classics;
- To learn about the Hicks' and Patinkin's interpretation of New classical synthesis of Keynes's General Theory;
- To have an idea regarding 'Keynes in the Walrasian framework';
- To get a knowledge about how there has been a rise of Non-Walrasian macroeconomics; and

- To apprehend the fix price multimarket equilibria as explained by Malinvaud, and
- To be acquainted with Benassy's Fix-price model.

1.2 Introduction

Keynes presented his *The General theory of Employment, Interest and Money* (1936) as challenge to the classical adherents of Say's Law of markets, claiming classical economics as a special case of his more General Theory. Keynes's interpretation of Say's Law was : equality of aggregate demand price of output as a whole to its aggregate supply price for all levels of output; which is equivalent to the notion that there is a tendency toward full employment.

While noting that Karl Marx coined the term "classical " to describe Ricardo, James Mill and their predecessors back to Petty and Boisguillebest, Keynes extended it to late adherents of Say's (or James Mill's) Law, including, for example J.S. Mill, Marshall, Edgeworth and Prof. A.C Pigou.

Keynes took Pigou's ***Theory of Unemployment***, published in 1933, as the brilliant and explicit exposition of the classical theory, particularly of the two main classical postulates. The first postulates was that the real wage is equal to marginal productivity of labour (the economy is on its labour demand curve); the second was that the marginal utility of wage equals to the marginal disutility of labor (the economy is on its labour supply curve).

Keynes's Critique of Classical Economics

J.R. Hicks's (1937) widely–reprinted "Mr. Keynes and the 'Classics' : A Suggested Interpretation" ignored both Say's Law and the classical postulates of the labour market, and made only passing mention of uncertainty. Instead he focused on a three-equation model of aggregate demand. Here the classical theory was a special case, where liquidity preference does not depend on the interest rate (a vertical LL, later LM curve); and Keynes's theory is a special case, where saving depends only on

income, not on the interest rate. Hicks argued that Keynes's *General Theory of Employment* is the Economics of Depression" relevant to the horizontal segment of the LL (or LM) curve at low levels of income (the liquidity trap), but retracted this last claim on 1945. Modigliani (1944) also considered Keynesian unemployment equilibrium to be a special case.

Keynes offered a sharply different view of what distinguished him from the Classics in his reply in the *Quarterly Journal of Economics'* to the four views of the *General Theory. Keynes* summed up :

> … I doubt if modern economists really accept Say's Law that supply creates its own demand. But they have not been aware that they were tacitly assuming it.
>
> (Keynes 1973 : Vol. xiv)

Coordination Failure and Walras Law

Robert Clower and Axel Leijonhufvud reopened the debate in the 1960s. They took seriously Keynes's rejection of Say's Law, and its sophisticated version, Walras Law, and interpreted the economics of Keynes as the economics of coordination failure. Clower and Leijonhufvud critiqued Walras' Law, the notion that the value of excess demand sums identically to zero across all markets including money. They believed that this law holds only for the notional demands, not effective demands. An excess supply of labour in one market need not imply excess effective demand in another market. This is because the wages an unemployed worker does not receive are not part of the worker's budget constraints for goods.

Demand constrained firms fail to hire workers. When markets fail to clear, because too high an interest rate discourages investment, effective demand signals may fail to both coordinate decisions and move the economy to full employment. As Clower said :

> "The sum of all excess market demands, valued at prevailing market prices, is at most zero,"… Contrary to the findings of traditional theory, excess demand may fail to appear anywhere in the economy under conditions of less than full employment."
>
> (Clower 1969 : 292)

Keynes thus differed from Classical theory in rejecting Say's law (in the form of Walras's Law for effective demands) and had sound grounds for doing so.

1.3 Neo-classical Synthesis of Keynes' General Theory : Hicks and Patinkin

The neo-classical synthesis suggests that Keynes was right in the short term, and classical economists were correct in the long-term. Markets may be subject to short-term shocks which put them out of equilibrium. But, in the long-term, free markets were best for distributing resources. The neo-classical synthesis suggests government intervention should primarily be concentrated on the short-term, stimulating demand in a recession, and dealing with rigidities in labour markets, such as monopolies, minimum wages and monopsonies.

The idea of neo-classical synthesis was first put forward by John Hicks (who developed the IS/LM model (investment saving–liquidity preference money supply) in 1937, which is based on Keynesian macroeconomic insights and (a major Israeli monetary economist and interpreter of Keynes).

The final stage in the creation of the neoclassical-Keynesian synthesis was Patinkin's book *Money, Interest and Prices* (1965), which included money in a Walrasian economy. This analysis obtained the standard (neo-) classical results, namely *the neutrality of money and the impossibility of unemployment equilibrium* when prices and wages are flexible. However, Don Patinkin (1922-1955) in 1956 tried to link IS-LM with tatonnement adjustment of prices a la Walras. He tried to link it with the conceptual structure of General Equilibrium model. In his *Money, Interest and Prices (1956)* Patinkin applied Hicksian **general equilibrium** analysis to Keynesian macroeconomics, brilliantly integrating the real economies, (where the relative prices are determined) and the monetary economics, (where the absolute prices is determined by some version of the quantity theory of money (the Cambridge equation), by treating money as a commodity which render services. He claimed that the dichotomization——the separation between the real sector and the monetary sector—is invalid because by Walras's Law, the excess demand for money is just the sum of excess supplies in all other markets, and hence must share the same parameters. The fact that in the neoclassical formulation the money supply appears only in the money market is self-contradictory. However, in his other numerous writings he has had sharp words of criticism for central elements of Keynes's

General Theory, particularly the notion of involuntary unemployment and the absence of a supply function in Keynes's macro-model.

It is interesting to note that Paul Samuelson in his Introductory Text Book presented also the dominant tendency of the 1950s and 1960s calling it as "neoclassical synthesis": synthesis of neoclassical microeconomics and hydraulic Keynesianism—the last term coined by Alan Coddington (1983)—an American neoclassical synthesis that John Robinson of the Cambridge University dubbed as "Bastard Keynesianism."

The assumption that economies gravitate towards a unique equilibrium lies at the core of the "grand neoclassical synthesis" that Samuelson announced in the third edition of that text book

However, most of the mainstream macroeconomic research in the decade following the publication of the *General Theory*, took the view that since wages could be legitimately regarded as inflexible in the short-run, the Keynesian theory was essentially applicable in the short run, and the neo- classical Walrasian theory applied in the long-run when wages were flexible (this view of course ignores Chapter 19 of the *General Theory,* wherein Keynes tried to show that his theory applied even when wages were flexible downwards). This view is also regarded as a neo-*classical synthesis*. We call it the *Keynes-Walras synthesis* to set it apart from the IS-LM synthesis discussed by Hicks (1937) and Samuelson earlier. The difference between the two syntheses is well-brought out by Woodford (1999, p.9-10), when he states "the neo-classical synthesis, as developed by John Hicks and Paul A. Samuelson among others, proposed that both the Keynesian theory and the neoclassical general equilibrium theory could be viewed as correct, though partial accounts of economic reality…. The details of how one got from the Keynesian short-run to the "classical" long run were not really worked out….". Similar views have been expressed by Howitt when he observes :

> Since it was widely believed that wages were less than fully flexible in the short run, it seemed natural to see Keynesian theory as applying to short run fluctuations and general equilibrium theory as applying to long-run questions in which adjustment problems could safely be ignored. This view came to be known as the 'neoclassical synthesis. (Howitt, 1987)

1.4 Keynes in Walrasian framework

Hicks interpretation of Keynes's *General Theory* through the IS-LM diagram, developed in his famous 'Mr. Keynes and the "Classics'" (Hicks 1937), set the course of Keynesianism. The IS-LM apparatus is a hybrid consisting of a Walrasian element of a simultaneous equilibrium on interdependent markets built on Marshallian micro-foundations. The problem was that theory in the Marshallian tradition was 'in time', whereas theory in the Walrasian tradition was not.

The IS-LM model is often characterized as Walrasian. Even Patinkin concluded that Keynes had unwittingly followed Walras' footsteps. Such a stance is inappropriate for modern economics. The logic is that as soon as it is admitted that the Walrasian approach is not the exclusive way of doing general equilibrium analysis, Patinkin's conclusion falls. A second reason is that Hicks, the initiator of the IS-LM tradition ([1937] 1967), is considered a Walrasian economist–at least, he was when writing his 'Mr. Keynes and the 'Classics'. This was also the period during which he was working on *Value and Capital* (1939), which is often credited for having revived Walrasian theory. Hence the conclusion that IS-LM must be Walrasian as well. The snag, however, is that *Value and Capital* is less Walrasian than it usually claimed. The critics say, Hicks was never more than a half-hearted Walrasian. Though Hicks believed that Walrasian theory opened a window on new horizons yet he always read Walras through Marshallian glasses. Contrary to subsequent Walrasians, he did not want to limit his analysis to the study of the logical existence of equilibrium. Even he was not ready to adopt the auctioneer hypothesis. Marshall was to him a better reference for studying the working of markets than Walras.

Let us see whether the IS-LM model belongs to the Marshallian or the Walrasian approach. First, the economy that the IS-LM model analyses is composed of markets that function separately, each of them being an autonomous locus of equilibrium. Likewise, no auctioneer is supposedly present. The monetary character of an IS-LM economy is also undeniable. But then nobody seems to have raised the issue of how equilibrium is arrived at in this model. The IS curve describes every combination of income and interest at which the goods market is clearing, the same is true about the LM curve with respect to the money market. Nothing is stated about how these

market clearing results are arrived at. What is even more perplexing is how the intersection of the IS-LM curves can be obtained.

In his study of Modigliani's 1944 IS-LM model, Rubin (2004) shows that Modigliani was concerned with the formation of equilibrium. However, the fact that in Modigliani's reasoning the adjustment took place exclusively in the money market, requiring no across markets changes, is a testimony to the Marshallian character of the IS-LM model

The conclusion to be drawn is that the IS-LM model is a simplified Marshallian general equilibrium model.

1.5 Transition to Disequilibrium Macroeconomics

Don Patinkin can be considered the first modern author having constructed a simplified Walrasian general equilibrium model in his *Money, Interest and Prices* (1965; first edition 1956). It was later revived by Barro and Grossman in their disequilibrium model.

Don Patinkin's book *Money, Interest and Prices* (1965) stands out as a bridge between pre-Keynesian economics, Keynesian economics and modern economic literature. Its economic rigour, building the macroeconomic model on microeconomic foundations, was unprecedented in the literature on monetary economics. He considered unemployment essentially in the context of economic dynamics.

In Chapter 13 of *Money, Interest and Prices (1965)* Patinkin took an additional step in dealing with the problem of unemployment, arguing that if firms cannot sell their optimum (competitive) output they will not employ their optimum labour input. This gave rise to a new area of research, viz, disequlibrium macroeconomics, further developed by Clower, Barro and, Grossman and others.

The reinterpretation of Keynes as a non-Walrasian equilibrium economics : Clower, Leijonhufvud and others

The 1970s witnessed an upsurge of interest in establishing the mico-foundations of macroeconomics, not by the Walrasian route of competitive equilibrium, but via a discarding of the fictional role of an auctioneer in a tatonnement process. The main protagonists in this approach are Clower, Leijonhufvud, Malinvaud and the French school, whose respective approaches we now discuss briefly.

1.5.1 Clower, Robert Wayne

Keynes' contribution has been reinterpreted by Robert Clower (1965) (Hick's student at the Oxford in the 1950s), as the outcome of general disequilibrium, in which price rigidities lead to quantity constraints for households and firms, which generally have spillover effects in other markets.

In Clower's (1965) "dual decision hypothesis," Clower argued that when an economic system is not in equilibrium people formulate their market demands differently than in Walrasian theory. He demonstrated that the Walras's Law is inconsistent with Keynesian economics. Specifically, people respond not just to changes in the prices they face but also in the quantities they are able to buy and sell in various markets. Thus excess supply in one market can lead frustrated sellers to curtail their demands in other markets, causing the excess supply to spread, in what Axel Leijonhufvud called an "income-constrained process," much like Keynes's multiplier process.

However, Clower (1965, pp 184-21) reinterpreted Keynes's unemployment equilibrium by distinguishing '*notional'* demand' (the demand for households at prices which reflects a full-employment equilibrium) from 'effective demand (the demand for households whose actual income have fallen through unemployment). Adjustment to unemployment equilibrium takes place through incomes and not though relative prices. This dual decision hypothesis recognizes that, in a market system, a household cannot buy and sell what it pleases if there is an excess supply in the economy. In this way, Clower attempts to reconcile **Walras' Law** with **Keynes's** *General Theory*.

1.5.2 Leijonhufvud

Axel Leijonhufvud was a close friend of Hicks for many years. His restatement of Keynes's economics attracted much attention. In his classic *On Keynesian Economics and the Economics of Keynes : A Study in Monetary Theory (1968)*, he disposed of the income-expenditure model as the 'economics of Keynes' because the comparative static nature of that model cannot deal with the genuine dynamic question of self-adjustment. He argued that Keynesian economics was a very different from the economics of Keynes. Keynes's followers had come to the conclusion that Keynesian

economics was a special case of the more general classical theory only because they had mis-presented his ideas.

Leijonhufvud was one of the first to claim that mainstream Keynesian theory was in need of a fundamental reorientation. He argued that the theory of markets underlying IS-LM was fatally flawed and should be replaced.

Leijonhufvud proposed a radical reform of macroeconomic theory that would focus more clearly on the adjustment processes of actual economies. The IS-LM model is essentially a Walrasian general equilibrium model that has been tampered with by preventing the money wage rate from adjusting to its market-clearing value. But Walrasian general equilibrium theory is ill-suited for studying the problems of depression and involuntary unemployment, or for addressing the question of whether market forces can be relied on to restore equilibrium. This is because Walrasian theory was designed specifically to study ideal states of perfect coordination, states in which all markets are in equilibrium and the concept of involuntary unemployment is meaningless. All the behavioral assumptions of the theory are based on the presumption that markets will always clear. It contains nothing to represent the market forces that might drive the system to such a coordinated state, other than an unconvincing story about a mysterious “auctioneer.”

Thus Leijonhufvud’s main focus was on the behaviour of an economy in the absence of the Walrasian auctioneer. Instead of this Walrasian approach, Leijonhufvud proposed what he called a “cybernetic” approach, one with no presumption that the system is in an equilibrium state.

The book was an instant success, and was widely hailed as an intellectual *tour de force*. Critics of Keynesian economics, especially Milton Friedman, praised its breadth of vision and its devastating attack on IS-LM. Together with Clower’s contribution, it inspired young economists with no stake in IS-LM to start developing a disequilibrium approach to macroeconomics, of which the most cited work was the Barro-Grossman (1971) article. It is remarkable that a book without a single equation could have such a major influence on a discipline dominated by mathematical modeling.

The rational-expectations approach is as dominant in theoretical macroeconomics today as IS-LM was in 1968. However, recent developments in the theory of

disequilibrium learning in macroeconomics (see Sargent, 1993; and Evans and Honkapohja, 2001) show that at least some macroeconomists are still aware of the problems that Leijonhufvud raised, and are following the cybernetic approach that is antithetical to rational expectations. Moreover, no one who remembers how quickly the reigning orthodoxy fell after 1968 can rationally expect that the current orthodoxy is here to stay.

Several critics complained that its interpretation of Keynes was based on questionable textual evidence, that something much like IS-LM can indeed be found in the General Theory, and that Keynes actually took an equilibrium approach to modeling the market for aggregate output. Leijonhufvud defended himself against these charges, but he also insisted, as he had in the book, that his primary aim had not been to write doctrinal history but to present a vision of an alternative approach to macro theory. In that sense the book was indeed a success.

Leijonhufvud's influence on the course of macroeconomic theory was long-lasting, in the sense that IS-LM has never recovered its position in macro theory.

In a later attempt to find out 'What was the matter with IS-LM?', Leijonhufvud (1983) came to the conclusion that IS-LM ignores the sequence of events *within* the period and fails to capture the essential elements of Keynes's theory. The IS-LM apparatus is a hybrid consisting of a Walrasian element of a simultaneous equilibrium on interdependent markets built on Marshallian micro-foundations. The problem was that theory in the Marshallian tradition was 'in time', whereas theory in the Walrasian tradition was not, as Hicks later came to realize.

1.5.3 Barro, R.J. & Grossman, H.I.

Barro and Grossman (1971) in their article augmented both Patinkin's analysis of labour markets and Clower's dual decision hypothesis with the Clower constraint, which postulates (as explained by them) that, if workers cannot supply their optimum labour services they will not purchase their (competitive) quantity of goods. Barro and Grossman go on to show how equilibrium can be established in the fix-price model of this type. In their view, Keynesian analysis was essentially one of fix prices.

To speak more, the central idea of the Barro-Grossman model is that of *equilibrium with rationing*—sometimes called the *economics of disequilibrium.*

Suppose that for some reason—such as an external shock—an economy develops a significant level of unemployment. Workers will find that they cannot sell as much labour as they would normally expect to sell, and they will have to cut back on their purchase of consumption goods. Firms will find that they cannot sell the goods they wish to sell at the prevailing prices, and so will not be willing to employ more labour. The economy gets stuck in a "Catch 22" situation, in which spending cannot rise because workers cannot find jobs, even if they offer to work for a low wage, and firms will not employ more workers, because even if they lower prices, they cannot increase their sales revenue. Both groups are *rational*—that is, they face constraints on the quantities they can sell at the prevailing prices.

The key to the model is a distinction introduced by Robert Clower (1965) between *effective* and *notional* demands (where notional demands are sometimes called Walrasian). In an equilibrium with rationing, effective demand equals supply. Thus, if price changes depend on effective demands, there is no pressure to change prices. It is therefore possible to have an equilibrium with rationing in which there is high unemployment. Market forces will not bring the economy back toward full –employment equilibrium.

The Barro-Grossman model is a fix-price model in the sense that prices are taken as a parameter when determining quantities of employment and output. They are not necessarily constant. In the late 1970s, Barro interpreted this as meaning that prices are fixed by long-term contracts.

Criticism of the Barro- Grossman model

The folklore in macroeconomics is that the Barro –Grossman model went out of fashion in the 1979 because it did not make sense to assume rigid prices when inflation was running at a level that exceeded 25% in some OECD countries.

Over the years, the criticism of these models increased because they required arbitrary rationing rule (Drazen,1980), and because they were too complicated technically. The disappearance of widespread involuntary unemployment in the post–Second War era, is probably to do with the growing unpopularity of these models.

But it can be said without any hesitation that possibly the main significance of the Barro-Grossman model in the history of macroeconomics is that it was an important part of the search for micro-foundation of macroeconomics. Barro-Grossman

wanted to construct a macroeconomic model with rigorous microeconomic foundations (rigorous in the sense of being based on maximizing behavior by individual firms and households). Since macroeconomics at that time synonymous with Keynesian economics, Barro and Grossman created a Keynesian model. Their model comprised a representative household and a representative firm. When Barro abandoned the fix-price approach, he retained those elements and when households and firms were combined, there emerged the representative agent model that is characteristic of modern macroeconomics.

It had been known for some time that traditional Keynesian macroeconomic models of unemployment involved, explicitly or implicitly, the assumption of temporary fixed prices and/or wages as noted by Hicks. The systematic study of temporary equilibrium models with quantity rationing in the 1970s produced deep insight on this issue and unveiled the hidden but central role played by quantity signals as perceived by traders in addition to the price system, to achieve an equilibrium in such models.

1.5.4 Edmond Malinvaud

French–born leading Western econometrician and economic theorist**,** Malinvaud's (1977) careful examination of fix price multimarket equilibria, following the tradition of Clower (1965) and Barro & Grossman (1971), has greatly helped to classify the conceptual difference between Keynes's explanation of involuntary unemployment due to insufficient aggregate demand (where firms are constrained in product markets), and the classical unemployment associated with the real wage being too high (where firms are not constrained in product market).

In fact, Malinvaud used a model of equilibrium with rationing (not the Barro-Grossman model) because it was the only framework he could find in which to make sense of stagflation–that is, of simultaneously rising inflation and unemployment. Taking the wage rate and the price level as parameters was the first step in discussing what might cause an economy to move between different regimes : Keynesian unemployment (unemployment accompanied by a surplus of goods), classical unemployment (unemployment and shortage of goods) and repressed inflation (shortage of labour and goods) and also overproduction and under-consumption..

In what follows is that Malinvaud developed a theory of unemployment, based on disequilibrium analysis. Malidvaud adopted a fixed prices approaches (as being more realistic in modern industrial economies), and assumed that adjustment in the markets occurred via quantities. He argued that unemployment could arise either from rationing in the goods or in the labour markets. He gave his famous "cross-diagram in the wage-prices plan, with two upward sloping lines representing combination of wages and prices representing equilibrium in the labour and goods markets respectively. The intersection of these two curves represented Walrasian equilibrium (P*, W*). he then distinguishes the above four cases : (1) Keynesian unemployment; (2) classical unemployment; (3) prices higher and wages lower than their respective equilibrium levels leading to over-production and under-consumption, and repressed inflation.

Malinvaud offered different policy prescription depending on which of the above states an economy found itself.

This research has had policy relevance in the early 1980s because the high rates of unemployment in Western Europe were diagnosed as classical rather than Keynesian by many economists.

The Rise of Non-Walrasian Macroeconomics

In what follows is that Walras's law was rejected by Robert Clower, Axel Leijonhufvud, Parts of Don Patinkin's *Money, Interest and Prices* in 1956, Robert Barro and Herschel Grossman. They all rejects Walras' Law (the value of excess demands adds to zero over all markets) as inapplicable to effective demands when agents are quantity-constrained in some markets. If labour is in excess supply, the wages that unemployed workers fail to receive are not part of their budget constraints for demanding goods, and so there is no effective signal to firms that their goods would be demanded if they hired more workers. Although this group is non-Walrasian in the sense of rejecting Walras's law for effective demands, economists in this approach emphasize constrained optimization and the interdependence of markets.

This non-Walrasian macroeconomics (also called temporary equilibrium or Keynesian Disequilibrium Theory) and related approaches did flourish in France (Benassy, Grandmont, Henin, Laroque, Malinvaud, Younes) Japan (Iwai, Negishi, Nikaido, Uzawa).

1.5.5 Benassy, Jean-Pascal

He is one of the pioneers of developing the fix- price literature along with Dreze (1975) and Younes (1975). Let us see how it becomes the pioneer in this field.

Recent works on the microeconomic foundations of macroeconomics (Barro & Grossman, Benassy, Malinvaud, Younès) make use of the Hicksian *fix-price method*. In these studies, prices are assumed to be temporarily fixed in the short run, and adjustments take place through quantity rationing. A basic assumption of these models is that only agents on the "long side" of a market are rationed. However, Fixprice model was born at the interface of two extensions of general equilibrium theory : the study of out-equilibrium price dynamics and the incorporation of price-setting behavior by firms. Fixprice analysis aims at providing micro-foundation for macroeconomic theory and policy. Now the question arises : what are the theoretical roots of the fix -price model.

We are here discussing **Out of equilibrium price dynamics :**

The Walrasian approach postulates that prices adjusts very rapidly in response to excess demand or supply, so that no transactions occur before equilibrium is reached. A rigorous formulation of this idea is the Walras–Samuelson tatonnement process. Walrasian excess demands provide the 'market signals' for the adjustment of prices in the Walras-Samuelson tatonnement. If transaction did occur at non-Walrasian prices, then such a conjecture would be falsified, since some agents would be unable to realize their plans. This led Patinkin to postulate that disequilibrium transactions in a market create spillover effects on others; so that, for example, the pressure of excess demand in one market affects the price movements in all other markets'. Patinkin's formulation was imprecise but his search for the 'relevant market signals' motivates Clower's (1965) 'dual-decision hypothesis'. This idea generalized by Barro and Grossman (1971, 1976) was central to Benassy's fix-price model.

Benassy's model is simple. His model reveals intimate connection between market power and the fixity or stickiness of prices and wages.

Benassy's Fix- price Allocation :

Fix-price analysis postulates a common medium of exchange (money) in each market. Thus, there are n + 1 goods (from 0 to n) in the case of n markets, the zero good being the money The analysis addresses two equations. First, given a price

vector p (normalized with respect to money), what allocations are compatible with it? Second, given a p and an allocation compatible with it, which is the type of disequilibrium in each market? The answers are derived from three basic principles : (a) voluntary trading; (b) absence of market frictions, and effective demand.

The fix-price model provides a general framework (which includes Walrasian markets as a limit) for price-guided allocation mechanisms.

It has several applications : (a) short-run analysis, which assumes that it takes time for prices and quantities to adjust, (b) market power (imperfect or monopolistic competition); (c) price controls : This is Dreze's formulation of price (or wage) negotiation. Jacques Dreze (1976) pioneered the incorporation of quantity constraints in general equilibrium models. He introduced the so-called Dreze equilibrium at which supply is constrained only when prices are inflexible downward, whereas demand is constrained when prices are inflexible upward. While commodities might be rationed, money is not.

Fate of Disequilibrium Macroeconomics

By the late 1970s, disequilibrium macroeconomics seemed to have been reached a dead-end. While disequilibrium macroeconomics recognized the flaws in the tatonnement process, they failed to plug the lacuna in an explanation of how prices changed in real time.

The inflationary context of the 1970s in the USA and Europe rendered 'fixed prices' assumption extremely suspect in the eyes of theorists and policymakers. Macroeconomics then went into two different directions. On the one hand, you had the New Classical School, built up on the foundations laid by Barro, Barro and Fischer, Grossman, Lucas, etc.. Fixed prices were abandoned, but the assumption of representative agent was retained. and the key elements of rational expectations were introduced. The New Classical Macroeconomics (and its off-shoot the Real business Cycle School) thus came into the fore. The observed real world business fluctuations were reconciled with this framework, using errors in expectations.

The other direction to which a great deal of macroeconomics was devoted was *New Keynesian Economics*. They did take many of the issues that had exercised in the earlier disequilibrium macroeconomics such as limited information, monopoly, coordination failure etc. as they applied in labour markets. But they abandoned the

old disequilibrium agenda, focusing instead on partial equilibrium analysis of single markets, with a view to seek explanations for wage and price rigidities.

In this way, the micro-foundations of disequilibrium macroeconomics were lost by the 1970s.. In fact, in any meaningful sense of the term, the micro-foundations of macroeconomics had been abandoned.

1.6 Conclusion

Macro-disequilibrium model tries to analyze modern macroeconomics and is non-Walrasian macroeconomics (also called temporary equilibrium or Keynesian Disequilibrium Theory). In this framework, Clower was interested in dynamic price adjustment mechanisms in which markets are not typically competitive. Leijonhufvud who tried to popularize the idea of disequilibrium macroeconomics was interested in the idea of inter-temporal disequilibrium. In this vein, other contributors are Barro-Grossman, Malinvaud and Benassy.

1.7 Summary

Reductionists, Fundamentalists and Hydraulic Keynesianism : Alan Coddington in his book *Keynesian Economics : The Search for First Principles* (11983) identified three broad approaches : reductionist, fundamentalists and hydraulic Keynesianism. Reductionists seek to reduce Keynesian macroeconomics to the logic of optimizing choice. Fundamentalist Keynesians see Keynes's ideas as a fundamental challenge to any reductionist program. Hydraulic Keynesians constructed aggregate flow models for the forecasting and guidance of aggregate demand management.

Neoclassical-Keynesian Synthesis : Hahn (1977) succinctly summarizes the neoclassical-Keynesian synthesis :

Keynes attempted to show that full-employment short-run equilibrium did not exist, and in this he was wrong. His mistake was attributed to the neglect of real cash balances in influencing the demand for current goods.

The 'synthesis' reconciled Keynes's theory with that of the neoclassical school (or, classics in Keynesian terminology). In doing so, it reduced Keynes's theoretical

observation. to the observation that markets could not adjust to full-equilibrium if prices, in particular money wages are inflexible.

The synthesis has always been rejected by a group of post-Keynesian economists whose older members were Joan Robinson, Richard Kahn.. However, it was not until the mid-1960s that economists elsewhere, notably Clower and Leijonhufvud began to question the neoclassical-Keynesian synthesis as the correct interpretation of what Keynes had been trying to say.

Walras's law : Walras's law states that the sum of excess demands over all the goods in the economy must equal zero and this applies whether or not the markets are in general equilibrium. So if there is a positive excess demands over m-1 markets, there must be negative excess demand (that is, positive excess supply) in the m^{th} market.

tatonnement : The auctioneer's job is to call out a set of relative prices and find the levels of excess demand on each market at this set of prices. If general equilibrium is not achieved, the auctioneer tries another set of prices. Prices are raised in markets with excess demand and are lowered in markets with excess supply. This is where the Walras's law functions as an adjustment mechanism. According to Walras's law, excess demands in some markets must be matched by excess supplies in other markets so that prices rise and fall in each type of market in order to move it towards market-clearing equilibrium. The auctioneer keeps on trying different sets of relative prices in this way until he finds one set at which all markets are cleared. It is only then that trading actually occurs. The process by which the auctioneer gropes towards the equilibrium set of relative prices and quantities is known as *tatonnement* (or groping).

Bastard Keynesianism : It crucially supposes that those individuals' efforts to maximize utility and firms' efforts to maximize profits in markets lead the economy, as if by an invisible hand, toward a unique equilibrium. Joan Robinson protested that the imposition of neoclassical thinking on the theories of Keynes is utterly illegitimate. About a quarter of a century after Samuelson first published his text book, theorists gave up the effort but Arrow and Debreu had launched to model the invisible hand. But by that time macroeconomic project assuming a unique and stable equilibrium had gone too far to be easily abandoned.

Contribution of Clower, Barro & Grossman and Benassy : There are two distinct views on the underemployment of resources. In the standard neoclassical world of

Arrow-Debreu model, underemployment of resources cannot occur. In the competitive equilibrium, involuntary unemployment does not exist.

The Keynesian tradition, in contrast, builds on wage and price rigidities in its explanation of underemployment of resources. Indeed, Keynes's contribution has been reinterpreted by Clower (1965) and Barro and Grossman (1971) as the economics of general disequilibrium, in which price rigidities lead to quantity constraints for households and firms, which generally have spillover effects in other markets. This lead has been further developed in the fix –price literature, originated in the work of Benassy (1975), Dreze (1975) and Younes (1975) and in General Equilibrium theories on temporary equilibrium (See Grandmont 1977 for Survey).

Although fix-price literature stresses wages and price rigidities, Keynes himself postulates that it is possible to encounter self-satisfying expectations, beliefs which are individually rational but which may lead to socially irrational outcomes (Keynes, 1936, Ch 12). We, therefore, would like to address the question whether underemployment of resources is possible when expectations are rational, agents optimize, and trade takes place at competitive prices. The underlying reasons for underutilization if comes from coordination failures, self-justifying expectations which are individually rational but socially suboptimal. Here comes the contribution of Byrent (1983), Cooper (1999), Roberts (1987), Jones & Manuelli (1992), Citanna et al. (2001).

Fixprice model : It provides a general framework (which includes Walrasian markets as a limit) for price-guided allocation mechanisms.

1.8 Exercise

Short-answer type questions

1. What was the astonishing performance of Hicks' (1937) article 'Mr. Keynes and the Classics'?
2. What is neoclassical synthesis?
3. How does Keynes-Walrasin synthesis differ from neoclassical synthesis as developed by Hicks and Walras?
4. What is dual decision hypothesis?

5. Why did Clower and Leijonhufvud believe that Walras Law holds only for the notional demands, not effective demands.?
6. In what sense the Barro-Grossman model is a fix-price model?

Medium-answer type questions

1. How did Clower and Leijonhufvud interpret the economics of Keynes as the economics of coordination failure?
2. Write down the contribution of Robert Clower
3. Write down the contribution of Axel Leijonhufvud.
4. Write down the contribution of Barro-Grossman in macro-disequilibrium model.
5. Write down the criticism of leveled against Barro- Grossman model.
6. How did Malinvaud develop a theory of unemployment? From his cross-diagram, how one can offer policy prescriptions? Give reasons.
7. State the fate of micro-foundations of disequilibrium macroeconomics.

Long-answer type questions

1. Describe the idea of neo-classical synthesis as put forward by John Hicks and Don Patinkin.
2. Enumerate the contribution of Don Patinkin in monetary economics.
3. Do you agree with the view that the IS-LM model is a simplified Marshallian general equilibrium model? Give reasons.
4. The central idea of the Barro-Grossman model is that of an *equilibrium with rationing*— or the *economics of disequilibrium.* Do you agree? Give reasons for your answer.
5. What is Benassy's fix-price analysis? State its several applications.
6. How has there been a rise and fall of micro-foundations of macro disequilibrium model? Give a brief note on it.

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Unit 2 ❑ Rational Expectations and New Classical Macroeconomics

Structure

2.1 Objectives

After going through this unit you will be able

- To know about Imperfect information models that includes
- Adaptive Expectation Hypothesis
- Rational Expectation Hypothesis
- Rational Expectation and Policy Ineffectiveness Proposition, also the role of expectation in macroeconomics and Workers' Misperception Model

- To have an idea of Phillips curve- both shotand long run including Natural rate hypothesis
- To get knowledge about Lucas 'surprise' supply equationand its application to current global crisis.

2.2 Introduction

All but the most trivial of economic activities require that individuals (a) predict the outcomes associated with the choices available to them, and then (b) choose a course of action based on that forecasts. Both processes are manifestations of reasoning on the part of the economic agent. Thus, expectations, choice and rationality are very closely related concepts in economic theory and in reality.

Virtually, all macroeconomic decisions involve expectations concerning uncertain outcomes. The decision to buy government bonds in the hope of realizing capital gains involves an expectation as to the course of future interest rates. Numerous other examples could be cited.

That expectations play a such a central role is well recognized by all schools of thought.

Neoclassical view of expectations

The neoclassical view of expectations (and decision making) is strongly influenced by their belief that market systems are optimal and efficient. They further contend that human beings are by nature rational utility- maximisers. This characterization of human behavior is rather opening minded. For example, rational economic agents will choose the option that would maximize their utility given the average income. This view is formalized in expected utility theory (also known as rational choice or subjective utility)

The theory of rational expectations (REs) intentionally makes no attempt to explain how expectations are formed.

Keynes and Exogenous Expectations

There can be no doubt that Keynes laid great emphasis upon the importance of expectations. His entire theory of the business cycle is based on the unstable nature of long-term expectations. Indeed, responding to his critics in his famous defence of

the *General Theory* (Keynes, 1937) emphasized the pivotal role of unstable nature and uncertainty of long-term expectations as being a point of departure from the classical model. Keynes's concern was with the dichotomous nature of expectations formation.

In the *General Theory* Keynes pays considerable attention to the factors making for the precarious nature of long-term expectations. The Stock Exchange is one influence.

Post –Keynesian View

One of the earliest post-Keynesian attempts to model changing expectations is provided by Metzler (1941). His concern was primarily with the way expectations could account for inventory cycles. Stated simply, the expected value of any variable is related not only to its recent pst values but also to its recent trend.. His formulation is as follows :

$$P^*_{t+1} = P_t + \alpha (P_t - P_{t-1})$$

where the subscripts denote the time- period and the asterisk indicates the expected value of the variable as opposed to its actual value, whilst α is a coefficient of expectation.

Adaptive expectations were first introduced into economics by Cagan (1956) in a most influential volume which heralded the monetarist counter-revolution in macroeconomics. The Adaptive expectations approach asserts that agents will formulate expectations like the following :

$$P^*_{t+1} = P_t + \alpha (P_t - P^*_t)$$

where the symbols have the same meaning as before. That is to say, the price we expect next period is equal to the price we expected this period plus some fraction of the extent that our current expectation was shown to be incorrect. To illustrate, assume a value of α equal to 0.5, if the current price level were to be 100, whereas our expectation of the current price level one period ago had been 90, then our expectation of the price level next period would be 95.

Besides, Post Keynesian economists have been highly of the so-called "Rational Expectations Revolution". Because they draw their inspiration from Keynes, post-Keynesians believe that market system is inherently unstable and prone to instability.

With respect to expectations, the most important factors in this regard are uncertainty and non- ergodicity.

Paul Davidson argues that, in order for rational expectations to hold true, it must be possible to create probability distribution of future events based on those from the past (*Davidson 1982-3*) But this can only be accomplished if we can assume that processes that create events in the economy do not change over time, i.e., if the economic world is ergodic.

Davidson also says that crucial choice involves, *by definition*, situations where the very performance of choice destroys the existing distribution functions. This makes rational expectations impossible.

In building their explanations of expectations, post- Keynesians argue that the future is uncertain. Uncertainty causes the expectations of economic agents to be tenuous and subject to sudden and violent change. In general, it is argued that fundamental uncertainty forces agents to adopt different methods of decision making.

Keynes himself goes so far as to say that if "mathematical expectations were the only source of direction, then enterprise will fade and die" (Keynes 1936 : 162).

New Classical View

The seminal paper "Expectations and Neutrality of Money" by New Classical macroeconomist Robert E. Lucas highlights the role of expectations in the conduct of monetary policy, In Lucas's model, only unanticipated changes in the price level have real effects. If a monetary expansion is completely expected, it has no real effects. This points to something quite important in the real conduct of monetary policy: only surprises matter. The central lesson from Lucas's research is that government should strive to minimize the uncertainty surrounding monetary policy.

Institutional Views :

Institutionalist economists argue that it is all the more acute for Keynes who made uncertainty and expectations central to his analysis.

In conclusion, we can articulate that for all schools of thought, central paradigmatic themes play an important role in the modeling of expectations. Of late, extensive theoretical and empirical work are being done in psychology on the subject of expectations and decision- making.

2.3 Imperfect Information Models

2.3.1 Adaptive Expectation Hypothesis (AEH)

From the time of Cagan's (1956) study of hyperinflation until the mid-1970s, the most widely used hypothesis was that of adaptive expectations.

The term adaptive expectation (or Error-learning) refers to the way economic agents adjust their expectations about future events based on past information and on some adjustment term. Robert Lucas (1986) refers to the trial-and-error process through the models of behavior are determined as "adaptive."

Suppose we want to forecast the inflation rate $\boldsymbol{\pi_t}$ which is measured by variations in the price index over time, $(P_t - P_{t-1}) / P_{t-1}$. Let an individual forecasts the future rate for Year 5 based on the previous four yearly inflation rates.

Year 1 : 5% inflation rate with weight 10%

Year 2 : 4% inflation rate with weight 20%

Year 3 : 3% inflation rate with weight 30%

Year 4 : 2% inflation rate with weight 40%.

The individual's expected inflation rate E (π_t) will be :

0.05 (0.10) + 0.04 (0.20) + 0.03 (0.03) + 0.2 (0.40) = 0.030 or a 3% inflation rate forecast for year 5. In this way inflation rate can be calculated.

Adaptive Expectation when applied to inflation

The most common way to formulate the expectation of inflation is as a function of past inflation rates. This idea is called "adaptive expectations,

and it may be written

$$x_t = x_{t-1} + g(\pi - x_{t-1}) \quad \text{.....(2.1)}$$

where x_t is the expected rate of inflation at time t, x_{t-1} is the rate of inflation expected at time t – 1, π_t is the actual rate of inflation, and g in the coefficient of adaptation.

Note that :

The coefficient of adaptation is a positive fraction. To understand the implications of the adaptive expectations hypothesis, consider two extreme cases. When g = 0, Eq. (13-2) implies that

$$x_t = x_{t-1}$$

which means the expected rate of inflation never changes and is unaffected by the actual movement of prices. Therefore, price expectations are inelastic. Some rate of inflation is regarded as normal, and deviations from that rate are assumed to be temporary

At the other extreme, if g = l, we have

$$x_t = \pi_t$$

in which case the expected rate of inflation adapts completely to changes in the actual rate of inflation. This extreme view is associated with the rational expectations school.

However, above Eq. (2.1) can be written as

$$x_t = g\pi_t + (1 - g)\, x_{t-1} \text{.....(2.2)}$$

If this is true, it must also be true that

$$x_{t-1} = g\pi_{t-1} + (1 - g)\, x_{t-2} \text{.....(.2.3)}$$

Using Eg (2.3) to replace x_{t-1} in Eq. (2.2) gives

$$x_t = g\pi_t + g(1 - g)\pi_{t-1} + (1 - g)^2\, x_{t-2} \text{ .....(3.4)}$$

Similarly since

$$x_{t-2} = g\pi_{t-2} + (1 - g)\pi_{t-3}$$

we can substitute this into Eq (3.4) to get

$$x_t = g\pi_t + g(1 - g)\pi_{t-1} + g(1 - g)^2\pi_{t-2} + (1 - g)^3 x_{t-3}$$

It is evident, therefore, that in general

$$x_t = g\pi_t + g(1 - g)\pi_{t-1} + g(1 - g)^2\pi_{t-2} + (1 - g)^3 x_{t-3} + \text{.....+ } (1 - g)^n x_{t-n}$$

.....(3.5)

Equation (3.5) shown that the expected rate of inflation in a weighted average of all past inflation rates, with the influence of past rates diminishing in d geometrically decaying pattern.

Sometimes adaptive price expectation is expressed in continuous form. Thus that hypothesis is written

$$\frac{dx}{dt} = g(\pi - x)$$

If g = 0, dx/dt = 0, and expectations are wholly unadaptable. If g is very large, we can write

$$\frac{1}{g}\frac{dx}{dt} = \pi - x$$

and let $g \to \infty$ so that $\pi = x$. This gives the rational expectations assumption that expectations adapt instantaneously..

Applications :

The adaptive expectations has plenty of applications in macroeconomics such in the analysis of hyperinflation by Phillip Cagan (1956), in consumption function by Milton Friedman (1957), in investment behavior by L.M Koyek (1954) and in Philips curves for inflation and unemployment. In the 1970s its popularity became declining and the Rational Expectations Hypothesis became dominant.

The empirical success of the idea was ultimately challenged in the 1970s by Rational Expectations Hypothesis, developed by John Muth (1961) and extended by Thomas Sargent and Neil Wallace (1975) and Lucas (1976). More recent work, such as George Evans and Gary Ramey (2006), follows Muth (1960) and reconsiders the Lucas critique in the context of adaptive expectations.

Critique of Adaptive Expectations :

A powerful criticism of the AEH is that it assumes people keep basing their expectations on the values of lagged variables and fail to learn from their past errors. When inflation is rising the error between actual and predicted inflation is positive over successive periods, and so serially correlated. This error is repeated and so called systematic. Yet no attention is paid to it if expectations are adaptive.

The narrowness of this approach to expectations was first advanced by P. Cagan in 1956 with the argument that forecasters often take into account information other than the past behaviour of the variable being studied.

Advocates of the rational expectations view would argue that this interpretation in the name of adaptive expectation is inadequate because expectations are forward-looking rather than being dependent on past behavior. Rational economic agents use all available information in formulating their expectations, One such source of information is expected policy change. Thus the expected rate of inflation will rise if expansionary monetary and fiscal policies are anticipated, quite independently of current or past actual inflation rates.

Despite the criticisms leveled against adaptive expectations, this approach has great appeal. It is a comparatively simple means of modeling expectations and it is based on a model of behavior which appears sensible and in keeping with empirical observations. Moreover, in the case of a once-and-for-all shock or disturbance, which pushes the economy from one steady-state equilibrium to another, it performs tolerably well (Shaw, 1969, p. 28).

Second, the adaptive expectations mechanism underpins much of the monetarist assault upon Keynesian aggregate-demand strategies.. In particular, it questions the permanence of the trade-off between unemployment and inflation depicted in the negatively sloped Phillips curve. In so doing, it establishes the basis of the concept of the "natural level of unemployment" implicit in the notion of the vertical long—run aggregate supply curve.

2.3.2 Rational Expectation Hypothesis (REH)

Rational expectation is now a central pillar to new classical macroeconomics. During the 1970s, the rational expectations hypothesis (REH) gradually replaced the adaptive expectations hypothesis as the dominant way of modeling endogenous expectations. A major weakness of the adaptive expectations hypothesis is the implication that economic agents make *systematic errors*, an outcome inconsistent with optimizing behavior.

By *rational expectations*, we simply mean those based on the efficient use of all available, relevant information. This does not mean that individuals have perfect foresight: they may make errors, even large ones. It does imply, however, that these errors are systematic and that it is not possible for person to improve upon their prediction based on the information at hand. To make the concept operational, these expectations are generally assumed to be the same as those implied by the relevant economic theory, except for a random element. Consequently, individuals are assumed to act as if they knew the relevant theory.

In the macroeconomics literature, the REH came in two main forms. A *weak* version of the hypothesis states that, in forming expectations about the future value of a variable, rational economic agents will make the best (most efficient) use of *all* publicly available information about the factors that they believe determine that variable, subject to the constraint of the costs of collecting that information. A

stronger, and much more controversial, form of the REH is the Muthian hypothesis "those expectations since they are informed predictions of future events are essentially the same as the predictions of the relevant economic theory" (Muth, 1961, p. 316). This strong version was adopted by leading exponents of the new classical school and incorporated into their macroeconomic models. In the Muthian REH, economic agents' subjective expectations of economic variables will coincide with the true or objective mathematical conditional expectations of those variables. With respect to the formation of expectations of inflation (P^{e}_{t}), the REH can be expressed as follows in Equation 3 :

$$P^{e*}_{t} = E\ (P^{*}_{t} \mid \varphi_{t-1}). \qquad (3)\ \lambda$$

where P^{*}_{t}, is the actual rate of inflation; E (P^{*}_{t}, | φ_{t-1}) is the rational expectation of the rate of inflation subject to the information available up to the previous period (φ_{t-1}). It is important to emphasize that agents with rational expectations do not have perfect foresight. To form a rational expectation of inflation, agents will need to take into account what they believe to be the "correct" macroeconomic model of the economy. Agents will also make errors in their forecasts due to incomplete information. However, with rational expectations, agents' expectations of economic variables on average will be correct. Furthermore, unlike the adaptive expectations hypothesis, where agents make repeated errors, rational agents will not form expectations that are systematically wrong (biased) over time. If expectations turn out to be systematically wrong, agents will learn from their mistakes and change the way they form expectations, thereby eliminating systematic errors. More formally, the strong version of the REH implies that the forecasting errors from rationally formed expectations will be random with a mean of zero, will be unrelated to those made in previous periods (serially uncorrelated over time), and will have the lowest variance compared to any other forecasting method. Notwithstanding the many criticisms launched against the REH, during the 1970s, there was undoubtedly a "rational expectations revolution" in macroeconomics to such an extent that by the late 1970s, the REH was being incorporated into "new" Keynesian models with sticky wages and prices (Gordon, 1990).

Implications for Rational Expectations

The theory of rational expectations has several important implications for macroeconomics. **First,** econometric models are not very useful in evaluating

alternative economic policies. because the proponents of the rational expectation theory argue that the parameters of the models change when new policies are introduced. They claim that the actions of households and firms are based in part, on the monetary and fiscal policies. If new policies be implemented, households and firms will behave differently and, as a result, the parameters of the model will change. Since the estimates of the effects of the new policies are based on the original set of (estimated) parameters, the actual effects may be quite different. Consequently, econometric models are not very helpful in selecting appropriate policies.

A *second* implication of the theory of rational expectations is that no tradeoff exists between inflation and unemployment. The relationship between inflation and unemployment is discussed earlier, but we discuss it briefly here because of the implications of the theory of rational expectations for the relationship. For years, it was argued that lower unemployment rates could be obtained at the expense of higher inflation rates through more rapid increases in aggregate demand. In the late 1960s, this view was criticized by several economists who argued that a tradeoff existed in the short run, but not in the long run. Proponents of the rational expectations theory go even further. They argue that no tradeoff exists even in the short run. Sometimes it is seen that even though the inflation rate has increased, the unemployment rate remains the same: hence, no tradeoff exists :

A *third* implication (which is related to the second) is that discretionary monetary and fiscal policy cannot be used to stabilize the economy. Suppose, for example - that government purchases increase. According to the rational expectations theory households and firms anticipate the effects of the increase. Money wages and prices will increase, but output and employment will remain the same.

According to the rational expectations theory, however, discretionary policy will not be successful in stabilizing the economy. Advocates of the rational expectations approach argue that monetary and fiscal policies should be designed so as to minimize uncertainty. For example, they favor increasing the money supply at a constant rate.

Debate continues regarding the merits of the theory of rational expectations. Proponents of the theory argue that, households and firms have strong economic

incentives to forecast future business conditions accurately since their economic welfare depends on this ability. Thus, they will obtain information and use it efficiently.

Finally advocates of the theory claim that any other theory is ad hoc and implies that individuals are systematically wrong. Consequently, they argue that the use of such theories should be avoided.

Criticism leveled against Rational Expectations

Opponents of the theory of rational expectations offer several major criticisms.

First, they note that if policy makers have more information about the economy or their own actions than does the general public, policies can be devised that will alter output and employment. To illustrate, suppose, the monetary authorities increase the growth rate of the money supply. Since the more rapid increase in the money supply is unanticipated, output and employment will increase. Of course, if the rational expectations view is correct, output and employment will remain to their original levels after the public learns of the new policy. Consequently, the policy is effective only during the learning process.

A *second* criticism of the theory of rational expectations has to do with the assumption of wage and price flexibility. Under the theory, money wages and price are assumed flexible. But for reasons, they may be "Sticky." As a consequence, even if expectations are formed rationally, money wages and prices may adjust slowly, resulting in changes in output and employment

Thirdly, as we know, the best known application of RE models has been to an interpretation of the observed relation between the unemployment and inflation. A.W. Phillips (1958) noted a negative relation between the unemployment rate and the wage inflation rate in the United Kingdom between 1861 and 1957. A similar relation was found also in the United States for much of the same sample period. Since then, the negative relation has broken down. Lucas (1976) and Sargent and Wallace (1973) offered interpretation of the Phillips relation and its subsequent breakdown. This interpretation asserts that there may be a stable relation between unemployment and unexpected inflation.

Fourthly, the rational expectations model assumes that economic agents behave as if they know the structure of the economy so that they can compute the optimal

forecasts that represent their expectations. But the structure of the economy is always changing, as technology, tastes and government interventions change. These changes themselves vary qualitatively from time to time. In this case, it may never be appropriate to assume that their forecasts are optimal forecasts.

Fifthly, critics charge that the rational expectations theory cannot explain the prolonged periods of unemployment that we sometimes observe. If expectations are formed rationally and if wages and prices are flexible, they claim that deviations from the equilibrium levels of output and employment should be short-lived. Since this implication appears to be inconsistent with actual experience, many critics reject the theory on this basis. In response, proponents have constructed theories of the business cycle based on rational expectations. These theories are capable of explaining the observed movements in output and employment. Whether these theories provide a better explanation than more conventional theories is a question that is still being debated.

Sixthly, The concept of "bounded rationality" is seen by many mainstream economists themselves as a valid criticism of REH. Sergeant (1993) in an early contribution recognized the limitations of REH tried to salvage the REH by introducing "adapting learning mechanism" for agents. Here also the question rises. The question is whether *rational* agents, with a limited knowledge of economic mechanism, can converge to a ration expectations equilibrium via an adaptive learning mechanism.

Finally, the behavioral economics revolution, still very much under way since its beginnings around 1980, can be described a groping for alternatives to rational expectations models, alternatives that do not impose unrealistic complexity on individual decision- making. George Akerlof and Janet Yellen (1985) have argued for 'near-rational expectations' models. Richard Thaler (1991) has argued that we must turn to something which he calls' quasi-rational economics'.' Roman Frydman and Michael Goldberg (2007) have argued that we must work on something which they call 'imperfect knowledge economics.' These are important beginnings, though today none of the alternatives has yet won widespread acceptance among economists.

Moreover, Stiglitz (2007) questions the applicability of rational expectations to situations such as the recent Global Financial Crisis, which are (almost once-in-a-lifetime) occurrences and for which past experience can be no guide for the future.

What follows the theory of rational expectations is controversial. At present only a small minority of economists appears to support the theory. Despite the criticisms, rational expectation models may well be useful for some applications when compared with alternative models based on expectation proxies.

2.3.3 Rational Expectation and Policy Ineffectiveness Proposition

Although implicit in the early new classical papers by Lucas, the new classical policy ineffectiveness proposition was first formally presented in a highly controversial paper by Thomas Sargent and Neil Wallace (1975). The proposition can best be illustrated using the conventional aggregate demand/supply (AD/AS) model shown in Figure 2.1. Assume that an economy is initially operating at point A. where the price level (P) is fully anticipated and output and employment (and by implication, unemployment) are at their long-run (full information) equilibrium (natural) levels. Suppose the monetary authorities announce that they plan to increase the money supply from $\mathbf{M_1}$ to $\mathbf{M_2}$. Rational economic agents will take this information into account in forming their expectations and fully anticipate the effects of the increase in the money supply on the general price level, so that output and employment will remain unchanged at their natural levels. The rightward shift of the aggregate demand curve from AD_1 (M_1) to AD_2 (M_2), induced by an *announced* monetary expansion, will be completely offset by an upward shift of the short-run aggregate supply curve from $\mathbf{SRAS_1}$, to $SRAS_2$, as money wages increase in response to an upward revision of price expectations. In the case of an anticipated monetary expansion, the economy will move immediately from point A to C, with no change in output and employment even in the short run (monetary neutrality). In contrast, if the monetary authorities surprise economic agents by engineering an unanticipated increase in the money supply (a monetary shock), rational economic agents with incomplete information will misperceive the resultant increase in the general price level as an increase in relative prices and react by increasing the supply of output and labor.

In terms of Figure 2.1, the aggregate demand curve would shift to the right from AD_1 (M_1) to $\mathbf{AD_2}(\mathbf{M_2})$, to intersect $\mathbf{SRAS_1}$, at point B. Output (y) will deviate from its natural level (Y_{Nt}) as a consequence of deviations of the price level (P_B) from its expected level (P_A). Any increase or decrease in output or unemployment will only be temporary because once agents realize that there has been no change in relative prices, output and employment will return to their long-run equilibrium (natural)

levels. In terms of Figure 2.1, as agents fully adjusted their price expectations the aggregate supply curve shifts upward, from $SRAS_1$ to $SRAS_2$ to intersect AD_2 at point C. The analysis is symmetrical with respect to a fall in aggregate demand to AD_3 (M_3) Here an unexpected negative monetary demand shock leads the economy to follow a path illustrated by points D and E, whereas an expected negative monetary demand shock will move the economy from A to E.

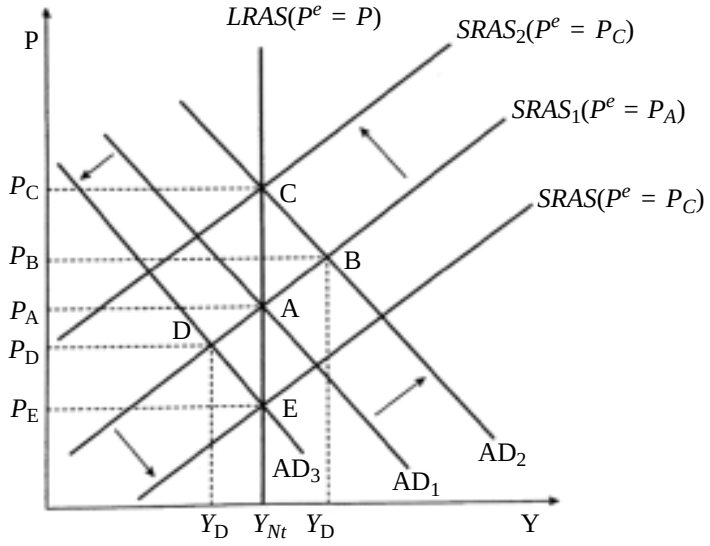

Fig. 2.1 : Monetary Policy Effectiveness and Expectations

Implications of the policy ineffectiveness proposition

One of the most important contentions of rational expectations is the ineffectiveness of system-atic fiscal and monetary policies in reducing unemployment. The basic idea is that a predict-able attempt to stimulate the economy would be known in advance, and would have no effect on the economy. This is known as the policy ineffectiveness theorem. With rational expectations and flexible prices and wages, anticipated government policy cannot affect real output or employment.

The policy ineffectiveness proposition has major *implications* for the controversy over the role and conduct of macroeconomic stabilization policy. If the money supply is determined by the authorities according to some "known" rule, then they will be unable to influence output and employment even in the short run. The use of a sys thematic monetary policy will be anticipated by agents. Hence, only departures from a known monetary rule will influence real variables. An important implication of this

analysis is that a credible announced policy of disinflation will result in little or no sacrifice ratio in terms of output and employment because expectations of inflation will adjust instantaneously to the rate of inflation consistent with the announced reduced rate of monetary expansion. In this new classical scenario, only supply-side policies that influence the natural rates of output and unemployment will have lasting effects on real aggregate economic activity. However, as new Keynesian models demonstrate, monetary policy can be effective in a world of rational expectations once the assumption of continuous market clearing is abandoned.

Lucas Critique :

Lucas Critique is associated with the term 'policy ineffectiveness proposition' because Lucas's main conclusion was that if market participants are well-informed and rational government attempts to influence activity by measures that induce false expectations will be ineffective. Thus, fiscal action to stimulate aggregate demand by, for example, cutting taxation will be ineffective because consumers will foresee that future taxes will have to rise in due course to serve the debt created by extra government borrowing.. This is 'Lucas Critique' of government policy (Lucas, 1976).

Lucas also challenged the notion that disinflation necessarily required an increase in unemployment for some time. This is also known as the Lucas Critique.

The logic of Lucas's argument can be explained briefly. If wage setters kept forming expec-tations of inflation (π^e) by looking at the last year's inflation (π^e), i.e., $\pi^e = \pi_{t-1}$ then the only way to decrease inflation would be to accept high unemployment for some time.

Lucas also shows that econometric models based on the assumption of structural parameters invariant to policy changes lead to biased conclusions on the effects of macroeconomic policies.

2.3.4 Workers' Misperception Model

The first and second theory of explaining the upward sloping of the short-run aggregate supply curve is the *sticky –wage* and the *sticky- price* theory respectively. According to the first theory, the short run aggregate supply curve slopes upward because wages are "sticky in the short run i.e, nominal wages are slow to adjust to changing economic conditions, while the sticky price theory emphasizes that prices

of some goods and services also adjust sluggishly in response to changing economic conditions. This slow adjustment of prices occurs in part because there are costs to adjusting prices, called *menu costs*. As a result of these costs, prices as well as wages may be sticky in the short run.

A third approach to explaining the upward slope of the short-run aggregate-supply curve is the misperceptions theory. According to this theory, changes in the overall price level can temporarily mislead suppliers about what is happening in the individual markets in which they sell their output. As a result of these short-run misperceptions, suppliers respond to changes in the level of prices, and this response leads to an upward sloping aggregate-supply curve.

To see how this might work, suppose the overall price level falls below the level that suppliers expected. When suppliers see the prices of their products fall, they may mistakenly believe that their *relative* prices have fallen; that is, they may believe that their prices have fallen compared to other prices in the economy. For example, wheat farmers may notice a fall in the price of wheat before they notice a fall in the prices of the many items they buy as consumers. They may infer from this observation that the reward to producing wheat is temporarily low, and they may respond by reducing the quantity of wheat they supply. Similarly, workers may notice a fall in their nominal wages before they notice that the prices of the goods they buy are also falling. They may infer that the reward for working is temporarily low and respond by reducing the quantity of labor they supply. In both cases, a lower price level causes misperceptions about relative prices, and these misperceptions induce suppliers to respond to the lower price level by decreasing the quantity of goods and services supplied.

Similar misperceptions arise when the price level is above what was expected. Suppliers of goods and services may notice the price of their output rising and infer, mistakenly, that their relative prices are rising. They would conclude that it is a good time to produce. Until their misperceptions are corrected, they respond to the higher price level by increasing the quantity of goods and services supplied. This behavior results in a short-run aggregate-supply curve that slopes upward.

In sum, there are three alternative explanations for the upward slope of the short-run aggregate-supply curve : (1) sticky wages, (2) sticky prices, and (3) misperceptions about relative prices. Economists debate which of these theories is correct, and it is

very possible each contains an element of truth. However, all three theories suggest that output deviates in the short run from its long-run level (the natural rate) when the actual price level deviates from the price level that people had expected to prevail. We can express this mathematically as follows :

$$\begin{matrix}\text{Quantity} \\ \text{of output} \\ \text{supplied}\end{matrix} = \begin{matrix}\text{Natural} \\ \text{rate of} \\ \text{output}\end{matrix} + a \left(\begin{matrix}\text{Actual} \\ \text{price} \\ \text{level}\end{matrix} \; \square \; \begin{matrix}\text{Expected} \\ \text{price} \\ \text{level}\end{matrix} \right)$$

where *a* is a number that determines how much output responds to unexpected changes in the price level.

Notice whether the upward slope of the aggregate-supply curve is attributable to sticky wages, sticky prices, or misperceptions, these conditions will not persist forever. Over time, nominal wages will become unstuck, prices will become unstuck, and misperceptions about relative prices will be corrected. In the long run, it is reasonable to assume that wages and prices are flexible rather than sticky and that people are not confused about relative prices. Thus, while we have several good theories to explain why the short-run aggregate-supply curve is upward sloping, they are all consistent with a long-run aggregate-supply curve that is vertical.

2.4 Phillips Curve Analysis

The Original Phillips curve

The statistical relationship between inflation and unemployment

The Phillips curve approach starts with a model of wage behavior. In 1958, A.W. Phillips found a historical relation between the rate of money wage change and the rate of unemployment in the United Kingdom, and the concept of Phillips curve became popular.In fact, in 1958 the results of a statistical investigation undertaken by A.W Phillips between unemployment (U) and the rate of change in money wages in the United Kingdom over a period 1861-1957, were published in *Economica*. Phillips found evidence of a *stable* relationship between these two variables that appeared to have existed for almost a century. The negative (non-linear) relationship between unemployment and wage inflation is depicted in Figure 2.2.

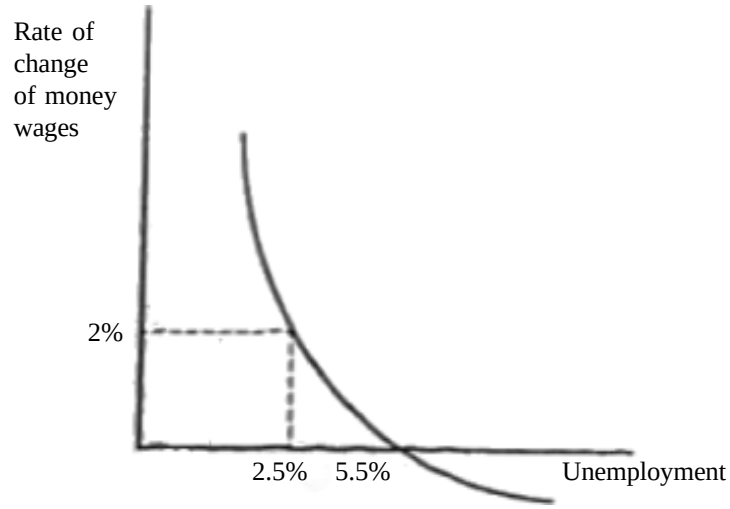

Fig. 2.2 : The Phillips curve

The estimated average relationship indicated that, when the level of unemployment was approximately 5.5%, the rate of change in money wages were zero. Furthermore, at an unemployment level of approximately 2.5%, the rate of change in money wages was approximately 2%. In consequence a 2.5% level of unemployment was compatible with price stability.

The Economic Rationale for Original Phillips Curve and Lipsey's Reformulation

As noted, Phillips's study was a statistical investigation and the economic rationale for the curve was provided by Richard Lipsey in an article subsequently published in *Economica* in 1960. Lipsey argued that money wages will rise when there is an excess demand for labour. Moreover, the greater the extent of excess demand for labour, the faster the rate or speed at which money wages will increase. While it is straightforward to illustrate a state of excess demand for labour diagrammatically, it is more problematic to actually measure excess demand for labour. To get round the problem that excess demand for labour is not directly observable, Lipsey used the the level of unemployment as a proxy or surrogate measure for excess demand in the labour market. He postulated that a negative (non-linear) relationship exists between excess demand and unemployment, as shown in Figure 2.3.

Reference to figure 2.3 reveals that when the demand and supply of labour are equal (that is, excess demand is zero) there will still be some positive amount of unemployment. As excess demand for labour increases, unemployment will fall (for

example, as vacancies increase and jobs easier to find) but by increasingly smaller amounts Unemployment will never fall to zero because of various factors such as those individuals who change their jobs and who will be unemployed while they are searching for new employment.

A combination of two hypotheses, namely that :

- the rate of increase in money wages depends positively on excess demand for labour
- excess demand for and unemployment are negatively related
- provided the economic rationale for the Phillips curve shown in Figure 2.1.

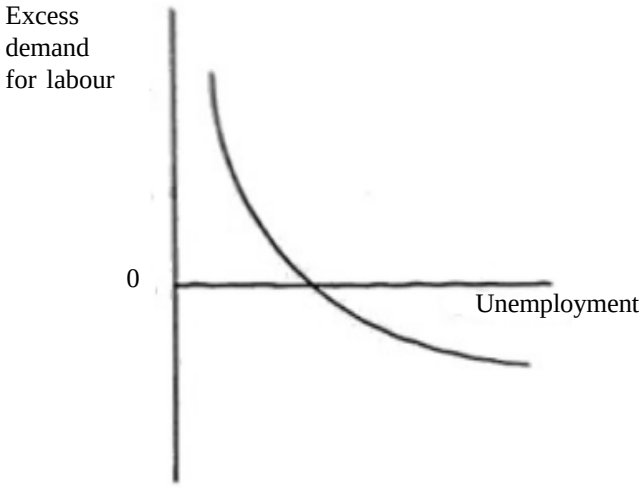

Fig. 2.3 : The relationship between the excess demand for labour and unemployment

The Philips curve can also be described by the equation :

$$\dot{W} = \frac{dw}{w} = \mathbf{f(U)}$$

where $\dot{W}$ = rate of change in money wages

U = unemployment (a proxy measure for excess demand for labour)

The original Phillips curve as a menu for policy choice

During the 1960s, the Phillips curve was quickly adopted as part of the then prevailing Keynesian orthodoxy. This is because it provided the authorities with a menu of possible inflation-unemployment combinations for policy choice. Given the

apparent stable trade-off between inflation and unemployment policy makers were faced with a clear-cut choice. If they decided to run the economy at a lowest level of unemployment they would have to accept a cost in terms of higher rate of inflation. Alternatively, reducing the rate of inflation would involve a cost in terms of higher rate of unemployment.

2.4.1 Short -run and Long run- Phillips curve

By the 1970s, it was fairly clear that a permanently exploitable Phillips curve did not appear to be in place. Friedman (1968) and Phelps (1968) argued, for instance, that a shift in policy towards a higher level of inflation with the aim of keeping unemployment low could not in the longer run keep wages from increas-ing. Rational workers would see through the Phillips curve reasoning and would not accept persistent decreases in their real wages.

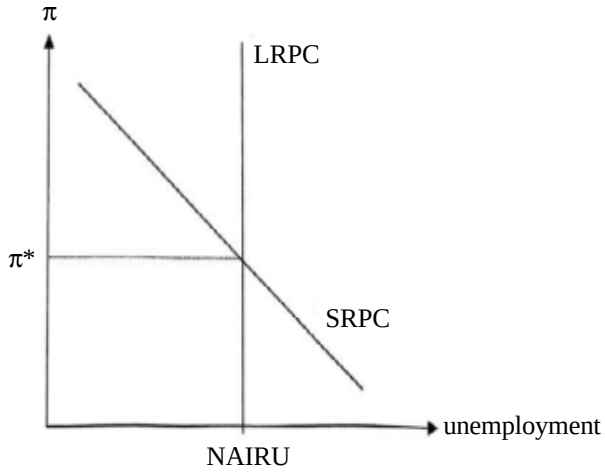

Fig. 2.4 : Short and Long-run Phillips curve

The implication of this type of reasoning is that in the longer run, there should be a normal or *natural rate of unemployment*-sometimes referred to as the non-accelerating inflation rate of unemployment (NAIRU)—from which mone-tary or fiscal policy could not diverge. Short-run deviations might be possible, as indicated by the short-run Phillips curve (SRPC) in Figure 2.4, but in the longer run there should not be an exploitable relationship between inflation and unemployment.

Expectations- augmented Phillips curve

The expectations-augmented Phillips curve can be described by the following equation :

$$\dot{W} = f(U) + \dot{P}^e$$

where $\dot{W}$ = rate of change of money wages

U = unemployment

$\dot{P}^e$ = the expected rate of inflation

When the economy is in equilibrium at the natural rate of unemployment and there is no excess demand for labour, the rate of increase in money wages $(\dot{W})$ will equal the rate of increase in prices $(\dot{P})$ and the expected rate of increase in prices $(\dot{P}^e)$. In this situation the real wage will be constant. The vertical long-run Phillips curve traces a locus of possible points where inflation is perfectly antici-pated (that is, $\dot{W} = \dot{P} = \dot{P}^e$) at the natural rate of unemployment. The intersec-tion of the short-run Phillips curve (SRPC) with the vertical long-run Phillips curve represents our initial starting point where the rate of wage and price inflation and the expected rate of inflation are all equal to zero.

Summing up

In the monetarist view, inflation is *initiated,* by excessive monetary expansion, which leads to excess demand in the labour market. This causes a rise in money wages, which firms then pass on to consumers in the form of higher prices. Expectations of further price increases lead to increased wage claims, resulting in an inflationary 'wage-price' spiral. For monetarists, the chain of causation runs from changes in the money supply (and its rate of expansion) to changes in prices (and their rate of increase, namely inflation).

Policy Implications of the Expectations- augmented Phillips curve :

One of the main policy implications of the expected-augmented Phillips curve is that, any attempt to maintain unemployment below the natural rate will result in an accelerating rate of inflation, which can only be financed by accelerating monetary growth. So monetarists arguments are that an inflation-unemployment trade-off exists in the short-run along a given short-run Phillips curve, once economic agents have fully adjusted their inflationary expectations the trade off disappears, resulting in a vertical long-run Phillips curve at the natural rate of unemployment. The natural level of unemployment is associated with a stable (or non-accelerating) rate of inflation which is itself determined by the rate of monetary expansion.

2.4.2 Samuelson and Solow on Phillips curve

By 1960, two eminent neoclassical synthesis Keynesians, Samuelson and Solow, proclaimed that the data for the United States indicated a Phillips curve trade off where 'price stability is seen to involve about 5½% unemployment; whereas… 3% unemployment is seen to involve a price rise of about 4½% per annum (Samuelson and Solow, 1960). The Phillips curve equation has become the price equation for Keynesian IS-LM model. To be more precise, they found the American Phillips curve lay slightly to the right of that of the UK with the rate of unemployment of 5%, but leading to 2.5% in inflation in the USA. They also drew attention to a Phillips curve with prices and NOT wages on the vertical axis.

Unfortunately for these two Keynesians, the 1970s produced an upward sloping Phillips relationship as higher unemployment rates were correlated with higher rates of inflation. These two Keynesians heralded Phillips curve tradeoff as inapplicable. Bereft of an explanation of inflation in a period of rapidly rising prices, their analysis fell into ill-repute among economists.

The Natural Rate of Unemployment Hypothesis as advanced by Milton Friedman

Friedman defines the *natural rate of unemployment* as that rate of unemployment which is consistent with labour-market equilibrium and at which the price level could be stable. The natural rate of unemployment is determined by the real factors which affect the amount of frictional and structural unemployment in the economy.

Keynesians interpreted the Phillips curve as a model of inflation. In his Presidential address to the American Association in 1967, Milton Friedman attacked on the Keynesian theory of the Phillips curve. Friedman proposed that the concept of "natural rate of unemployment" or NAIRU (non-accelerating-inflation rate of unemployment), which he defined as the amount of unemployment that would exist when there is no tendency for price or wage to rise , that is to say the average real wage and the price level is constant. In Figure 2.4 The long-run Phillips curve is labeled NAIRU.

Friedman claimed that the long run Phillips curve is vertical at the 'natural rate of unemployment. If policy makers tried to trade off unemployment and inflation along a short-run downward sloping Phillips curve they would merely exacerbate inflationary expectation pressures that would then require higher rate of unemployment

to prevent workers from making truculent demands. When the data of the 1970s showed a positive relationship between unemployment rates and inflation rates, the Friedman's natural rate of unemployment hypothesis seemed to be validated and the Phillips curve was buried.

Friedman concluded, "there is always a temporary trade-off between inflation and unemployment; there is no permanent trade off."

On the theoretical front, Robert Lucas and others challenged the idea of even a temporary trade –off between inflation and unemployment. There is not even a short run trade- off between inflation and unemployment.Combining rational expectations of inflation with Friedman's view that only unanticipated inflation affects inflation. The conclusion is that the unemployment cannot be affected by monetary policy. But in the Lucas theory, the trade-off between inflation and unemployment arises due to policy **surprises**. The arguments of Lucas and others created a revival of classical economics, in which monetary policy affects inflation without affecting unemployment

We may now provide here **the History of the Rise and Downfall of the Phillips Curve :**

- In 1958, British economic historian AW. Phillips (1958) published an article documenting an inverse relationship between nominal wage changes and the unemployment rate in England for nearly a century.
- In 1960, Paul Samuelson and Robert Solow (1960) dubbed this relationship the Phillips Curve and suggested that American policy makers could use it as a tool to help decide policies for aggregate demand management.
- In 1967, Milton Friedman (1968) gave the Presidential Address to the American Economic Association, in which he challenged the interpretation of the Phillips Curve as a relationship in which causality runs from unemployment to inflation and that the trade-off between unemployment and inflation is stable. Instead, he propounded what became known as the "natural rate hypothesis."
- In 1970 a collection of papers that explored the theory of the Phillips Curve, which became known as "the Phelps volume" (Phelps 1970), boosted the natural rate hypothesis.
- In August, 1971, President Nixon abruptly changed economic policy, including the imposition of a three-month freeze on wages and prices. This was followed by other forms of wage and price controls for the next two years.

- In 1976, Robert Lucas(1976) published 'Econometric Policy Evaluation: A Critique.' The paper called into question the stability of relationships, such as the Phillips curve, if individuals have rational expectations.
- In 1978, the Federal Reserve Bank of Boston (1978) published a conference volume that was devoted to burying the Phillips curve.

2.5 Lucas 'Surprise' Supply Equation : Application to financial crisis of recent past

The Lucas aggregate supply function or Lucas "surprise" supply function, based on the Lucas imperfect information model, is a representation of aggregate **supply** based on the work neoclassical macroeconomist Robert Lucas. The model states that economic output is a function of money or price "surprise".

The neo classical aggregate –supply function, often called the Lucas- Sargent-Wallace supply function or Lucas surprise supply function has the following form :

$$y_t = y^* + \gamma (P_t - E_{t-1} P_t) + \gamma (y_{t-1} - y^*] + u_t$$

where y_t is the logarithm of real output (or unemployment)

y^* is the logarithm of the natural level of real output assumed constant

P_t is the logarithm of the price level

$E_{t-1} P_t$ is the expected logarithm of the price level.

u_t is a random shock—a real shock, to represent shocks to technology

λ is a positive constant.

We observe from the above equation that real output (or unemployment) in the new classical model is assumed to deviate around its natural or normal level (y^*) as a consequence of real shocks to technology (such as technical innovation, etc). and also as a consequence of deviations of the price level from its expected level (price surprises).

Application of Lucas Supply equation to financial crisis of recent Past

The Lucas function is known as the "surprise" aggregate supply curve precisely because an unpredictable nominal shock takes agents by surprise and leads them to change their output with respect to its natural level. From the current financial crises during 2007-09 we know that that there has been a housing bubble. Lucas's surprise

supply function can be applied to this financial crisis of the recent past to know specially how the agents react with this unpredictable shocks and how to change their decisions in this context, since the aggregate supply function is formed by a constant and a cyclical component depending on the unpredictable nominal shock.

2.6 Conclusion

Earlier versions of Phillips curve postulate that there exists a stable trade-off between (wage or price) inflation and unemployment or output. Policy makers soon began to exploit the Philips relation which gave them a choice of lowering unemployment or increasing output at the cost of higher inflation and vice-versa. However, high rates of unemployment and inflation during 1970s were inconsistent with the Phillips relation. In this respect Phelps (1967) and Friedman (1968) argued that the trade-off between inflation and unemployment is not a permanent or long-run phenomenon.

Friedman-Phelps critique put forward two important propositions in modeling inflation : (i) it distinguished the relationship between inflation and output in the short-run and long-run; and (ii) it introduced the role of expectations in price adjustment process. The explicit role of expectations in the inflation dynamics carried the debate further on how the expectations can be formed. Phelps (1967) assumed adaptive expectation hypothesis in modeling expectations. Adaptive expectations assume that expectations are formed based on the past experience alone. Lucas (1972) and Sargent and Wallace (1975), however, argued that economic agents make expectations rationally and are capable of making accurate expectations taking all relevant information into account. Thus, rational expectations hypothesis implied that only unanticipated changes in the price level would affect output in the short run. In essence, the short run trade-off between output and prices arise due to misperceptions or imperfect information on the part of price setting agents (Lucas 1972). Rational expectations and policy ineffectiveness proposition first formally presented in a highly controversial paper by Thomas Sargent and Neil Wallace (1975), along with incorporating the Lucas' surprise' supply function is also taken into account.

Since role of expectations plays a major role in macroeconomics we have introduced the role of expectations in macroeconomics at the beginning, also the role

of adaptive expectation as introduced by Cagan (1956), its great appeal and its applicability to economics and its subsequent replacement by rational expectations hypothesis.

2.7 Summary

Lucas Imperfect Information model : Models of this genre typically include two types of shocks: real shocks in the form of preference shifts that alter relative demand for goods in the market; and monetary shocks that change the aggregate price levels that have no real effects, if the changes are observed, but otherwise, it can have real effects as well.

The key insight from Lucas's model is that an unexpected or unanticipated deviation in aggregate demand can have real effects on output, and prices, and consequently predicts a positive relationship between output and inflation.

Phillips curve : It depicts the negative relationship between the inflation rate and the unemployment rate.

Short –run Phillips curve : it depicts the relationship between inflation and unemployment that exists for a given expected rate of inflation.

Long-run Phillips Curve : The long run Phillips curve is vertical at NAIRU.

Price Expectations augmented Phillips Curve : The Phillips curve can be written as

$$Wt - Pt = f(Ut)$$

$$Wt = f(Ut) + Pt$$

where Wt and Ut denote the rate of wage inflation and level of unemployment in period t, respectively, and Pt denotes the expected rate of unemployment. This equation is known as the price expectations augmented Phillips curve.

NAIRU : The rate of unemployment at which inflation is stable. Friedman defined NAIRU as the amount of unemployment that would exist when there is no tendency for price or wage to rise. One of its properties is that the average real wage is at an equilibrium level.

Neo classical economics : An approach based on the three assumptions of continuous market-clearing, incomplete information and rational expectations.

Adaptive expectations : Adaptive expectations were first introduced into economics by Cagan in a most influential volume which heralded the monetarist-counter-revolution in macroeconomics against Keynesians and post-Keynesian economics. Stated simply, the adaptive expectations approach asserts that agents will formulate expectations not only in the light of actual historical values but also with reference to the extent that their prior expectations of the future price level have been proved to be incorrect. Again, if we restrict ourselves to expectations of the future price level we may express this a s:

$$\mathbf{P^*_{t+1} = P^*_t + \alpha\ (P_t - P^*_t);\quad 0 \leq \alpha \geq 1}$$

where the subscripts denote the time-period and the asterisk indicates the expected value of the variable as opposed to the actual value, whilst α is a coefficient of expectation. That is to say, the price we expect next period is equal to the price we expected this period plus some fraction of the extent that our current expectation was shown to be incorrect.

Rational expectations : An approach that assumes people make the best use of all available information to forecast the future.

To be more specific, if economic agents are rational, they will make full use of all the available information when forming expectations and not just rely on past values of the relevant variable (as did the AEH). Expectations which are conditioned of all the available information are called *rational* expectations. When expectations are formed rationally the errors between actual inflation and the expected rate of inflation are random and serially correlated or independent over time. There is no systematic error by definition because any systematic error would reveal that information had not been fully used when expectations are formed. So the expected or mean error is zero. If expectations are rational, then

$$(\dot{P}/P) = E(\dot{P}/P)_t + e_t$$

where ε_t is a serially uncorrelated error term with a zero mean.

When expectations are formed rationally then people use information derived from the model which they think explains how the economy behaves. This means that if inflation is due to monetary expansion, then information about the current movements in the money supply will be important in conditioning expectations.

Lucas Supply Function : This is different from adaptive expectation. Lucas Supply Function states that output is the function of growth in technological progress and population, difference between the realized and expected price level and output in the previous period :

$$y_t = k_t + \gamma (p_t - p_t^*) + \lambda y_{t-1}$$

in which y is real output, p_t is the price level, p_t^* is the expected price level, γ and λ are parameters and k_t is the growth rate.

Lucas supply curve : The so-called Lucas supply curve, which makes explicit the dependence of output on the difference between the realized and expected price level, is the new classical reformulation of the expectation-augmented Phillips curve of Milton Friedman (1968) and Phelps (1968). The new classical approach is consistent with the *natural rate* hypothesis of Friedman and Phelps—that deviations of output from its natural or full-employment level cannot be sustained without a sustained deviation of actual from expected inflation.

Policy Ineffectiveness Proposition : The Rational Expectations Hypothesis, conceived by John Muth (1961) and formulated by Lucas and Prescott (1971), is an essential feature of new classical economics and an important innovation in the study of macroeconomics. Lucas justifies Rational Expectations based on the implausibility of systematic forecast errors in the face of the "recurring character of the business cycle." (1977. p. 15).

Lucas's work and the neoclassical economics have had a lasting influence. One of the most important implications, further developed by Thomas Sergant and Neil Wallace (1975), is the policy ineffectiveness proposition. They argue that systematic monetary policies—those manipulations of money and interest rates by the central bank that one anticipated by market participants—can have no hope of influencing income or employment.

In short. it is the proposition that anticipated changes in monetary policy have no effect on output and employment.

Disinflation : A fall in the general price level, frequently accompanied by a reduction in the level of national income. A disinflation is often deliberately brought about by the authorities in order to combat inflation and to eliminate the BoP deficits.

Instruments of disinflationary policy include fiscal measures (e.g. tax increases), monetary measures (e.g. higher interest rate), prices and income controls.

Stagflation : A situation where high unemployment and high inflation occur simultaneously : a combination of stagnation and inflation.

2.8 Exercise

Short-answer type questions

1. What is Keynes's view about expectations? or How did Keynes lay great emphasis upon the importance of expectations?
2. What is adaptive expectation? Mention its applications in the real world.
3. Why was adaptive expectations eventually abandoned?
4. Do you agree with the view that Adaptive Expectations approach has great appeal? Elucidate
5. State some assumption of rational expectation?
6. What are rational expectations? In which field is it used? State three criticisms of rational expectations?
7. What are the assumptions of New classical Economics?
8. What is price expectation –augmented Phillips curve?
9. What is the policy relevance of the Phillips curve?
10. How can the government reduce the natural rate of unemployment in order to achieve higher output and employment levels?
11. What is Lucas 'surprise ' supply equation?

Medium-answer type questions

1. What is Post-Keynesian view regarding the role of expectations? Expectation?
2. Write down the criticisms leveled against the REH?
3. Explain three theories for which the short –run aggregate supply curve is upward sloping.
4. What is Samuelson and Solow's views on the Phillips curve
5. How does the concept of NAIRU as advanced by Milton Friedman bring about a revolution in explaining the Phillips curve?

6. What were Milton Friedman's criticisms against Phillips curve?
7. What is meant by the term the 'natural rate of unemployment'? What policies might be used to reduce the natural rate ?

Long-answer type questions

1. Write down the different views concerning the role of expectations in macroeconomics?
2. What is AEH? What are its practical application? Do you agree with the view that AEH is not without its flaws? Give reasons for your answer.
3. What is REH? Mention some of the important implications of REH?
4. What is policy ineffectiveness proposition? In terms of Figure, show the working of the policy ineffective proposition?
5. What is the essential message of 'worker misperception' model? How does it arise? How does the misperception theory explain the upward sloping supply curve of the short- run aggregate supply curve? Explain.

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Unit 3 ❑ New Keynesian Macroeconomics

Structure

3.1 Objectives

After going through this unit you will be able to

- Know what the New Keynesian model is;
- Learn about Mankiw's Sicky price (menu cost) model;
- Understand the Lindbeck and Snower's (1986) Insider- Outsider model; and.
- Acquainted with a simple formulation of Romer's (2005) efficiency model.

3.2 Introduction

New Keynesian macroeconomics is an approach that explores a variety of reasons for wage and price stickiness that prevents market clearing. It emerged mainly as a response to the theoretical crisis facing Keynesian economics that emerged during the 1970s. In their brief survey of New Keynesian economics Mankiw and Romer (1991) define New Keynesian economics with the following questions : Question (1) Does the theory violate the classical dichotomy? That is, is money non-neutral? Question (2) Does the theory assumes that real market imperfections in the economy are crucial for understanding economic fluctuations?

Of the mainstream schools only New Keynesians answer both questions in the affirmative. Non-neutrality arises from sticky prices, and market imperfections explain the behavior of prices. Thus, according to Mankiw and Romer, it is the 'interaction of nominal and real imperfections' that distinguishes New Keynesian economics from other research programs in macroeconomics. In contrast, the early real business cycle models gave a negative response to both questions.

New Keynesian models assume price-making monopolistic, rather than perfectly competitive, firms. Although the theory of monopolistic competition has been developed independently by Joan Robinson (1933) and Edward Chamberlin (1933) before the publications of Keynes's *General Theory*, it is only recently that mainstream theorists have began seriously to incorporate imperfect competition into non-market-clearing models. In this matter, New Keynesians were the first off the mark.

New Keynesian economists inhibit a brave new theoretical world characterized by imperfect competition, incomplete markets, heterogeneous labour and asymmetric information, and where the agents are frequently concerned with fairness.

3.3 Sticky Price (Menu Cost Model)

New Keynesian Economics argue that menu costs are the reason for price stickiness. Price stickiness, the suboptimal adjustment of prices in response to demand shocks, can result in business cycles.. Gregory Mankiw proved in 1985 in his article "Small Menu Costs and Large Business Cycles : A Macroeconomic Model of Monopoly" that sticky prices can be both privately efficient and socially inefficient. In fact, as Mankiw points out, even small menu costs can cause large welfare losses. In other words, Mankiw has shown that imperfectly competitive firms may obtain only small benefits from adjusting prices to demand fluctuations, so that even small menu costs (price–adjusted costs) can make *price sticky*, with nominal demand fluctuations being reflected in output, not just in prices.

New Keynesian theory assumes that while some goods in the economy are homogeneous and trades in perfectly competitive markets, many goods—especially at the retail level—are differentiated by firms in some characteristic or other. Such differentiation is often in the form of colour, in packaging, in location or brand

royalty. Such differentiation in practice is usually not enough to create a monopoly for the firm but enables it to function in a monopolistically competitive manner. Profit maximization by a monopolistically competitive firm implies that it is not a price taker, as are firms in perfect competition, but a price setter with a downward sloping demand curve for its product.

Changing the set price imposes a variety of costs, collectively known as **menu costs**. Examples of these are : physical costs of resetting prices such as the printing of new price lists, and catalogues, informing customers, remaking the merchandise, etc. These menu costs, though often relatively small as a percentage of price the price of the firm's product, can still be greater than the gain in revenue from a small price change. Consequently, the firm may not find it optimal to respond to demand changes with price changes unless the demand changes imply large enough price changes. Over time, as demand increases occur, the optimal price change becomes large enough for the firm to be willing to incur the menu costs and change the actual price of its product. How small menu costs can produce large macroeconomic fluctuations have been discussed by Mankiw and by Akerlof and Yellen.

The above arguments imply that a monopolistic competitive firm will change its prices infrequently, but will respond by intervening by changing its output at the existing prices. In the long run, the price will adjust to demand and, even in the short run, if the demand increase is large enough, the price adjustment will occur. In the economy as a whole, an increase in aggregate demand will cause some sectors and firms,, especially those with competitive markets, to adjust their prices faster while others will not immediately do so but will respond to demand changes with supply changes. Consequently, an increase in aggregate demand will be partly met with an increase in prices and partly met by an increase in output.

The increase in aggregate output to meet an increase in aggregate demand requires an increase in employment. And the increase in aggregate demand will be accommodated through an increase in employment and output, without necessarily a change in real wages.

In the Akerloff and Yellen model published in 1985, inertial wage-price behavior by firms 'may be near-rational'. Firms that behave suboptimally in their price-setting

behavior may suffer losses but they are likely to be small. Akerlof and Yellen also demonstrated that that, when imperfect competition in the product market is combined with efficiency wages in the labour market, aggregate demand disturbance will lead to cyclical fluctuations.

In the presence of menu costs and/or near-rational behabiour causes nominal price rigidity, shocks to nominal aggregate demand will cause large fluctuations in output and welfare. Since such fluctuations are inefficient, this stabilization policy is desirable. Obviously, if money wages are rigid , the marginal cost curve will be sticky, thus reinforcing the impact of menu costs in producing price rigidities.

One implication of this menu cost approach to price stickiness is that prices will adjust faster the greater the increase in demand, so that higher the inflation rate, the more quickly will price adjust and less will be the effect of aggregate demand increases on real output. Hence, at higher rates of inflation, nominal shocks will produce smaller real effects.

3.4 Insider-Outsider Model of Lindbeck and Snower (1986)

Firms want to cut wages but are prevented from doing so by contacts and labour unions. This is insider-outsider theory. The intuition for understanding how unions affect unemployment is the assumption that unions cares only about their own members, *the insiders*, who are already employed, and will aim for wage levels that are beyond full employment equilibrium. The theory of insiders and outsiders in the labour market was pioneered by Lindbeck and Snower (1986).

Why don't unemployed workers offer to work for lower wages than those currently paid to employed workers'? If they did so, wages would be bid down and employment would increase. There appears to be an unwritten eleventh commandment: 'Thou shall not permit job theft by underbidding and stealing the jobs of thy comrades.' The insider-outsider theory also attempts to explain why wage rigidity persists in the face of involuntary unemployment (see Ball, 1990, and Sanfey. 1995 for reviews).

The insider-outsider approach to real wage rigidity was developed during the 1980s in a series of contributions by Lindbeck and Snower (1985. 1986. 1988a,

1988b). In this model the insiders are the incumbent employees and the outsiders are the unemployed workers. Whereas in efficiency wage models it is firms that decide to pay a wage higher than the market-clearing wage, in the insider-outsider approach the focus shifts to the power of the insiders who at least partially determine wage and employment decisions. No direct effects of wages on productivity are assumed.

Where does the insider power come from? According to Lindbeck and Snower, insider power arises as a result of turnover costs. These include hiring and firing costs such as those associated with costs of searching the labour market, advertising and screening, negotiating conditions of employment, mandatory severance pay and litigation costs. Other important costs are production-related and arise from the need to train new employees. In addition to these well-known turnover costs, Lindbeck and Snower (1988a) also emphasize a more novel form of cost—the insider's ability and incentive to cooperate with or harass new workers coming from the ranks of the outsiders. If insiders feel that their position is threatened by outsiders, they can refuse to cooperate with and train new workers, as well as make life at work thoroughly unpleasant. By raising the disutility of work, this causes the outsiders' reservation wage to rise, making it less attractive for the firm to employ them. To the extent that cooperation and harassment activities lie within the control of workers, they can have a significant influence on turnover costs by their own behaviour.

Because firms with high rates of turnover offer both a lack of job security and few opportunities for advancement, workers have little or no incentive to build reputations with their employers. Low motivation damages productivity and this represents yet another cost of high labour turnover.

Because it is costly to exchange a firm's current employees for unemployed outsiders, the insiders have leverage which they can use to extract a share of the economic rent generated by turnover costs (the firm has an *incentive* to pay something to avoid costly turnover). Lindbeck and Snower assume that workers have sufficient bargaining power to extract some of this rent during wage negotiations. Although unions are not necessary for insider power, they enhance it with their ability to threaten strikes and work-to-rule forms of non-cooperation.

Although the insider-outsider theory was originally put forward as an explanation of involuntary unemployment, it also generates some other important predictions (see

Lindbeck and Snower, 1988b). First, insider-outsider theory implies that pronounced aggregate shocks which shift the demand for labour may have persistent effects on wages, employment and unemployment. In countries with large labour turnover costs and powerful unions, this 'effect persistence' will be significant. Second, in cases where the shocks are mild, firms with high turnover costs have an incentive to hoard labour, and this reduces employment variability. Third, the insider-outsider model can provide a rationale for many features associated with 'dual labour markets'. Fourth, this model has implications for the *composition* of unemployment. Lindbeck and Snower (1988b) argue that 'unemployment rates will be comparatively high for people with comparatively little stability in their work records'. This offers an explanation for the relatively high unemployment rates which are frequently typical among the young, the female population and various minority groups.

While the insider-outsider theory and efficiency wage theories provide different explanations of involuntary unemployment, they are not incompatible but complementary models, since the amount of involuntary unemployment 'may depend on what firms are willing to give and what workers are able to get' (Lindbeck and Snower, 1985).

Implication : Firms will employ more outsiders in good times. And strong labour unions increase unemployment. Secondly Insider wages are countercyclical and will be higher in bad times. The intuition is that firms and insiders reach this decision jointly in order to keep outsiders from getting employed.

3.5 Efficiency Wage Model (A very simple formulation of D. Romer, 2005)

Firms pay high wages in order to motivate workers and reduce shrinking. This is efficiency wage theory,

The key assumption in efficiency wage theory is that the wage rate affects individual worker behaviour. More specifically, it is assumed that a higher wage will induce workers to work harder, or to exert more effort. There may be several reasons why this is true. In developing countries, a higher wage means higher and more stable food consumption, which in turn has a direct effect on effort. In more

advanced countries, a key link is that workers' true effort is hard for firms' managers to monitor. If workers could easily get a similar job elsewhere for the same wage, they would have an incentive to shirk on the job. A wage somewhat higher than necessary would thus make shirking-and the associated risk of getting fired more costly for the individual worker. A third reason might be that higher wages improve the quality of job applicants. A higher wage might also build loyalty among workers and to the firm, whereas lower wages cause anger and shirking. A very simple formulation of these ideas (which follows the exposition in Romer 2005) is to assume a firm with a profit function

$$\pi = F(eL) - wL \qquad (3.1)$$

where F(eL) is the firm's production function, *eL* is "effective" labor, un is the wage rate, and L is the number of people employed. Labor is the only factor of production and the price of the goods produced is normalized to unity the so that F(*eL*) is the firm's total revenue. The production function has the standard features $F'(eL) > 0$ and $F''(eL) < 0$. The key assumption in the model, however is that effort that reacts to the wage level according to a function $e(w)$ where $e'(w) > 0$. Hence, the wage has both negative and a positive impact on the firm profits; on the other hand, it constitutes a direct cost in terms of wage payment; on the other hand, it increases net revenue due to a greater worker effort.

The firm's maximization problem is to choose the level of the wage *w* and the number of people employed *L* so as to maximize total profits. $\pi = F(e(w)L) - wL$. The first-order conditions for maximum are

$$\frac{\partial \pi}{\partial w} = F'(e(w)L)Le'(w) - L = 0 \qquad (3.2)$$

$$\frac{\partial \pi}{\partial L} = F'(e(w)L)e(w) - w = 0 \qquad (3.3)$$

From (3.3), we find that $F'(e(w)L) = \frac{w}{e(w)}$. This might be interpreted as a modified version of the standard optimization criterion; that the marginal product of labor $F'(e(w)L)$ should be equal to the (effort-adjusted) marginal cost $\frac{w}{e(w)}$.

Substituting this expression back into (3.2) and rearranging terms yields the optimality condition

$$\frac{\tilde{w}}{e(\tilde{w})}e'(\tilde{w}) = 1 \qquad (3.4)$$

The term on the left-hand tide is the elasticity of effort with respect to the wage. The wage at which this equality holds is $\tilde{w}$. Whether such a wage can be found depends to a large extent on the character of the *e(w)* function.

The efficiency wage equilibrium is $\tilde{w} > 0$. The firm's labor demand is in turn implicitly given by the expression in (3.3).

3.6 Conclusion

In what follows is that, though the Key Keynesian economics explores a variety of reasons for wage and price stickiness that prevents market clearing**,** New Keynesian developments has failed to give a single unified New Keynesian model since many of the most research program of them are 'article-laden. Yet is a great advancement in the history of macroeconomic thought as it gives beautiful theories that capture the modern days' phenomena. For example, New Keynesian economist Mankiw shows that sticky **prices** can be both privately efficient and socially inefficient. Mankiw also demonstrates that a private incentive ensures a high price adjustment when aggregate demand expands, but a small adjustment following a contraction in aggregate demand. From a social planner's point of view, prices may be stuck too high, but never too low, which translates into downward price stickiness. The theory of insiders and outsiders in the labour market pioneered by Lindbeck and Snower (1986) answer the question : Why don't unemployed workers offer to work for lower wages than those currently paid to employed workers'? It also attempts to explain why wage rigidity persists in the face of involuntary unemployment. Finally, Romer finds that a higher wage will induce workers to work harder, or to exert more effort and there are several reasons why this is true.

3.7 Summary

New Keynesian Economics : It is an approach that explores a variety of reasons for wage and price stickiness that prevents market clearing**.** However, one problem with new Keynesian developments is that the research program has proved to be so 'article –laden' that there is no single unified new Keynesian model.

The New Keynesian Efficiency Wages Hypothesis : This hypothesis explains why firms may find it unprofitable to cut money wage rates even when faced by persistent involuntary unemployment.

Market clearing : occurs when all goods or services supplied in a market are sold.

3.8 Exercise

Short-answer type questions

1. What is Menu Cost model?
2. How do menu costs contribute to sticky prices?
3. What are the criticisms of menu cost literature?
4. What is the essence of efficiency wage theories?
5. What are the main messages of Insider-outsider model?
6. What is meant by Neo Keynesian Macroeconomics?

Medium-answer type questions

1. Write a brief note on the development of the New Keynesian macroeconomics?
2. Give an account of the menu cost model as advanced by Gregory Mankiw.
3. Briefly discuss the Insider-Outsider Model of Lindbeck and Snower (1986).
4. Within the Insider-Outsider model of real wage rigidity, who are the insiders and who the outsiders?
5. Although the insider-outsider theory was originally put forward as an explanation of involuntary unemployment, it also generates important predictions. Do you agree? Then mention the predictions?

6. What are the key assumptions of efficiency Wages models? or What are the potential reasons for efficiency wages?
7. Why may firms find it profitable and rational to pay a so-called efficiency wage which is above the market clearing real wage rate?

Long-answer type questions

1. What is Neo-Keynesian macroeconomics? How does it places its importance in the modern macroeconomics?
2. What is menu cost ? How the use of menu cost dominate the recent macroeconomics dynamics?
3. In the Insider–outsider model in the new Keynesian framework, who are the insiders and who are the outsiders? How does this insider-outsider model work?
4. What are the essential differences between efficiency- wage model and insider–outsider model? Give arguments.
5. How successful have New Keynesian economists been in their quest to develop coherent micro-foundations for sticky price models?

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Unit 4 ❑ Real Business Cycle (RBC) Theory

Structure

4.1 Objectives

After going through this Unit you should be in a position to

- explain how the economy transits through the process of business cycles;
- explain the underlying ideas behind real business cycles theory;
- appreciate the importance of technological innovation; and
- appreciate the possibility of economic fluctuations due to supply shocks.

4.2 Introduction

The extent of this module is partly indicated in the title. It is about real business cycle (RBC) theory. Initially, it exposes you to New Classical Business Cycle theory, a specie which belongs to the same genus that spawns the RBC approach. The literature in the field is technical, so we will work through some elementary, but not trivial, treatments of the subject and strongly recommend plunging into the classics

in the area, once some quantitative skills have been imbibed. The theory will expose you to the traditional theory of unemployment, and add on to your education in microeconomics that ends with the theory of general equilibrium.

The perspective of the former is that business cycles emerge naturally in the evolution of a capitalist economy as a system. Particularly, the connection between the short-run dynamics of traditional theories of employment and the cycles that emerge from their long-run extension would be written along aggregative lines. The painstaking work of pioneers like, Wesley Clair Mitchell and others consisted in closely scrutinizing this time series aspect of important macroeconomic magnitudes and tracing short and long cycles therein. The strategy of the latter, on the other hand, is to develop the story of market-clearing over time to account for the phenomenon of fluctuations and cycles. A distinction is made between the two notions.

Fluctuations might not present the periodicity indicated in the word ‘cycles’. Real business cycles are fluctuations generated by shocks which might not reflect the rhythms of ebb and flow of classical cycles. New Classical Business Cycle research, on the other hand, is oriented towards explaining the familiar pattern of boom and slump, one following the other in regular succession. Perhaps for this reason, the role of money and finance in both approaches might be distinguished. In the former, the shocks referred to are changes in technology and tastes. Money is a veil. On the other hand, money and finance are part of the model of expansion and contraction developed by New Classical Business Cycle theorists.

To generalize, the following elements accentuate cycles : the division of labour, the length of the roundaboutness of production, the durability of goods, the income share of durable goods, the costs of moving between jobs, transaction costs, and the degree of learning by doing. Correspondingly, countercyclical factors are : a decrease in the roundaboutness of production, a decrease in the level of the division of labour, a decrease in the durability of goods, decreases in transaction costs and a decrease in the degree of learning by doing.

4.3 Simple Real Business Cycle Model

The real business cycle theory has been evolved out of the American new classical school of 1980s. It is the outcome of research mainly by Kydland and Prescott, Barro

and King, Long and Plosser, and Prescott. Later, Plosser, Summers, Mankiw and many other economists gave their views of the real business cycles. They view aggregate economic variables as the outcomes of the decisions made by many economic agents acting to maximize their utility subject to production possibilities and resource constraints.

Their views mainly relate to technology shocks, labour market, interest rate, role of money, fiscal policy, prices and wages in business cycles. Here, we will primarily discuss the importance of the comparative statics on technological shock.

The real business cycle theory is based on the following assumptions :

1. There is a single commodity in the economy.
2. Prices and wages are flexible.
3. Money supply and price level do not influence real variables such as output and employment.
4. Fluctuations in employment are voluntary.
5. Population is given. So there is fixed labour force.
6. There are rational identical economic agents in the economy.
7. These agents make optimizing decisions.
8. Everyone has the same preferences which depend only on consumption in each year.
9. More consumption is preferred to less so that the marginal utility from consumption diminishes.
10. The economy is subject to irregular (random) real supply side shocks.
11. It is a single sector economy.
12. There are substantial changes in the rate of technology that affect the whole economy (which is viewed as a single sector).
13. There is constant return to scale production-technology.
14. The economy is in a steady state.

We now turn our model of the economy under flexible prices into a model of fluctuations. The new feature of the model is the behaviour of labour supply. In a classical model the supply of labour is fixed which determines the level of employment.

Yet employment fluctuates over the business cycle. II we maintain classical assumption that labour market clears, as new classical economists do, then we must examine what causes fluctuations in the quantity of labour supplied.

After discussing the determinants of labour supply, we modify classical model, aggregate income to include changes in labour supply. The supply of output depends in part on the supply of labour, which means that the greater the number of hours people are willing to work, the more output the economy can produce. We examine how various events influence labour supply and aggregate income according to real-business-cycle theory.

Real-business-cycle theory states that the quantity of labour supplied depends on the incentives that workers receive at any point in time. When workers are well rewarded, they wish to work more hours, and vice versa. This willingness to reallocate hours of work over time is called the inter-temporal substitution of labour. For example, a second year college student has two years summer vacations left before graduation. He wishes to work for one of these summers and to relax during the other summer. How should he choose which summer to work?

Let W1 be his real wage in the first summer, and W2 the real wage he expects in the second summer. Choosing which summer to work means comparing these two wages. Since the student can earn interest on money earned earlier, money earned in the first summer is worth more than money earned in the second summer.

Let r be the real interest rate. If the student works in the first summer and saves his earnings, he will have (1 + r) W1 a year later. If he works in the second summer, he will have W2. The inter-temporal relative wage is (1 + r) W1/W2. Working in the first summer is more attractive if the interest rate is high or if the wage is high relative to wage expected to prevail in the future.

According to real-business-cycle theory, all workers calculate cost-benefit analysis to decide when to work and when to enjoy leisure. If the wage is temporarily high or if the interest rate is high, it is good time to work. If the wage is temporarily low or if the interest rate is low, it is a good time to enjoy leisure. Real-business-cycle theory incorporates inter-temporal substitution of labour into the classical model of the economy. This analysis of labour supply shows that the interest rate influences the attractiveness of working today. The higher the interest rate, the greater the

amount of labour supplied, and the greater the amount of output produced. Figure 1 shows the real-business-cycle model of the economy. Because of inter-temporal substitution of labour, the real aggregate supply curve slopes upward rather than vertically, which means a higher interest rate makes working more attractive, which increases labour supply and, thus, output.

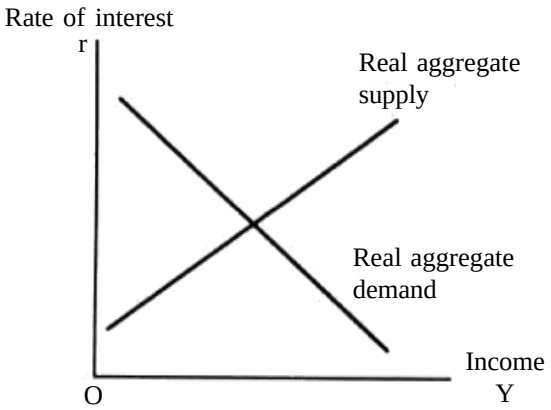


Figure 1 : Real Business Cycle Model

The real interest rate adjusts to equilibrate real aggregate supply and real aggregate demand. We can use this model to explain fluctuations in output. Any shock to the economy that shifts aggregate demand or aggregate supply changes equilibrium output. Inter-temporal substitution of labour leads to a corresponding change in the level of employment as well.

4.4 Technology Shocks

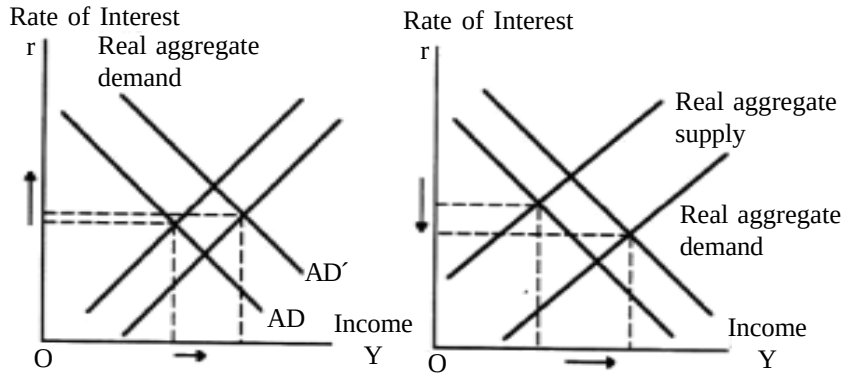
4.4.1 How a technology shock will influence on aggregate output and employment?

Many theorists emphasize the role of shocks in technology. To see how technological shocks cause fluctuations, suppose some improvements in tech-nology are available, such as, faster computers. According to this theory, this change affects the economy in two ways.

Firstly, the improved technology increases the supply of goods and services. As the production function is improved, more output is produced for any given input. The real aggregate supply curve shifts outwards.

Secondly, the availability of the new technology rises the demand for goods. For example, firms wishing to buy these computers will raise their demand for goods. For example, firms wishing to buy these computers will raise their demand for investment goods. The real aggregate demand curve shifts outwards as well.

Figure 2 shows two effects. A beneficial shock to the technology raises both real aggregate supply and real aggregate demand. In Figure 2(a), demand shifts more than supply. In Figure 2(b), demand shifts less than supply.



(a) Real aggregate demand shifts more than real aggregate supply

(b) Real aggregate supply shifts more than real aggregate demand

Figure 2 : The Effects of Technological Shocks

4.5 The Policy Implications of Real Business Cycle Theory

- If people aren't working because there is a recession, this is an efficient response to the fact that productivity is low today : people take time off when productivity is low and work harder when productivity is high. This is an assumption of the model, not a conclusion–this is indeed logical.
- The only thing the government should do about a recession is to try to improve productivity–Encourage competition–Lower transaction costs–Promote innovation–All of these things are desirable anyway, not just when there is a recession.
- The Real Business Cycle theorists believe that the government's ability to stabilise the economy is limited. They view the business cycle as the efficient and natural response of the economy to technological changes given competitive market structure prevails.

In a competitive theory of fluctuations the equilibria are Pareto- optimal. The idea that the government in any way attempt to reduce these fluctuations is therefore anathema to RBC theorists. Such policies are almost certain to reduce welfare. As Prescott has argued the policy implications of this research is that costly efforts at stabilization are likely to be counter-productive.

- Given competitive market structures, by the 1st Welfare Theorem, the allocation is efficient.
- If technological change is the key factor in determining both growth and fluctuations, we certainly need to develop a better understanding of the factors which determine the rate of technological progress, To RBC theorists, the emphasis given by Keynesian and monetarist economists to the issue of stabilization has been a costly mistake. In a dynamic world instability is as desirable as it is inevitable..
- Finally Chatterjee (1999) has pointed out that the emergence of REBCT is a legacy of successful countercyclical policies in the post-Second World War period. These policies, by successfully reducing the volatility of GDP due to aggregate demand disturbances compared to earlier periods, has allowed the impact of technological disturbances to emerge as a dominant source of modern business cycles.

4.6 Criticisms of Real Business Cycle Theory

The real business cycle theory has been highly controversial. Its exponents maintain that it is a realistic theory based on large fluctuations in output and employment displayed by the US economy. But its foremost critic, Lawrence Summers points out that the real business cycle models “have nothing to do with the business cycle phenomena observed in the United States or other capitalist economies.” According to Mankiw, “Real business cycle theory does not provide an empirically plausible explanation of economic fluctuations.” Summers, Mankiw and many other economists have criticized the real business cycle theory on the following grounds :

1. **Intertemporal substitution :** The first criticism against RBC theory comes from theoretical standpoint. The income effect and substitution effect are connected with conventional neoclassical analysis of labour supply.A higher real wage induces an

increase in labour supply through the substitution effect, but at the same time a higher real wage also has an income effect that induces a worker to consume more leisure. In real business cycle models the substitution effect must be very powerful compared to the income effect if these models are to plausibly explain large variations of employment induced by technology shocks. Thus,In the real business cycle theory, there is intertemporal substitution of labour and work. Over the business cycle, individuals reduce the supply of labour in response to small reductions in the real wage or small decreases in real interest rate. If individuals expect increases in their real wage, they will enjoy leisure today and work more in the future. If they expect decreases in their real wage, they will work hard today and enjoy leisure in the future. But it is unlikely that individuals are so responsive to intertemporal changes in real wage.

2. Technological Shocks : In the real business cycle theory as put forward by Prescott, the only driving force behind cyclical fluctuations is technological shocks. Critics do not agree with this. According to them, technological shocks leading to changes in total factor productivity are hard to find. There is also no direct evidence of the existence of large technological shocks. Therefore, the existence of large changes in technology is an unjustified assumption of real business cycle theory. Muellbauer (1997) argues that the kind of technological volatility implied by REBCT [real (equilibrium) business cycle theory)] is 'quite implausible.' He gives reason saying that that technological diffusion tends to be slow.

3. Lack of Robust Empirical Testing : A final important criticism relates to the lack of robust empirical testing. In an assessment of the empirical plausibility of real business cycle theory, Eichenbaum (1991) finds the evidence put forward by its proponents as 'too fragile to be believable'.

4. Voluntary Employment : An important fourth criticism relates to the issue of unemployment. In real business cycle models unemployment is either entirely absent or is voluntary. Critics find this argument unconvincing and point to the experience of the Great Depression.

5. Exchange Mechanism : A fifth criticism relates to the pervasive use of the representative agent construct in real business cycle theory. Real business cycle theorists sidestep the aggregation problems inherent in macroeconomic analysis by using a representative agent whose choices are assumed to coincide with the

aggregate choices of millions of heterogeneous individuals. Such models therefore avoid the problems associated with asymmetric information, exchange and coordination.

6. Neutrality of Money : A sixth objection to real business cycle theory relates to the neutrality of money and the irrelevance of monetary policy for real outcomes. However, the majority of economists like Romer and Romer (1989, 1994), Blanchard (1990), Ball (1994) remain unconvinced that money is neutral in the short run

7. Wages and Prices : This theory assumes that wages and prices are flexible. But critics point out that wages and prices are inflexible. They believe that changes in monetary policy lead to short-run aggregate demand disturbances that can have important real effects on output and employment because of the nominal price and wage rigidities.

8. Fiscal Policy : The RBC theory assumes that the government has no role to play in stabilization policy. If the government adopts policies to stabilize employment, they are ineffective and can harm the economy by impeding the invisible hand. But critics do not agree that stabilization policy has no role to play.

9. Negative Technological Shocks : This theory does not explain large negative technological shocks that mark recession. Historical evidence shows that periods of disinflation are of low output and unemployment. These effects are completely absent in the real business cycle theory.

10. Absence of Microeconomic fluctuation : A tenth objection is that REBCT does not provide any deep microeconomic foundations to explain technological change and innovative activity.

11. Incomplete Theory : The real business cycle theory is an imperfect and incomplete theory. It does not explain the turning points of the business cycle. No doubt real supply shocks have important effects on output and employment, they do not create peaks and troughs in the business cycle as actually observed.

Kydland and Prescott (1982) in their article ‘Time to Build and Aggregate Fluctuations’ have convincingly argued that a dynamic stochastic general-equilibrium model (DGSE) driven by technological shocks can mimic the main statistical features of U.S. macroeconomic time series. An oft-quoted statement used in support of technology shocks attributed to Prescott (1986) can be found on page 7 of Rebelo

(2005), asserting that such shocks "account for more than half the fluctuations in the post-war period with the best point estimate near 75%.." The theory survived for adding new features such as labour hoarding, invisible labour or capital utilization, which makes technology shocks less volatile.

However, since 1999, a new wave of attack on the RBC hypothesis appeared. These recent studies have found that positive technology shocks, identified using an econometric technique known as structural vector auto-regressions, are contractionary on the part of labour input, contrary to business cycle experiences. Contemporary research conducted by Neville Francis and Valerie A. Ramey (2005) has concluded that the technology-driven RBC hypothesis appears dead. This gives the literature new life. RBC research has reemerged to the forefront of macroeconomics since the mid-1990s. Schlefer (2012) argues that RBC models suppose that productivity shocks generate business cycles, but they measure productivity by Solow residual. In fact, RBC models are a tautology: business cycles occur because growth surges and declines.

4.7 Conclusion

In what follows is that Real business-cycle theory (RBC theory) is an offshoot of new classical macroeconomics models in which business-cycle fluctuations are accounted for by real (in contrast to nominal) shocks. According to RBC theory macroeconomic fluctuations in the economy can be largely explained by technological shocks and changes in productivity. Real business cycle models either completely reject or play down the role of aggregate demand in influencing the economic cycle. Real business cycle models also suggest that government intervention to influence demand in the economy is generally counterproductive and the optimal policy is to concentrate on supply-side reforms which help the economy to be more efficient and flexible.

4.8 Summary

Real Business Cycle Theory :

The real business cycle theory has been evolved out of the American new classical school of 1980s. It is the outcome of research mainly by Kydland and Prescott, Barro

and King, Long and Plosser, and Prescott. Later, Plosser, Summers, Mankiw and many other economists gave their views of the real business cycles.

It is an approach in which fluctuations in aggregate output and employment are driven by persistent supply-side shocks to the economy, most notably random fluctuations in the rate of technological progress.

In their joint article "Time to Build and Aggregate Fluctuations" (1982), Kydland and Prescott established the microeconomic foundation for business cycle analysis. This is the most fully worked out real business cycle (RBC) model that views that business cycles are equilibrium real phenomena, driven largely by productivity shocks. They argued that this productivity shocks accounted for roughly two-thirds of the volatility of US output over the business cycle in the post war periods. This productivity- driven view of business cycle has come to be known as "RBC' theory.

DGSE models : The famous Dynamic Stochastic General-equilibrium (DGSE) models are dynamic, picturing an economy as moving frame-by- frame over time, as if in a jerky moving picture. Each frame might depict one economic quarter. As the economy proceeds from frame to frame, it is hit by stochastic, or random, shocks..Following Kydland and Prescott, these models allow positive technological shocks, which tend to increase growth, and negative technological shocks, which tend to decrease it. The models also allw fiscal shocks, as the government might spend more in one particular period, tending to increase growth, and less the next, tending to decrease it. Contemporary Keynesians also incorporate monetary shocks that produce real short-run effects. There can be other shocks, as well, such as a "cost-push" jump in oil prices.

DSGE models assume that the core economy is stable. Never torn by destructive internal mechanisms such as speculative bubbles, runs on banks, or sovereign-debt traps, the economy always moves smoothly toward its unique equilibrium (Schlefer, 2012, p. 207-08).

Division of Labour : A method of organizing production in such a manner that each labour specializes in a part of the production process. It was Adam Smith who emphasized on the gains to the economy due to division of labour.

Learning by Doing : It refers to the improvement in efficiency of labour through experience.

Pareto Efficiency : It refers to allocation of resources in such a manner that further change in the allocation pattern cannot improve the utility or satisfaction of one individual without reducing that of another.

Transaction costs : The additional costs, apart fromm price of the commodity, required to carry out a transaction/ exchange.

4.9 Exercise

Short-answer type questions

1. Highlight the importance of real business cycles.
2. State any 2 criticisms of real business cycles.
3. What are the factors that accentuate cycles?
4. What are the sources of business cycle movement if people can correctly anticipate the actions of policy makers?

   Or

   How do business cycle occur?
5. Why is it said that the main driving force of business cycles is the technology shocks?
6. What is Real Business cycle theory?
7. Do you think that the ideas of Kydland and Prescott on business cycle was charged with new ideas? Give reasons.

Medium-answer type questions

1. Compare and contrast new classical models and real business cycle model.
2. How a technology shock will influence on aggregate output and employment?
3. Show with diagram the effects of technological shocks?
4. State some of the policy implications of RBC Theory.
5. State some of the recent criticisms leveled agauinst the Real Business Cycle Theory.

Long-answer type questions

1. Real business cycle models explain fluctuations in output by means of exogenous shocks. The outcome is irregular fluctuations. Elaborate upon the difference between such form of random movements and the periodicity of cycles.

2. Discuss how a technology shock will impact on the aggregate output and employment.
3. What are the criticisms leveled agauinst the Real Business Cycle Theory.
4. State the main assumptions of RBC theory.

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Unit 5 ❑ Basics of Infinite Horizon Model & Overlapping Generation Model (OLG)

Structure

5.1 Objectives

After going through this Unit you should be in a position to

- compare the optimal growth problem of the central planner and that of the decentralized perfectly competitive economy;
- if you go through the Mathematical portions carefully you should be in a position to understand the basics of the dynamic optimization exercise. and
- the role of overlapping generations framework in eliminating dynamic inefficiency.

5.2 Introduction

This chapter uses the same assumptions as the solow Growth model, with one key difference : the savings rate is endogenously determined by utility maximising consumers. Therefore, the evaluation of the capital stock is determined in a general equilibrium model with households maximising lifetime utility and perfectly competitive firms maximising profits.

5.3 Ramsey Model—Command vs. Control Economy

We will build on the discussion of Ramsey's (1928) model by allowing the labour force to grow.

We will build Economy is closed.

1. The Economy is closed.
2. Let labour L_t grow at a rate n, and the effectiveness of labour be A_t and grows at a rate g, which means

$$\frac{\dot{L}_t}{L_t} = n \tag{1}$$

$$\frac{\dot{A}_t}{A_t} = g \tag{2}$$

3. As before, let labour be supplied inelastically, in other words we do not consider unemployment in the model.
4. Output is a functionof capital (K_t) and effective labour (A_tL_t). In other words,

$$Y_t = F(K_t, A_tL_t) \tag{3}$$

(4)

Further, the production function is homogeneous of degree one as in Solow's (1956) model. Then we can write the production function in intensive form as follows.

$$\frac{Y_t}{A_tL_t} = y_t$$

$$\frac{A_tL_tF\left(\frac{K_t}{A_tL_t}, 1\right)}{A_tL_t}$$

$$\Rightarrow y_t = f(k_t) \tag{5}$$

where we have denoted $f(k_t) = F\left(\frac{K_t}{A_tL_t}, 1\right)$.

In addition, we will include the discount factor in the objective functional as opposed to the manner in which Ramsey (1928) had handled it. This version of the model is associated with Cass (1965).

5. As before, output is either consumed or invested,

$$Y_t = C_t + \dot{K}_t \tag{6}$$

$$\Rightarrow \frac{Y_t}{A_t L_t} = \frac{C_t}{A_t L_t} + \frac{\dot{K}_t}{A_t L_t}$$

$$\Rightarrow y_t = c_t + \dot{k}_t + nk_t \tag{7}$$

The last equality is derived from the fact that,

$$\dot{k}_t = \frac{A_t L_t \dot{K}_t - K_t A_t \dot{L}_t - K_t L_t \dot{A}_t}{A_t^2 L_t^2}$$

$$= \frac{\dot{K}_t - k_t A_t \dot{L}_t - k_t L_t \dot{A}_t}{A_t L_t}$$

$$\Rightarrow \frac{\dot{K}_t}{A_t L_t} = \dot{k}_t + (n+g)k_t \tag{8}$$

Then k_t, c_t, y_t is capital, consumption, and output per unit of labour.

6. There is no depreciation of capital. Although this is a deviation from the Solow model, it is not a very significant one since all it needs is for your to think of the capital stock as the net capital stock.
7. As in Solow's (1956) model $f(.)$ is increasing and strictly concave in k_t, and satisfies the Inada conditions, $f(0) = 0$, $f'(0) = \infty$, and $f'(\infty) = 0$.
8. Initial capital is non-zero, $k_0 > 0$.
9. The utility of the infinitely lived representative individual or family unit is,

$$U_s = \int_s^{\infty} u(c_t) e^{-x(t-s)} dt \tag{9}$$

where ρ is the discount factor and is strictly positive, and $u(c_t)$, the integrand is the instantaneous utility function of the agent/family unit, and is strictly increasing and concave.

Social Planner's Choice

We can state the Social Panner's problem as follows,

$$\max_{c_t} U_0 = \int_0^{\infty} u(c_t) e^{-\rho t} dt \tag{10}$$

$$\text{susbject to} \quad f(k_t) = c_t + \dot{k}_t + (n+g)k_t \tag{11}$$

$$k_0 = A \quad A \text{ is given} \tag{12}$$

Put another way, it is the social planner's intention to maximize the representative agent or household's welfare. Note now that we will be using consumption c_t as the control variable, while k_t will be the state variable. In solving this problem, we are in effect solving it from the point of view of the social planner, and the equilibrium discovered is sometimes referred to as the *Command Optimum* equilibrium. We can then write the present value Hamiltonian as,

$$H = u(c_t)e^{-\rho t} + \lambda(f(k_t) - (n+g)k_t - c_t) \tag{13}$$

or, alternatively since it is easier to work with the current value Hamiltonian, we can write.

$$H_c = u(c_t) + \gamma_t(f(k_t) - (n+g)k_t - c_t) \tag{14}$$

where as in our discussion of Optimal Control Theory, and the current value Hamiltonian, γ_t is the costate variable. Then using the Maximum Principle.

$$\frac{\partial H_c}{\partial c_t} = u_c(c_t) - \gamma_t = 0 \tag{15}$$

$$\dot{k}_t = f(k_t) - c_t - (n+g)k_t \tag{16}$$

$$\dot{\gamma}_t = r\gamma_t - \gamma_t(f'(k_t) - (n+g) \tag{17}$$

(18)

and we have all the ingredients that we require to obtain a qualitative understanding of the model. First note that from equation (15) we have,

$$u_c(c_t) = \gamma_t$$

$$\Rightarrow u_{\infty}(c_t)\dot{c}_t = \dot{\gamma}_t \tag{19}$$

Then substituting equations (15) and (19) into equation (17) (which is the equation of motion for the costate variable) we have,

$$\Rightarrow u_{\infty}(c_t)\dot{c}_t = u_c(c_t)(\rho + n + g - f'(k_t))$$

$$\Rightarrow \frac{u_{\infty}(c_t)\dot{c}_t}{u_c(c_t)} = \rho + n + g - f'(k_t) \tag{20}$$

which is, as you may recognize, the Ramsey's Rule (or sometimes referred to as the *Keymes-Ramsey Rule*). If you do not see it, just realize that whereas we had stated Ramsey's Rule in terms of $\dot{K}$ in our previous discussion, where *K* is the state variable, here it is stated in terms of the control variable c_t.

At this juncture, if you look hard, you may recognize that the coefficient to $\dot{c}_t$ looks like a elasticity measure of sorts, or what you may recognize in our discussion of the Calculus of variations when we were depicting the phase diagram. You would be right on both counts, in that it is the elasticity of the marginal utility with respect to consumption, and it describes the curvature of the utility function. In fact there is a better interpretation of the ration $\frac{u_{cc}(c_t)}{u_c(c_t)}$ is to notice that it is related to the instantaneous elasticity of substitution. Consider the following, the elasticity of substitution of consumption across two period is just,

$$\sigma(c_t) = \frac{d(c_s / c_t)}{d(u'(c_s)/u'(c_t))} \frac{u'(c_s)/u'(c_t)}{c_s / c_t}$$

$$\Rightarrow \lim_{s \to t} \sigma(c_t) = -\lim_{s \to t} \frac{d(c_s / c_t)}{d(u'(c_s)/u'(c_t))} \frac{u'(c_s)/u'(c_t)}{c_s / c_t}$$

$$= -\lim_{s \to t} \frac{u'(c_t)/c_t}{du'(c_s)/dc_s} \frac{u'(c_s)/c_s}{u'(c_t)/c_t}$$

$$= -\frac{u_c(c_t)}{u_{\infty}(c_t)c_t}$$

which reveals that on the limit as $s \to t$ we get the instantaneous elasticity of substitution, which is the negative of the inverse of the coefficient to $\dot{c}_t$ of our Keynes-Ramsey rule, so that we can write the Keynes-Ramsey rule as,

$$\frac{\dot{c}_t}{c_t} = \sigma(c_t)[f'(k_t) - \rho - (n+g)]$$

This condition is essentially the continuous time version of the standard efficiency requirement since your first year, that at equilibrium, marginal rate of substitution should be equal to the marginal rate of transformation. You should read Blanchard

and Fischer (2000) if you are interested to know a more intuitive, but technical interpretation of the Keynes-Ramsey rule in discrete time.

We have soled much of the problem, with the exception of verifying that the transversality condition are met. Noting that since this is the infinite horizon problem, our transversality conditions based on our earlier discussion of Optimal Control Theory are,

$$\lim_{t\to\infty} H = 0 \tag{21}$$

$$\lim_{t\to\infty} \lambda_t = 0 \tag{22}$$

To see that these conditions are met, first note that by the assumptions we have made regarding the utility function, c_t^* must be an interior solution, in other words, be finite. This then means that the first term of the Hamiltonian in equation (13) will tend towards zero as t tends towards ∞. This then leaves the second terms. To understand how it behaves at $t \to \infty$, we have to examine the second transversality condition. From the maximum principle, equation (15), we have

$$\gamma_t^* = u_c(c_t^*)$$

$$\Rightarrow \lambda_t^* = u_c(c_t^*)c^{-\rho t}$$

$$\Rightarrow \lim_{t\to\infty} \lambda t^* = 0$$

where the last equality follows since by assumption $u(.)$ is strictly increasing and concave. Therefore, the final terms in the Hamiltonian of equation (13) will tend to zero. Thus all the transversality conditions are met.

We are now ready to examine the qualitative aspects of the equilibrium path of such an economy using a Phase Diagram. to do so, we would need the differential equations for k_t and c_t which are equations (16) and the Keynes-Ramsey rule of (20) respectively. We know that at steady state, $\dot{k}_t = 0,$ which gives us,

$$c_t = f(k_t) - (n+g)k_t$$

$$\Rightarrow \frac{\partial c_t}{\partial k_t} = f'(k_t) - (n+g)$$

$$\Rightarrow \frac{\partial c_t^2}{\partial^2 k_t} = f''(k_t) < 0$$

which says that output per unit of effective labour is divided between consumption and the maintenance of capital in lieu of population growth and growth in effectiveness of labour. Further, the locus of $\dot{k}_t$ is concave. For when consumption is in steady state, we have $\dot{c}_t = 0,$ from which we derive a *Modified Goldern Rule* since it is now augmented by the discount factor.

$$f'(k_t) = \rho + n + g$$

You should recall from our discussion previously of Solow's (1956), the marginal productivity of capital is set equal to the maintenance of capital. However, based on the Keynes-Ramsey Rule, the discount factor is included since we have to contend with the fact that present consumption typically weighs heavier in our minds. Consequently, the increase in the right hand side of the equation of the *Golden Rule*, gives that the production function is increasing and concave, implies that k_t would have to be lower. This *Modified Golden Rule* has powerful implications. Since the level of capital determines the productivity of capital, and consequently real interest rate (through the return of capital in production), it means that our impatience manifested in the discount factor, population growth, and growth in effectiveness will determine our rate of growth as an economy. At this juncture, you should notice that this was not what we observed in Ramsey's (1928) original model since he had not included the discount factor. This version of the model we are currently discussing is associated with Cass (1965). Finally, note that at this locus of points associated with $\dot{c}_t = 0,$ we have a constant k_t^* so that it is a vertical line. Both of the loci are depicted below together with the sketching bars. to define the sketching bars, we have to determine how the deviations outside of the loci would move, which as before, we do using the differential equations for $\dot{c}_t$ and $\dot{k}_t$.

$$\frac{\partial \dot{k}_t}{\partial c_t} = -1 < 0 \tag{23}$$

$$\frac{\partial \dot{c}_t}{\partial k_t} = \sigma(c_t) f''(k_t) < 0 \tag{24}$$

which says that for points to the north of the $\dot{k}_t = 0,$ where consumption is increasing in relation to points on the locus, k_t must be decreasing, or in other words moving in a westward direction, while below it, in a castward direction. Similarly, for points to the left of the $\dot{c}_t = 0,$ locus, k_t is falling in relation to points on the locus, so that

c_t must be increasing, or moving in a northward direction, and those points to the right in a southward direction. All of which are depicted on figure 1.

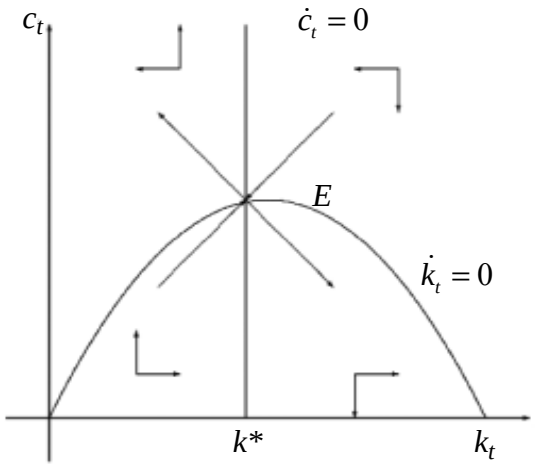

Figure 1 : Dynamics of Capital and Consumption

It clear that it is only at point *E* do we get to a steady state equilibrium, and it is only there that both the conditions set out by the differential equations, i.e. that determining consumption and the Keynes-Ramsey Rule, as well as the transversality conditions are met. And the stream lines that point towards point *E* are the only ways to get to that *saddle point.*

5.4 Governments' role in a Decentralized Economy

Since the individual is an element in the economy, and there are firms, unlike in Solow's (1956) model, it is worth examining if the individual making her own choices could do better or worse or no different than the social planner's choice. We will make the following assumptions in addition to what was made earlier, most of which are restatements, while others are meant to clarify the necessary framework within a complete decentralized economy.

Assumptions of the Model

1. The Economy is closed.

2. The choices to be made by the individuals or families are how much labour and capital to supply to the firms (from the supply of which they obtain wages ω_t, and rent r_t.), and how much to save or consume. Each individual unit can either save by accumulating capital or lend to other units in the economy.
3. We will assume that this units are indifferent between accumulating capital or lending, so that the interest rate on debt and rental rate of capital are equal. These choices are made based on the lifetime (infinite horizon) utility function of the family unit.
4. The individual unit then faces the following problem precisely,

$$\max_{c_t} U_s = \int_0^{\infty} u(c_t) e^{-\rho(t-s)} dt \qquad (25)$$

$$\text{subject to } c_t + \dot{h}_t + (n+g)h_t = \omega_t + r_t h_t \quad \forall t \qquad (26)$$

$$k_0 = A \quad A \text{ is given.} \qquad (27)$$

where $h_t \equiv k_t - d_t$, which is just family unit wealth. It is dependent of capital in their possession less the debt they possess d_t.

To understand the derivation of the budget constraint, note that for each unit of effective labour, consumption is net of her effective wages, net wealth from her investments or savings, and her investment rate. In other words,

$$C_t = A_t L_t \omega_t + (K_t - D_t) r_t - (\dot{K}_t - \dot{D}_t)$$

$$C_t / A_t L_t = \omega_t + (K_t - D_t) r_t / A_t L_t - (\dot{K}_t - \dot{D}_t) A_t L_t$$

$$c_t = \omega_t + (k_t - d_t) r_t - (\dot{K}_t - \dot{D}_t) A_t L_t$$

$$c_t = \omega_t + h_t r_t - \dot{h}_t - (n+g) h_t$$

since,

$$\frac{\partial (K_t - D_t)/A_t L_t}{\partial t} = \frac{(\dot{K}_t - \dot{D}_t) L_t - (A_t \dot{L}_t + L_t \dot{A}_t)(K_t - D_t)}{A_t^2 L_t^2}$$

$$\dot{h}_t = \frac{(\dot{K}_t - \dot{D}_t)}{A_t L_t} - (n+g) \frac{K_t - D_t}{A_t L_t}$$

$$\dot{h}_t = \frac{(\dot{K}_t - \dot{D}_t)}{A_t L_t} - (n+g) h_t$$

To draw links to the model in your text, this model here essentially assumes that the rate of growth of the household mirrors that of the entire economy.

5. To ensure this problem has its parallel in the centralized command optimization problem, as before, both capital and labour are supplied to the firms inelastically. This means then that each unit considers only how much to consume and save in each period.

6. Likewise, each identical firm has the same technology, and they choose how to rent in terms of capital and effective labour. The firms are assume to exist in a competitive market(s) and take prices, real wages and rents as given.

7. Since these competitive firms are profit maximizers, it is common knowledge to you now that the first order conditions to profit maximization are,

$$f'(k_t) = r_t \tag{28}$$

$$f(k_t) - k_t f'(k_t) = \omega_t \tag{29}$$

To see this, note that the profit function can be written as,

$$\prod(K_t, A_tL_t) = F(K_t, A_tL_t) - A_tL_t\omega_t - K_tr_t$$

$$\Rightarrow \prod(K_t, A_tL_t) = A_tL_tF(K_t/A_tL_t, 1) - A_tL_t\omega_t - K_tr_t$$

$$\Rightarrow \frac{\partial \prod(K_t, A_tL_t)}{\partial K_t} = F'(K_t, A_tL_t) - r_t$$

$$= A_tL_tF'(K_t/A_tL_t, 1)(1/A_tL_t) - r_t$$

$$= f'(k_t) - r_t = 0$$

& $$\Rightarrow \frac{\partial \prod(K_t, A_tL_t)}{\partial A_tL_t} = F(K_t/A_tL_t, 1) - A_tL_tF'(K_t/A_tL_t, 1)K_t/(A_tL_t)^2 - \omega_t$$

$$= f(k_t) - k_tf(k_t) - \omega_t = 0$$

where r_t is the real interest rate, and ω_t is the real wage rate for effective labour.

8. Both of these groups have *Perfect Foresight* so that they can anticipate all current and future ω_t and r_t.

9. *No-Ponzi-Gave Condition* is assumed so that individuals and families cannot have exploding debt. This condition is stated as,

$$\lim_{t\to\infty} h_t e^{-\int_0^\infty r_s - n - g)ds} \geq 0 \tag{3}$$

Decentralized Equilibrium

To solve for the individual unit's problem, the Hamiltonian can be written as,

$$H = u(c_t)e^{\rho t} + \lambda_t[\omega_t + (r_t - n - g)h_t - c_t] \tag{31}$$

$$\Rightarrow H_c = u(c_t) + \gamma_t[\omega_t + (r_t - n - g)h_t - c_t] \tag{32}$$

Then again, finding the Maximum Principle conditions yields (where here we have c_t as the control variable, and h_t as the state variable)

$$\frac{\partial H_c}{\partial c_t} = u_c(c_t) - \gamma_t = 0 \tag{33}$$

$$\dot{h}_t = w_t + (r_t - n - g)h_t - c_t \tag{34}$$

$$\dot{\gamma}_t = \rho\gamma_t - \dot{\gamma}_t(r_t - n - g) \tag{35}$$

First note that,

$$\dot{\gamma}_t = u_{cc}(c_t)\dot{c}_t$$

$$\Rightarrow u_{cc}(c_t)\dot{c}_t = u_c(c_t)(\rho - r_t - n - g)$$

$$\Rightarrow \frac{u_{cc}(c_t)\dot{c}_t}{u_c(c_t)} = \rho + n + g - f'(k_t)$$

which is exactly the *Keynes-Ramsey Rule* we obtained from the command economy problem. In other words, the dynamics associated with this decentralized economy is as in our command economy.

At this juncture, it is important for you to notice the primary importance that *expectations* take in this model. All decisions are made based on knowledge of the paths that wages and rental/interest rates would take. The mechanism can be characterized in general as follows : First, interest rates determine the *marginal propensity to consume* out of the individual unit's wealth, and in turn the value of wealth through the individual's lifetime income. Secondly, the expectations on wages will determine consumption through the lifetime source of income it generates. This expectations together determine consumption and saving choices. Consequently, capital accumulation is determined and the sequence of factor prices.

Finally, note that since this economy is competitive, has no externalities, and that all agents are homogeneous, the *First Welfare Theorem* holds, and this economy is *Pareto Efficient,* and by extension, the command economy is likewise.

We can build on the model by including considerations for the government. We will make the following assumptions.

1. Government expenditures are exogenous. These expenditures are financed by either taxation or borrowings.
2. Denote government's per capital demand for resources is denoted as m_t. This is funded by a per capital lump-sum tax of τ_t. Let $\tau_t = m_t$ so that the government's budget is always balanced.
3. The household's budget constraint is now,

$$c_t + \dot{h}_t = \omega_t + (r_t - n - g)h_t - \tau_t$$

The phase diagram path (dk/dt) = 0 goes down by the amount of tax as shown in figure 2 from E to E´; rest everything including the logic remains the same as depicted in figure 1.

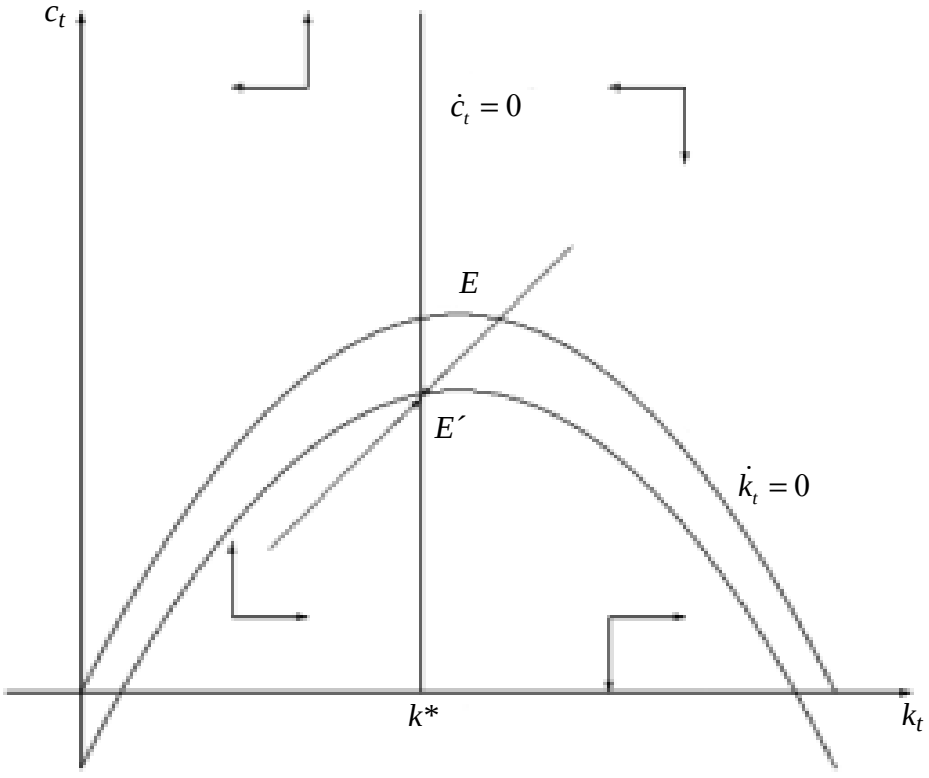

Figure 2 : Effects of Public Spending

5.5 OLG basic model—Two period & Dynamic Inefficiency

The model

Time, information, and demography

Discrete, indexed by *t*.

In each period, one worker is born. The worker lives two periods, so there is always one young worker and one old worker.

We're going to assume for the time being that workers have perfect foresight, so we'll dispense with the E_t's.

Workers

Each worker is identified with the period of her birth—we'll call the worker born in period *t* "worker *t*". Let $c_{1,t}$ be worker *t*'s consumption when young , and let $c_{2,t+1}$ be her consumption when old. She only cares about her own consumption when old. She only cares about her own consumption. Her utility is :

$$U_t = u(c_{1,t}) + \beta u(c_{2,t+1}) \quad (1)$$

The worker is born with no capital or bond holdings. When young, she supplies one unit of labour inelastically to the market and receives wages ω_1. She can consume or save (buy capital).

$$c_{1,t} + k_{t+1} \_ b_{t+1} \leq \omega_t \quad (2)$$

When old, she is retired and lives off of her capital and bond income :

$$c_{2,t+1} \leq r_{t+1}k_{t+1} + R_{t+1}b_{t+1} \quad (3)$$

At time zero, there is an old generation (worker – 1) with an exogenous capital stock $k_0 > 0$ and bond holdings $b_0 = 0$. Notice that the only variable with a subscript to denote generation is consumption, since only the young work and invest, and only the old receive investment income.

Notice that the old are not allowed to issue bonds. Also notice that the depreciation rate is 100%. This is for two reasons : first, if the depreciation was lower we would have to specify how capital is passed on from the old to the young; and second, that since each period is supposedly a whole generation of 30-40 years 100% depreciation is empirically plausible.

Firms

Firms are just like before. Each firm chooses k_t, L_t to maximize :

$$F(k_t, L_t) - r_t k_t - \omega_t L_t \tag{4}$$

where F is a neoclassical production function.

Equilibrium

An equilibrium is a sequence of prices $\{r_t, \omega_t, R_t\}$ and allocations $\{c_{1,t}, c_{2,t}, L_t, b_t\}$ such that :

1. Taking prices as given, the allocations k_{t+1}, c_{1+t}, $c_{2,t+1}$ and b_{t+1} solve worker t's utility maximization problem for all $t \geq 0$.
2. Taking prices as given, the allocations k_t and L_t solve the firm's profit maximization problem.
3. Markets clear, i.e., for all t, we have $L_t = 1$, $b_t = 0$, and $c_{1,t} + c_{2,t} + k_{t+1} = F(k_t, 1)$.

Solving the model

Consumers

The Lagrangean for the worker t's utility maximization problem is :

$$\begin{aligned} L = {} & u(c_{1,t}) + \beta u(c_{2,t+1}) \\ & + \lambda_t(\omega_t - c_{1,t} - k_{t+1} - b_{t+1}) \\ & + \theta_t(r_{t+1}k_{t+1} + R_{t+1}b_{t+1} - c_{2t+1}) \end{aligned} \tag{5}$$

The first order conditions are :

$$u'(c_{1,t}) - \lambda_t = 0 \tag{6}$$

$$\beta u'(c_{2t+1}) - \theta_t = 0 \tag{7}$$

$$-\lambda_t + \theta_t r_{t+1} = 0 \tag{8}$$

$$-\lambda_t + \theta_t R_{t+1} = 0 \tag{9}$$

Putting the first order conditions together, we get :

$$\beta u'(c_{2,t+1})\, r_{t+1} = u'(c_{1,t}) \tag{10}$$

which looks very similar to the Euler equation from the RA model. However, notice that the consumption levels are not aggregate consumption for the period but rather consumption for a particular generation.

As before, prices will adjust so that no young agent wishes to buy or sell bonds.

$$R_t = r_t \tag{11}$$

for all $t > 0$.

Firms

The firms face the same problems as before, so we get :

$$r_t = \frac{\partial F}{\partial k_t} = f'(k_t) \tag{12}$$

$$w_t = y_t - r_t k_t \tag{13}$$

(14)

We will look at an application of a two-period OLG Model with Constant Relative Risk Aversion (CRRA).

Next, let's find out what determines savings rates. For the rest of the discussion, let utility be CRRA :

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

Then (10) can be rewritten as :

$$\frac{c_{2,\,t+1}}{c_{1,\,t}} = (\beta r_{t+1})^{1/\sigma}$$

Now :

$$c_{2,\,t+1} = r_{t+1} k_{t+1}$$

$$k_{t+1} = c_{2,\,t+1}/r_{t+1}$$

which means :

$$k_{t+1} = \frac{(\beta r_{t+1})^{1/\sigma}}{r_{t+1}} c_{1,\,t}$$

Notice that, conditional on the interest rate, the savings rate is unaffected by the wage. For the time being, call that big number γ, so that $k_{t+1} = \gamma c_{1,\,t}$. Next we substitute back into the budget constraint.

$$(1 + \gamma)\, c_{1,\, t} = \omega_t$$

The savings rate is k_{t+1} / ω_t or $\frac{\gamma}{1+\gamma}$.

$$s_t = s(r_{t+1}) = \frac{\beta^{1/\sigma} r_{t+1}^{(1-\sigma)/\sigma}}{1+\beta^{1/\sigma} r_{t+1}^{(1-\sigma)/\sigma}}$$

So is savings increasing or decreasing in the interest rate? It depends on the value of σ. If $\sigma < 1$ savings is increasing in the interest rate, and if $\sigma < 1$ savings is decreasing in the interest rate.

Why is this? Remember that σ indicates the strength of a person's desire to smooth consumption. When interest rates go up, two things happen. First, the relative cost of consumption today versus consumption tomorrow will increase. This is commonly called the substitution effect, and will push consumers towards buying more consumption tomorrow (investing). School, the consumer experiences an effective increase in income—he can save less today and still consume the same amount tomorrow. This is commonly called the income effect. The income effect will cause the worker to want to consume more today and thus save less. As σ grows, the income effect becomes more important.

If $\sigma = 1$, utility is Cobb-Douglas. We know that when utility is CD, a person spends a constant fraction of income on each good regardless of prices or income. In other words, savings rates are constant at $s = \frac{\beta}{1+\beta}$.

Dynamic Inefficiency

One important aspect of the OLG model is that the steady state equilibrium needs not be efficient, in contrast to the conventional general equilibrium models where the First Welfare Theorem guarantees Pareto efficiency. Because there are an infinite number of agents in the economy (summing over future time), the total value of resources is infinite, so Pareto improvements can be made by transferring resources from each young generation to the current old generation. Not every equilibrium is inefficient; the efficiency of an equilibrium is strongly linked to the interest rate and the Cass Criterion which in turn gives necessary and sufficient conditions for when an OLG competitive equilibrium allocation is inefficient. In Diamond's version of the

model, individuals tend to save more than is socially optimal, leading to dynamic inefficiency.

Why is it that the steady state could be dynamically inefficient in the overlapping generations framework, while such possibility is ruled out in the optimal growth framework?

The answer lies in the fact that in the overlapping generations individuals are selfish (no bequest). Since they do not have to share the benefits of their investment with their successive generations (who are growing at the rate n), when they consider the possible future return to their investment, the return is not net of the population growth. To put it differently, the relevant return for them is not [f´(k) – n] but just f´(k). Hence they would be interested in investing as long as this return is positive, even if it falls short of n. This is the reason for their possible 'over-saving'.

5.6 Conclusion

Ramsey model is conceptually simplest model. Competitive firms rent capital and hire labor to produce and sell output, and a fixed number of infinitely lived households supply labor, hold capital, consume, and save. This model, which was developed by Ramsey (1928), Cass (1965), and Koopmans (1965), avoids all market imperfections and all issues raised by heterogeneous households and links among generations. It therefore provides a natural benchmark case. The second model is the overlapping-generations model developed by Diamond (1965).The key difference between the Diamond model and the Ramsey–Cass–Koopmans model is that the Diamond model assumes continual entry of new households into the economy.

5.7 Summary

Infinite Horizon Dynamic Optimization Problem — An optimization exercise where the objective function is defined over several time periods staring from time zero to infinity, and where the relevant variables are dynamically linked from one period to another through a dynamic (difference or differential) equation.

Rate of Time Preference	The rate at which future utility is discounted vis-à-vis current utility.
Steady State	A long run equilibirum point where all the relevant dynamic variables remain constant over time.
Phase Diagram	A diagram which plots the dynamic (difference or differential) equations in order to characterize the direction of movements of the variables over time.
Golden Rule	When the marginal product of capital in an economy is equal to the rate of population growth. This is also the point where the steady state value of per capita consumption is at its maximum.
Modified Golden Rule	When the marginal product of capital in an economy is equal to the sum of the rate of population growth and the rate of time preference.
No-Ponzi-Game Condition	A condition that tules out the situation where an individual keeps on borrowing to meet previous debt obligations and eventually in the long run ends up with negative assets.
Ricardian Equivalence	A situation where the government's policy to influence some economic outcome is nullified by the actions of the private agents so that there is a equivalence between the pre-policy (competitive) and post-policy economy.

Dynamic Efficiency : The situation where an increase in future consumption implies a fall in current consumption so that future utility cannot be increased without reducing current utility.

Overlapping Generations model : A framework where agents have finite lifetime and at every point of time more than one generation of agents coexist. However,

Overlapping Generations model is a general equilibrium model which examines the consequences of an economy being demographically structured such that each generation overlaps in time with its successor. Like other economic models, an OLG model is a simplified theoretical representation of complicated economic processes through a set of identities and equations that describe the behavior of various agents interacting with each other. The most distinguishing feature of an OLG model lies in the way it captures the changing behavior of consumers over different phases of their lives. The model has been used in the study of the rate of interest, business cycles, national debt and tax incidence.

Since consumers in an OLG model are modeled as individuals who live for n periods ($n \geq 2$), peoples born in n different periods (or n different generations) coexist in any given period t while consumers die at the end of n periods, reproduction assures that there will be an infinite succession of consumers, each living for n periods.

5.8 Exercise

Short-answer type questions

1. What do you mean by Overlapping Generations model?
2. What are the basic assumptions of OLG model? Mention one of the key advantages of the OLG model.
3. What is the most distinguishing feature of an OLG model? In what field is the model used?
4. What is the key difference of OLG Model relative to Ramsey Model?
5. Why is the Ramsey model bereft of dynamic efficiency problems?
6. Mention one of the major differences between the balanced growth path of the Diamond and Ramsey –Cass–Koopmans model?

7. Why is it that the steady state could be dynamically inefficient in the overlapping generations framework, while such possibility is ruled out in the optimal growth framework?

Medium-answer type questions

1. Discuss the difference between Command and Control Economy.
2. What is the reason for having dynamic inefficiency in OLG model?
3. Consider standard Ramsey model. Using phase diagram show that the equilibrium is saddle path stable?
4. What is the government's role in a decentralized economy?

Long-answer type questions

1. Discuss the Ramsey Model.
2. One can build up Ramsey model by allowing labor force to grow with taking several assumptions. What are the assumptions?
3. Derive the basic dynamic equation of the standard two period overlapping generations model with production. Explain the intuition behind this equation.
4. Discuss the condition under which dynamic inefficiency occur occurs in OLG model? Why is it that the steady state could be dynamically inefficient in the overlapping generations framework?
5. Are modern economies dynamically inefficient? Give reasons for your answer.

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Unit 6 ❑ Structuralist Macro Models

Structure

6.1 Objectives

After going through this unit you will be able

- To acquaint with the seminal ideas of Lewis and Kaldor;
- To learn about Kaldor's agriculture-industry model and Inter-sectoral terms of trade; and
- To have an idea about the polish economist Michal Kalecki's development model.

6.2 Introduction

(A) Seminal Ideas of William Arthur Lewis (1915-91)

The seminal ideas of Lewis have been reflected in his two most famous works, an on *economic development with unlimited supplies of labour* (1954) and his book on "The Theory of Economic Development" (1955).

In his book he identifies three proximate causes of growth: efforts to economize, increase in knowledge and its applications, and increases in capital and other resources per head. While his name will long be associated with the study of of

economic development, he also wrote on tariffs, the economic history of the world economy and specific nations, cost-benefit analysis, and planning. He got Nobel Prize jointly with Theodore Schultz for "pioneering research into economic development, with particular consideration of the problems of developing countries.".

Classical Elements in Lewis's ideas :

Lewis's formal model(s) of economic development contains many elements of Classical Political Economy. These include that wage is not determined by the neoclassical forces of supply and demand for labour. Rather it is fixed or predetermined by economic and social circumstances of the traditional sector.

Another classic element in the Lewis model is the connection between savings and the distribution of income. Together with Adam Smith and other classical economists, Lewis sees the basic problem as low savings. The key to development is to be found in mechanisms which dramatically increase the saving rate. Increased savings, in a capitalist, economy, come mainly if not entirely from savings out of the profits of the capitalists.

The reason why savings are low in an underdeveloped economy relatively to national income is not that the people are poor, but the capitalists' profits are low relative to national income. As the capitalists sector expands, profits grow and an increasing portion of national income is reinvested (Lewis 1954 : 190).

Lewis's Basic Model

Lewis' basic model may be set out as follows. First, let us assume two sectors in the economy. One, a capitalist or modern sector, uses physical capital owned by the capitalists, and employs wage-labour for profit. The other sector is an overpopulated traditional or subsistence sector.In this sector, output is assumed to be shared equally among the workers and therefore, their wages is related to the average product of labour in that sector, and not the marginal product. At least some of the labour in the traditional sector may be characterized as "surplus labour," in the sense that it can be withdrawn from the sector without any noticeable loss of output. This is because, in this sector, marginal productivity of labour is very low and may be even zero or negative.

Lewis argues that in the early phases of industrialization, the capitalists sector will be able to hire labour at the going wage rate in the subsistence sector plus a

margin. Since, by assumption, the average productivity of labour (AP_L) in the modern sector will be above the marginal productivity of labour (MP_L) of the last unit hired, the capitalist is able to obtain profits on the intra-marginal units of labour. These profits, again by assumptions, are reinvested in the form of new physical capital goods. This process of capital accumulation increases the marginal (and average) product of labour in the modern sector, the amount of labour hired (at the constant wage), the capitalists' surplus, savings and investments, and so on. As productivity increases in the capitalist sector. so too does the profit share and with it the saving rate.

The key to the model is the notion that the supply of labour to the modern sector is infinitely elastic at the going wage rate. One reason for this will be the existence of disguised unemployment in the traditional sector where the marginal product is "negligible, zero, or even negative" (Lewis 1954 : 141).

Criticism of the model

The model is subject to a number of criticisms, especially since some of the key assumptions do not appear to fit the reality of life in most contemporary Third World countries.

First, the model assumes that employment transfer proceeds at the same rate as capital accumulates in the modern sector. But there are labour saving advances going on.

Second, implicit in the model is the notion that there is surplus labour in the rural areas and full employment in the urban areas. Research indicated that the reverse is more likely to be true in many Third World countries.

Third, nominal and real urban wages in the capitalist sector of many Third World countries appear to be able to rise rapidly, even when there is substantial unemployment.

Fourth, the model presumes the existence of entrepreneurs.

Extension by Ranis and Fei

Lewis's model of growth has occupied a central position in the literature of development economics since it was published in 1954. His model was later extended by Fei and Ranis, (1964), who saw the development process as occurring

in three stages. The first stage was essentially that modeled by Lewis. In the second stage, the transfer of labour out of agriculture results in a shortage of agricultural output, a rise in the (relative) price of of agricultural products, and a rise in wages in the modern sector. In the third stage, investment takes place in t agricultural sector and with it we see the commercialization of agriculture. As a result of this process, the real wage tends to equality with the MP_L in both the traditional sector and modern sectors and so dualism comes to an end.

(B) Seminal Ideas of Nicholas Kaldor (1908-86)

The 1950s in Cambridge was perhaps the most fruitful period in Nicholas Kaldor's academic life. In a remarkable series of papers between 1956 and 1966, Kaldor (1908-1986) helped to lay the foundation of the 'neo-or post- Keynesian school of economics.' Kaldor's macro-theory of functional distribution of income derived its inspiration from the insight in Vol 1 of Keynes's *Treatise on Money* (1930)—that profits are the results of the expenditure- decisions of entrepreneurs, not the cause : the so-called 'widow's curse'. Kaldor's model is beautiful in its simplicity, and will surely rank in the history of economic thought as one of the fundamental theoretical breakthroughs of the 20^{th} century. The model states that given that investment is autonomous determines savings, and given that the propensity to save out of profits exceeds out of wages, there will be a unique distribution of income between wages and profits associated with that level of investment.

Kaldor's theory of distribution spawned an enormous literature (secondary), including the Pasinetti's paradox which showed that even if workers save and receive profits, the theory remains intact with only the distribution of income between workers and capitalists affected not by the equilibrium share of wages and profits in total income**.**

Next, we know that monetarism is simply the idea that inflation is caused by too much money chasing too few goods. Kaldor attacked vigorously the four main pillars of the application of monetarism in the U.K.

First, money supply is exogenously determined and demand for money is a stable function of money income; secondly, that government borrowing is the major source of increase in the money supply; thirdly, government spending crowds out private

spending, and fourthly, that there is a natural rate of unemployment, and if government try to reduce unemployment below the natural rate, there will be an ever- accelerating inflation. Kaldor found all propositions, wanting, either theoretically or empirically. In the 1970s and 1980s his intellectual assault became a crusade, and this led him to publish 'The Scourage of monetarism (1982).

However, Nicholas Kaldor was one of the most distinguished economists of the 20th century, whose name will be recorded in the history of economic thought as a brilliant theoretician and applied economist. Hardly a branch of economics scaped his pen.

6.3 Kaldor's Agriculture-Industry Model & Inter-Sectoral Terms of Trade

Nicholas Kaldor found that the growth of a country's manufacturing output was correlated with the growth of productivity in other economic sectors. He argued that as the manufacturing sector grows, it is able to absorb surplus agricultural labour. Consequently, productivity and living standards rise in the agricultural sector and terms of trade in this way goes also in favour of agricultural sector. But there will be an uneven sectoral growth between agriculture and industry as well an effect on the movement in terms of trade on long-term industrial growth.

In addition, "industrialization tends to accelerate the rate of change in technology, not just in one sector, but in the economy as a whole" (Kaldor 1967, p 23). Hence, productivity rises in all economic sectors, and living standards improve throughout the nation.

From these facts, Kaldor concluded that economic growth depends first and foremost on the growth of an industrial sector. A healthy and thriving manufacturing sector means rapid economic growth and rising standards of living. The policy conclusion that Kaldor drew from this analysis is that governments must support domestic manufacturing industries. Government can do this through the direct purchase of manufacturing goods, or by supporting manufacturing industries with tax breaks, regulatory relief. other incentives or assistance.

6.4 Kaleckian Development Model

Michal Kalecki's early writings are remarkable for his independent discovery of the **Principle of Effective Demand** in a two- sector, two-class model in which investment depends on expected profitability and aggregate profits are determined by the expenditure decisions of capitalists. Kalecki stresses the contradictory nature of investment: it not only creates demand but also capacity that requires further demand increases to allow full utilization. Kalecki (1899-1970) in the early 1930s extended his analysis to the case of an open economy, for which he formulated a more sophisticated and dynamic version of the now-famous Harrod export multiplier.

Kalecki's macro theory of profits :

In considering Kalecki's theory of profit it is important to bear in mind a number of things. First, the theory deals with the level of profits. Second, it pertains to the total level of profits in the economy. Third, the theory does not deal with the "origin" of profits, rather it deals with the realization of the surplus in the form of profits. Finally, we will regard here the word " profits" as a shorthand for " all non-wage income". The theory owes a great deal to Marx, especially his analysis of simple and extended reproduction. At the microeconomic level, profit refers to a situation in which revenue exceeds costs. At the macroeconomic level, profit theory is essentially concerned with the distribution of national income between workers and capitalists.

National Income may be divided into three categories :

Wage income (W), profit income (P), and taxes, or government income (T).Similarly national spending (or GNP) may be divided among Consumption (C) out of wage income (Cw)

Two –sector Economy

We assume that two sectors are fully vertically integrated with respect to raw materials and that capital goods do not depreciate. We also assume that all profits are saved and all wages are spent in the current period.

Models of Profits

Suppose the level of investment expenditure is I, total wages bill paid by firms in the capital goods sector is W_{cg}, the profits received by firms in the capital-goods sector is P_{cg}. Thus we have total investment emanating from the capital goods sector is :

$$I = W_{cg} + P_{cg} \quad \ldots (1)$$

It is the wages of workers in the capital goods sector which generate profits in the wage-goods sector (P_{wg}) of an equivalent amount, that is,

$$P_{wg} = W_{eg} \quad \ldots (2)$$

Inserting P_{wg} for W_{eg} in equation (1), we see that,

$$I = P_{wg} + P_{cg} = P \quad \ldots (3)$$

A neat way of summarizing this result is provided by a saying, attributed to Kalecki, that "workers spend what they get, and capitalists get what they[capitalists] spend." "It is clear that capitalists may decide to consume and to invest more in a given period, …, but they cannot decide to earn more (Kalecki, 1971).

If we relax our assumption that workers spend all their income and allow for saving for workers out of their wages (S_w**),** profits will be reduced on that account. Continuing to assume that all profits are saved, we will have:

$$P = I—Sw \quad \ldots (4)$$

It is also possible for consumption out of profits (C_p). In this event (4) must be rewriiten as :

$$P = I—Sw + C_p \quad \ldots (5)$$

As Kalecki (1971) shows that it is easy to generalize the model to allow for activities of the government and trade. If this is done we find that aggregate profits are determined as :

$$P = I—Sw + C_p + (G - T) + (X - M) \quad \ldots (6)$$

which shows a clear link within each period between the size of the budget deficit and the size of the export surplus, on the one hand, and the aggregate level of profits (before tax) on the other. The appearances of the export surpluses in this relationship has an interesting implications for theories of imperialism For a set of trading partners, the world as a whole, the sum of exports and imports are equal and so there can be no additional profits. to the trading bloc on this account. Commercial policy acts simply to redistribute profits which arise from each nation's domestic spending propensities between capitalists of different nationalities.

Kalecki hypothesized that capitalist's consumption was made of a stable part and a part proportionate to real profits after tax in earlier periods. Given this, and

neglecting trade plus government and workers' savings, current aggregate profits will depend on :

(a) the size of the autonomous component of capitalists' consumption,

(b) current investment,

(c) propensity to consume out of profits, and

(d) lagged aggregate profits. Lagged aggregate profits in turn will depend on lagged aggregate investment. Ultimately, then current profits will depend on current and past levels of investment., the autonomous element in capitalists' consumption, and current and past investment outlay.

Other Uses of the Macro Theory of Profits

Kalecki's macro theory of profits has been invoked in many aspects of political economy. This includes an examination of financial instability in capitalist economies, as shown by H.P. Minsky, advances in the theory of taxation.

The Phenomenon of the Business Cycle

By 1939 the seeds of an alternative approach to macroeconomics had already been sown. The Polish neo-Marxist Michael Kalecki had published a model of the business (or trade) cycle which incorporated the principle of effective demand and went beyond the "General Theory of Employment, Interest and Money' in deriving a theory of profits from the class nature of capitalist society and the prevalence of oligopoly, rather than "perfect completion" on which Keynes had relied.

However, the phenomenon of the business cycle was central to Kalecki's economic analysis of capitalism. The central feature of Kalecki's explanation of the business cycle is the influence of investment on economic activity, and hence the determinants of investment. He, on the one hand, distinguished between the decision to invest and the placing of orders for investment, and on the other hand, the actual investment (for example, because it takes time to build a factory). Investment orders depend on profits, and profits are generated by actual investment. He also postulated that investment is negatively influenced by the size of the capital stock. Combining these elements, he arrived at a mixed differential-difference equation for which there may be many solutions. The mixed differential-difference equation was the basis of Kalecki's attempt to generate a self-perpetuating cycle. Kalecki argued that 'the long

run trend is but a slowly changing component of a chain of short-period situations; it has no independent entity'. Kalecki acknowledged the link between the cycle and money creation. He asked: Business fluctuations are strictly connected with credit inflation.

The Monetary System as Visualized by Kalecki

Kalecki presented a number of ideas who now appear in the structuralist Post Keynesian analysis of endogenous money and he developed a substantial analysis of the working of the monetary system. He viewed the rate of interest as essentially a monetary phenomenon and not as a mechanism for bringing about equality between savings and investment. He wrote that ' the rate of interest cannot be determined by the demand and supply of capital because investment automatically brings into existence an equal amount of savings. Thus, investment "finances itself" whatever be the level of rate of interest. The rate of interest is, therefore, the result of the interplay of other factors.

Political Business Cycle

Besides, Kalecki in 1943 raised many doubts on the possibilities of achieving prolonged full employment in a laissez-faire capitalist economy. Kalecki also predicted the emergence of a political *business cycle*, in which fiscal and monetary policy is repeatedly eased before election and tightened soon afterwards (Kalecki 1990, pp 347-56).

Development

We can summarize Kalecki's writings on development in terms of four themes. The **first** is that unemployment is seen to arise from a shortage of capital equipment, rather than from a deficiency of effective demand as in the industrialized capitalist economies, so that constraints on employment and the pace of development arise more from the supply side than from the demand side. This led Kalecki to an identification of binding constraints: difficulties of expanding agricultural production, problem of achieving the desired rate of investment, and shortages of foreign exchanges. These essentially economic constraints were generally compound by the political resistance of powerful groups whose interests would be harmed by economic development.

The **second theme** is the need for the expansion of agricultural production as a part of the development process, since development and increased incomes lead to an increased demand for food. If that increased demand for food is not satisfied, then the price of the food is likely to rise thereby reducing real wages. But the agricultural sector is likely to suffer from low productivity and outdated techniques. Since there are often powerful obstacles to the development of agriculture, such as feudal or semi-feudal relations in land tenure and the domination of peasants by merchants and money lenders, substantial institutional changes would be required to sustain agricultural and economic development.

The **third theme** is that of market mechanisms, that are unlikely to produce outcomes. He saw a strong need for planning and direct government intervention, particularly in investment and foreign trade.

The **fourth theme** is the distributional aspects of growth and development, and in particular, a concern that the process of development should benefit the poor.

In his work on developing countries, Kalecki developed the concept of 'intermediate regime'. Countries with intermediate regime had generally achieved political independence after the Second World War and could not be considered as either socialist or laissez-faire capitalist economies. Kalecki argued that the governments of the intermediate regimes represented the interest of the lower middle- class, rich peasants and the manager of the state sector. The poorest sectors of the society were still unorganized and lacked any political power. He further argued that in order to keep power these representatives of the middle-class would have to achieve political and economic emancipation, carry out land reforms and assure continuous economic growth. State capitalism develops at the expense of socialism in the economies of intermediate regimes because it helps the middle-class.

6.5 Conclusion

In what follows from this unit is the fact we have been acquainted with the seminal ideas Lewis and Kaldor which have placed these two economists in a good place in the history of economic thought. Besides, Kaldor's agriculture-industry model and the intersectoral terms of trade also shows how both the agricultural and industrial sector improves simultaneously with industry going fast in development in comparison

to agriculture when long-term growth is to be considered.In addition to that, we have been further acquainted with the Kaleckian development model and his macro theory of profits, his analysis of political business cycle etc., which eventually influenced the post-Keynesian economist of the modern period.

6.6 Summary

Lewis- Fei- Ranis model : A model of economic development for a two- sector close economy in which the growth of the industrial sector increases demand for the agricultural sector's produce and attracts labour from the low-productivity agricultural sector thus raising overall output and productivity of the economy as a whole.

Pasinetti paradox : A reformulated version of the Kaldor model, where rate of profit is determined by the rate of growth and the saving rate of the capitalists, independently of the saving of workers or the underlying technology of the economy, which constitutes the Pasinetti Paradox.

Structuralists and their models : Structuralist models offer important insights that neoclassical theory does not offer. Structuralists agree with Keynes that demand affects investment and growth in the long run; they are long-run Keynesians. They also agree with the classical view that division of income among classes—capital and labour at first cut, but more narrowly defined groups in some models—affects investment and growth in the long run. The models are *"structuralist"* in the sense that they allow different economies to have different structures, shaped by social convention outside of markets. They do not envision any single ideal economy.

6.7 Exercise

Short-answer type questions

1. What are the two most famous works of Lewis in which his seminal ideas have been reflected?
2. In his book on "The Theory of Economic Development (1955)", Lewis identifies three proximate causes of growth. What are these three proximate causes of growth?

3. Why did Lewis assume that the supply of labour in the modern sector is infinitely elastic?
4. How did Ranis and Fei extend Lewis's model of growth?
5. For what reasons Michal Kalecki's early writings are remarkable?
6. What is Kalecki's prediction in regard to the emergence of a political business cycle?
7. What is Michal Kalecki's view about the rate of interest in his monetary system?
8. Write, in a nutshell Michal Kalecki's contribution in Macroeconomics?

Medium-answer type questions

1. What are the classical elements in the Lewis's model?
2. Write down the criticisms leveled against Lewis Model of growth?
3. State some of the notable contributions of Kaldor?
4. How does Kalecki analyze the nature of capitalist economies? Explain.
5. Do you agree with the view that the phenomenon of the business cycle was central to Kalecki's economic analysis of capitalism? Give reasons.
6. How in Kaldor's agricultural-industry model, the inter-sectoral-terms of trade both favours agriculture and industry?

Long-answer type questions

1. State the seminal ideas of Arthur Lewis.
2. How can you set up Lewis's basic model? What is the key to the model?
3. State the seminal ideas of Nicholas Kaldor
4. How in Kaldor's agricultural-industry model, the inter-sectoral-terms of trade both favours agriculture and industry? What is Kaldor's conclusion in this context?
5. Enumerate Kalecki's macro theory of profits.
6. How can you summarize Kalecki's writings on development in terms of four themes.
7. What is Kalecki's famous aphorism, How does Kalecki derive it from the simple income-expenditure model?

6.8 References

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