An exploration of money interest in the theory of value

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An Exploration of Money & Interest in the Theory of Value

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Research Guide:

Dr. Rajas Parchure

Declaration by the Research Scholar

This is to certify that the thesis entitled **"An Exploration of Money and Interest in the Theory of Value",** submitted by me to the Gokhale Institute of Politics & Economics, Pune for the award of the degree of Ph. D is a bonafide record of research work carried out by me under the supervision of **Dr. Rajas Parchure.** The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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Thesis Certificate

This is to certify that the thesis entitled **"An Exploration of Money and Interest in the Theory of Value",** submitted by **Milind Desai** to the Gokhale Institute of Politics & Economics, Pune for the award of the degree of Ph. D is a bonafide record of research work carried out by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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Milind Desai

Table of Contents

Chapter Summary & Outline

Chapter I: Literature Survey

1. Introduction & Hicks' ISLM framework and attack on Keynes
2. Pigou's and of Real-Balance effect
3. Choice theoretic approach and monetary theory
4. Patinkin's integration of money & value
5. Clower & Hahn critique of Patinkin

Chapter II: Closed Sraffa stock-flow system

6. Equations of the System
7. A numerical example

Chapter III: A theory of Currency Money

8. Equations of the System
9. A numerical example

Chapter IV: A theory of Interest Rates

10. Functions of Banks
11. Risks
12. Equations
13. Numerical example
14. Remarks on the theory of interest rates

Chapter V: A theory of Currency & Bank Money

15. Equations of the System
16. A numerical example

Chapter VI: Fiscal & Monetary Policy

17. Fiscal policy- Public god, taxation and borrowings
18. Monetary Policy- CRR and OMO
19. Interplay of Fiscal and Monetary Policies

Chapter VII: Conclusions

20. Section I: Comparisons with Keynesian & Patinkinisque Syntheses
21. Section II: Monetary and Value Theory

Chapter-wise Annexures

i. Annexure to Chapter 1- Survey of Classical, Keynesian & Neoclassical Monetary Theory
ii. Annexure to Chapter 2- Sraffa's Economics
iii. Annexure to Chapter 3
    a. A Model of Commodity Money
    b. A Model of Currency Money with deficit financing
iv. Annexure to Chapter 5- Failure of Quantity Theory of Money as a closing equation
v. Annexure to Chapter 6- Inter-temporal Equilibrium

List of Tables- Chapter-wise solutions of the hypothetical numerical examples

List of Abbreviations

S_{ij} - i^{th} Stock coefficient in the j^{th} industry

A_{ij} - i^{th} flow coefficient in the j^{th} industry

L_j - Labour used in the j^{th} industry

w- Uniform wage rate across industries

r- Uniform rate of profit across industries

P_j - Price in the j^{th} industry

i_t - Interest rate in the t^{th} period, t=1 to n

l_t - Loan/ Debt in the t^{th} period, t=1 to n

D_t - Deposit in the t^{th} period, t=0 to n

B_j - Output for the j^{th} industry

g- Growth rate of the economy

α- Marginal propensity to consume of the capitalists

β- Marginal propensity to consume of the workers

k_{ij} - i^{th} money turnover ratio in the j^{th} industry

k_c^p - Capitalists share in the currency out of their incomes

k_e^p - Capitalists share in the equity out of their incomes

k_0^p - Capitalists share in the demand deposits out of their incomes

k_1^p - Capitalists share in the fixed deposits period 1 out of their incomes

k_2^p - Capitalists share in the fixed deposits period 2 out of their incomes

k_3^p - Capitalists share in the fixed deposits period 3 out of their incomes

k_c^w - Workers share in the currency out of their incomes

k_e^w - Workers share in the equity out of their incomes

k_0^w - Workers share in the demand deposits out of their incomes

k_1^w - Workers share in the fixed deposits period 1 out of their incomes

k_2^w - Workers share in the fixed deposits period 2 out of their incomes

k_3^w - Workers share in the fixed deposits period 3 out of their incomes

Curr- Currency in the economy

NNP- Net National Product

Abstract

The most serious challenge the existence of money poses to the theorist is this- even the best developed models of the economy cannot find room for it.

On one more thought, another great economist had posed this:
How to make money appear without making standard theory disappear?

Yet another in the theory has to offer:
Recent work on the existence of an equilibrium has been concerned with a world without money while all work in monetary theory has ignored the 'existence' question.

Do all of these have something in common? Yes indeed- these are thoughts as well on "An exploration of money and interest in the theory of value". When Ostroy has to question us on how to make money appear without making standard theory disappear- to him the standard theory is the theory of value. Also, Hahn's best developed models are not different than the standard mainstream neoclassical models of the time. He also questions Arrow- Debreau reasoning in proving the existence of a monetary equilibrium. These similarities are indeed good enough motivations to begin this thesis. In what is to follow, we would be exploring the possibility of synthesizing a monetary and value theory. In the process, since precedents have shown that the monetary economy cannot be integrated with the mainstream theory, we deviate from the standard mainstream theory itself. Instead, we find that the model proposed by Sraffa in his 1960 book comes to our rescue. The Sraffa system of production of commodities by means of commodities becomes an ideal system for us to describe the real activity in the economy. On the monetary front, mainstream theories before us cannot be adapted to suit the requirements of the real system described and hence, we develop a pure theory of banking during the course. Unifying the two doctrines of monetary and real system, we proceed to explore the properties of the such an

economy using hypothetical (numerical) examples of economic situations. In the end, we get over all the three questions above (and more questions as well that are posed in the theory but not listed above) and provide for the role of money through this integration of the monetary and value theory. In so doing, we would come across the conclusion that though this integration may be possible in the non-standard theory, a natural monetary equilibrium is not possible. More so, and importantly, it would be discovered that money is not neutral in theory as well. Money affects prices, outputs, interest, employment and fiscal activities equally. It plays an important role in determination of the overall economic behavior.

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Chapter I: Literature Survey

1. Exchange, value, money and price (ratios) have played an important role in the production of commodities and distribution of incomes across various societies and cultures. However, there does not exist a single theory unifying all of these under one doctrine. While exchange and value are regarded at the firm level, money and distribution are regarded at the national level; while price ratios are considered under "real" analysis; absolute prices are lumped under "monetary analysis". To quote Grandmont (Grandmont, 1985) in this sense, *One of the major theoretical issues that underlies, implicitly or explicitly, quite a few recurrent controversies in macroeconomics is whether a competitive monetary economy has built in mechanisms that are strong enough to remove excess demands and supplies on all markets, through an automatic adjustment of the price system*[1]. Moving into the strands of literature available before us, a clear delineation exists between classical, neoclassical and Keynesian schools of thought. In neoclassical economics, the value of an object or service is often seen as the price it would command in an open and competitive market. This is determined primarily by the demand for the object relative to its supply. Many neoclassical economic theories equate the value of a commodity with its price, whether the market is competitive or not. As such, everything is seen as a commodity and if there is no market to set a price then there is no economic value. In classical economics, the value of an object or condition is the amount of discomfort/labor saved through the consumption or use of an object or condition (Labor Theory of Value). Though exchange value is recognized, economic value is not dependent on the existence of a market and price and value are not seen as equal. In this tradition, to Steve Keen (Keen, 2001) "value" refers to *the innate worth of a commodity, which determines the normal ('equilibrium') ratio at which two commodities exchange*[2]. To Keen and the tradition of David Ricardo, this corresponds to the classical

[1] Grandmont, J M (1985): *Money and Value: A Reconsideration of Classical and Neoclassical Monetary Economics* (Econometric Society Monographs)
[2] Steve, Keen (2001): *Debunking Economics : The Naked Emperor of the Social Sciences* (Palgrave Macmillan)

concept of long-run cost-determined prices, what has been referred to in the Wealth of Nations (Smith, 1776) called "natural prices" and Das Kapital (Marx, 1872) referred to as the "prices of production." It is part of a cost-of-production theory of value and price. Ricardo, but not Keen, used a "labor theory of price" in which a commodity's "innate worth" was the amount of labor needed to produce it. In another classical tradition, Marx distinguished between the "value in use" (use-value, what a commodity provides to its buyer), "value" (the socially-necessary labour time it embodies), and "exchange value" (how much labor-time the sale of the commodity can claim, Smith's "labor commanded" value). By most interpretations of his labor theory of value, Marx, like Ricardo, developed a "labor theory of price" where the point of analyzing value was to allow the calculation of relative prices. Others see values as part of his sociopolitical interpretation and critique of capitalism and other societies, and deny that it was intended to serve as a category of economics. According to a third interpretation, Marx aimed for a theory of the dynamics of price formation, but did not complete it[3]. Roy Harrod (Harrod, 1937),[4] James Meade (Meade, 1937)[5] and Oskar Lange (Lange, 1938)[6] had attempted to express the main relationships of Keynes's (Keynes, 1936) theory as equations in order to elucidate the interrelationships between the theory of effective demand and the theory of liquidity preference. The 1937 (Hicks, 1937)[7] Econometrica article, "Mr Keynes and the Classics: A suggested interpretation", suggested two curves, "SI-LL" to illustrate these relationships. These curves have since become famously known as the IS-LM model and were popularized by a now-converted Alvin Hansen[8] (Hansen: 1949, 1953). The IS-LM model has remained one of the most formidable pieces of pedagogic machinery and, as far as back-of-the-envelope diagrammatic reasoning is concerned, one of

[3] Refer Annexure for a detailed discussion of Classical, Keynesian & Neoclassical Monetary theories. This chapter would focus primarily on the works of Hicks, Patinkin, Clower & Hahn
[4] Harrod, R, "*Mr. Keynes and the traditional theory",* Econometrica, Vol 5, 1937
[5] Meade, J, *"A simplified model of Mr Keynes' System",* Review of Economic Studies, 1937
[6] Lange, O, *"The rate of interest and the optimum propensity to consume",* Economica, Vol 5, 1938, pp 12-32
[7] Hicks, J, *"Mr Keynes and the classics; A suggested reinterpretation"*, Econometrica, Vol 5 No 2, 1937, pp 147
[8] Hansen, A H (1949): *Monetary Theory and Fiscal Policy* (New York: McGraw-Hill)

the most efficient ever devised in economics. It is not, however, without substantial problems, both as an internally consistent model or as a representation of Keynes's theory. The crucial feature of the Keynesian system Hicks and Hansen concentrated on when formulating the simple IS-LM is the interaction between the real and monetary markets. From the real market, one extracts the level of income (Y) and from the money market, one obtains the interest rate (r). These variables, in turn, affect elements in the other market - in the simplest version, income affects money demand and interest affects investment. This interaction clearly violates the "classical dichotomy" and, as we shall see, it also does not support the neutrality of money. Financial-real interaction is the core of the IS-LM version of Keynes's theory - therefore, Hicks (Hicks, 1937)[9] concluded with perfect Walrasian instincts, it is necessary to solve for the money and real markets simultaneously. However, many Keynesians, such as Pasinetti (Pasinetti, 1974)[10], have argued that Keynes's system should be thought of "block recursively" or "sequentially" and thus should not be solved simultaneously. Specifically, it can be argued that the Keynesian system ought to be seen as a sequence of alternating "asset market" and "goods market" decisions - the interest rate being first determined by a portfolio decision in the financial markets and only thereafter determining investment, output and employment in the real market which then feeds back into another portfolio decision, etc. This criticism is noteworthy because the portfolio (LM) decision is made in the context of a stock constraint whereas the real market decisions (IS) are made in a flow constraint. Furthermore, as Richard Kahn (Kahn, 1984)[11] and Joan Robinson (Robinson: 1973, 1978, 1979) emphasized later, the simultaneous equation method of the IS-LM, by eliminating sequential time, also eliminates the time-dependent concepts which they saw as fundamental to Keynes's theory - such as uncertainty, expectations, speculation and animal spirits. As John Hicks (Hicks: 1980, 1988) himself notes in his recantation, these different time references for IS and LM

[9] Hicks, J, (1937), "*Mr Keynes and the classics; A suggested reinterpretation*", Econometrica, Vol 5 No 2, pp 147.
[10] Pasinetti, L., *Growth & income distribution: essays in economic theory,* 1974
[11] Kahn,R., *The making of Keynes' General Theory,* Cambridge University Press, 1984

makes the simultaneous IS-LM model incongruous (see also Leijonhufvud[12], 1968, 1983; Davidson, 1992). Keynesian General Theory is a glorified version of the solution to the age old problem: determining the value of money, achieving a truly integrated theory unifying exchange and money. After General Theory, Hicks, Allen and Hansen attempted a version of the Keynesian model and titled it the IS-LM model. It must be understood that Keynes was able to demonstrate with significant levels of acceptability that a system that involves money in any of its forms, consoles or bonds, credit or paper is never able to achieve its fullest potential. As a result, any model involving money should not attempt to explain equilibrium but should aim at attempting explanations towards the frictions that a monetary model presents. In terms of the General Theory, wage rigidity, liquidity trap, principle of effective demand and involuntary employment, all tying back to only one thing, frictions in the monetary system are offered as explanations to the theory of money and production economy. However, the unification of monetary and value theory is attained ingeniously through the multiplier-accelerator principle and hence, through a series of business cycles. Interest rates adjustment is a pivotal element in Keynesian analysis while wages *have to* remain rigid. The equilibrating factor in Keynesian synthesis was output thorough the saving-multiplier-accelerator principle. However, the General theory spurred an all important economic phenomena- the Hicksian IS-LM framework. Hicks constructed his suggested interpretation of the Keynes' General Theory in 1937, a year after the publication of the theory. Hicks immediately recognized some similarities between his model and the General Theory. The theory of effective demand forms an essential part of the IS-LM model. Effective demand manifests itself in the spending of income, and for income to increase, employment should increase, and thus consumption increases at a rate lesser than income. Despite similarities, there are two fundamental differences between the General Theory and the IS-LM model. The IS-LM model is a perfect competition model in which the all the prices is flexible (flexprice model). Keynes however made use of price

[12] Leijonhufvud, A (1968): *On Keynesian economics and the economics of Keynes,*(Oxford University Press) pp. 27.

rigidity in his model. Keynes assumptions of money wage and price rigidity led to the Neo-classical Synthesis. Another feature of the General Theory concerns the length of the period. Keynes used a short-term period, assumed to be a year, whilst Hicks used an ultra short period called a week. Victoria Chick[13] (Chick, 1982) used a quarter as a suitable period in her analysis of the IS-LM model. She pointed out that investment component is fixed at the beginning of the quarter through interest rate as determined by the liquidity preference and long-term expectations. The IS-LM model is constructed from an Investment Savings schedule and the demand for money (L) and supply of money (M) schedules. Hicks made use of two parameters to derive his schedule called the IS schedule. He determined the price of the one parameter in terms of another. For instance the price of A in terms of C and B in terms of C. If A and B are equilibrates, the third (A and B) equilibrates. Keynes also used two parameters. He used income (Y) in terms of wage units and the rate of interest (r). He made investment to be dependent on the interest rate and savings to be dependent on income. For each rate of interest there is a corresponding level of income at which savings equals investment. Therefore there is no excess demand in the goods market. Hicks expressed this relation between income and interest rates as the IS curve. Unlike the Classical model, Keynes viewed a positive relationship between savings and income. According to the General Theory, the level of income also depends on the desire to consume. If consumption rises with income, but the marginal propensity to consume is less than unity, the savings must rise with income. Another feature of Keynes' theory is that of savings being equal to investment. An increase in income results in increased savings, which results in a decrease in the interest rate. Savings and investment are equal and the locus of these equilibrium points represents the downward sloping IS curve. Another characteristic of the General Theory is the liquidity preference theory or demand for money. The money market equilibrium requires the demand for money and the supply of money to be equal. It therefore also depends on the relationship

[13] Chick, Victoria, "A comment on '*IS-LM: An Explanation*", *Journal of Post Keynesian Economics,*1982, Vol IV, No 3, pp 439

between interest rates and the level of income. The demand for money can be analysed on the motives for people to hold money. Keynes identified three motives namely the transaction, precautionary and speculative motive. The transaction motive depends positively on the level of income. An increase in the level of income thus will increase the demand for active balances (transaction and precautionary motive). The demand for idle balances (speculative motive) is based on the function of interest rates based on expectations of future interest rate. The Neo-classical Synthesis differ from the IS-LM model in the sense that consumption is not determined by income alone, but also through wealth effects as introduced by Pigou[14] (Pigou, 1943). Like the IS-LM curve, a fall in price will shift both the LM and IS curve rightwards as it is presented in the wealth effects of Pigou. The increase in the real value of money leads to an increase in wealth, thus increasing consumption that is equal to investment. Monetary policy, together with price and wage flexibility can restore the economy to full employment, but the adjustment process might be to slow, and can only be speeded through fiscal policy. The acceptance of this view forms the basis of the Neo-classical Synthesis. An essential part of the General Theory is the effective demand theory, in terms of which aggregate supply is equal to aggregate demand. Say's Law also postulates that "supply creates its own demand." In terms of a monetary economy it will mean that the value of things sold is equal to the value of things bought. The introduction of money as a medium of exchange however does not necessarily agree with this notion, because income won't be necessarily entirely been spent on purchases, and even if so, it will only cover recovery costs and not large profits. This notion strengthens the IS-LM model in the sense that the part of the money not been spent will either be invested or saved. More so, what Hicks did to Keynes, Patinkin did to Hicks. Hicksian analysis stated that the General Theory was a special theory and not General at all. This, he stated because he was able to demonstrate that the rigidities that the Keynesian synthesis talked about with respect to the wage-price rigidity or the liquidity trap added

[14] Pigou, A.C., "The classical stationary state", *Economic Journal,*1943

nothing new, but only made (Hicks') LM curve flatter, a special case of the classic money supply curve

2. Techniques of varying nature had been proposed even since Keynes announced the concepts from General theory. Samuelson[15] (Samuelson, 1939) came with his accelerators, Hicks with the full blooded mathematical version of the Keynesian model whilst Robinson and company still debating over problems of aggregation in the Hicksian or the Keynesian cases. In two articles which appeared in Econometrica, Patinkin examined classical monetary theory. The main conclusion of this was that the classical attempt to dichotomize the economic processes of a monetary economy into a real sector, dependent upon and determining relative prices, and a money sector, dependent upon and determining absolute prices, cannot possibly succeed. These propositions were attacked by W. B. Hickman (Hickman, 1950)[16], W. Leontief (Leontief, 1950)[17], C. G. Phipps (Phipps, 1950)[18] in criticisms. These criticisms led to developing what later became the most important classic in economic literature, second only to General Theory[19]. Patinkin's decision to resume his book project was made while working in 1952-1953 on a paper on "Keynesian Economics and the Quantity Theory", following an invitation (in October 1951) by Kenneth Kurihara to contribute to a book (Kurihara,1954)[20] on Keynesian economics after Keynes. However, instead of his original plan for a text on employment theory, Patinkin decided to write a book on monetary theory, moving the discussion of the integration between monetary and value theory through the real balance effect to the first part ("microeconomics") of the book and the chapters on the theory of employment to the second part ("macroeconomics"), which is close to the organization of his 1947 dissertation. Chapters 13 and 14 on unemployment - partly based, respectively, on Patinkin - were preceded by a full employment aggregative model (chapters 9 to 12), first advanced in his 1954 contribution to the Kurihara volume. As recalled by

[15] Samuelson, Paul, "Dynamics, Statics & the stationary state", *The Review of Economics & Statistics,* 1943
[16] Hickman, W.B., *"The determinacy of absolute prices in classical economic theory",* Econometrica, 1950
[17] Leontief, W., "*The consistency of the classical theory of money & prices",* Econometrica, 1950
[18] Phipps, C.G., "*A note on Patinkin's "Relative Prices"",* Econometrica, 1950
[19] Patinkin, Don (1954): *Money, Interest & Prices: An integration of Monetary & Value theory* (MIT Press)
[20] Kurihara, K. ed. *Post-Keynesian Economics,* 1954

Patinkin, “it was in the process of writing this article that I decided to write my 1956 book”. Patinkin argued that the propositions of the quantity theory of money - such as the long-run neutrality of money - are based only on the assumption of an absence of money illusion, and hold under any form of the aggregate demand function, a claim that he carried to MIP as the general theoretical conclusion of the book. An important point to note is Patinkin aimed the formal synthesis of monetary and value theories through two approaches: in part one of his book through the microanalysis and in part two through the macroanalysis. These two analyses have their formal basis in what Patinkin developed as the real balance effect. Patinkin picked up this trend from his predecessors in Scitovszky, Haberler and Pigou. Nonetheless, all was not well for long. Specifically, Haberler (Haberler, 1937)[21], Scitovsky (Scitovsky, 1941)[22] and Pigou (Pigou, 1943)[23] postulated that the consumption decision is based not only on current income but on "real net wealth". Initially, "real net wealth" referred to the real supply of money (M/p) and the real supply of bonds (B/p). The conventional Keynesian consumption function makes consumption, at best, a function of real disposable income and interest rates, but Haberler-Pigou proposed the inclusion of real net wealth as well, thus C = C(Y, r, V) where V = M/p + B/p. The implication of this new consumption function should be clear. In situations of unemployment, as money wages and price levels decline, then the real money supply rises (the Keynes effect) which, as we saw, shifts the LM curve to the right. However, the "Pigou Effect" (or "Real Balance" effect) implies that as M/p rises, so does V and consequently consumption rises as well - shifting the IS curve to the right. Thus, Pigou proposed, even the "special cases" of a liquidity trap or interest-insensitive investment are not sufficient to maintain unemployment equilibrium as the rightward shifts of the IS curve via the "Pigou Effect" will ensure we are taken to full employment equilibrium. Thus, the only possible way to have unemployment equilibrium in a Keynesian model is if there are sticky wages and prices, period. While many neoclassicals cheered this development, there was a sense of unease

[21] Haberler, G., *Prosperity & Depression,* League of Nations, 1937
[22] Scitovsky, T., *“A note of welfare propositions in economics”,* Review of Economic Studies, 1941, pp. 69
[23] Pigou, *ibid*

about these wealth effects for the implications they had for their own macroeconomic theory. Specifically, as Metzler (Metzler, 1951)[24] noted *In salvaging one feature of classical economics - the automatic tendency of the system to approach a state of full employment - Pigou and Haberler have destroyed another feature, namely, the real theory of the interest rate*. In other words, the "dichotomy" between real and monetary sectors, so popularized by neoclassical economists, was broken by the Pigou Effect; as increases in the money supply could now affect real items like consumption, interest and output. In a careful and elaborate disquisition and elucidation, Don Patinkin arrayed various arguments in defense of this "wealth effect". Specifically, he noted, the neoclassical theory was contradictory anyway - it is impossible to reconcile the Quantity Theory of Money with the assumption of dichotomy. In fact, as he went on to argue, the "neutrality hypothesis" and the Quantity Theory itself requires a real balance effect that violates dichotomy. Furthermore, it helps solve the old problem of negative interest rates that the neoclassical loanable funds theory could not really rule out.

3. Patinkin's real balance effect for the micro economics and Chapters 13 and 14 for the macro economy gave a distinctive character to Money, Interest and Prices. Whilst the former was incorporated into many analyses of deflation and price theory, the later was used and made one of the foundations of disequilibrium macroeconomics. To quote an unpublished chapter from Patinkin, *when I wrote chapter 13 of my book in 1956... I felt at the time, and still feel, that that was the most novel and important contribution of the book*[25]. Although Patinkin did not organize his discussion of the concept of involuntary unemployment around Keynes's definition, he mentioned on several occasions that (contrary to Lange's interpretation) Keynes's notion of "unemployment equilibrium" did not mean that the labor market is in equilibrium without any tendency for money-wages to change. An important point worthy of noting is the fact that through his book and

[24] Metzler, L, "*Wealth, saving & the rate of interest",* Review of Political Economy, vol59, 1951, pp. 93
[25]Unpublished verbatim records of the 1987 Perugia conference on "the notion of equilibrium in Keynesian theory", organized by M. Sebastiani

his econometrica articles, Patinkin aimed at proving, amongst other things, that the neoclassical dichotomy between real and monetary sectors cannot be maintained. Patinkin aimed at removing this dichotomy out of the monetary and value analyses. To this end, in his micro analysis, he had used the standard utility analysis with a modification for real money balances as an argument in the utility functions. With these, he used the Walras' law and tried to identify an equilibrium in the system. In the macro analysis, he aggregated all of these individual demand curves, of course assuming all individuals to be homogenous, and in effect therefore assuming all Engel curves to be parallel to one another. In so doing, Patinkin had also introduced a fresh market, the market for bonds following Keynes and thus his variables were price, interest and the level of real balances, operating at conditions of full employment where money balances where assumed to be a given. Thus, his analysis is more concentrated towards explaining disequilibrium economics rather than identifying an economic equilibrium. As we shall see, Patinkin failed on two counts: one in terms of the analytical framework he had suggested and second in terms of the mathematical stability and existence of the solutions of his system. In effect, due to the fact that in Patinkin's model, money appears from nowhere and the model does not maintain the link between real and monetary analysis, the model appears to be a glorified version of barter. The main reason for this being the element of time in his system. Trading is synchronized amongst weeks and every week individuals receive their endowments and they trade starting Monday thorough Saturday when the system attains equilibrium. There is no explanation as to how the system moves to a new level or an explanation to provide for the additions to existing stocks is missing. In this model, in which time is divided into discrete contracting periods called weeks, it is important to distinguish between equilibrium at a point of time and equilibrium over time. As Hicks has put it, a stationary economy " . . . is in full equilibrium, not merely when demands equal supplies at the currently established prices, but also when the same prices continue to rule at all dates. The level of dynamics in the system is crude and rudimentary. With all these, however, the whole point of Patinkin's book was to attack the neoclassical dichotomy. In so

doing, Patinkin employed certain concepts and analytical devices of his own. Patinkin has in his system, what he calls, a demand curve of individuals for money and what he defines as corresponding "market equilibrium curve". The point remains and the question still remains open: can all this not be done without:

a. Maintaining false separations between real and nominal balances in Patinkinisque world?
b. Do we need to adhere to the Walras' law in this system because sticking to Walras' law, we are getting into the same debate that wither the excess demand in commodity markets will be cleared by excess supply in money markets, bond markets held constant or some similar feature
c. Labour market in Patinkin operates at full employment and still Patinkin manages to demonstrate disequilibrium.

All said, this question of whether a monetary theory can co-exist with a value theory, or to be more on the bulls-eye, are these two doctrines: real and monetary in reality separable? *In order to understand how Patinkin's model works, it is necessary to analyze: (1) the individual's weekly equilibrium; (2) how he reaches full equilibrium; (3) how this full equilibrium is altered by a changed desire for balances; (4) how it is altered by a change in the price level (5) how the market reaches full equilibrium; (6) how full equilibrium in the market is altered by a change in the money stock; (7) how weekly market equilibrium is altered by a change in the money stock which takes place when full equilibrium does not obtain; (8) the effects on the market of a non-proportional change in individuals' stocks of money; (9) the bearing of the above on the demand for money; and (10) the part played in the above by the real-balance effect. Since Patinkin neglects the conditions for full equilibrium, his analysis is devoted mainly to (1), (7), (8) and (9)*[26]. Patinkin's contribution to the field of monetary theory is important primarily due to two reasons- one that Patinkin intended to provide the micro-foundations of monetary theory. Choice theoretic frameworks to explain the monetary theory were not available in the Patinkin era. Patinkin began his quest

[26] G.C. Archibald and R.G. Lipsey (1958): "Monetary and Value Theory: A Critique of Lange and Patinkin", *Review of Economic Studies,* Vol. XXVI

for these. Along with such a process, Patinkin also aimed at developing a theory that would retain the assumptions of the theory and as well find a place for money! In so doing, Patinkin discovered two results- one that in the short-run, money is neutral; however, in the long run the effects like the real balance effect begin to operate and money looses its neutrality- money in the long run is non-neutral

4. Clower (Clower, 1965)[27] had discovered that there was a flaw with the analytical construct Patinkin had devised to employ. This had to do with the Patinkinisque budget constraint, which Clower suggested to dichotomize. If the real-balance was so critical to Patinkin in establishing a link between real and monetary forces, Clower found that the right place to attack was where the real balances resided. Also, with respect to Patinkin's real balance, Archibald and Lipsey (Archibald & Lipsey, 1958) quote *this is necessary because Patinkin's analysis is incomplete and leaves many important points obscure. We find that, while the price level is of course determined by the desire to hold balances together with the stock of money, the role of the real-balance effect is only to provide an explanation of how the system behaves in disequilibrium. Thus the real-balance effect is irrelevant to those famous propositions of the quantity theory which are the result of comparative static analysis*[28]. Clower (Clower, 1967) pointed out that in the Patinkinisque world, the budget constraints need not always constitute an appropriate definition of choice alternatives in a monetary economy. *It can be shown, indeed, that an increase in unsold stocks of any commodity the price of which is fixed, in a Patinkinisque world, generate an increase in the general price level and so, indirectly rise in the sales of the goods whose price is fixed. Again, therefore, we arrive at a conclusion that is offensive to our intuitive conception of the working of a money economy, a conclusion that indicates that money plays no distinctive role in economic activity*[29]. What Clower therefore attacked in Patinkin was the model itself, and with comfortable ease was able to demonstrate that

[27]Clower, R W (1965): "The Keynesian Counterrevolution: A theoretical appraisal" in F. H. Hahn and F. Brechling (eds.), *The Theory of Interest Rates*
[28] *Ibid*
[29] R.W. Clower (1967), "A Reconsideration of the micro foundations of monetary theory", *Western Economic Journal,* December

Patinkin's monetary economy was no better that a perfect barter. For Clower, the peculiar feature of a money economy is that some commodities are denied the role as potential or as actual means of payment. To use his terms, *Money buys goods, good buy money but goods do not buy goods.* Clower suggested that one could get over this issue through dichotomization of the budget constraint; one as a constraint on expenditure and another as a constraint on income. Clower himself does not suggest that this method is fool-proof but according to him, it at lease guarantees the existence of the required solutions.

5. An important problem was highlighted by Grandmont and Younes (Grandmont & Younes, 1972). *Monetary theorists have been criticized for having neglected the "existence problem" that is the problem of the existence of an equilibrium where money has positive value in exchange. On the other hand, we are reminded by R. W. Clower that one of the weaknesses of contemporary monetary theory is that it primarily considers money as a store of value but does not pay enough attention to its function as an exchange intermediary. One can reasonably expect that the two problems are closely related*[30]. People of this school predict that the monetary economy has an economic equilibrium and when it comes to existence of the economy, the problem has to be dealt more mathematically and rigorously rather than philosophically. First, the evolution of the economy is presented by the authors as a succession of temporary or short run equilibria. The model is augmented to provide for an exchange economy where only spot transactions are allowed and where (fiat) money is the only store of value, which is similar to the economy studied by Friedman (Friedman, 1969)[31] or Patinkin (Patinkin,1965)[32]. What is proved that a short run monetary equilibrium always exists in that type of model when, among other conditions, the elasticity of the traders' price expectations with respect to current prices is " small ". The theorem is valid even when money has no role to perform as a medium of exchange. We now examine the validity of the classical dichotomy. *Indeed, if we look back to ..... we see that*

[30] Jean-Michel Grandmont and Yves Younes (1972), "On the Role of Money and the Existence of a Monetary Equilibrium", *Review of Economic Studies*
[31] Friedman, M (1969): *The Optimum Quantity of Money* (New Brunswick, New Jersey)
[32] *Ibid*

there exists some kind of dichotomy between "real " and " monetary " quantities. For, if we "solve" equations .... with the additional requirement $\|p\| = 1$*, it is possible to compute (stationary) relative equilibrium prices, equilibrium consumption and " real " equilibrium money holdings. Then, using the Quantity Theory, we can determine the monetary equilibrium price level and nominal money holdings from equation. This is what P. A. Samuelson (*Samuelson, 1968*)*[33] *claimed to be the classical dichotomy. It must be however emphasized that it is conceptually equivalent to the Quantity Theory. This dichotomy does not permit the separate determination of stationary relative prices and equilibrium consumption ignoring monetary phenomena.* However, those who have managed to grab a copy of Arrow's[34] article, conclusions and quotes presented above seem confusing, misleading or wrong. Arrow has found that in the premises of the standard monetary theory, mathematical solutions do not exist in the Patinkinisque world. *Recent work on the existence of an equilibrium has been concerned with a world without money while all work in monetary theory has ignored the 'existence' question*[35]. In the context of monetary theory, the role of money has either been undermined by theorists or proved futile by mathematical analysts. The point however remains where it was as faced by Marx or Keynes or a Patinkin or a Friedman of late: *How to make money appear without making the standard theory disappear?* This remains the motivation for the rest of this work where we would aim to deviate from the *standard theory*. It may be the case that in the ambit of the proposed standard theories, the role of money had been forced from the outside and hence the conclusions had to be the way they are today. It is in here that we would like to stress that a standard theory would be abandoned in the light of the problems and issues highlighted above. We would aim to develop an economic model so as to capture and explaining the workings of the monetary economy. In Patinkin, microanalysis through real balance and macroanalysis

[33] Samuelson, P. A. (1968), "What Classical and Neo-Classical Monetary Theory Really Was ", *Canadian Journal of Economics*, (1), pp. 1-15.
[34] Hahn, F.H, 1971: *Trading out of Equilibrium, a Pure Exchange Economy,* Chapter 13
[35] Hahn, F.H (1965): "On some problems of proving the existence of an equilibrium in a monetary economy" in F. H. Hahn and F. Brechling (eds.), *The Theory of Interest Rates*

through the theory of unemployment fail to produce a unique role for money, the crux of Patinkin's work. Keynesian analysis came close to this, but Keynes failed to provide a modeling framework and argued philosophically that money is a friction to economic activity. Arrow, Hahn and the other took immense trouble of crafting mathematical edifices to these theories only to find some problems on proving the existence of solutions of such models. After all the discussions, it appears that the standard theory has been incapable of finding a place for money. In the current work, we therefore aim to change this course of thought. We aim to propose an alternative theory and discover whether such a theory would be capable of finding a place for money while keeping the standard assumptions relatively constant. Ultimately, the results of all these debates can be summed up simply as follows

a. Money cannot appear in a model of economic theory where standard assumptions and frameworks are followed
b. Where such a force-fitting is done, as seen in Patinkin or Clower, equilibrium and the existence of solutions becomes impossible as demonstrated by Arrow, Hahn, Debreu
c. Hahn went to the extent of concluding that even if money is made to appear in the choice theoretic frameworks, the solution would only be trivial where the price of money would be zero. With zero exchange prices, what would be the role of money in such an economy? Therefore, one need to leave the ambit of standard theory if one needs to construct the synthesis of monetary and value theory.
d. Do wages have to remain rigid and should the interest rate be caught in a trap, is money a *veil* to economic activity
e. Does a quantity theory equation to explicitly provide for a relationship between money and prices have reasonable requirement?
f. And finally, can there be an underemployment equilibrium in case where a different view on approaching the problem is proposed?

Therefore so, if it is not possible to *make money appear without making standard theory disappear*, the ideal way out would be to ***make money appear by making standard***

theory disappear. In what shall follow, we would aim to do exactly the same. We begin with exploring an alternative theory of value and then only when the footings are firmly established, we would set out to develop the integration of money and prices.

Chapter II: Closed Sraffa System with Stock-Flow Variables

6. If money cannot appear without making standard assumptions disappear, it would only be plausible by *making money appear with making standard theory disappear and modifying the standard assumptions to make a new theory appear.* This is the aim of the following chapter- to provide an alternative to the standard mainstream neoclassical theory. The basic system described here can be extended in various logical manners depending on the purpose the reader aims to take it. In a true sense, we would aim to extend the agrarian Sraffa system[36] to non-agrarian industries as well in the first place. The production system in its natural form seems to be an agrarian system where production of commodities is happening by means of production. However, in actual industrial set-ups, the production has several important components as stocks or inventories of commodities, fixed capital and circulating capital. However, the aim of this synthesis is to provide for the role of money in the economy. This role can only be provided for by foregoing the standard theory since as discussed, attempts to make money appear without making standard theory disappear have turned futile. Hence, we take the course of Sraffa's economics in order to demonstrate the synthesis. Money, it should be noted, is a balance sheet item. Money is normally and, at most times, is a stock concept which facilitates the *flow* in the economy. Therefore, the Sraffa model needs to be adequately expanded and made accommodative so as to incorporate money. We can, in this chapter, clearly see that the basic Sraffa model can be extended to incorporate such concepts of stock and flow variables. Stock variables would be regarded as the fixed capital in the economy and the regular activities of the enterprise would be the flow variables in such an economy. The stocks primarily could be conceived to consist of machinery, factory shed, stock of raw materials and the like. The regular payments to like the provision of seeds for production, uniforms for labour, administrative expenses, rent, rates and electricity et al would ideally form the flow variables in the economy. The flow

[36] Refer annexure to this chapter for a detailed discussion on the theory and development of Sraffa's economics. The annexure contains notes on the basic Sraffa system of book one of this 1960 Production of Commodities by Means of Commodities

variables are required over the entire production period in the sense that since these are regular payments, they need to be made often. The stocks form the capital in the system and as such, like every other form of capital, command a rate of profits. We would, for simplicity sake, assume the rates of profits across all industries to be uniform- preserving the Sraffian tradition. This model of continuous industrial production carries over all the essential properties of the Sraffa system. When the production process is properly primed, the flow of purchases of inputs is exactly matched to the flow of output and its sale so that capital is needed only to finance the holding of stocks. A model that contains stocks and flows can be represented as under:

$$\left(S_{11}p_1 + S_{21}p_2 + ... + Sk_1B_t\right)r + \left(A_{11}p_1 + A_{21}p_2 + ... + Ak_1B_t\right) + wL_1 = p_1B_1$$
$$\left(S_{12}p_1 + S_{22}p_2 + ... + Sk_2B_t\right)r + \left(A_{12}p_1 + A_{22}p_2 + ... + Ak_2B_t\right) + wL_2 = p_2B_2$$
$$.....$$
$$\left(S_{1n+m}p_1 + S_{2n+m}p_2 + ... + Sk_{n+m}B_t\right)r + \left(A_{1n+m}p_1 + A_{2n+m}p_2 + ... + Ak_{n+m}B_t\right) + wL_{n+m} = p_{n+m}B_{n+m}$$

In the above model, the stocks are represented by the matrix *S* and the flows are represented by the matrix *A*. We represent outputs using the standard *B* matrix and the usual variables prices (*p),* rate of profits (*r)* and the wage rate, *w* remain the same from the standard Sraffa model. We aim to use the same notation throughout the course of this thesis. It would be prudent to note the major changes in the model incorporating the stock-flow model over the standard Sraffa model. There are no changes in the parsimony of the model; however, the interpretation of standard variables changes. Every industry in particular would have its own rate of profit, though in equilibrium, these rates converge to a uniform rate through flight of capital (stocks) from one industry to another. This equality of rate of profits still remains the same in the current set-up as well. However, in terms of a standard Sraffa model, the own rate of growth of individual commodities was defined as $\sum_{i=1}^{m+n}\sum_{j=1}^{m+n} p_iB_i - p_iA_{ij} \Big/ \sum_{i=1}^{m+n}\sum_{j=1}^{m\_n} p_iA_{ij}$. However, this definition of own rate of growth changes in the stock-flow model and takes the form:

$\left(\sum_{i=1}^{m+n}\sum_{j=1}^{m+n} p_i B_i - p_i A_{ij}\right) \Big/ \left(\sum_{i=1}^{m+n}\sum_{j=1}^{m\_n} p_i S_{ij}\right)$. It is important enough to understand that the profits only on a stock component form a part of the valuation of the commodities. The production relations do not allow for the sales revenue to cover up the capital or the stock parts. In fact, the stocks are perennially present. This system has *n* equations in *n+2* unknowns- the *n* prices and the 2 distributive variables. Either one of the prices can be fixed as *numeraire* so that there would be *n+1* unknowns. The uniform rate of profits that prevails across industries is

$$r = \frac{p_i B_i - \sum_j A_{ji} p_j - wL_i}{\sum_j S_{ji} p_j}$$

This rate is assumed to prevail across all industries. However, the system still moves with Sraffa's *one degree of freedom.* In order to eliminate this degree of freedom so as to enable us determine the unknowns of the system, we would require an additional equation. In the discussion so far, the discussion on demand is missing. We would resort to the demand equations in order to appropriately *close* the system. We would use the Engel-Stone-Geary type of functions[37] to do

[37] Stone-Geary Function

The Stone-Geary function is often used to model problems involving subsistence levels of consumption. In these cases, a certain minimal level of some good has to be consumed, irrespective of its price or the consumer's income.

The Stone-Geary uses the natural log function to model utility. The sum of all the proportions of the goods consumed must equal 1. In the problem below, the subsistence levels of A and B are α and β. The term I is income, and pk {k=a,b} are the prices of A and B.

The Lagrangean and the First-Order conditions are:

$$L = \gamma \ln(A-\alpha) + (1-\gamma)\ln(B-\beta) + \lambda(I - p_a A - p_b B)$$

$$L_A = \frac{\gamma}{A-\alpha} - p_a\lambda = 0$$

$$L_B = \frac{1-\lambda}{B-\beta} - p_b\lambda = 0$$

$$L_\lambda = I - p_a A - p_b B = 0$$

Use the first 2, FO conditions to eliminate the Lagrangean Multiplier.

so. The functions would be suitably adjusted with respect to the form and the

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$$\frac{\gamma/(A-\alpha)}{(1-\gamma)/(B-\beta)} = \frac{p_a\lambda}{p_b\lambda}$$

$$\Rightarrow \frac{\gamma}{1-\gamma}\frac{B-\beta}{A-\alpha} = \frac{p_a}{p_b}$$

$$\Rightarrow p_a(1-\gamma)(A-\alpha) = p_b\gamma(B-\beta)$$

$$\Rightarrow A-\alpha = \frac{p_b\gamma(B-\beta)}{p_a(1-\gamma)}$$

$$\Rightarrow A = \frac{p_b}{p_a}\frac{\gamma}{1-\gamma}(B-\beta)+\alpha \qquad B = \frac{p_a}{p_b}\frac{1-\gamma}{\gamma}(A-\alpha)+\beta$$

Substitute into the third, FO condition.

$$I = p_aA + p_b\left(\frac{p_a}{p_b}\frac{1-\gamma}{\gamma}(A-\alpha)+\beta\right)$$

$$\Rightarrow I = p_aA + \frac{p_b}{p_b}\frac{1-\gamma}{\gamma}p_a(A-\alpha)+p_b\beta$$

$$\Rightarrow I - p_b\beta = p_aA + \left(\frac{1-\gamma}{\gamma}p_a(A-\alpha)\right)$$

$$\Rightarrow I - p_b\beta = p_aA + (1-\gamma)\left(\frac{p_aA}{\gamma} - \frac{p_a\alpha}{\gamma}\right)$$

$$\Rightarrow I - p_b\beta = p_aA + \frac{p_aA}{\gamma} - \frac{p_a\alpha}{\gamma} - p_aA + p_aA$$

Multiply the last equation above through by γ/pa.

$$\frac{\gamma}{p_a}\left(I - p_a\alpha - p_b\beta\right) = A-\alpha$$

$$\Rightarrow A^* = \alpha + \frac{\gamma}{p_a}\left(I - p_a\alpha - p_b\beta\right)$$

$$\Rightarrow B^* = \beta + \frac{1-\gamma}{p_b}\left(I - p_a\alpha - p_b\beta\right)$$

Notes

1. Each of the functions of A* and B* are the Marshallian demand functions for the Stone-Geary utility.
2. The first term on the right-hand-side of the equality, is the subsistence consumption. A consumer will always consume this amount irrespective of their budgets or the price.
3. The term I - paα - pbβ is the income the consumer has left over, after the subsistence levels are met. It is in effect, the residual income.
4. The amount of A and B that this residual income is used to buy, is now negatively influenced by price, and positively influenced by the good's importance. For instance, if γ increases, it implies that good A is relatively more important than B. According to these demand functions, our consumer will purchase less of B and more of A, all other things equal.

nature; however, the essential properties of reflexivity, transitivity and importantly symmetry and substitutability of the Slutksy matrix would be intact. The required missing degree of freedom between the equations and the variables can be also filled in by considering the composition of commodities which the individual agents desire to purchase; the demand equations for the n commodities. Walras' law dictates that only n-1 of these will be independent, and that we shall use the empirical demand functions that designed are designed by Stone as where is the capital stock, L is the annual labour and the constants alpha and beta are propensities of capitalists and wage earners to consume or spend. This would take the following form

$$p_i B_i = \alpha rk + \beta wL$$

The following points need to be noted. 1) The demand equations of the above type are introduced only for non-basic Sraffa commodities. Such commodities would be referred to as consumption goods in the economy. 2) The marginal propensities α and β would always be given; α being the MPC of capital owners (capitalists/ industrialists/entrepreneurs) and β being the MPC of wage earners (workers/ households)[38]. With this equation, assuming we have a two commodity system as follows, we can determine the prices by assuming the suitable demand equation for commodity 2.

$$\left(S_{11}p_1 + S_{21}p_2 + ... + Sk_1B_t\right)r + \left(A_{11}p_1 + A_{21}p_2 + ... + Ak_1B_t\right) + wL_1 = p_1B_1$$
$$\left(S_{12}p_1 + S_{22}p_2 + ... + Sk_2B_t\right)r + \left(A_{12}p_1 + A_{22}p_2 + ... + Ak_2B_t\right) + wL_2 = p_2B_2$$
$$\alpha rk + \beta wL = p_1B_1$$

Therefore, the prices of both the goods in this system are determinate and all the standard properties of Sraffa system are preserved in the continuous production economy[39].

It is the flows that have to be replaced period on period as the system gravitates to equilibrium. The dual system that would be used to determine the outputs in the system is similar but for the fact that the growth rate is attributed to the stock coefficients and the flow coefficients are determined simultaneously along with

[38] The terms in the parenthesis have been used interchangeably in the entire document
[39] Refer end-note to this chapter for more on this

the stock coefficients. More so, the dual or the q-system would take the following form:

$$\left(S_{11}x_1 + S_{12}x_2 + ...S_{1n}x_n + \sum_{j=1}^{m} S_{1j}\right)g + \left(A_{11}x_1 + A_{12}x_2 + ...A_{1n}x_n + \sum_{j=1}^{m} A_{1j}\right) = B_1x_1$$

$$\left(S_{21}x_1 + S_{22}x_2 + ...S_{2n}x_n + \sum_{j=1}^{m} S_{2j}\right)g + \left(A_{21}x_1 + A_{22}x_2 + ...A_{2n}x_n + \sum_{j=1}^{m} A_{2j}\right) = B_2x_2$$

.....

$$\left(S_{n1}x_1 + S_{n2}x_2 + ...S_{nn}x_n + \sum_{j=1}^{m} S_{nj}\right)g + \left(A_{n1}x_1 + A_{n2}x_2 + ...A_{nn}x_n + \sum_{j=1}^{m} A_{nj}\right) = B_nx_n$$

$$L_1x_1 + L_2x_2 + ...L_nx_n = L$$

More so, the properties in terms of the relation between the rate of profits and the rate of growth would not change much and instances where it changes dramatically would be pointed out; not for the reason of drawing comparisons, but for the cause that this relation would be the important relation between two important variables- rate of profit and rate of growth. The standard system of the dual is being used here. We would aim to close this chapter on the following note: a basic Sraffa model can be extended to incorporate the stock-flow concepts[40] in the economy and we would aim to use such an extended Sraffa model in the following work.

7. Let us take up a numerical example to study the workings of this system. Let us assume the following hypothetical economic system with stocks, flows, labour and output. The model has two capital (basic) and one consumption (non-basic) goods industries

$$(1p_1 + 2p_2)r + (1p_1 + 2p_2) + 5w = 20p_1$$
$$(3p_1 + 2p_2)r + (1p_1 + 3p_2) + 5w = 30p_2$$
$$(2p_1 + 3p_2)r + (3p_1 + 2p_2) + 10w = 30p_3$$

For the last industry, since it is a non-basic good, we would have a demand equation specifying its consumption pattern. Let us assume that the workers consume with a propensity of 0.2 out of their wage incomes only (to be precise,

[40] The model with stock-flow has been presented earlier by Prof. Rajas Parchure in his *Pure Theory of Value*. An interested reader may drill the subject further down from here. For my purposes, I assume (and I know as well) that the conclusions presented in the book are accurate.

let us assume that workers do not have a share in profits). Thus, we have the demand equation

$$0.2(20w) = 30p_3$$

It is important to mention the dual of this system which specifies the output requirements of the individual industries

$$(1q_1 + 3q_2 + 2)g + (1q_1 + 1q_2 + 3) = 20q_1$$
$$(2q_1 + 2q_2 + 3)g + (2q_1 + 3q_2 + 2) = 30q_2$$
$$5q_1 + 5q_2 = 10$$

Finally, we have the growth profit equation of the following type

$$r = \frac{g(6p_1 + 7p_2) - 0.8(20w)}{(6p_1 + 7p_2)}$$

Therefore, we have 8 equations in 9 unknowns (3 prices, profit rate, wage rate, growth rate, and the three outputs). We would begin by assuming an arbitrary rate of profits; say 0.20 and let us assume the wage-rate as the numeraire. Accordingly, we obtain $p_1 = 0.29, p_2 = 0.20, p_3 = 0.38$ with *r*=0.20 and w=1. From this, we can immediately determine $B_3 = 10.40$ using the demand equation and hence, we would adjust the equation of the third industry to this effect $(0.69p_1 + 1.04p_2)r + (1.04p_1 + 0.69p_2) + 3.46w = 10.40p_3$ and hence, the dual changes as well to

$$(1q_1 + 3q_2 + 0.69)g + (1q_1 + 1q_2 + 1.04) = 20q_1$$
$$(2q_1 + 2q_2 + 1.04)g + (2q_1 + 3q_2 + 0.69) = 30q_2$$
$$5q_1 + 5q_2 = 10$$

Using the growth profit relation, we have *g*=6.01. and thus, the output multipliers are 1.67 and 0.44. With these, we obtain the new production equations for industry 1 and 2 respectively as under.

$$0.67((1p_1 + 2p_2)r + (1p_1 + 2p_2) + 5w = 20p_1)$$
$$0.44((3p_1 + 2p_2)r + (1p_1 + 3p_2) + 5w = 30p_2)$$
$$(0.69p_1 + 1.04p_2)r + (1.04p_1 + 0.69p_2) + 3.46w = 10.40p_3$$

And so on, the process would continue until all demand for commodity 3 equates the supply at the going prices. Thus, we obtain the solutions in the augmented Sraffa model to incorporate stock-flows using the following algorithm

- Start with an arbitrary rate of profits and a numeraire, in this case the wages
- Determine the prices and demand for consumption goods at the going prices
- Adjust the price equations for the consumption goods to reflect the new demand by multiplying the entire equations by the ratio B^i_{new} / B^i_{old}
- Determine the growth rate using the growth-profit relationship and formulate the dual of the problem
- Determine the output multipliers and create new set of *basic* price equations for capital industries
- Repeat the process until $B^i_{new} - B^i_{old} = 0$

In the following chapter, we would adapt this base model of Sraffa stock-flows to find a place for money and determine the properties of the system so developed

End Note to Chapter 2

Properties of the Extended Sraffa Model[41]

Writing the original equations for unit outputs in matrix notation

$SP + AP + wL = P$……..*I*

whose solution for the price vector is

$$P = \left[I - A - rS\right]^{-1} wL$$

$$= \left[I - (I - A)^{-1} Sr\right]^{-1} (I - A)^{-1} wL$$

which is positive if the Hawkins-Simon conditions (Hawkins and Simon 1949) that the principal minors of *I-A* be positive hold. It is easy to see that the principal minors of $I - (I - A)^{-1} Sr$ will be positive if $(I - A)^{-1}$ is positive. Consider the price system at w=0

$$P = \left[(I - A)\right]^{-1} (S \Pr)$$

with λ= $1/r$ the above expression is

$$\left[\lambda I - (I - A)^{-1} S\right]P = 0$$

If $(I - A)^{-1}$ is positive $(I - A)^{-1} S$ must be non-negative. So by Perron-Frobenius theorem, it has a dominant positive eigenvalue λ_d with which is associated a non-negative vector X_d. The maximum rate of profit, R, is the reciprocal of λ_d. Thus for values r<R the matrix $I - (I - A)^{-1} Sr$ has positive minors so that the solution of prices must be strictly positive. We can also write the equation I in the following form by multiplying it by the eigenvector X_d:

$X_d S \Pr + X_d AP + X_d wL = X_d P$ …….. *II*

At *w=0*

$$r = R = \frac{X_d (I - A)P}{X_d SP}$$

If $X_d (I - A)P$, the standard national product is set equal to unity and further if $X_d L = 1$ then substituting this in equation II gives

[41] Based entirely on a working paper developed by Dr. Rajas Parchure (2008), "The Sraffa System for Continuous Industrial Production", *GIPE working paper series*, November

r=R(1-w)

which is the linear wage-profit frontier.

Also the dual of the system in terms of unit output is

$$S^T X + A^T X + F = X$$

where F denotes the final consumption. At F=0 the economy has maximum rate of growth G=R. So for g<R

$$X = \left[I - A^T - gS^T\right]^{-1} F$$

$$= \left[I - gS^T\left(I - A^T\right)^{-1}\right]^{-1}\left(I - A^T\right)^{-1} F$$

which are gross outputs required to satisfy final consumption vector F. The similarity of the above to the Leontief's dynamic system is at once apparent

Chapter III: Monetary Economy with Currency Money

8. Continuing the train of thought from the previous chapter where we provided for a theory with stock-flow in the Sraffian edifice, we now set to explore the role of money and interest in the theory of value. We would aim to attempt a closure to this perennial debate of monetary and value synthesis, starting this chapter. A capitalist economy which produces commodities by means of commodities has been the topic of discussion all this while in the previous chapters. In the last chapter, we augmented the standard stock-flow model of a capitalist economy to convert it into a system of a commodity money economy. However, many would argue that commodity money (or money commodity!) is not, or may be not, an accurate representation of a true monetary economy. After all, it is hard, even to think, that people carry stocks of commodities, however small or light-weighted this commodity is, for their daily trades ranging from buying securities to breads. As a result, we would also aim to move a little farther from this theoretical commodity standard towards a far more realistic form of money- money in the form of currency. By currency money, we mean any form of non-commodity standard, measure and medium of exchange. This may be purely cash provided by the government, say. Or currency money may be introduced through an ingenious method that is normally resorted to in fiscal activities-seignorage. Seignorage normally implies printing of currency notes or increasing the money supply through changes in the fiscal routines, so as to tackle inflation. Whichever method it may take, it would be important to note that as currency can exist in an economy searching for a standard and means of payments. The evolution of money also reached its epoch of plastic money through this stages as well-commodity (various from salt to gold to metals to mules). This provides a rationale and motivation to start the analysis of a monetary economy with a system of currency money. All contracts and offers of contracts are represented in terms of this currency money. Furthermore, it is peculiar characteristic of currency money that it is the state or community which enforces the delivery, but also it decides what it is that must be delivered as a lawful or a customary

discharge of a contract which has been concluded in terms of such currency money. Keynes in his Treatise provides an apt definition to currency or fiat money- *fiat money is representative (or token) Money (i.e. something the intrinsic value of the material substance of which is divorced form its monetary face value)- now generally made of paper except in case of small denominations- which is created and issued by the State, but is not convertible by law into anything other than itself, and has no fixed value in terms of an objective standard.* Important points worth a mention are that the intrinsic value of currency money is not equal to its monetary value- the intrinsic value is not equal to the value in circulation. Also, it is created by the state and is independent of a standard. As a result, when an economy moves away from commodity standard to a form of money that is not pegged to any standard, there would be necessarily certain effects on the economy as a whole. This chapter aims to analyze these effects to an extent. Currency money provides an improved convenience to the economic agents thorough an invariable measure of value and also a standard which can be used as a medium of exchange; its value in use and its value in exchange do not change much and often. Let us begin where we left in the previous chapter. In the previous chapter, we analyzed the properties of a commodity money economy. We aim to keep rest all the things unchanged in this chapter; but we intend to change the medium of exchange in this chapter. We would replace the commodity money by currency in the system of this chapter. The production system would be similar to the one detailed out in the chapter on commodity money. There would continue to be stocks of commodities, flow expenditures of commodities, wages, a commitment to profits, along with stocks and flows of money in terms of this new currency money. Hence, the commodity price-production relations would be augmented for these money stocks (or currency expenditures by the government).

$$(S_{11}p_1 + S_{21}p_2 + ... + k_1 p_1 B_1)r + (A_{11}p_1 + A_{21}p_2 + ...) + wL_1 = p_1 B_1$$
$$(S_{12}p_1 + S_{22}p_2 + ... + k_2 p_2 B_2)r + (A_{12}p_1 + A_{22}p_2 + ...) + wL_2 = p_2 B_2$$
$$.....$$
$$(S_{1n+m}p_1 + S_{2n+m}p_2 + ... + k_{n+m} p_{m+n} B_{n+m})r + (A_{1n+m}p_1 + A_{2n+m}p_2 + ...) + wL_{n+m} = p_{n+m} B_{n+m}$$

Currency money needs to be given a specific role in this economy. The role of currency money is to be a standard and a measure of value. Also, in so doing, it itself must not undergo a lot of change in value; invariably so the currency standard should be a store of value as well. With this functionality, we may now proceed to provide for an entry point of currency. All industries and business seek capital in form of illiquid assets and also in form of liquid money. Therefore, it can be safely assumed that capital includes money stocks. The money stocks would be assumed to be held in as a proportion of the total turnover the particular industry generates. This, we would call the money turnover ratios, *k* as before. The government provides for purchases of individual commodities and stocks of individual commodities. The volume of these purchases generates a flow of currency from the government to the industries. Thus, currency is introduced in the production-price system. The coefficients $k_i p_i B_i$ represent the money holdings of the capitalists. These money holdings to an extent are the capitalists money demands since these money holdings are necessary for smoother production runs and also an integral part of the otherwise illiquid capital. The government is assumed to know or at least collect information from all the entrepreneurs in the economy about their monetary requirements and accordingly provides every industry with its necessary *currency* (cash) requirement. The production price equations therefore have various components: capital stocks, flow variables, labour terms and finally the end output. The capital stocks are themselves composed of real stocks of commodities and monetary stocks of currency. The capital i.e. the total stocks including the money stocks, $\sum_{i=1}^{n+m}\sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i$ is assumed to be owned by both the capitalists and the workers. These individual equities of the workers can be represented by $e_x\left(\sum_{i=1}^{n+m}\sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i\right) \forall x = k, w$. Here, the *k* refers to the capitalist and the *w* refers to the workers. Having depicted the production price relations, these would enable in determining the absolute prices, wages and profits. With these variables, we can determine the level of national income in the economy, and

hence the overall consumption and savings of the economy. The consumption technology is assumed to be governed by the familiar linear expenditure systems of Stone. As the individual commodity demands are determined for consumption goods industries, the outputs of capital goods industries will be determined using the output system. Along with determination of outputs, the growth rate of the system is also determined from this sub-system.

$$\alpha_i wL + \beta_i rK = p_m B_m$$

$$\left(S_{11}x_1 + S_{12}x_2 + ...S_{1n}x_n + \sum_{j=1}^{m} S_{1j} \right) g + \left(A_{11}x_1 + A_{12}x_2 + ...A_{1n}x_n + \sum_{j=1}^{m} A_{1j} \right) = B_1 x_1$$

$$\left(S_{21}x_1 + S_{22}x_2 + ...S_{2n}x_n + \sum_{j=1}^{m} S_{2j} \right) g + \left(A_{21}x_1 + A_{22}x_2 + ...A_{2n}x_n + \sum_{j=1}^{m} A_{2j} \right) = B_2 x_2$$

.....

$$\left(S_{n1}x_1 + S_{n2}x_2 + ...S_{nn}x_n + \sum_{j=1}^{m} S_{nj} \right) g + \left(A_{n1}x_1 + A_{n2}x_2 + ...A_{nn}x_n + \sum_{j=1}^{m} A_{nj} \right) = B_n x_n$$

$$L_1 x_1 + L_2 x_2 + ...L_n x_n = L$$

It should be observed here that currency money, unlike commodity money of the previous chapter, does not appear in the output system. While only basics enter the output system, it should be noted that commodities which are used in *production* of every other commodity are regarded as basics. Currency money is *not produced* commodity in the system and is externally provided by the government. Hence, currency money finds no role in the system of output determination. This is an important property of real and monetary forces. Real outputs are unaffected by the presence or absence of money. Yet again, for the closure of this system, we rely on Sraffa's labour conservation equation. Consumption, as described in the first equation above, is carried out of incomes by both, capitalists and workers. While consumption technologies are explained, savings and investment become an integral part of the discussion. Additions to savings are done by both, the capitalist and workers. Similar to industrial money holdings, households (or workers) also keep a certain fraction of their wealth in terms of currency. Further, all consumptions and savings are represented in terms of this currency money. Workers add to their savings, which is only in the form of

industrial capital. Capitalists also save in the form of industrial capital. Depending on the individual propensities, both the agents may decide to allocate their savings to capital and currency. The total amount of currency in the system has to therefore, incorporate these savings and thereby additions to capital. Additions to capital and the existing capital stocks together are defined as the total currency in the system. Technically,

$$Currency = \left(e_w \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) + e_k \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) \right) +$$

$$\Delta \left(e_w \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) + e_k \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) \right)$$

An important equation in this relationship in this analysis is the growth-profit relationship, which is derived form the simple saving-investment relationships in the economy. This relationship takes the following form:

$$r = \frac{g\left(\left(e_w + e_k \right) \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) \right) - \left(k_e^w \left(1 - \beta \right) wL \right)}{\left(k_e^w \left(1 - \beta \right) e_w \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) + k_e^k \left(1 - \beta \right) e_k \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) \right)}$$

This relationship is developed using the principle of growth rate[42]. In a currency money economy, yet again using the quantity theory equation leads to providing no solution or meaningless solutions to the system. We, after inspecting and appreciating the invalidity of quantity theory to this system as well would propose a different and a simpler closing equation for the above system. This equation may take the following form:

$$\left(\left(e_w + e_k \right) \left(\sum_{i=1}^{n+m} \sum_{j=1}^{n+m} S_{ij} p_j + \sum_{i=1}^{n+m} k_i p_i B_i \right) \right) \left(1 + g \right) = Currency$$

Necessarily, it is important that the term in the parenthesis following the Δ in the equation for currency would be equal to the total savings in the economy. This would be always true because in this economy, the only medium of savings is through equities. Thus, all the incomes in the economy which are unconsumed

[42] In any economy, growth rate, g=S/K, where S=Savings and K=Capital

would be translated into equities through savings. The closing equation thus introduced implies that the total currency, defined as equities plus the additional capital, would be equal to the current level of capital plus an additional to the capital stock. Both the sides of this equation are similar, one written in terms of current values and the left hand side written in terms of equilibrium values. Our model of currency money is now complete. The model incorporating currency money involves $m+n$ absolute prices and outputs, wage rate, rate of profits and rate of growth. Hence, this model involves $2m+2n+3$; a step ahead of the commodity money system, which had two lesser variables to determine- one the absolute prices and secondly the currency in the system. We would now describe some more economic properties of an economy with pure currency money. The conclusions that we aim to draw from here become more explicit and intelligible with the use of a hypothetical numerical (economy). We would use similar model of the previous chapter with the following exception- the money commodity producing economy of the previous chapter would be eliminated; we would continue to have five industries in the model. Of these, three would be capital goods industries, those commodities which enter the production of every other commodity. The last two equations in the production system would be the consumption good industries. The closing equation for this set of production relationships would be the monetary closing equation as discussed above.

9. Let us explore the system in greater details with a numerical example. However, we would like to provide a rough sketch of the algorithm used to arrive at the solutions.
    a. Start the price equations with an arbitrary value of the rate of profits, r^*. This would make the price system determinate and hence, solve for the $n+m$ prices and the wage rate
    b. Determine the demands for the consumption goods industries using the demand equations
    c. Adjust the consumption goods industries to the new demand by scaling the commodity inputs up/down as required

d. Proceed with the dual and solve for the outputs and the growth rate of the basic variables
e. Readjust the price equations to reflect the new basic outputs akin to the adjustments done to the consumption goods industries
f. Calculate the excess demands, $X_{d\_new} - X_d$
g. Use the growth profit frontier to determine the new rate of profits, *r***
h. Repeat the process from Step a till all excess demands, $X_{d\_new} - X_d = 0$

In current context of currency money, we have the following relations:

$$(3p_1 + 0.4p_1 + 2p_2 + 5p_3)r + (2p_1 + 5p_2 + 3p_3) + 5w = 40p_1$$
$$(2p_1 + 5p_2 + 1.5p_2 + 3p_3)r + (5p_1 + 7p_2 + 5p_3) + 5w = 60p_2$$
$$(2p_1 + 3p_2 + 6p_3 + 5p_3)r + (2p_1 + 5p_2 + 3p_3) + 10w = 50p_3$$
$$(3p_1 + 5p_2 + 6p_3 + 0.6p_4)r + (3p_1 + 2p_2 + 5p_3) + 10w = 60p_4$$
$$(2p_1 + 3p_2 + 5p_3 + 2.5p_5)r + (2p_1 + 5p_2 + 7p_3) + 10w = 50p_5$$
$$(12.4p_1 + 19.5p_2 + 30p_3 + 0.6p_4 + 2.5p_5)(1 + g) = 1493$$
$$0.45(40w + 20r) = 60p_4$$
$$0.45(40w + 20r) = 50p_5$$
$$(3q_1 + 2q_2 + 2q_3 + 5)g + (2q_1 + 5q_2 + 2q_3 + 5) = 40q_1$$
$$(2q_1 + 5q_2 + 3q_3 + 8)g + (5q_1 + 7q_2 + 5q_3 + 7) = 60q_2$$
$$(5q_1 + 3q_2 + 5q_3 + 11)g + (3q_1 + 5q_2 + 3q_3 + 12) = 50q_3$$
$$5q_1 + 5q_2 + 10q_3 = 20$$
$$321r = 660g - 2w$$

We would now begin analyzing the properties of this economy with currency money. Production price relationships and the closing monetary equation provide the solution to the prices and the wage rates. These are absolute prices and absolute wage rates measured in terms of the currency issued by the state. In the process, it is discovered that commodity 1 and commodity 2 are excess supply industries with initial outputs greater than the desired/demanded levels by the economic agents. Necessarily, therefore, these industries shrink in size. An example of this reallocation can be given. Assume that we obtain the following results at iteration 1.

$p_1 = 10$

$p_2 = 7$

$p_3 = 12$

$p_4 = 10$

$p_5 = 12$

$r^* = 0.25$

$w = 5$

With these, we can determine the level of excess demands as under using the demand equations- $0.45(40w + 20r) = 60p_4$ $0.45(40w + 20r) = 50p_5$

The excess demands would be determined as

$0.45(40*5 + 20*0.25) = X_{d4\_new} *10$

$0.45(40*5 + 20*0.25) = X_{d5\_new} *12$

$X_{d4\_new} = 9.225$

$X_{d5\_new} = 7.6875$

Accordingly, we would multiply equation 4 in price equations by $9.225/60$ and equation 5 by $7.6875/50$ throughout to reflect the new demands.

The volume of employment of labour and other resources in these industries reduces and as such, therefore, the prices in this industries fall. A reallocation of these resources and labour happens is seen in other industries. Similar adjustments happen to the labour resources as well. Finally, prices and wage rate along with labour are determined. Equilibrium is determined only when demands match supplies- necessarily when markets clear. The solution of the production-price system after clearing for all excess demands is presented here

Table III-A: Nature of currency money disequilibrium- Prices

r	P1	P2	P3	P4	P5	w
1.69	9.65	7.44	12.16	9.46	11.64	21.71

More importantly, we can also evaluate the real wage rate in terms of prices of the consumption gods industries. Thus, the real wage rates are 2.29 and 1.86. Along with these levels of prices, the absolute levels of outputs are determined through

the demand equations. Excess demands in consumption gods industries determine the new levels of demand, depending upon the income levels earned by the agents in the economy. The capitalists own only the capital and hence the capitalist income includes profits. The labourers earn wages and a share in profits as well. This determines the workers' incomes. The capitalists and workers incomes are 951 and 885 respectively. The propensity to consume along with the respective incomes determines the consumption demands. Therefore, the outputs and the growth rates are as under

Table III-B: Nature of currency money disequilibrium- Outputs

B1	B2	B3	B4	B5	g
29	47.04	62.27	60.29	49.83	2.68

The functional distribution of the income is the ratio between the income earned by the capitalists and the workers. It is important to note that the prices determine the level of aggregate demand and hence the national income. In the process, the volume of employment is also determined for every industry. Depending on the marginal propensities to consume, the respective savings in the economy are determined. The net value of capital determines the rate of profits in the economy. As capital reduces, the profit rate increases in the industries. This value of capital and the value of national product are determined simultaneously in this system along with prices and wages. At the outset, there are excess demands in industry 3, 4, and 5. These excess demands are greater than the excess supplies in the system and hence, the net value of excess demands is positive. The overall positive excess demands in the economy drive the prices downwards, till a point where the value of excess demand is equal to zero. Those commodities where there is excess demand individually would tend to decrease in size and hence the value. The economic equilibrium in the economy is attained in this manner. The economy is dynamically stable in the sense that the economic equilibrium is independent of the initial conditions or as to where one starts analyzing the properties of this economy with. The total currency in this economy given by the sum of equity and addition to capital is 1470. The total capital, given by the value

of stocks at equilibrium, is 479. An important property of this system needs to be analyzed in the light of the volume of employment in the current economy and the value of net national product, or the national output it generates. It should be noted that equilibrium is defined in this system in terms of commodity market clearing. There is no explicit equation, or representation of a labour market. Currency is simply addition to purchases of the commodities by the government. Thus, the current economy as described by the results above can be stated to have attained equilibrium. The total amount of labour in this system at the outset is 40 (sum of the labour terms). However, the demands of the individual commodities dictate that the volume of employment in the economy happens to be only 34. More so, there is a big blunder that is committed in the process by the economy (or someone!). Looking at the production relations, one can tell that 40 resources would have been employed in the economy; they are employed as well but the economy pays salary/ wage incomes only to 34 resources. This is weird! In effect, it can be seen that there is an unemployment gap in the economy. The value of this unemployment gap can be evaluated at the specified wage rate. The volume of this gap is 133. In terms of the net national product, it can be evaluated in terms of market prices and factor costs. The NNP at factor costs is 1836 and the NNP at market prices is 1703. The gap between the two NNP valuations is (always) exactly equal to the value of (un)employment gap i.e. 133. An important characteristic worth noting is that this gap in terms of unemployment and national income valuations is not seen in the system with commodity money. This is only seen to be a characteristic of currency money so far. We would investigate this property in other monetary economic systems as well. This unemployment gap is a crucial characteristic of the currency money system therefore. We would comeback to this system later when we explore more properties of the monetary system. For the purposes of the current chapter, it is important to highlight the important property of a currency money system: In such a system, an unemployment gap leading to the distortion of an identity (NNP market prices and factor costs). As surprising an idea this may be, but this would remain a property of the currency money system. Necessarily, this gap is not the Keynesian gap in

its exact sense, where the deviation between the employment levels, full and actual, is the Keynesian gap due to involuntary unemployment. In the sense of the current context, this gap may be thought of as a similar distortion. However, since we do not have an explicit labour market, it may not be prudent to appropriate this gap to the involuntary participation of the labour force. However, this gap can be surely corrected or eliminated from the system through provisions of public expenditures or more so by creating more demand (again of the type Keynes advocated- the gap of effective demand). We would explore this through provisions of public expenditures, where the government would purchase additional commodities, generate deficit based financing and provide these expenditures without any returns. Naturally so, this gap is bound to exist. Whilst we have closed every single sub-system through its respective closing counter-part, the currency money that is introduced by government purchases of individual commodities is yet to find a counter-part. The missing link is the fact that since the government purchases represent expenditure by the government, it should also be represented as regular flow expenditure for the businesses. In short, the government is required to create currency money through deficit financing. Deficit financing refers to provision of expenditures or money without resorting to any collections from the economic agents via taxes or duties. Having said so, it therefore is evident that without deficit financing, this model of currency economy is incomplete. A valid question or argument is this: why is deficit financing not required in a system with commodity money? An important point here is that commodity money is internal money to the system and rightfully so is *a produced means of exchange*. However, with currency money, as it enters the system, it is bound to create disturbances which should then be resolved from within the system. The government is assumed to provide this external *currency* to the system through purchasing of commodities from the industries and households. This way, deficit financing is introduced in this economy. A point worth noting is the fact that in a pure currency money economy, deficit financing would only be the appropriate medium of balancing the economy. The solutions and the process of equilibrating this currency money economy would be deferred

to the annexure. More importantly, in the actual monetary economy, often we come across other forms of money like deposits & loans. We would attempt to present cases for a deposit money economy. However, as deposits enter the system, it would be prudent to lay the foundations for such an entry. In the next chapter, therefore, we would present a theory of interest rates- an important foundation for the entire monetary economy.

Chapter IV: Theory of Interest Rates

10. A bank is a financial intermediary that accepts deposits and channels those deposits into lending activities. Banks are a fundamental component of the financial system, and are also active players in financial markets. The essential role of a bank is to connect those who have capital (such as investors or depositors), with those who seek capital (such as individuals wanting a loan, or businesses wanting to grow).Banking is generally a highly regulated industry, and government restrictions on financial activities by banks have varied over time and location. The current set of global standards are called Basel II. In some countries such as Germany, banks have historically owned major stakes in industrial corporations while in other countries such as the United States banks are prohibited from owning non-financial companies. In Japan, banks are usually the nexus of a cross-share holding entity known as the keiretsu. In France, bancassurance is prevalent, as most banks offer insurance services (and now real estate services) to their clients. The most recent trend has been the advance of universal banks, which attempt to offer their customers the full spectrum of financial services under the one roof. The oldest bank still in existence is Monte dei Paschi di Siena, headquartered in Siena, Italy, which has been operating continuously since 1472. The definition of a bank varies from country to country. Under English common law, a banker is defined as a person who carries on the business of banking, which is specified as
    a. conducting current accounts for his customers
    b. paying cheques drawn on him, and
    c. collecting cheques for his customers.

    In most English common law jurisdictions there is a Bills of Exchange Act that codifies the law in relation to negotiable instruments, including cheques, and this Act contains a statutory definition of the term banker: banker includes a body of persons, whether incorporated or not, who carry on the business of banking' (Section 2, Interpretation). Although this definition seems circular, it is actually functional, because it ensures that the legal basis for bank transactions such as cheques does not depend on how the bank is organised or regulated. The business

of banking is in many English common law countries not defined by statute but by common law, the definition above. In other English common law jurisdictions there are statutory definitions of the business of banking or banking business. When looking at these definitions it is important to keep in mind that they are defining the business of banking for the purposes of the legislation, and not necessarily in general. In particular, most of the definitions are from legislation that has the purposes of entry regulating and supervising banks rather than regulating the actual business of banking. However, in many cases the statutory definition closely mirrors the common law one. Examples of statutory definitions: "banking business" means the business of receiving money on current or deposit account, paying and collecting cheques drawn by or paid in by customers, the making of advances to customers, and includes such other business as the Authority may prescribe for the purposes of this Act; (Banking Act (Singapore), Section 2, Interpretation).

a. "banking business" means the business of either or both of the following:
    i. receiving from the general public money on current, deposit, savings or other similar account repayable on demand or within less than [3 months] ... or with a period of call or notice of less than that period;
    ii. paying or collecting cheques drawn by or paid in by customers

A bank can generate revenue in a variety of different ways including interest, transaction fees and financial advice. The main method is via charging interest on the capital it lends out to customers. The bank profits from the differential between the level of interest it pays for deposits and other sources of funds, and the level of interest it charges in its lending activities. This difference is referred to as the spread between the cost of funds and the loan interest rate. Historically, profitability from lending activities has been cyclical and dependent on the needs and strengths of loan customers and the stage of the economic cycle. Fees and financial advice constitute a more stable revenue stream and banks have therefore placed more emphasis on these revenue lines to smooth their financial performance.

In the past 20 years American banks have taken many measures to ensure that they remain profitable while responding to increasingly changing market conditions. First, this includes the Gramm-Leach-Bliley Act, which allows banks again to merge with investment and insurance houses. Merging banking, investment, and insurance functions allows traditional banks to respond to increasing consumer demands for "one-stop shopping" by enabling cross-selling of products (which, the banks hope, will also increase profitability). Second, they have expanded the use of risk-based pricing from business lending to consumer lending, which means charging higher interest rates to those customers that are considered to be a higher credit risk and thus increased chance of default on loans. This helps to offset the losses from bad loans, lowers the price of loans to those who have better credit histories, and offers credit products to high risk customers who would otherwise been denied credit. Third, they have sought to increase the methods of payment processing available to the general public and business clients. These products include debit cards, prepaid cards, smart cards, and credit cards. They make it easier for consumers to conveniently make transactions and smooth their consumption over time (in some countries with underdeveloped financial systems, it is still common to deal strictly in cash, including carrying suitcases filled with cash to purchase a home). However, with convenience of easy credit, there is also increased risk that consumers will mismanage their financial resources and accumulate excessive debt. Banks make money from card products through interest payments and fees charged to consumers and transaction fees to companies that accept the cards. Thus, interest, deposits, loans, credit and debt form the basis of banking activities in the economy

11. In so doing, the banks face major risks of business. In the common parlance, these risks are the interest rate risk, liquidity risk and the credit risk, as well as broader systematic risks. Most of the times, banks tend to describe these risks using probability analysis- we shall also not differ in this regard. Of the major risks faced by banks, one important risk is the risk of solvency- the ability to remain in business and remain liquid. The risks therefore that we are talking about is faced

by the banks because of its customers- the risks of withdrawls. For the sake of simplicity, we would assume away all other risks. In the banking system, the banks face the risk of withdrawals of their deposits such that they may not have any funds left for advancing loans. In this sense, the banks maintain reserves, linked to the withdrawal probabilities that they estimate at the beginning of each period.

Period	0	1	l
0	p_{00}	p_{10}	p_{l0}
1	p_{01}	p_{11}	p_{l1}
k	p_{0k}	p_{1k}	p_{lk}

The withdrawal matrix is decreasing in periods i.e. nearest period deposits have larger probabilities of withdrawal than the higher period deposits. With such a withdrawal system in place, the banks need to determine an optimal reserve base with which they can conduct their operations. Such reserves can be determined using the following matrix

Period	0	1	l
0	p_{00}	p_{10}	p_{l0}
1	$1-\left[(1-p_{00})(p_{01})\right]$	$1-\left[(1-p_{10})(p_{11})\right]$	$1-\left[(1-p_{l0})(p_{l1})\right]$
k	$1-\left[(1-p_{00})(1-p_{01})(p_{0k})\right]$	$1-\left[(1-p_{10})(1-p_{11})(p_{1k})\right]$	$1-\left[(1-p_{l0})(1-p_{l1})(p_{lk})\right]$

This reserve system is generalized for l period deposits and k period loans. In short, the reserve matrix looks like $R_{lk}=1-\prod\prod(1-p_{l-1,k})p_{lk}$. The theory of interest rates proposed here is an operational theory of loans and deposits wherein the interest rates are determined by the behavior of investors and the behavior of borrowers; behavior here is described in terms of withdrawal probabilities for deposits and technological coefficients for loans.

12. The real question therefore is how do banks determine what interest rates have to be charged on what accounnts? Economists have tried to identify theories for this busines behavior of the banks; however almost all of the established standard mainstream theories have either failed or have not come close enough to the empirical manner in which the rate of interest is determined. In the present section, we aim to provide a theory characterizing this mechanism of the banking system. Once the reserves are determined per the previos section, the banks need

to match their deposits supply with the demand for loans. For this, we use an assignment based optimization, where in the banks are interested in minimizing the reserves, subject to the effeciency condition that all loans are met. In such a case, we obtain the equations for determining the interest rates in the system

$$\sum_{l=k=0}^{b} R_{lk} + \sum_{k=1}^{b} D_{0k} + \sum_{t=1}^{b} \sum_{l=k=1}^{b} D_{lk}(1+i_t)^t = L_t^a i_t$$

13. Let us assume the following loans and deposits schedule to fully understand the interest rate theory

Period	*Deposits*	*Loans*
0	97.5	
1	112.5	145
2	100	145
3	125	145

In this case, the banks have a total of 435 deposits and 435 loans to make. In total, the loans and deposits are fully matched. The banks use the period zero depsoits first since they are chapest for the bank- zero period deposits are not paid any interest while if they are lent out, they bring in profits in terms of interest. Thus, naks use zero period deposits, in this case 97.5, to advance one period loans. Since these do not fully satisfy the demand, banks resort to period one deposits (that banks pay interest on) to meet the loan demand for 145. Similarly, the remaining assignments are made to obtain the following (the first subscript denotes the deposit period and the second denotes the loan period advanced- thus the subscript 01 would read as zero period depsoit utilized to finance 1 period loan)

$$D_{01} = 97.5; D_{11} = 47.5$$
$$D_{12} = 65; D_{22} = 80$$
$$D_{23} = 20; D_{33} = 125$$

Let us assume a banking probability matrix that assumes that immediate period deposits would have a higher withdrawal probability- on the vertical axis we have time periods 1, 2, and 3 while on the horizontal one we have deposit periods 0, 1,

2 and 3. Using such a probability matrix, we can create the reserve matrix using the formula above- $R_{lk} = 1 - \prod (1 - p_{l-1,k}) p_{lk}$

$$prob = \begin{vmatrix} .05 & .04 & .035 & .03 \\ .107 & .088 & .0736 & .06395 \\ .16951 & .1381 & .1152 & .1014 \end{vmatrix}$$

Using this reserve matrix, we can now estimate the reserves in the baking system for each period

$$R_1 = 6.775$$
$$R_2 = 11.608$$
$$R_3 = 14.979$$

Thus, we would now have the equations for the banking system as

$$6.775 + 97.5 + 47.5(1 + i_1) = 145(1 + i_1)$$
$$11.608 + 65(1 + i_1) + 80(1 + i_2)^2 = 145(1 + i_2)^2$$
$$14.979 + 20(1 + i_2)^2 + 125(1 + i_3)^3 = 145(1 + i_3)^3$$

Solving for these equations, we obtain i_1=6.9487%, i_2=11.7171% and i_3=17.6643%

14. To conclude this chapter, a few remarks on the proposed theory become imperative. The assignment matrix becomes crucial in determining the level and the slope of the term structure of interest rates. In other words, the way the banks finance their loans determines what rates of interest would prevail in the economy. Let us consider the classic and full assignment solution to any problem to start with. Considering 3 period loans and 3 period deposits, we would ideally have the following assignment solution

Period	0	1	2
1	D_{01}	D_{11}	D_{21}
2	D_{02}	D_{12}	D_{22}
3	D_{03}	D_{13}	D_{23}

For the above case therefore, this matrix would look like

Period	0	1	2	3
0	0	0	0	0
1	97.5	47.5	0	0
2	0	65	80	0
3	0	0	20	125

If the pattern of assignment is carefully noticed, it may be seen that the matrix is lower triangular. The slope of the term structure for this problem is upward as well. In short, it can be generalized that the slope would be upwards in case the matrix is upper triangular.

Consider the other case, where the matrix is upper triangular

Period	0	1	2	3
0	0	0	0	0
1	0	0	110	35
2	0	65	80	0
3	0	0	20	125

The new equations in this case are

$$4.9 + 97.5 + 110(1 + i_2)^2 + 35(1 + i_3)^3 = 145(1 + i_1)$$

$$11.608 + 65(1 + i_1) + 80(1 + i_2)^2 = 145(1 + i_2)^2$$

$$14.979 + 20(1 + i_2)^2 + 125(1 + i_3)^3 = 145(1 + i_3)^3$$

The term structure in this case is upward sloping and necessarily so, therefore it may be concluded that the shape of the matching-matrix would determine the slope of the term structure.

Chapter V: A Theory of Currency & Bank Money

15. It has been shown in the previous chapters that a Sraffa system can be extended to incorporate the effects of stock and flow coefficient. It was also seen that extending the Sraffa system in this manner does not distort the basic properties of Sraffa system. In such a system with stock and flow coefficients, production is carried out in its real sense; unlike the Sraffa system that has an agrarian flavour. The stocks in such a system take the form of capital; a capital truly measurable in terms of the inputs valued at the going market prices. A mark-up on this (value) capital is charged by the producers as the rate of profits. This marked-up capital plus the recurring expenses of materials and labour produce a defined scale of sales revenue. In such a capitalistic environment, it is important to then drop the notions of barter and express commodity prices and the wage rate in terms of a defined standard of value. However, this standard of value needs to be store as well as a medium of exchange. For the standard to be a "*store*" it would be sufficient to provide durability to the standard; however for it to be a medium of exchange, it should possess a few properties: firstly that it should be commonly accepted as a means of exchange and any exchange without it should be made impossible. Secondly, it should be necessarily used in every activity of the economy, from production to consumption and investment. It is important albeit it is used in every activity, it should never be used up. Thirdly, it should have a value in exchange: the exchange value of money is defined in terms of its purchasing power. Lastly, the medium of exchange should be able to make trades possible and markets exist: it in itself should be a good hedge for inflation. We have already explored the roles of currency and commodity money in previous chapters. In an active capitalist economy, it would be prudent to assume that the producers require credit along with assuming some money stocks with them. The previous chapter on commodity money exhibited that producers normally tend to keep these money stock balances. The tract of monetary chronologies is as under: the preliminary medium of exchange was commodity. Owing to the complications of the system, the a role of a state was established and the state decided to convert

the commodity equivalent into some fixed value, and printed either notes or minted coins of the same value; somewhere around the 1920s, the governments decided to boycott this commodity standard and move on to a free float currency backed adequately through a banking system. The roles and the preliminary responsibility of a banking system were enabling the smooth flow of the legal tender and manage public money. Currency money system also had a regulator in the form of a government. However, in case of a bank money or a banking system, it is the bank which regulates all the transactions. Production activities are conducted with the use of bank money and a true capitalist monetary economy emerges. While dealing with commodity money, it was seen that the most important function it performs is that of a unit of value and medium of exchange. This medium needed to be invariable and a standard of account and hence currency money was required. However, even currency money may not possess durability unless it is stored. The banking system provides the storage function in an economy. The banking system is responsible for creation of two most important forms of assets: the deposits and secondly the loans or advances. The deposits and loans taken together form the basis for a monetary production. An economy with credit money is necessarily an economy with deposits. After all, it is production of credit by means of credit (deposits). All economic agents deal in deposits or loans at some point in time. Capitalists save in form of deposits, so do the workers. These deposits itself are churned as loans or credit to those who demand these loans. As we pause here, we may ask the question that if loans are created, they must be borrowed by some economic agents. The producers are assumed to manage their production activities using these loans. It is financial motive alone that requires producers to borrow from the banking system. Money enters the scene with its role in production, consumption, investment, and above all exchange. In such a system, goods buy money, money buys goods but goods would not buy goods! The production system takes the following form:

$$\varepsilon_{11}(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)r + (\delta_{11})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(1+i_1)$$
$$+(\delta_{12})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_2) + ...(\delta_1)(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_t)$$
$$+(\delta_{1t})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_t) + A_{11}p_1 + A_{12}p_2 + ...A_{1n}p_n + L_1 w = B_1 p_1$$
.....
$$\varepsilon_{n1}(\psi_n B_n p_n + S_{n1}p_1 + S_{n2}p_2 + ...S_{nm}p_n)r + (\delta_{n1})(\psi_n B_n p_n + S_{n1}p_1 + S_{n2}p_2 + ...S_{nm}p_n)(1+i_1)$$
$$+(\delta_2)(\psi_n B_n p_n + S_{n1}p_1 + S_{n2}p_2 + ...S_{nm}p_n)(i_2) + ...(\delta_1)(\psi_n B_n p_n + S_{n1}p_1 + S_{n2}p_2 + ...S_{nm}p_n)(i_t)$$
$$+(\delta_t)(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_t) + A_{n1}p_1 + A_{n2}p_2 + ...A_{nm}p_n + L_n w = B_1 p_1$$
$$\sum_{t=1}^{t} \delta_{nt} = (1 - \varepsilon_{nt})$$

As described, the production relations consist of capital plus current working stocks along with labour to produce a given volume of output. The capital consists of money plus tangible capital valued in terms of prices. This capital can be expressed in shorthand as $\left(\Psi_i p_i B_i + \sum_{i=1}^{n}\sum_{j=}^{n} S_{ij} p_j\right)$, where Ψ_i is the money-turnover ratio. This is akin to the *k* introduced in the preceding chapters. This capital as explained is financed in two parts: debt and capital, with ∂_t being the debt equity ratio and correspondingly, ε being the equity portion and ∂_t being the debt portion. As can be seen from the relations, loans of maturity *t* are available to the producers, and these are repaid and renewed at the end of every period from the banking sector. For example, one period loans obtained at the beginning of the first period are repaid along with interest where as for loans of other maturities, only interest is paid for renewing the debt. It can be said that loans with maturities greater than 1 are never repaid. Notwithstanding anything, this does in no way mean that the loans of maturities greater than 1 are never repaid. In fact, loans of two period maturity will be repaid in the next year, since in the next year when it enters the books, it will have an outstanding maturity of 1 year and it is only that 1 year loans are repaid. This arrangement of the manufacturing sector with the banking sector is a safe assumption to begin with! At the beginning of every period, the bank matches its deposits and loans and allocates debt in the best possible manner to the producers who apply for it at the beginning of the year. Thus interest cost becomes an integral part of the production relations. Such a

capitalist rational economy with money would provide the role for capital and hence its cost: not in terms of profits but in terms of interest. Rate of profits and rate of interest are purely distinct in this system. Rate of profit can be thought of as the net operating profit generated by businesses after meeting all its expenses out of the collect sales proceeds. Interest on the other hand is a payment the businesses make to the lending institutions to maintain a smother production schedule. Thus, it is worthy to note that capital generates profits, but to generate the profits, it in the process makes way for interest. The demand and supply of capital would and ideally can never determine either interest or profits; such a matching would only determine the price of capital, which is what would exactly happen in the system just outlined. The intersection of borrowers and lenders to provide for capital would ideally determine interest, and after the prices of capital and the money rates of interest facilitating capital are determined, only then can be profits determined, else not! A capitalist monetary economy engaged in the business of producing commodities for generating profits ideally intends to grow, expand and create more value. The realizations of every period's profits are the only motivation for a producer to continue production. The labourers on the other hand, work and remain employed till a point that the wages they generate are able to cover their requirements of consumption and investments. No external forces stop the functioning of such an economy other than the hindrance to creation of wealth for each of the classes. Thus, the distribution of incomes in the economy becomes and important feature of such an economy. Entrepreneurs engage themselves in the process of production. They own a part of the companies and the factory sheds, they control production but they cannot quit production in an irrational manner. As a result, the economic agents of production are supposed to be rational and profit seekers. The other part of the ownership of the production process is with the workers: the system incorporates an equitable view point where in the workers and capitalists, both possess a share in the ownership of capital. The producers obtain capital in form of equities and debt. Equity capital is subscribed to by capitalists as well as workers. This equity capital may be assumed to be in the form of a 0% preference share which pays no dividend and

paying it off to its owners is out of question as rationality forbids liquidation. The debt is subscribed to by the producers in the course of their daily activity of production and they require these lines of credit in order to reduce their cost of capital. Debt also provides them gains from financial leverage by making their interest costs tax deductible. We can assume safe firms to begin with in the sense that their debt-equity or capital leverage ratio can be assumed to be 1:1. Such firms are not said to be highly levered firms! The next question is what are the sources of financing for the entrepreneurs? The workers invest and subscribe to the equity capital, but since they themselves may be risk-averse, they could be assumed to invest in safe bank deposits as well! This assumption of risk-averse workers is not necessary and can be altered in any manner. The workers obtain wages and invest the savings in equity and deposits depending upon their propensities to consume and their risk appetites. All this while, we are talking in terms of credit money. It is now worthwhile to provide an explanation to the sources of lines of credit to the entrepreneurs. The workers are assumed to save in form of deposits as well. As a result, we are compelled to introduce a banking system explicitly. This compulsion is not merely because the workers are saving in form of deposits; it is also due to the fact that producers are ready to buy these deposits in form of credit. Therefore, a necessary market for translating the deposits from workers to credit to producers has to be provided for. This role is necessarily the role of a developed banking system which is never dormant and undertakes the activity of collecting deposits and disbursing loans. Being an economic banking activity, its sole rational objective would also be profit seeking. The banking sector also would require capital in form of chairs, furniture, computers et al and that it would be convenient to assume that the banking system is owned by all the producers. The regulated banking system functions under the directives of the banking mandates and it is not possible for producers to usurp all the deposits in form of loans. In such a scenario, the various parties between themselves have a fixed economic relationship. These relations can be explicitly demonstrated in form of the balance sheets of each of the economic individuals.

Balance- Sheet of Firms

Liabilities		**Assets**	
Equity:			
Workers' Eqy	30		
Capitalists' Eqy	170	Cash	150
Debt	450	Assets	500
Total	**650**	Total	**650**

Balance-Sheet of Workers

Liabilities		**Assets**	
Wealth	480	Cash	50
		Savings: Deposits	400
		Savings: Equity	30
Total	**480**	Total	**480**

Balance-Sheet of Banks

Liabilities		**Assets**	
Capital	50	Loans to producers	450
Reserves	10	Other assets	10
Deposits	400		
Total	**460**	Total	**460**

It should be noted here that the total capital requirement of the firms is 650. The workers own a net wealth of 480 of which, depending on their propensities save in form of deposits and equities. They also retain a small portion of their wealth in the form of cash. The banks receive 400 of the deposits from workers and raise another 50 as their own capital. Thus, the banking system is able to make a loan advance of 450 after also keeping its own asset base intact. The producers require these loans since they receive only 200 worth of equity-30 from the workers and 170 from the capitalists' wealth. Thus, the remaining 450 for the production system is obtained from the banking system in the form of loans. These loans are

necessarily interest bearing loans and as explained above, they have defined maturities. The banking system or a stable money market would exist when the demands for money and supply of money are equated by tatonnement. In this system, the rate of interest and the rate of profits are absolutely different. The rate of interest is determined from a banking-financial system using the matching of deposits to loans or credit that is demanded by the producers. The producers demand loans of various time-periods and maturities at the beginning of every time period. It would be necessary to articulate here the nature of loans in this manner. Though deposits are time dated, interest on deposits and loans accrue at the end of the period. As a result, it would imply that producers obtain loans at the beginning of every period. These loans are as under: One period loans are repaid and renewed every year, two and three period loans are renewed every period and accordingly, loan requirements are determined. The deposits are held by workers through various maturities and in doing so, the banks compensate the deposit holders by paying them interests. It would be safe to assume that interest paid and interest received by banks are the same. Alternatively, assuming a spread of convenient basis points, one can always determine bid rates and ask rates for the banking system. In this case, the system mentioned herein would solve for mid-rates. Let that be! The banking profits would be an addition to the total incomes of the capitalists since the banking system since the banking system is owned by the all the producers. Now comes the deposit part of the story! The deposits held by banks for the public can be withdrawn at any point in time as these are assumed to be held in the form of demand deposits. Time deposits are expensive for the bank to use for loan disbursement. Demand deposits therefore always carry a contingency claim on them and these causes the banks to set aside an expected amount of withdrawal from their entire deposit base. Consider the scenario like this: assume that the banks have a deposit base of 100. Against these deposits, the banks face a demand of loans for 80. Assuming that out of the 100 worth of deposits, 30 happen to be immediate demand deposit of maturity zero! In such a case, banks have two options. The traditional operations manager would make a disbursement of loans worth only 70 (100 minus 30) and thus would crowd out

loan demand worth 10. For this manager, the interest rate schedule would be higher since he would always have a situation wherein demand would exceed supply. This in turn affects the banks profitability since it is paying interest on 100 worth of deposits and obtains interest on only 70 worth of it. Now consider the other case. If the banks know that it expected withdrawal (even considering the zero period immediately due demand deposits) is only 20, it can effectively raise its disbursements, match loan demands and thus maintain a higher profitability. Thus, ideally banks would do this: ascertain likelihoods or probabilities of withdrawals and develop operational reserve system depending upon these. They would always meet all the loan demand using this risk management system and hence would be more profitable than the conventional bank without this risk management! Assuming a given withdrawal matrix, we would have a defined reserve system for the banks of the following form:

Period	0	1	l
0	p_{00}	p_{10}	p_{l0}
1	$1-[(1-p_{00})(p_{01})]$	$1-[(1-p_{10})(p_{11})]$	$1-[(1-p_{l0})(p_{l1})]$
k	$1-[(1-p_{00})(1-p_{01})(p_{0k})]$	$1-[(1-p_{10})(1-p_{11})(p_{1k})]$	$1-[(1-p_{l0})(1-p_{l1})(p_{lk})]$

In short, the reserves can be described as $R_{lk}=1-\prod(1-p_{l-1,k})p_{lk}$. Using these reserves and the matching conditions for the deposits, the interest rates can be determined. The theory of interest rates proposed here is an operational theory of loans and deposits wherein the interest rates are determined by the behavior of investors and the behavior of borrowers; behavior here in described in terms of withdrawal probabilities and technological coefficients. Both of these are known and given to all the economic agents at all points in time and as such, no uncertainty is involved in any manner whatsoever. A pure monetary theory of interest rates is proposed here. Necessary within this system is the need to define incomes and the share of distribution in such a system. Incomes become important because they govern two important decisions in any economy: consumption and savings. In our capitalist monetary economy, incomes determine consumption, savings, investments and hence the sustainability of the economy

per se. In a pure monetary economy with no taxes and no intervention of government, the incomes can be easily defined as under

$$Y_k = r * E_k + I_b + \sum_{i=1}^{t}\sum_{i=1}^{t} \mu_t i_t D_t$$

$$Y_l = r * E_l + w * L + \sum_{i=1}^{t}\sum_{i=1}^{t} (1-\mu)_t i_t D_t$$

The capitalists earn rate of profits on their equity capital along with I_b which is the banking profits and can be expressed as: $\Pi^{banks} = \sum_{t=1}^{b} L_t^a i_t - \sum_{t=1}^{b} i_t D_t$. The share of ownership in deposits of the capitalists or the producers is μ whereas the workers share would be necessarily (1- μ). The *mu's* in the system can be determined and need not be given[43]. The ratio of one period holding of the capitalists or producers to the total one period deposit (sum of workers and producers holding of one period deposit) would be μ1. Thus, the monetary system simultaneously provides a theoretical foundation to the theory of income distribution. Shares in income are determined by the current economic conditions in terms of the prices, rates of profits, rates of interest and the various value relations. In a true monetary economy, value and distribution of income happen simultaneously and none can preclude the other! In an economy where production, consumption and all the economic activity is conducted in pursuit of money, the distribution of income and before that, the determination of income would also involve the discussion around money. It is after all, the valued output that needs to be distributed: and for valuing output, the value of money needs to be known. Thus in a monetary economy, the distribution of monetary assets and the shares of ownership of various assets only would govern the principle of income distribution. So be it! Once the distribution of income is known, marginal propensities to consume and Stone's linear expenditure systems would determine the level of consumption in the economy. Linear expenditure system provides for using the closest form of an

[43] However, here the $\mu_{ik} = \{(1-e_k)D_i\} / \sum_i D_i$. In simple terms, the share of capitalists in one period deposits is determined by their propensity to save in one period deposits. A similar case holds for μ_{iw}

empirical demand function. Any other demand function would just do the same purpose. It is worthy however to note again that in a monetary economy, incomes only would determine demand. This is the case since goods would be traded not for their satisfaction or utilities but for their intrinsic worth: money! Money assumes the central role in monetary economy and determines income distribution, savings, investments, consumption and in the process since is a medium of exchange, determines prices as well. However, its role is obviously not limited to determination of prices. The marginal propensities to save determine the level of savings. Along with determination of prices, income distribution and consumption facilitation, money also determines a number of other things in the monetary economy. Money, since is involved in the discussion on personal distribution of income, also becomes an integral part of functional distribution of income. It is this functional distribution of income that determines the level of national income in the economy. The level of national income in a monetary economy cannot be determined without determining the level of money supply in the economy. The omnipresent nature of money makes it necessary to first determine how much is the intrinsic worth of the economy in terms of the purchasing power of money. The level of national income thus needs to be known along with money supply in order to determine several policy variables like the velocity of circulation of money and the relation between money and prices. Only then, we can state that the enormous work of creating the formal synthesis of money and value is complete[44]. Money, interest and prices just happen to be the corner stones of integrating monetary and value theories. The net national product in this economy would the valued sum of total outputs less the valued sum of inputs in the economy. This is net national product at market prices. Net national product at factor costs would then be the sum of profits, wages and interest in the economy. NNP at factor costs divided by the total money supply gives the income velocity of money and NNP at market prices divided by money supply gives the transaction velocity of money. It is important to note the fact that unless the entire macro-economic equilibrium is attained, it is impossible to determine the velocity

[44] I hope to make this remark right at this stage. The reason would become clear soon for the first reader.

of circulation of money. Though ideally it may sound like one, velocity of circulation of money is not always a flow variable. Instead, it is akin to a yardstick which the monetary regulator in the economy may employ to gauge the level of inflation or the purchasing power of money. In this respect, to use a quantity theory like equation in the model would not help. The national income is an important variable in the model of a monetary economy since once the value of national income is known, other values like consumption, savings and more importantly investment are known. Consumption is as always, governed by Stone's functions, savings is a residue after consumption, the last but yet an important variable is investment. To determine all these variables, various parameters have to be introduced in the system. We would now start providing a list of these parameters that help in determining various other variables that are necessarily connected to the national income.

- kp_t refers to producers or capitalists' propensity to invest in period *t* deposits
- kw_t refers to workers or labourers' propensity to invest in period *t* deposits
- k_e refers to producers or capitalists' proportion of wealth saved in equities
- W_k and W_l refer to wealth coefficients of capitalists and workers respectively
- *D* refers to a fixed initial value of deposits

Similarly, using these modeling parameters, various other variables are obtained. Also, the delta rule or rule of changes is applied using these parameters itself. For e.g. the addition to deposits is defined as $\delta D_t = kp_t S_k + kw_t S_w$. This defines the savings relation in the economy as well. Similarly, other necessary variables are developed. Consistent with theories of general economic equilibrium, this monetary theory of value provides roles, rationales and theories of determination of arbitrary economic relationships. The most arbitrary economic relationship is the relation between the rate of profit and the rate of growth in the economy. The other arbitrary relationship is the relationship between money supply and prices. These two relationships in isolation would require a separate chapter. I would propose to cover these in a nutshell and only to the extent relevant for this synthesis. As described earlier, the rate of profit is the surplus of outputs over

inputs and other costs of administration. It is a pure accounting term in this economy. On the contrary, rate of growth is the standard Harrod-Domar relation between savings and investment. Using these two relationships, the growth profit frontier in this monetary economy can be obtained as:

$$r = \frac{\left(\left(g * M_s\right) + \Delta Currency - \left(1-\beta\right)\left(Y_{Labourer} - Su.Cons_{Labourer}\right) - \left(1-\alpha\right)\left(Y_{Capitalists} - Su.Cons_{Capitalists}\right)\right)}{\left(1-\beta\right) * Equity_{Labourer} + \left(1-\alpha\right) * Equity_{Capitalists}}$$

Here, Ms is the money supply, Su.Cons is the subsistence consumption of each of the economic classes and alpha and beta are the marginal propensities to consume of the capitalists and the labourers[45]. The relation between prices and money supply in a monetary theory is of the non-quantity theory type of a relationship. The total money supply in a monetary theory should cover the current and the future needs of the entrepreneurs and hence the production sector along with meeting requirements of deposit holders as well. This is in fact the closing equation of the entire system and happens to be the equation of exchange. In a monetary economy, the capital inclusive of money stocks is an important element and this capital times the rate of growth plus the current capital requirements should be met by the total supply of money. The determination of savings, investments, national income and money supply through wage-price determination leads to determination of the growth rate in the system. Technically so, the growth rate is defined as the ratio between savings and capital. Hence, it is imperative in this system that all the variables are known and identified in the system. In a subsequent chapter, we would take currency and deposits together to investigate the properties of this system. The monetary theory of value presented in the previous chapter consists of various smaller models in itself and the equilibrium in each of these models simultaneously would determine the macro-economic general equilibrium. These smaller models or sub-systems of this economy consist of a production-price system, a banking system, output system, consumption system, investment system and savings system. The consumption and savings system are interlocked in one another and the investment system determines the growth profit relation in the economy. The production system rests

[45] The terms labourers and workers are used interchangeably, so are the terms capitalists and producers as well.

on the augmented Sraffa style of production equations. These equations exhibit a uniform rate of profits across all industries. This may be thought of as a modeling assumption or a depiction of reality. In the long run, it is observed that the rates of profits tend to equate across industries and over a still longer run, rates of profit across industries would tend to equalize. With the rates of profits equalized across industries and the rates of growth assumed to be equalizing across industries, it provides and ensures for capital reallocations and flight of capital in the system. Capital allocation and labour allocation are carried out in the process of this search for equilibrium. Moving on, the consumption technology is governed by Stone's linear expenditure system. These are empirical demand functions and are used here because in the current set-up, subjectivity based demand systems would torture the validation of the model. All said, it should be added that the choice of demand functions as convenient to the user can be made. However, enough care should be exercised to endogenize the demand functions and remove arbitrariness from the system. The income determination and determination of consumption and savings is an important sub-system in the model as will be seen shortly. The economic equilibrium is dependent on clearing of the consumption goods industries. Therefore, it may not be wrong to add that a market exclusively for consumption goods industries is created. The capital goods industries also need to clear and their demand supply matching also leads to price and quantity formulation. Thus, commodity markets are adequately created. Another set of equations is the system of output determination. In this system, the growth rate is also determined. This system also rests on Sraffa's standard system concept. However, we do not intend to create a standard system but would use Sraffa's concepts of multipliers and system's own rate of maximum profits- this rate we have dubbed as the growth rate of the system. There is another set of equations which are the closing equations in each sub-system. These are called as closing equations because they help in providing a mathematical solution to the system. More so, the closing equations have economic implications as well. In the system of output determination, we use the labour conservation equation- the rationale being that the entire level of employment in the economy is conserved; however,

this does not preclude the fact that labour is mobile. In fact, the labour conservation equation enables the labour to decide which best industry to stick to. However, it also implies that in so doing, no labour is out of his job. The production price system uses its own closing equation. In accepted theory, the solution to the prices in absolute terms is obtained using an equation of the quantity theory type. However, in this model, we will have to move away from the received doctrine considerably. The quest of a monetary closing equation is the crucial link in integration of monetary and value theories. Preliminary investigations with the quantity theory have yielded us surprising (and absolutely useless) conclusions ranging from yielding no solutions to multiple solutions. This, we believe has been an issue haunting many economists following the track of integrating monetary and value theories. As an important conclusion, therefore what we observe is that monetary and value theories as a union is inconsistent with quantity theory[46]. That does not, in any manner, ask the question: *How to make money appear without making standard theory disappear?*[47] – or there are also statements of the fashion: *the most serious challenge the existence of money poses to the theorist is this- even the best developed models of the economy cannot find room for it*[48]. We may however like to conclude this debate on the following note: if we need to make money appear, we need to get out of the standard theory- the standard theory may find no role for money. That however does not preclude money from having an important role in the economy. That role is not about *price determination* but is of *value determination*. In effect, if the quantity theory has to be abandoned at the cost of a pure theory of money and value, we do not mind taking the route. We would also provide an overview of a quantity theory disequilibrium in a short while. In summary, the entire set of equations can be collapsed in a nutshell so as to provide a concise monetary theory of value:

[46] Refer the annexure for a discussion on the failure of solutions in the system with quantity theory equation
[47] Ostroy, 1973
[48] Hahn, 1982

$$\alpha\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right) r + (1-\alpha)\sum_{t=1}^{b}\left\langle\left\{\left[\partial_t\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right)\right] i_t\right\}\right\rangle + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij} p_j + wL_i = p_i B_i$$

…….

(I)

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\psi_i p_i B_i * (1+g) = M_s = Deposits + Currency + Equity \ \ldots\ldots\ldots\ldots\ldots\ldots$$

……. *(II)*

$$\sum_{l=k=0}^{b} R_{lk} + \sum_{k=1}^{b} D_{0k} + \sum_{t=1}^{b}\sum_{l=k=1}^{b} D_{lk}(1+i_t)^t = L_t^a i_t \ \ldots\ldots\ldots\ldots\ldots\ldots$$

(III)

$$\alpha_i wL + \beta_j(rS + I_b) = B_i p_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

(IV)

$$r = \frac{\left((g * M_s) + \Delta Currency - (1-\beta)\left(Y_{Labourer} - Su.Cons_{Labourer}\right) - (1-\alpha)\left(Y_{Capitalists} - Su.Cons_{Capitalists}\right)\right)}{(1-\beta) * Equity_{Labourer} + (1-\alpha) * Equity_{Capitalists}}$$

……

(V)

$$\left(\sum_{j=1}^{m}\sum_{i=1}^{m} S_{ji} x_i + \sum_{i=j=1}^{n} S_{ji}\right)(1+g) + \left(\sum_{j=1}^{m}\sum_{i=1}^{m} A_{ji} x_i + \sum_{i=j=1}^{n} A_{ji}\right) = B_i x_i \ldots$$

(VI)

$$\sum_{i=1}^{m} L_i x_i = L \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

(VII)

Equations I through VII represent a set of various equations formally detailing out the monetary theory of value in the form explained in previous chapters. The term R_{lk} in equation III is the reserves part of the banking sector which are determined using withdrawal probabilities. This form, as we shall see later is the most basic model and is explained in detail since if the foundations are clear; the rest of the theory would be smoother. This model referred to is a model of a monetary economy employing money in the form of credit and deposits along with currency. The sum of deposits and currency therefore would be the total money supply in the economy as seen in equation II. Equation II closes the set of

production relations along with demand equations. It is our replacement for the quantity theory of money. As will be shown, the Walras' law does not hold in a monetary economy. It would be important to reinstate the fact that in a monetary economy, Walras law has no role. The way the economic relationships are depicted, it is clear that commodity markets exist, a market for banking services exists and also the markets for money per se exists. The model of this economy lacks an important explicitly determined market- the market for labour. Employment is determined in the system using the output system and commodity market conditions. It is assumed that all forthcoming labour is the only labour in the economy. Explicitly, labour demand and labour supply is not introduced. The model, even without such a depiction seems complete economically and in terms of specification. As we detail out the entire model, it becomes imperative to provide a list of parameters and variables: those which are always given in the model and those which are modeled- explicitly or implicitly. The model assumes a given set of technological coefficients implying a set of production equations and the factor input proportions at the beginning of every period. All the producers are assumed to know their requirements of capital and stocks at the beginning of the period and their engineer workers help them develop an understanding about the quantities of inputs. In short, the production technology and input-output relations are known and given. Economists and consultants like us guide the producers to determine the exact level of outputs at the beginning of the year. The banking system is also assumed to know the matrix of probability withdrawals expressed in the theory of interest rates above so that it may calculate its reserve requirements as and when required. The wealth proportions are known at the outset, which clearly state the quantity of currency and deposits of various maturities that each producer and labourers holds in his portfolio. This also implies that marginal propensities to consume and hence to save are given. The asset choices for parking the savings are also assumed to be exogenous to the system. These portfolio determining variables are given; in short it would be safe to say that the proportion of assets held in the portfolio by each agent is known. Each worker and producer starts in the system with a known and fixed quantum of

wealth which is also a non-zero quantity always. Additions to wealth through savings are determined using the model and the given portfolio decisions. The model determines real and monetary variables explicitly. In the process, it also helps us determine the national income, personal distribution of national income, transaction and income velocities of money, investment gap, level of employment and the growth rates on various monetary assets considered: here namely currency, equity and deposits (credit). To summarize, in the general form of the model that will soon be introduced, we can group variables in three distinct classes- the economic variables namely the prices, outputs, profits, wages and growth; secondly the parameters namely the individual wealth holding, the propensities to consume and hence, the asset-wise propensities to save; lastly, we would have a distinct breed of variables which would be policy variables, namely the amount of public expenditure, the public debt, deficit financing, CRR, OMO etc. which when tweaked often provide vital relationships of interest underlying the motivation of this thesis. Our aim of this synthesis is exploring the role of money in these policy variables and ascertaining the essential properties money and interest have in determining, affecting and impacting every other variable. With enough discussion dedicated to the nature of variables, it would merit some attention to pen-down the number of variables. This is a necessary step as it will be seen that the model can conveniently be categorized as a computable general equilibrium model. In CGE models, often the consistency of the model is shown through the equality of number of equations and variables. It would therefore not sound a waste of energy in doing this. The production-price sub-system that is employed consists of m basic equations and n non-basic equations. The n non-basic or consumption goods are consumed through n demand equations or the consumption system. The output system comprises of m basic equations. The closing equation involving the relation between money and prices provides closure to the production-price relationship. The output system is closed using the labour conservation equation. For the banking sector, there would be t interest rate equations in t interest rates depending upon the maturities of loans and deposits. Here, the index t would depend on what maturities do these loans and deposits

have. The profit growth relation determines is one of the most important equations for the monetary economy. These equations solve for $m+n$ prices and an equal number of outputs, rates of profits, growth and wages. Thus, the model of the monetary theory of value is a model in $2m+2n+t+3$ equations in as much number of unknowns. The monetary economy revolves around the price-production block, the banking sector block, the output-growth block and the consumption-saving block. General macro-economic equilibrium would be ideally a combination of equilibrium in all these sectors, needless to say, the equilibrium be simultaneous. The banking sector provides a logical starting point to the system[49]. We advance in our quest for exploring the monetary economy with the demand and the supply of loans. The demand for loans is the vertical summation of time-designated debts of the production system. The supply of deposits is the savings habit of capitalists and workers, also in various time designated deposits. A specially designed algorithm is used where in banks match the deposits to various loans and determine the lending options in terms of the harmonization of their lending matrix, deposits matrix and the profitability matrix. This allocation would be optimal in terms of balancing deposits and savings. Given that the pattern of loan financing by the banks is determined, the next step is to determine the reserve requirements using the withdrawal probabilities. With this optimal allocation of deposits and loans the bank sets up its operational equations equating the reserves, receipts and payments. These would take the form of equations III in 19 above. These equations equate the interest rates on loans, which the banks would receive, to the interest rates on the deposits that the banks need to pay. As a result, the interest rates in the system are determined. This is a theory of interest rates. Once the theory of interest rates determines the money rates of interest, the interest value of the debt can be known using the debt portion of capital for each industry. It is important to note that this is still an

[49] It would be immaterial if we were to choose any other point to start exploring the system. The results would just remain the same. It is worthy to note here that, given the dynamics of the entire economy, a starting point per se is not only immaterial but also irrelevant. This I say because of the fact that in a monetary economy of this stature, it would be impossible to place a finger on any sub-section of the economy and say with confidence that the economic operations start at this point. We are assuming that the banking sector is a reference point just because it becomes easier to explain the system this way. After all, "interest" is the ultimate variable of interest in a monetary economy.

unknown value debt, since prices are yet to be determined. We start exactly in determining so. An arbitrary rate of profits is chosen[50] and using this, prices and wage rates are determined: money prices and money wages are determined. Once the prices are determined in the economy, ideally we would move to determine consumption; more so whether consumption at the determined prices is viable or not. We would more often than not discover that at the prices just determined, none of the consumption equations balance. As a result, using the prices, we would now have to determine new demands that the consumer's pockets can back. Moving the supplies towards the demands, the production equations of the consumption goods industries need to be rescaled depending on the new demands. It would be seen that this would imply certain consumption goods industries increasing in size in terms of their absolute outputs and certain others would shrink in size. Those of the first types would be industries with excess demands; the other type would be the ones with excess supplies. Similarly, for the capital goods sector, equations of the form VI and VII would determine absolute outputs and hence, all of the system readies itself to go through a new round of iterations. This process would stop when equilibrium interest rates, equilibrium wages and prices would generate equilibrium incomes exactly sufficient to meet consumption and hence, savings requirements. As we begin iterating the system, new interest rates would be determined using the new loans and deposits. The trial value of rate of profits need not be used now and equation V will be used instead of the trial value. As the deposits and loans are matched again, it would be observed that the gap between the deposits and loans would reduce and interest rates would reflect the changes in the set up and moving marginally upwards as there would be a pressure on the deposits to make available more loans as the economy grows. In the price-production block, industries with excess demands in the previous iteration would exhibit an increase in prices and industries with excess supply would exhibit a reduction in their prices. At the same time, industries with excess demand would increase in size and those with excess

[50] Yet again, the system is insensitive to the choice of initial rate of profits. This choice is necessary since it must be remembered that Sraffa system in its pure form without numeraire is even indeterminate!

supply would contract. This would be determined from the output-growth and the consumption pattern in the economy. As there would be inflationary pressures in the economy due to rising interest rates and increased prices, the consumption spends would be increased supported by increases in the real wage rates. As a result, the addition to deposits compared to the previous iteration would be lower and the loan demand would be relatively higher. As this adjustments happen in the banking sector, in the production system, industries having excess supplies previously now shrink in size and industries with excess demands increase in size. As a result, there would be instances of excess demand industries getting transformed in to excess supply ones and the vice-versa. As a result, a whole set of iterations take place and determine the macro-economic equilibrium in this manner. This in itself is the summary of the monetary theory of value! The growth rate in this system is that rate which equates and determines a unique rate of profit across all the industries. As a result, it would be important to study the properties of this variable in the process of determination of equilibrium of the system. It would be seen that certain capital goods industries would be in excess supply and certain other in excess demand or deficient supply. As a result, the growth rate would aim to achieve co-ordination amongst all the industries to ensure that a. all industries enjoy a uniform rate of profits and b. all industries enjoy a unique rate of growth. Hence, as a result, industries with excess supply would witness flight of capital to those where there would be deficient supply. This notion confirms with the economic idea of capital finding its own way to profitable ventures; moving out from those where it is less profitable. This process would continue till a point where the rates of profit are equalized across industries and this flight of capital would stop. Similar factors determine the movement of economy from disequilibrium to equilibrium phases. Changes in production-price equations also have an impact on the equilibrium state of the economy. The debt component of this set is an input to the banking system as the demand for loans. Due to the changes dictated by the output-growth system, the nature of the technological coefficients undergoes changes and with a debt-equity ratio present, the loan demand also changes drastically. The banking system

attains its equilibrium not only when the demand for and supply of loans and deposits is equalized but also when the sum of technological coefficients valued by their respective prices equates the loan demand for individual time periods. To put this mathematically, the following two conditions must be met for equilibrium of the banking sector:

$$\sum_{t=0}^{n} Deposits_t = \sum_{t=0}^{n} Loans_t$$

$$\prod_{t=1}^{n}\left(\sum_{i=1}^{n}\sum_{j=1}^{n}\delta_t p_i S_{ij}\right) = Loans_t$$

With these conditions fully met, the banking sector would be in its equilibrium. Though this is defined as the equilibrium of the banking sector, it must be noted that this is not an equilibrium purely determined by the monetary factors alone. The equilibrium is characterized by the presence of the second condition which is a real-economy condition and as a process; the synthesis drops the difference between the real economic forces and the monetary economic forces and presents the picture of the economy as a whole and a non-dichotomized entity. Coming to the important variable, the prices and as explained, the prices try to achieve equilibrium in the real sector. Unlike the normal phenomena where the real sector is a given and economic prices have to be determined, in this model, prices determine the real sector and in the process are determined themselves. The only important factor is that the prices are not determining the real economy alone. In fact, no variable is solving the system all by its own! At the same time it would be crucial to add that as each variable teams up with certain other variables, the variable under observation exhibits key features that define the properties of the system as a whole. Here, as the prices determine (along with the growth-output system) and are determined by the real sector, adjustments happen through the empirical demand functions that are used in the model to determine the levels of consumption and the capital goods in the economy. This process further feeds into the growth-profit relation and determines the starting variable for the subsequent iteration: the rate of profit. As prices of certain goods increase, the prices of certain others would fall and these changes happen due to the output size

contractions or expansions are dictated by the price-output-growth patterns of the previous iterations. Needless to add, industries with excess demand would have shown lower prices and outputs in the previous iteration when they would have been in excess supplies and so on. Lastly, the rate of profit changes cause changes in to the wage rate since with only two factors of production, the wage-profit frontier is also defined in this economy. Therefore, as prices rise due to higher levels of output and higher interest rates, rate of profits rises and also the wage rate. As a result the incomes of the people rise and the demand for commodities and deposits also rise, causing an increase in demand for loans and a further increase in the outputs by expanding capital needs. In the whole process, the economy begins with lower values of GDP and NNP and these increases over iterations as the outputs and the prices change. At the same time, the banking sector achieves absolute equilibrium with the demand for loans being exactly equated to the deposits and no excess reserves existing with the banking system. The interest rates would now be the equilibrium interest rates consistent with the rates of profits, wage rates and the output system which would in turn be aligned with the demand and the consumption patterns which is fine tuned with the saving patterns and therefore with the banking system to complete the cycle. The economy remains stable in this phase unless acted upon by any external influences or radical changes in parameters which have been assumed to be constant in the entire process of equilibrium determination. The algorithm of progression from disequilibrium to equilibrium can be outlined as:

- Step 1: Start with trial value of rate of profits. Determine the unique allocation of loans to deposits and determine interest rates. The banking system helps determine this by completing the markets for deposits and loans.
- Step 2: Determine money prices and money wage rates using the trial values of rate of profit and calculated interest rates. It needs to be seen whether at these prices commodity markets for consumption goods clear or not. Evaluate the national income, use the know propensities to consume on each commodity and define consumption expenditures on

every commodity. Determine excess demands and/or excess supplies by ascertaining the exact demand quantities

- Step 3: Alter the equations by moving the supplies in the direction of demands and determine outputs and growth rates as in the case of currency money
- Step 4: Apply the multipliers to the production system in order to obtain a new set of equations.
- Step 5: Along with this, determine new savings channelized with new deposits, new loans and hence a new set of interest rates.
- Step 6: Determine the new rate of profit from the growth-profit relation and begin from step 1.

As we outline the theoretical process of exploring economic equilibrium in a capitalist monetary economy characterized as above, it is imperative to ask ourselves this question: Can we attain equilibrium in this system? The plain and simple answer to this rather complicated historical debate is NO! But it is not terrible. Not terrible because we can exactly identify the nature, causes and sources of this disequilibrium. Currency money as endogenous money to the economy also highlighted a similar property. The monetary disequilibrium can be easily corrected using the device of deficit financing of the sorts we had introduced in the chapter on currency money. It will soon be concluded that this happens to be unique property of the monetary economy.

As we try to explore the prominent question raised towards the end of the previous chapter, it would be prudent to analyze the system in a purely computational model.

16. We begin this analysis by introducing an indicative numerical example for an economic system that fits the properties of the theory described above. The sum of the loans is used to determine the optimal allocation of loans to deposits, which thus make up the banking system equations. The equations that we use are intended to explicitly describe an economy towards an understanding in our analysis. We would like to assume that the real economy would more or less behave in terms of its relations in a manner proposed by the theory, albeit the

scale of the system would be of course different. It should be noted that here, we are assuming the most general case of an economy; this would mean that the number of capital goods industries and the consumer goods industries are almost equal- we have two consumption goods industries and three capital industries. Let us revisit the workings of the full macro-economic monetary model as it graduates from disequilibrium to equilibrium. In this sense, consider an economy at time period *t*. At this juncture, the initial wealth endowments are given. The capitalist and the workers decide the level of deposits they intend to keep with the banking system and accordingly invest in deposits of varying maturities. These in our simple structure are primarily four- savings account deposits bearing no interest, period one, period two and period three deposits. These are determined by fixed percentage ratios in the model. The sum of these savings is less than unity for both capitalists and workers, indicating that both these economic agents also participate in the consumption activity in the economy. Along with deposits, these agents also invest in equity capital of the industries available in the economy. Therefore, we would have the following ratios: kw_0 implying proportion of workers' income in savings deposits, kw_1 implying proportion of workers' income in period one deposits, kw_2 implying proportion of workers' income in period two deposits, kw_3 implying proportion of workers' income in period three deposits and finally kwe implying workers' contribution to equity capital. Similarly, for the capitalists we would have kp_0 implying proportion of capitalists' income in savings deposits, kp_1 implying proportion of capitalists' income in period one deposits, kp_2 implying proportion of capitalists' income in period two deposits, kp_3 implying proportion of capitalists' income in period three deposits and finally kpe implying capitalists' contribution to equity capital. It is worthwhile to note the following conditions hold for the Pasinetti Paradox:

$$\sum_{i=0}^{3} kw_i + kwe = 1$$

$$\sum_{i=0}^{3} kp_i + kpe = 1$$

The rest of the ratios cw_4 and cw_5 for workers and cp_4 and cp_5 constitute α and β together implying workers and capitalists propensities to consume as below

$cw_4 + cw_5 = \alpha$

$cp_4 + cp_5 = \beta$

Alternatively, cw_4 can be rewritten as α_4 and so on. We shall use the later nomenclature to be consistent with the theory. The sum of $\sum_{i=0}^{3} kw_i + kwe$ and α would be unity and similarly, the sum of $\sum_{i=0}^{3} kp_i + kpe$ and β would be unity. In this regards, the equity and deposit structure can be determined with known initial endowments, Y_w and Y_p for workers and capitalists respectively. For example, the workers equity will be determined as $Y_w * kwe$ and shall appear in the production-price relations. The capitalists or the entrepreneurs in the economy require debt capital as well. The total capital stock $\left(\Psi_i p_i B_i + \sum_{i=1}^{n}\sum_{j=}^{n} S_{ij} p_j\right)$ is divided into debt and equity in various industries. Denoting equity proportion of the capital as ε and the debt proportion as δ we can rewrite the production-price equations as

$$\varepsilon_{11}(\psi_1 B_1 p_1 + S_{11} p_1 + S_{12} p_2 + ...S_{1n} p_n) r + (\delta_{11})(\psi_1 B_1 p_1 + S_{11} p_1 + S_{12} p_2 + ...S_{1n} p_n)(1 + i_1)$$
$$+ (\delta_{12})(\psi_1 B_1 p_1 + S_{11} p_1 + S_{12} p_2 + ...S_{1n} p_n)(1 + i_2)$$
$$+ (\delta_{1t})(\psi_1 B_1 p_1 + S_{11} p_1 + S_{12} p_2 + ...S_{1n} p_n)(1 + i_t) + A_{11} p_1 + A_{12} p_2 + ...A_{1n} p_n + L_1 w = B_1 p_1$$
$$.....$$
$$\varepsilon_{n1}(\psi_n B_n p_n + S_{n1} p_1 + S_{n2} p_2 + ...S_{nm} p_n) r + (\delta_{n1})(\psi_n B_n p_n + S_{n1} p_1 + S_{n2} p_2 + ...S_{nm} p_n)(1 + i_1)$$
$$+ (\delta_{n2})(\psi_n B_n p_n + S_{n1} p_1 + S_{n2} p_2 + ...S_{nm} p_n)(1 + i_2)$$
$$+ (\delta_{nt})(\psi_1 B_1 p_1 + S_{11} p_1 + S_{12} p_2 + ...S_{1n} p_n)(1 + i_t) + A_{n1} p_1 + A_{n2} p_2 + ...A_{nm} p_n + L_n w = B_1 p_1$$

Here, Ψ_i is the money-turnover ratio or in simple terms, Ψ_i is the ratio of money holdings to total turnover of the particular i^{th} industry. This capital as explained is financed in two parts: debt and capital, with ∂_t being the debt equity ratio and correspondingly, ε being the equity portion and ∂_t being the debt portion. This

implies that loans of maturity *t* are available to the producers. The following relations would hold

$$kpe + kwe = \sum_{n=1}^{m+n} \sum_{t=1} \varepsilon_{nt}$$

$$\sum_{t=1}^{t} \delta_{nt} = (1 - \varepsilon_{nt})$$

With these two restrictions on the capital structure, the debt-equity proportions would be determined. Consider the following example for one hypothetical industry from an economic system with three industries.

$Capital = (10p_1 + 20p_2 + 10p_3)$
$\varepsilon_{11} = 0.2; \delta_1 = 0.1; \delta_2 = 0.1; \delta_3 = 0.1$
therefore,
$equity = (2p_1 + 4p_2 + 2p_3)$
$Debt_1 = (1p_1 + 2p_2 + 1p_3)$
$Debt_2 = (1p_1 + 2p_2 + 1p_3)$
$Debt_3 = (1p_1 + 2p_2 + 1p_3)$

Similarly, we can determine the equity and debt in various industries and thereby generate the production-price relations. In this case, if the output of the first industry was 30, we would have the production-price equation for this industry as

$$(2p_1 + 4p_2 + 2p_3)r + (1p_1 + 2p_2 + 1p_3)(1 + i_1) + (1p_1 + 2p_2 + 1p_3)(1 + i_2) + (1p_1 + 2p_2 + 1p_3)(1 + i_3) + (2p_1 + 4p_2 + 2p_3) + 5w = 30p_1$$

In this example, the total period one debt is 4, period two debt is 4 and period three debt is 4 units of currency as well. Similarly, summing over the debts for all industries across the three periods, we would obtain the total loan demand in the economy. After the prices are determined, we can determine the *value* of equity and debt capital and correspondingly determine the debt-equity ratio. Each of these loans would be matched by the deposits in the banking system and thereby the interest rates would be determined. An increase in loan demand would push the rates up and vice-versa. In the banking system, the banks face the risk of withdrawals of their deposits such that they may not have any funds left for advancing loans. In this sense, the banks maintain reserves, linked to the withdrawal probabilities that they estimate at the beginning of each period.

Period	0	1	*l*
0	p_{00}	p_{10}	p_{l0}
1	p_{01}	p_{11}	p_{l1}
k	p_{0k}	p_{1k}	p_{lk}

With the above as the probability matrix, we can generate a system of expected reserves for the banking system.

Period	0	1	*l*
0	p_{00}	p_{10}	p_{l0}
1	$1-\left[(1-p_{00})(p_{01})\right]$	$1-\left[(1-p_{10})(p_{11})\right]$	$1-\left[(1-p_{l0})(p_{l1})\right]$
k	$1-\left[(1-p_{00})(1-p_{01})(p_{0k})\right]$	$1-\left[(1-p_{10})(1-p_{11})(p_{1k})\right]$	$1-\left[(1-p_{l0})(1-p_{l1})(p_{lk})\right]$

This reserve system is generalized for *l* period deposits and *k* period loans. In short, the reserve matrix looks like $R_{lk}=1-\prod\left(1-p_{l-1,k}\right)p_{lk}$. The theory of interest rates proposed here is an operational theory of loans and deposits wherein the interest rates are determined by the behavior of investors and the behavior of borrowers; behavior here is described in terms of withdrawal probabilities for deposits and technological coefficients for loans. Based on these conditions, we may now draw the production equations for the banking system, where the banks produce loans my means of loans- the deposits!

$$\sum_{l=k=0}^{b} R_{lk}+\sum_{k=1}^{b} D_{0k}+\sum_{t=1}^{b}\sum_{l=k=1}^{b} D_{lk}\left(1+i_t\right)^t = L_t^a i_t$$

These determine the interest rates in the economy, that then feedback into the production equations. However, in the production equations, we have *m*+*n* equations for *m* basic equations and *n* non-basic equations. So far, we have concerned ourselves with prices and interest. The other important variables are output and employment, only then we would have a complete monetary theory of prices, interest, employment and output. The output system determines the outputs that are necessary in order to replace the system so that the production activity continues, after allowing for consumption in the system. In order to allow the system to be replaced, there should be adequate growth in the system itself;

also the labour in the entire system cannot be reduced and since no population increases are assumed, the best that can happen is that the labour be conserved in the economy. In this dual problem, we can expect flight of capital from one industry to another; industries that are profitable would see accumulation of capital and the vice-versa. The process continues till all rates of profits are equal and there is no incentive for flight of capital. An important point here is when we talk of unequal rates of profits, it is the own rate of profit that we are referring our analysis to, as against the (definitional) equal rates of profits as expressed in the production-price equations above. For instance, in the example cited above,

$$(2p_1 + 4p_2 + 2p_3)r + (1p_1 + 2p_2 + 1p_3)(1 + i_1) + (1p_1 + 2p_2 + 1p_3)(1 + i_2) + (1p_1 + 2p_2 + 1p_3)(1 + i_3) + (2p_1 + 4p_2 + 2p_3) + 5w = 30p_1$$

we can determine the own rate of profit as {30-(2+4+2)-(1+2+1+1+2+1+1+2+1)} /(2+4+2)=1.25. It can be seen that when we solve the entire system, the uniform rate of profits shall prevail. In order to therefore determine the outputs, the growth rate and more so, the labour or the employment in the economy, we need a system of equations that dictates this. This is the output system of equations.

$$(S_{11}x_1 + S_{21}x_2 + ...S_{m1}x_m + S_{m1})(1 + g) + (A_{11}x_1 + A_{21}x_2 + ...A_{m1}x_m + A_{n1}) = B_1x_1$$
$$(S_{12}x_1 + S_{22}x_2 + ...S_{m2}x_m + S_{m2})(1 + g) + (A_{12}x_1 + A_{22}x_2 + ...A_{m2}x_m + A_{n2}) = B_2x_1$$
.....
$$(S_{1m}x_1 + S_{2m}x_2 + ...S_{mm}x_m + S_{mm})(1 + g) + (A_{1m}x_1 + A_{2m}x_2 + ...A_{mm}x_m + S_{m2}) = B_mx_1$$
$$L_1x_1 + L_2x_2 + ...L_mx_m = L_1 + L_2 + L_3$$

Therefore, we now *m+1* output equations in *m+1* unknowns- the *m* outputs and 1 growth rate. So far, we therefore have *2m+n+t+1* equations and *2m+n+t+3* unknowns- we fall short of 2 equations. The *t* equations are for t interest rates. However, in order to fill this gap, we must first concern ourselves whether the model is complete; we have determined outputs for capital industries, the outputs for consumption industries need to be determined. These will be done through the demand equations that solve for *n* outputs in *n* equations. These are Stone's linear expenditure systems

$$\alpha_i wL + \beta_j rS = B_n p_n$$

Thus, we now have *2m+2n+t+1* equations and *2m+2n+t+3* unknowns- still we are short of 2 equations. In order to solve this system completely, we require the closing equation for price system- an equation that most theories seek including the quantity theory- the relation between money and prices. We have discussed this equation before and would now present it here

$$\sum_{i=1}^{n}\sum_{j=1}^{m}\psi_i p_i B_i * (1+g) = M_s = Deposits + Currency + Equity$$

The last equation is also the most crucial equation in the entire scheme of things. This is the monetary growth-profit relation

$$r = \frac{\left((g * M_s) + \Delta Currency - (1-\beta)(Y_{Workers} - Su.Cons_{Workers}) - (1-\alpha)(Y_{Capitalists} - Su.Cons_{Capitalists})\right)}{(1-\beta) * Equity_{Workers} + (1-\alpha) * Equity_{Capitalists}}$$

We thus have a complete system with *2m+2n+t+3* unknowns in as many equations and the solution of this system shall exist! However, these solutions exist mathematically; in terms of economics, the solutions of a monetary economy do not exist until deficit financing is introduced as explained earlier. On attaining the equilibrium through deficit financing, new levels of income are determined- new savings are determined and using the growth rates from the system, the economy expands to new levels and a search for new equilibrium begins!
Assuming that we also have public goods in the scheme of things, we would have one output equation for the public good and one equation for the financing of the said public good- the public good commands no price! Thus, with that we would have two additional equations in tow variables- the quantum of public good and the tax rate. Thus, it would then be a case of *2m+2n+t+5* unknowns in as many equations.
Consider the example below that would enable us to understand the full working of the model. In this model, we would have currency and deposits simplicity.

Assume that we have the following initial matrices

$$S = \begin{vmatrix} 3 & 2 & 5 & 0 & 0 \\ 2 & 5 & 3 & 0 & 0 \\ 2 & 3 & 5 & 0 & 0 \\ 3 & 5 & 6 & 0 & 0 \\ 2 & 3 & 5 & 0 & 0 \end{vmatrix}$$

$$A = \begin{vmatrix} 2 & 5 & 3 & 0 & 0 \\ 5 & 7 & 5 & 0 & 0 \\ 2 & 5 & 3 & 0 & 0 \\ 3 & 2 & 5 & 0 & 0 \\ 2 & 5 & 7 & 0 & 0 \end{vmatrix}$$

$$B = \begin{vmatrix} 40 & 0 & 0 & 0 & 0 \\ 0 & 60 & 0 & 0 & 0 \\ 0 & 0 & 50 & 0 & 0 \\ 0 & 0 & 0 & 60 & 0 \\ 0 & 0 & 0 & 0 & 50 \end{vmatrix}$$

Here, *S, A,* and *B* are the stock, flows and output matrices respectively. In this example, we have assumed 3 basic good industries- that enter the production of every other industry- while 2 consumption goods industries are considered. Assume that the propensity of capitalists to consume, α , is 0.1and that of workers, β , is 0.8. Further, assume the following – capitalists hold 0.05 of incomes in currency, 0.05 of income in deposits of period 0, 0.1 of income in period 1 deposits, 0.1 of income in period 2 deposits and 0.2 of income in period 3 deposits. Similarly, for the workers, assume that workers hold 0.1 of incomes in currency, 0.25 of income in deposits of period 0, 0.25 of income in period 1 deposits, 0.2 of income in period 2 deposits and 0.1 of income in period 3 deposits. Further, assume that the capitalists hold 0.5 incomes in equity and workers hold 0.1 of their incomes in equity. Assuming initial income/ wealth endowments of 500 and 250 for capitalists and workers, we may calculate the respective holdings in money terms for equity, deposits and currency. We would

also assume the money turnover ratio – the ratio of money held by producers in their capital as a proportion of output – as the following:

$$k = \begin{vmatrix} 0.25 \\ 0.5 \\ 1 \\ 1.5 \\ 0.25 \end{vmatrix}$$

$$L = \begin{vmatrix} 5 \\ 5 \\ 10 \\ 10 \\ 10 \end{vmatrix}$$

We have therefore the equity and the deposit pattern in the economy. It is important that with this, the share of equity in total holdings can be given by ε, the deposit-equity ratio. Using this, we can ascertain δ, the debt portion as (1-ε). Assuming a three period debt and that debt are equally spread across all the three periods, we can estimate the capital structure in the individual industries. Using this information and the assumption set, we can now draw the production- price equations. In this case, the deposits of capitalists are 225 and that of workers are 200. The equity held by capitalists is 250 and by workers are 25. The currency held by capitalists in production is 10; therefore in this case the ε is equal to (275/710=) 0.4. Therefore, the δ in the economy would be 0.6, and when split across three periods, the debt portion in the capital turns out to be 0.20.

$$0.4\left\langle\left\{\begin{vmatrix}3&2&5&0&0\\2&5&3&0&0\\2&3&5&0&0\\3&5&6&0&0\\2&3&5&0&0\end{vmatrix}+\begin{vmatrix}0.25\\0.5\\1\\1.5\\0.25\end{vmatrix}\begin{Vmatrix}40&0&0&0&0\\0&60&0&0&0\\0&0&50&0&0\\0&0&0&60&0\\0&0&0&0&50\end{Vmatrix}\right\}\begin{pmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{pmatrix}(1+r)\right\rangle+$$

$$0.2\left\langle\left\{\begin{vmatrix}3&2&5&0&0\\2&5&3&0&0\\2&3&5&0&0\\3&5&6&0&0\\2&3&5&0&0\end{vmatrix}+\begin{vmatrix}0.25\\0.5\\1\\1.5\\0.25\end{vmatrix}\begin{Vmatrix}40&0&0&0&0\\0&60&0&0&0\\0&0&50&0&0\\0&0&0&60&0\\0&0&0&0&50\end{Vmatrix}\right\}\begin{pmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{pmatrix}(1+i_1)\right\rangle+$$

$$0.2\left\langle\left\{\begin{vmatrix}3&2&5&0&0\\2&5&3&0&0\\2&3&5&0&0\\3&5&6&0&0\\2&3&5&0&0\end{vmatrix}+\begin{vmatrix}0.25\\0.5\\1\\1.5\\0.25\end{vmatrix}\begin{Vmatrix}40&0&0&0&0\\0&60&0&0&0\\0&0&50&0&0\\0&0&0&60&0\\0&0&0&0&50\end{Vmatrix}\right\}\begin{pmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{pmatrix}(1+i_2)\right\rangle+$$

$$0.2\left\langle\left\{\begin{vmatrix}3&2&5&0&0\\2&5&3&0&0\\2&3&5&0&0\\3&5&6&0&0\\2&3&5&0&0\end{vmatrix}+\begin{vmatrix}0.25\\0.5\\1\\1.5\\0.25\end{vmatrix}\begin{Vmatrix}40&0&0&0&0\\0&60&0&0&0\\0&0&50&0&0\\0&0&0&60&0\\0&0&0&0&50\end{Vmatrix}\right\}\begin{pmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{pmatrix}(1+i_3)\right\rangle+$$

$$\begin{vmatrix}2&5&3&0&0\\5&7&5&0&0\\2&5&3&0&0\\3&2&5&0&0\\2&5&7&0&0\end{vmatrix}\begin{Vmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{Vmatrix}+w\begin{vmatrix}5\\5\\10\\10\\10\end{vmatrix}=\begin{vmatrix}40&0&0&0&0\\0&60&0&0&0\\0&0&50&0&0\\0&0&0&60&0\\0&0&0&0&50\end{vmatrix}\begin{Vmatrix}p_1\\p_2\\p_3\\p_4\\p_5\end{Vmatrix}$$

With this, the deposits in the economy are 435 and the loans are equal to 435 as well. We would need to match these as per the banking system rules. We have the banking system as under

Period	*Deposits*	*Loans*
0	97.5	
1	112.5	145
2	100	145
3	125	145

With this, we would have the following matching schedule:

$$D_{01} = 97.5; D_{11} = 47.5$$
$$D_{12} = 65; D_{22} = 80$$
$$D_{23} = 20; D_{33} = 125$$

The subscript "01" denotes zero period deposits used to finance one period loans and so on. Let us assume a banking probability matrix that assumes that immediate period deposits would have a higher withdrawal probability- on the vertical axis we have time periods 1, 2, and 3 while on the horizontal one we have deposit periods 0, 1, 2 and 3. Using such a probability matrix, we can create the reserve matrix using the formula above- $R_{lk} = 1 - \prod\left(1 - p_{l-1,k}\right)p_{lk}$

$$prob = \begin{vmatrix} .05 & .04 & .035 & .03 \\ .107 & .088 & .0736 & .06395 \\ .16951 & .1381 & .1152 & .1014 \end{vmatrix}$$

Using this reserve matrix, we can now estimate the reserves in the baking system for each period

$$R_1 = 6.775$$
$$R_2 = 11.608$$
$$R_3 = 14.979$$

Thus, we would now have the equations for the banking system as

$$6.775 + 97.5 + 47.5\left(1 + i_1\right) = 145\left(1 + i_1\right)$$
$$11.608 + 65\left(1 + i_1\right) + 80\left(1 + i_2\right)^2 = 145\left(1 + i_2\right)^2$$
$$14.979 + 20\left(1 + i_2\right)^2 + 125\left(1 + i_2\right)^3 = 145\left(1 + i_2\right)^3$$

The solution to this system would enable us to obtain the interest rates in the economy. These rates would be used in the production-price equations above. Using the propensities to consume for capitalists and workers, we can also create the demand equations for the consumption goods industries. We had assumed that the propensity of capitalists to consume, α , is 0.1and that of workers, β , is 0.8. Let us assume that α can be further broken down to reflect propensities for individual consumption goods such that α_4 is 0.05 and α_5 is 0.01; whereas we can assume β_4 is 0.4 and β_5 is 0.4. Based on these assumptions and the income assumptions, we can derive demand equations as under

$$0.05(rS) + 0.4(wL) = 60p_4$$
$$0.05(rS) + 0.4(wL) = 50p_4$$

Lastly, the output system can be developed using the relation

$$S'x(1+g) + A'x = Bx$$
$$L_1x_1 + L_2x_2 + L_3x_3 = L_1 + L_2 + L_3$$

All in all, we would arrive at the following initial equations for the system; the solutions for which are presented earlier:

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$

$$104.275 + 47.5(1+i_1) = 145(1+i_1)$$

$$11.608 + 65(1+i_1) + 80(1+i_2)^2 = 145(1+i_2)^2$$

$$14.979 + 20(1+i_2)^2 + 125(1+i_2)^3 = 145(1+i_2)^3$$

$$853 = B_4 p_4$$

$$848 = B_5 p_5$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

The above system has three capital goods industries, two consumption gods industries. It should be noted that production is carried out using capital in the form of equity and debt. Equity is subscribed equity from the workers and capitalists where their proportion of holdings in equities is given. As scaling happens in the production processes, production houses tap financial agents. The total capital requirement of the producers therefore is split in equity and debt. Debt, or loans are obtained from financial agencies, primarily, banks who provide these loans at a prescribed rate of interest. In this hypothetical example of the economy, we assume that there are loans of three maturities. Period one, period two and period three loans are available to the producers. The banks provide these loans from the deposits mobilized from the workers and capitalists who also invest in the banking system in form of deposits. Assuming the wealth of workers

to be 250 and that of capitalists to be 500[51] and various wealth holding proportions- there would be four wealth holding proportions each for capitalists and workers- we would obtain the required period 0, period 1, period 2 and period 3 deposits in the system. It is necessary to provide for time deposits and demand deposits in the system. Period 0 deposits are demand deposits and banks do not have to pay any interest on these. However, banks use them as well in creating loans. Depending on a fixed withdrawal probability matrix, the reserve requirements are determined. These are not statutory reserves. These reserves are operational reserves that the banks decide to maintain for their solvencies. However, since these reserves depend on the withdrawal probabilities, these are expected reserves and would not be able to cover the bank in case of run on the bank deposits. However, such conditions may also imply a revision in the probability matrix.

Table V-A: Withdrawal Probability Matrix

Period	0	1	2	3
1	0.05	0.04	0.035	0.03
2	0.107	0.088	0.0736	0.06395
3	0.16951	0.1381	0.1152	0.1014

The above table is the assumed withdrawal probability matrix. It is precisely known to the bank, say, that the probability of period 1 deposits being withdrawn in the 0^{th} period is 0.05. Accordingly, the banks may need to keep only 5% of the deposits and may use 95% in creating loans. The 5% that the banks decide to keep with it, idle and not earning, forms the part of reserves. For period 1 deposit being withdrawn in the first period, the reserves are (1-0.05)*).04=0.038. After periodic matching of deposits to loans, the banking system equations are obtained. These equations solve for three interest rates. Since we have shown that the conditions necessary to solve this system are met in terms of its mathematical determinacy, we would proceed to determine the solutions of this economy in detail. The temporal nature of the analysis must be described here. It should be noted that the

[51] It would not be absolutely wrong to prefix these numbers with a currency unit, either Rs. or $. In this theory, we are dealing only with absolute quantities and relative measures are not objects of desire in a pure theory of money.

economy depicted above starts its operations on a Monday, say, and ends on either Monday evening or Friday evening. The point being the analysis is intra-temporal and not inter-temporal at the moment- it refers to the current period only. The current period is defined as the period in which economy begins its operations and then tries to find equilibrium for that period. At the end of the iterative process expressed in the algorithms mentioned above, it becomes of interest to understand the final picture of the economy at equilibrium. The following table summarizes the results of the system just mentioned above.

Table V-B: Results of deposit money economy- interest rates

i1	i2	i3	Loans	Deposits
5.58%	9.38%	17.12%	475.93	475.93

The periodic matching of loans and deposits has been attained in this system. As described, the banking system is seen to achieve its equilibrium through matching of loans and deposits and accordingly the interest rates are determined. In normal conditions the probability matrix is well-behaved and convex. This means that under favorable economic conditions, people would behave rationally and this rationality produces a term structure of interest rates which is upward sloping. The interest rate structure is therefore not dependent only on demand and supply conditions of loans and deposits but also on the frequency and demand of own deposits. This theory of interest rates incorporates rightly the true nature of interest- its durability. It accords money its biggest property of *not being money*. Interest cannot be earned on money- else every one of us would have an ever swelling wallet. Interest is not earned on money- interest is paid for the characteristic of money of not being money. Using the input interest rates and the rate of profits determined using the growth profit relationships, the price equations solve for prices and wage rates. The following is results of price solutions.

Table V-C: Results of deposit money economy- Prices

R	g	P1	P2	P3	P4	P5	w
4.69	1.74	15.27	11.53	16.46	15.79	17.34	39.35

The outputs in this system are determined in the process of determining the general equilibrium and necessarily are a part of the general equilibrium itself.

Table V-D: Results of deposit money economy- Outputs

B1	B2	B3	B4	B5
30.95	50.14	59.76	48.45	43.54

As the economy progresses from the initial to initial period stability condition[52], it in itself undergoes a lot of changes in terms of its technological coefficients and hence, in terms of its income, spending and consumption patterns. It would also be important to describe and articulate the "*tussle"* that the economy undergoes as it reaches its initial period stability condition.

At this stage, we would pause and also evaluate some more variables of *economic* interest: the net national product of the economy, the income and the transactions velocity of money, the Harrod-Domar rate of growth depending on the capital-output ratio, the important ratios of capital-labour mix, real wages in terms of consumption goods prices et al.

The net national incomes in this system can be determined, as should be the case, in terms of market prices and factor costs.

$$NNP_{mp} = \sum p_i B_i - \sum p_i A_i$$

$$NNP_{fc} = \alpha_i \left(\psi_i p_i B_i + \sum S_{ij} p_j \right) r + \left(1 - \alpha_i^t \right) \left(\psi_i p_i B_i + \sum S_{ij} p_j \right) i_i^t + w \sum L_i$$

The NNP at market prices at the initial period stability conditions is 2784.865 in terms of the unit of account (for us, it would be Rupees). The NNP at factor costs is 2911.101. Notice the following

- The difference between NNP at market prices and NNP at factor costs arises in this model as well. This is the disequilibrium gap. This difference is 126.23

[52] I am not calling this 'initial period stability condition' as equilibrium of the system. The reason will be evident shortly. But at this juncture, it would not be deemed to be incorrect if the reader intends to replace the phrase with 'equilibrium'. I will still stick to the phrase!

- The difference between labour supply, 40 and labour actually employed, 36.7853 weighted by the current wage rate of 39.2523 is also 126.25
- Finally, the savings and investments also exhibit a difference of 126.33 (Check!)

The total money supply at the stable condition is Rs. 525[53]. Therefore, the transactions velocity defined as NNP at market prices divided by money supply is 5.35 and NNP factor costs divided by money supply, 5.43 is the income velocity in the economy. The total capital in this economy is, being measurable, is 750 and hence the capital-output ratio is given by 3.74. Given this, we now can also determine the debt equity ratio of the system and along with a fixed money turnover ratio; it can also help us in determining the monetary properties of this system. The debt-equity ratio in the economy measures the amount of circulating debt and hence, the credit money in the system. The ratio of credit money to total capital gives the gross leverage ratio and the ratio debt-equity ratio therefore in this system is the usual leverage ratio. The debt equity for this economy is 1.7. The equity portion is 0.36 and the debt portion needless to say is 0.64!

As we now understand that the economy is able to reach some sort of initial period stability condition, it would be prudent to explore how the economy attains this stability condition. It should be noted however, that this is not the final equilibrium for the period under consideration: an identity in terms of equality of NNP factor costs and NNP market prices is disturbed or more to say, is ridiculously lost! As a consequence, we still have not attained equilibrium. However, all the markets have cleared and it can be understood from the following. The following tables articulate the phases of the economy at various iterations in order to attain the stated stability condition. At the final iteration, the

[53] Yet again, we are at the crux of the monetary theory. The NNP under factor costs and under market prices do not equate automatically. There is something missing. We would have included that "missing" element at the outset itself. But remember, when we introduced the model as well, we said that the model was correctly specified in terms of equality of number of equations and variables. There was no scope for something to be missing. Yet it happens so. Therefore, this is not a mistake of overlooking something and hence we are presenting it as a case in monetary value theory.

equations of the economy change and so do the solutions. What do not change are the physical properties of the system!

Table V-E: Clearing of commodity markets

Iteration	P1	P2	P3	P4	P5
1	9.22	7.23	12.55	10.79	13.52
2	8.22	6.34	10.18	9.12	10.88
5	11.10	8.45	12.85	11.89	13.63
10	13.16	9.98	14.89	13.93	15.77
20	14.07	10.68	15.84	14.86	16.75
40	14.14	10.73	15.91	14.94	16.84
50	14.14	10.72	15.91	14.93	16.83

As can be seen from the table above, the economy moves along a steady growth path and there are at times cyclical turns in the prices and wages and ultimately it reaches more or less its long term equilibrium positions. It should be noted that since the prices are determined in this system, the commodity markets have cleared and no commodities have either excess demand or excess supplies at the 70^{th} iteration. We can also observe the important three variables and their trajectory- the rate of profits, wages and growth

Table V-F: Iteration-wise rate of profits, growth and wage

Iteration	w	R	g
1	51.39	1.68	1.32
2	35.07	1.98	1.33
5	37.77	3.02	1.45
10	41.22	3.65	1.52
20	43.08	3.88	1.55
40	43.30	3.89	1.55
50	43.30	3.89	1.55

It should be noted that wages increase in this economy. There is no case of a wage rate having only uni-directional flow. At times it increases and at times it falls. It is now important to understand as to why the economy stops at the 50^{th} iteration. It is so because the economy stops its search operations for optimal prices and

optimality of other variables till a point where markets clear! The money and the economic conditions should hold in such manners that at those levels, the producers and consumers are ultimately in equilibrium. The incomes of the workers should be able to cover the supply of goods at a price the exchange relations demand dependent upon the interest, money supplies and a host of other factors!

Table V-G: Iteration-wise interest, loan-deposits and employment

Iteration	i1	i2	i3	Deposits	Loans	Employment
1	6.95%	11.72%	23.7%	435	435	43.05
2	5%	6.27%	6.45%	467	305	42.97
5	5%	6.38%	6.56%	465	318	40.63
10	5.2%	7.94%	10.38%	472	425	39.29
20	5.55%	9.25%	16.12%	475	471	38.93
40	5.58%	9.39%	17.12%	475.93	475.93	38.93
50	5.58%	9.39%	17.12%	475.93	475.93	38.93

Ultimately, the banking sector, the production sector and the consumption goods industries attain simultaneous equilibria, however, it should be remembered that this is not the ultimate general macro-economic equilibrium; an identity is lost in the process!

As the economy progresses from its initial stage to this stability stage, the outputs undergo cyclical fluctuations amongst themselves. It should be noted that the commodity markets clear, the consumption and savings are balanced and the banking system has cleared after a series of 50 iterations. We now to set to simulate the system through changes in various parameters of the system. This we do to investigate the three classical doctrines in monetary economics, real economics and finance. These relate to the relevance of "Neutrality of money", "Kaldor- Passinetti paradox" and lastly the "Modigliani-Miller irrelevance theorem" to the framework of this model and hence to the working of an actual monetary economy. Lastly, we aim to explore the impact of changes in technology coefficients on the economy and its characteristics.

Changes in money turnover ratios: As a first step, we aim to determine the impacts of changes in money turnover ratios on the various macro-economic variables of the system. The money turnover ratio is the proportion of sales/turnover to money balances held by the

industrialists in their daily production processes. These also determine the current account deposits in the banking system, which along with current accounts of households determine zero period deposits. These zero period deposits are necessary to determine the allocation of loans along with deposits of other maturities. In effect, changes in money turnover ratios would have impact on the entire economy which can be observed through changes in a.) The real economy through the price equations and b.) The monetary economy through the deposit-loan system. The following table illustrates the impact of changes in money turnover ratio, which we call it as "*k*", on various economic variables. The equilibrium pictures of the economy are only sketched here. The "*k*" represented here are same as the Ψ's explained in the basic model of monetary economy

Table V-H: Impact of changes in money-turnover ratio on prices, wage and profit rates

Parameter of Change	Impact compared to AS-IS case	P1	P2	P3	P4	P5	w	r	Real Wage (W/P4)	Real Wage (W/P5)	Diseq. Gap
k1=0.25 k2=0.5 k3=1 k4=1.5 k5=0.25	*As Is*	14.14	10.72	15.91	14.93	16.83	43.30	3.89	2.90	2.57	126.23
k1=0.5 k2=1 k3=1.5 k4=2 k5=0.5	*All k rise simultaneously*	14.28	10.88	16.05	15.06	16.86	42.16	4.09	2.8	2.5	144.06
k1=0.15 k2=0.25 k3=0.5 k4=1 k5=0.15	*All k fall simultaneously*	14.07	10.64	15.74	14.77	16.84	44.10	3.73	2.99	2.62	111.63
k1=0.25 k2=0.5 k3=1 k4=2 k5=0.5	*Only k in consumption goods industries rise*	14.35	10.87	16.03	15.31	17.09	42.79	4.08	2.79	2.5	146.86
k1=0.5 k2=1 k3=1.5 k4=1.5 k5=0.25	*Only k in capital goods industries rise*	14.08	10.74	15.93	14.71	16.62	42.67	3.91	2.9	2.57	126.26

It can be observed from the above table that all the money turnover ratios rise, all the prices in the economy rise with a corresponding rise in the rate of profits. However, a look at the column of real wage rates exhibits that the real wages in terms of prices of either commodity falls. Inflationary pressures on the economy are experienced all round in terms of absolute magnitude but in terms of real wage, the economy may not look at a better level. An even worse case scenario is observed when all the capitalists decide to hold lesser

current account deposits and all of them reduce their money turnover ratios. In this case, adverse deflationary pressures cause the economy to get caught in the wage-price spiral and the real wages fall considerably. The only case where an improvement in the standard of living of the labourers (since only labourers receive wages) is seen to improve is when the capitalists increase their current holdings in the capital goods industries. Thus, we can conclude that if the capitalists increase their money turnover ratios, the rate of profits reduces (or remains constant), wages increase (*here*, marginally) and real wages increase with a deflationary impact on absolute prices. Changes in the money turnover ratios impact the monetary sector as well though marginally. We present the monetary side of the economy in the following table.

Table V-I*:* Impact of changes in money turnover ratios on interest rates

Parameter of Change	**Impact compared to AS-IS case**	**i1**	**i2**	**i3**
k1=0.25 **k2=0.5** **k3=1** **k4=1.5** **k5=0.25**	*As Is*	5.58%	9.39%	17.12%
k1=0.5 **k2=1** **k3=1.5** **k4=2** **k5=0.5**	*All k rise simultaneously*	5.04%	8.46%	14.84%
k1=0.15 **k2=0.25** **k3=0.5** **k4=1** **k5=0.15**	*All k fall simultaneously*	6.17%	10.40%	19.81%
k1=0.25 **k2=0.5** **k3=1** **k4=2** **k5=0.5**	*Only k in consumption goods industries rise*	5.34%	8.99%	16.08%
k1=0.5 **k2=1** **k3=1.5** **k4=1.5** **k5=0.25**	*Only k in capital goods industries rise*	5.23%	8.80%	15.65%

Changes in money turnover ratios impact the monetary side of the economy as well. We will explain one case which comes out as a better depiction of the economy and others can be inferred from the table. Consider the third block in the above table. If all the money turnover ratios fall simultaneously, there is a pressure on the deposits to match the loans required by capitalists. This is due to the fact that reduction in money turnover ratios necessarily implies that the current deposits of capitalists would decrease causing the overall deposit matrix to

reduce in size and with this reduction, the deposits reduce. This causes lesser disbursement of loans and at higher interest rates. At the same time, since increases in interest cost push up the outputs of the industries as it is evident from the values of outputs not presented here. With increased interest cost, the profits reduce which is seen from the table of prices at 3.73 compared to the base figure of 3.89. This causes further pressure on the capitalists to sell a higher output with increased costs and lower profits. Not only this, an overall reduction in money demand or money-turnover ratios causes interest cost to rise as seen, and hence the labour is preferred as a better option in production activity. The absolute wage rate rises in this case. With expenses rising, the only option the capitalists have to sell output is that they have to adopt an overall reduction in prices which is what exactly happens and in equilibrium, the interest rates are higher, the prices of commodities, wages and profit rates are lower thereby reducing the sizes of GDP and NNP. Thus, it may be concluded that changes in money turnover ratio influence the equilibrium positions of the economy considerably by impacting the real and the monetary sectors. With all these effects, *money cannot be neutral.*

Changes in propensities to consume: Propensity to consume determines two important aspects in any economy- the consumption behavior and the investment activity through the savings behavior. In our economy, workers and capitalists both can consume and both can save. The workers save in the form of deposits and any changes to MPC affects these deposits inversely and hence also interest rates and hence prices and profits. Thus, changes in MPC make it convenient to study changes in the entire economy in a way. The intention of including this simulation in the study is to investigate the existence of Kaldor-Pasinetti paradox in a monetary economy. Starting with a similar reasoning as above, we present the picture of the economy at its final equilibrium under different assumptions for MPC of both capitalists and workers. Here, "*a*" is MPC of capitalists and "*b*" is MPC of workers.

Table V-J*:* Impact of changes in MPC on prices, wage and profit rates

Parameter of Change	**Impact compared to AS-IS case**	**P1**	**P2**	**P3**	**P4**	**P5**	**w**	**r**	**Diseq. Gap**
b4=0.4 b5=0.4	As Is	5.21	5.75	18.84	12.59	2.32	19.81	0.97	126.23
a4=0.1 a5=0.1 b4=0.4 b5=0.4	Capitalists and Workers both consume	5.56	5.98	18.69	13.23	2.38	19.16	1.33	124.71
a4=0.15 a5=0.05 b4=0.5 b5=0.3	Capitalists and Workers both consume, but MPC of commodity 4 rises and MPC of commodity 5 falls	4.77	5.3	17.6	11.59	2.15	18.64	0.88	132.11
a4=0.05 a5=0.15 b4=0.3 b5=0.5	Capitalists and Workers both consume, but MPC of commodity 4 falls and MPC of commodity 5 rises	6.43	6.74	19.8	15.06	2.63	19.59	1.79	117.67
a4=0.2 a5=0.2, b4=0.45 b5=0.45	Capitalists and Workers both consume, but MPC of commodity 4 and 5 both rise	7.27	7.26	17.97	16.61	2.69	15.86	3.1	118.37
a4=0.4 a5=0.4 b4=0.5 b5=0.2	Capitalists MPC is greater than workers' MPC: Violation of Pasinetti-Kaldor condition	12.53	14.53	11.50	35.65	3.95	**-3.42**	**12.80**	**NA**

Table V-K*:* Impact of changes in MPC on interest rates

Parameter of Change	Impact compared to AS-IS case	i1	i2	i3	B4	B5	GDP	NNP
b4=0.4 b5=0.4	As Is	5	5.2	5.75	44.13	239.67	2621	1648
a4=0.1 a5=0.1 b4=0.4 b5=0.4	Capitalists and Workers both consume	5	5.2	5.75	43.36	241.79	2674	1690
a4=0.15 a5=0.05 b4=0.5 b5=0.3	Capitalists and Workers both consume, but MPC of commodity 4 rises and MPC of commodity 5 falls	5	5.2	5.75	59.6	188.37	2505	1543
a4=0.05 a5=0.15 b4=0.3 b5=0.5	Capitalists and Workers both consume, but MPC of commodity 4 falls and MPC of commodity 5 rises	5	5.2	5.75	28.94	288.42	2843	1834
a4=0.2 a5=0.2, b4=0.45 b5=0.45	Capitalists and Workers both consume, but MPC of commodity 4 and 5 both rise	5	5.2	5.75	39.81	246.2	2938	1898

Proceeding similarly as in case of money turnover ratios, we can present our analysis on a similar line of thought. A reduction in the MPC of any commodity causes a reduction in its demand and as such, the producers would have three options in this case. The commodity for which the MPC has declined may be produced in lesser quantities, its price may be reduced or a combination of both may be employed. As we can see in case 3 above, there is a decline in MPC of commodity 5 but that of commodity 4 rises. A decline in demand for commodity as commodity 5 which contributed 22% to the GDP in terms of its value causes far-reaching effects on the economy. The output of commodity 5 reduces in size as a result of reduction in its MPC and the reverse is true for commodity 4. At the same time, the prices of commodity 5 decline marginally and that of commodity 4 rise due to demand pressures. This causes the demand for capital as well and any positive changes in MPC would cause demand for capital and hence all other prices also rise. This can be seen clearly from the observation that when MPC of both commodities rise, the prices of all 5

commodities rise as well. However, the changes in MPC are so minuscule for the entire economy that the interest rates do not reflect them very well. However, when MPC rises, interest rates also rise and the converse is also true. This is due to the reduction in deposits that is caused due to reduction in deposits and since MPC is rising, there is demand for new goods and hence more loans are required. Hence, on one hand, there is a fall in deposits and on the other, the loans are increasing. This causes the interest rates to rise further. We would pause to revisit the famous Kaldor- Pasinetti paradox in the context of the model built. The model fails to produce equilibrium if the propensities to consume of capitalists exceed that of the workers. This is more so because it is the saving behavior of the capitalists and also the workers that influences the equilibrium path in the economy. This fact is validated in the last row of the above tables by the reason that when MPC of both, the capitalists and the workers rise, the economy coefficients undergo a significant change. The Kaldor-Pasinetti paradox is thus a reinstatement of the fact that workers should save either equally or more else the capitalists would appropriate all the profits leaving less for workers. It still remains a paradox since if all capitalists keep consuming, still their profits keep rising! As a result, all that capitalists need to do is only increase their consumption and appropriate all profits in the economy. This will keep happening till wages can go negative as well. *This validates that the Kaldor- Pasinetti paradox holds good in a monetary economy.*

Changes in debt-equity ratio: The debt-equity proportions in the economy are decided by the income holding parameters or the wealth distribution coefficients. These coefficients are constant and held to be that way. We would now provide a picture of the economy if these coefficients undergo a change and hence produce a change in the debt-equity proportions. The debt-equity ratio for the economy is determined as the ratio of industrial loans to industrial equity. Industrial equity is arrived at using the parameter of capitalists' proportion of wealth held in the form of equity. This as a percent of total capital base is the equity portion in the economy and 1 minus this proportion is the debt of the economy. This is what we refer to by the debt-equity ratio. The following tables summarize the simulated results under varying debt-equity proportions.

Table V-L*:* Impact of changes in debt-equity ratio on prices, wage and profit rates

Debt-equity ratio	P1	P2	P3	P4	P5	w	r	g
0.31	5.21	5.75	18.84	12.59	2.32	19.81	0.97	0.67
0.43	5.21	5.75	18.84	12.59	2.32	19.81	0.71	0.67
0.18	5.21	5.75	18.84	12.59	2.32	19.81	1.59	0.67
0.3	5.21	5.75	18.84	12.59	2.32	19.81	0.95	0.68
0.43	5.21	5.75	18.84	12.59	2.32	19.81	0.71	0.66
0.23	5.39	5.94	19.46	13.03	2.4	20.45	1.21	0.7

Table V-M*:* Impact of changes in debt-equity ratio on interest rates

Debt-equity ratio	i1	i2	i3	B4	B5	GDP	NNP
0.31	5	5.2	5.75	44.13	239.67	2621	1648
0.43	5	5.2	5.97	44.13	239.67	2621	1648
0.18	5	5.2	5.69	44.13	239.67	2621	1648
0.3	5	5.69	8.15	44.13	239.67	2621	1648
0.43	5	5.4	7.5	44.13	239.67	2621	1648
0.23	5	5.8	9.22	43.41	237.28	2641	1666

As the equity proportion declines, taking the case presented in the third row as our demonstration sample simulation, we see that the immediate impact is seen on the rate of profits. This variable increases compared to its base value of 0.97. This happens due to the fact that now there is less of capital available in form of equity and more loan capital is to be sought. As a constraint on these owned funds, the cost of these funds increases and hence the profit rates rises. Similarly, as a consequence, the demand for owed funds increases and hence, the loans increase. Thus, this causes a pressure on the deposits and causes the interest rates in turn to rise. However, these changes in the debt-equity ratio do not cause any changes in the values of real macro-economic variables like money prices, money wage rates, outputs and GDP and NNP coefficients. This happens due to the fact that as equity rises, there is a proportionate fall in debt and the converse is also true. *This is the validation of the Miller-Modigliani theorem or the famous leverage irrelevance theorem.* Having explored all of this, it should be also noted that all these simulations are

conducted on an economy which is primarily out of equilibrium. We need to close the gap before we can claim that an equilibrium is finally attained. The following points handle this case. At the current point, it should suffice to know that even of the economy is out of proportions, all other properties of a monetary economy hold good with this economy. We are an inch away from developing the final monetary theory of value. It is now important to handle the relationship between equilibrium and the initial period stability condition described in the previous section. At equilibrium, not only do markets clear but all equations are met; *identities* included. In fact, the question of not meeting an identity does not arise: identities are always true and a theory that dissatisfies this fact is not a theory in any sense; it is a fraud! Not even an intellectual fraud! This is exactly the nature of disequilibrium in this system. Notice that the NNP at factor cost is 2911.10 and NNP at market prices is 2784. The approximate gap between these two values is 126.32; this gap in itself should not be required to be measured if the theory were complete and correct. We say that the theory is correct and with regards to its completeness, it is complete with respect to all the agents being assigned their individual roles and all markets clearing in due sense. But still we see a gap: let us call this gap as the disequilibrium gap. This gap is a measure of the extent of an identity distortion. This may sound funny but it is logical if we read it along with the next point. But for now, it should suffice to say that this is a disequilibrium gap. More importantly, the gap between NNP factor costs and NNP market prices can be tracked down in our model. The value of this gap is exactly equal to the value of the difference between savings and investments[54]. Also, this gap is also equal to a unique variable in the economy: the gap between labour shown to be employed and labour actually employed in the economy. We would take each of these one by one[55].

a. The relevance of difference between NNP at factor costs and market prices being exactly equal to the gap between savings and investments is

[54] In this economy, investments are measured as $\sum_{i=1}^{m+n}(B_i - A_i)p_i$.

[55] We would like to add here that the explanations provided are mere conjectures at this point in time. The object of this thesis is merely to explore the monetary theory. In the process, if we have found disequilibrium, we would like to keep the theory of monetary disequilibrium away from this work. We are not however denying provision of our explanations to the described phenomena however. But it should be again noted that these can at best be only conjectures requiring theoretical analysis in detail. It is this analysis that we intend to keep away.

astonishing. Nowhere in the theory or its articulation in terms of mathematical equations have we introduced this condition; there is no such condition that we know. The gap may only be seen because of the gap in the employment, explained in b below. It can only be said that the savings are greater than investments. As a result, a remote possibility of a shortfall in savings causing this gap to occur can be the case. But still it does not provide a necessary explanation towards the breakdown of an identity of such standing.

b. The second cause of the monetary disequilibrium is even dangerous than the previous one; and even funnier. The economy is seen to behave like a bad consultant; it charges for a higher manpower but secretly a lesser manpower is actually employed. In the nation's wage bill and wage accounts, the amount of labour shown and billed is 40, but the production equations show only 36.78. It could only be concluded that the economy is able to produce its desired outputs using 36.78, but the employed 36.78 are selfish and they charge for 40, though all 40 are not employed at all. Note that this is similar to Keynesian under-employment. However, a minor difference exists. In the Keynesian case, only 38.93 were employed and exactly 38.93 were billed in the national accounts. Here, however, 38.93 are employed but 40 are billed. That is the primary difference from the Keynesian case. The value of this gap (40-36.78) in terms of wages is exactly equal to the identity distorting disequilibrium gap. This gap will always exist since more demand would be required to make the 36.78 workers believe that things are beyond their control and they need more hands actually. It may be the case that all this while, there may be contracts between 36.78 employed and remaining 3.22 unemployed towards revenue sharing, since all 40 will consume and save. Therefore, the physically unemployed would also need money for survival. As a result, there would always be some labour in the economy that would refrain from work and may be happy to receive .25[56] of the wages they

[56] These proportions may have been decided between 36 working and 4 non-working

would have received if they were in physical employment. Also, who are these 3.22 and 36.78 would be determined by the purely the preferences and substitutability relations that the individuals would have between money, leisure and work. It also may happen that the savings desire of a person is fulfilled and he needs no more money to save; his future expectations vanish. He would no longer require full wages. But those in employment may not like him going off the payroll. They would maintain his name, have him sit at home and provide him an agreed money sum. The question is how to create more demand to stimulate the 36 to make the 4 work! However, if more demand is created, it may have inflationary pressures and hence, may reduce employment even further. Thus, a nature of demand that creates money with a multiplier macro effect is required. Money creation is necessary since the purchasing power of money should not be affected. The nature of this "gap" does not improve when the conditions are reversed. Under specific cases, we do observe a "gap" reversal where the employed resources i.e. labour happens to exceed the actual available employment levels. We would examine the causes and the nature of this gap therefore in a short while.

Given the nature of this monetary disequilibrium, it can be safely concluded that in a monetary economy, there are limits to the extent of monetary activity. Money and its existence cannot clear everything with ease. In this model of the monetary economy, it should be noted that nothing has been attributed to rigid wages, liquidity traps or any kind of frictions that normally explain the existence of a monetary disequilibrium. It is far beyond true that in a theoretical monetary economy, disequilibrium is the only equilibrium. It is the quest for all these years to exactly show this disequilibrium. In the process, we have come almost close to answering this question. We have shown the nature of monetary disequilibrium without assuming any real balances, money-in-the-utility functions, or any other classical postulates. It is often said that construction of a theory is often more difficult than its criticism and it is in this note that we do not intend to keep this item open as well. It is important to answer another important question about the

disequilibrium in a monetary economy. Money is fully introduced on this system in form of currency and credit. It could well be introduced in any other form as well, but the result is going to be same. The new problem at hand now is this: in a monetary economy, monetary activities have their own limits! But though money played out its role in the economy, the fiscal activity can always help maintain the balance in the monetary economy. Hence it can be rightly said that all this while, we were operating in a government less economy and going forward, we are going to drop the assumption of a *laissez-faire* state. It is therefore evident that government has an important role in a monetary economy. As a result, it would be imperative to rephrase our result: In a laissez-faire monetary economy, disequilibrium is always seen. More importantly, in a laissez-faire economy, terms like disequilibrium and equilibrium make little or no sense at all: an identity is getting lost in such a system. Hence, at this moment, it would not be wrong to state that a non-laissez-faire economy is the object of consideration. We necessarily provide for the role of government. The government, once it sees any discrepancy in the functioning of the economy would normally aim to remove and clear the economy of this discrepancy. It can do so in a numerous ways: if its objective were to tackle investments, it would bring out taxation changes, if it were related to growth, it would resort to policy planning and allocation of budgetary sanctions; in this and the most important case of tackling labour market or employment, it normally resorts to deficit financing. It should be noted that there would be ways to clear this (Keynesian) gap and in the following chapter, we would present a few of them through a mixture of policy interactions. However, the following conclusions apply from this chapter:

a. A simultaneous increase in all money holdings leads to, among all other results, an overall increase in the disequilibrium gap
b. Reduction in propensity to consume increases the disequilibrium gap and the vice-versa. However, a mere reallocation of spending across the consumption basket has negligible impact on the gap

With this in the perspective, we set out on the last leg for this work- the elimination of this gap

Chapter VI: Fiscal & Monetary Policy

17. As we set out to now explore more properties of a monetary economy and identify methods to eliminate the disequilibrium gap of the previous chapters, it would be important to note the various agents in this economy. As we had started this modeling exercise, we had assumed capitalists and workers. The capitalists were in charge of the banking system and also the production system was partly held by them; the remaining ownership of capital and hence means of production was of workers'. We explained in previous chapters that in such an economy, equilibrium is impossible; instead it leads to distorting an identity altogether. Not irrecoverable this predicament, we figured out that an important participant in the economic activity was purely missing. This agent is the government or any regulator that provides for the infrastructure and other allied requirements necessary for the economy. Towards the concluding parts of the previous chapter, we introduced the government and established its role in a monetary economy. It also led to achieving a desired monetary equilibrium. In that chapter, we had assumed that the government makes deficit financing without provision of a public good. In this chapter, we intend explain the motivation for provision of a public good by the government. The role of government in an actual economy may range from providing all the activities for economic sustenance to economic stabilities. The form of deficit financing introduced in the previous chapter would fit into the second category. However, the government may provide certain goods without any return or expectations (we hope!). In the process of providing such goods, it may resort to various options and each of these options has an implication on the economy as a whole. The government may resort to providing the public goods using financing options depending upon its budgetary specifications. Given a closed economy of the type we are discussing, it would be prudent to assume that without any external inflows, the government would maintain a balanced budget, if at all it is to commit any budgetary provisions towards the supply of public goods. In such a case, the production system would have two more equations: one for the provision of public good and the other for

the provision of funds for the public good. The important question to answer at the outset is this: why does the government provide for a public good? The simplest answer is that it has no other option but to provide for it. The public good can take any form- the amount of defence expenditure, infrastructure of the form of roads, railways, bridges and under-passes or even expenditures on uniforms of public servants and their salaries as well. The public good may take the form of, as negligible as, facilitation of economic resources to as varied an activity as provision of adequate infrastructure, roads, and economic infrastructure so as to enable the private sector conduct its functioning smoothly. The government may also extend its role (and normally it does) to providing defence services. This is an indicative list of the economic activities of the government. The merit of this discussion will be seen shortly. The present section shall introduce the provision of a public good and its implications in terms of the fiscal policies. The production of public goods involves several inputs. It could range from cement for the infrastructure development to uniforms and food items for those employed in the defence sector. Thus, the provisioning of a public good involves usage of capital inputs, consumption inputs and for this section; it could be assumed that the government does not rely on borrowings as a source of revenue. It should be noted that the government does not aim/ budget any profit rate on the capital used in the process of provisioning of the public good. The public good normally takes the form of budgetary outlays and is a pure expenditure. It takes the form of pure value. Thus, while introducing the public good, it must be noted that the production of public goods has two definite characteristics: one that the inputs do not yield any profits and two that the output is a pure value and hence, does not command a price for itself. The output is in the form of expenditures which are derived using the values of capital and labour employed in the production of the public good. As a result, the production equations would then take the following form:

$$\alpha\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right) r + (1-\alpha)\sum_{t=1}^{b}\left\langle\left\{\left[\partial_t\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right)\right] i_t\right\}\right\rangle + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij} p_j + wL_i = p_i B_i$$

$$\left(M_p + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right) + \left(M_p + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij} p_j\right) + wL_p = X_p$$

The first block is the system of regular production equations. Along with this block, we introduce the system of public good equations. It must be noted that the two features of zero profit rates and absence of price coefficients are recognized in the equation above. The government does not aim to make any profits in providing the public good and at the same time, it commands no price at all. In fact, public good is not quoted in value and quantity terms; it is in effect a total value- a total expenditure or the like. The public good production equation takes the following form

$$\alpha\left(\psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right) + (1-\alpha)\sum_{t=1}^{b}\left\langle\left\{\left[\delta_t\right]\left(\psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right)\right\} i_t\right\rangle + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij} p_j + wL_p = X_p$$

It can be observed from the above equation that the production of public goods uses capital and certain consumption goods as well. However, since public good does not enter the production of every or any other good, the public good cannot be classified as a *basic* commodity. Introducing the equations for production of public good alone in the model makes the model indeterminate: we have an extra equation now! As a result, we need to search for an additional equation to close this system and make this system determinate. We need not go too far to complete our search. The equation we are looking for is the budget equation which relates the expenditure on public goods to the sources of funds to provide for this expenditure.

$$X_p = \left(\tau\left(r * E_k + I_b + \sum_{i=1}^{t}\sum_{i=1}^{t} \mu_t i_t D_t\right) + \left(r * E_l + w * L + \sum_{i=1}^{t}\sum_{i=1}^{t} (1-\mu)_t i_t D_t\right)\right)$$

Here, τ is the tax rate and it shall be assumed through the above equation that the government uses a balanced budget policy. It is more important, in the passing, to understand this role of government as a provider of public goods on the grounds of welfare considerations. It becomes important to understand that the

government performs this welfare function and it in essence, through taxes also achieves a redistribution of incomes. Incomes flow from the consuming agents to the government in form of taxes and from the government to the producers in form of public expenditure and hence back to the consumer class in form of factor incomes. The cycle continues! As the entire cycle is seen through its periodic phases, we may be able to understand this redistributive function of the government. As an alternative, the government may choose to provide the public good partly through the tax revenues and partly through deficit financing. In that case, the budget equation would necessarily look like:

$$X_p = \left(\tau \left(r * E_k + I_b + \sum_{i=1}^{t} \sum_{i=1}^{t} \mu_t i_t D_t \right) + \left(r * E_l + w * L + \sum_{i=1}^{t} \sum_{i=1}^{t} (1-\mu)_t i_t D_t \right) \right) + \left(\sum_{i=1}^{m+n} CG_i p_i \right)$$

However, we would assume that the government resorts to a balanced budget policy implying no deficit financing. Necessarily, since there is an income tax introduced in the system, it would be pivotal to understand the relationship between profit and growth under the conditions of a tax rate. The relation changes as under-

$$r = \frac{\left((g * M_s) + \Delta Currency - (1-\beta)(1-\tau)(Y_{Labourer} - Su.Cons_{Labourer}) - (1-\alpha)(1-\tau)(Y_{Capitalists} - Su.Cons_{Capitalists}) \right)}{(1-\tau)\left[(1-\beta) * Equity_{Labourer} + (1-\alpha) * Equity_{Capitalists} \right]}$$

Two points here are worthy of discussion. Firstly, we need to understand that the commodity introduced in this chapter- the public good- is a commodity that uses every or almost every other commodity but is hardly used in the production of every other commodity. In that sense, the public good takes the form of a non-basic good, or what Sraffa calls a luxury commodity. Secondly, it would be important to notice the base of the tax computations. It could be seen that the tax that is applied on the economy is applied to the incomes in the economy. Necessarily, this is assumed that we are dealing with income taxes (for simplicity of the current situation). However, any other tax would just have similar implications. Continuing in the fashion adapted in the course of this work, we introduce a mathematical model of the previous chapters with the only

modification being the introduction a public good equation and the associated balanced budget equation.

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$p_1 + p_2 + p_3 + p_4 + p_5 + w = X_p$$

$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$

$$104.275 + 47.5(1+i_1) = 145(1+i_1)$$

$$11.608 + 65(1+i_1) + 80(1+i_2)^2 = 145(1+i_2)^2$$

$$14.979 + 20(1+i_2)^2 + 125(1+i_2)^3 = 145(1+i_2)^3$$

$$853 = p_4(B_4 + Ap_4)$$

$$848 = p_5(B_4 + Ap_5)$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73 + Ap_1) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96 + Ap_2) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68 + Ap_3) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

$$X_p = \tau(Y_k + Y_l)$$

Let us understand the implications of the income tax thus introduced above. Since we have augmented the economy of the previous chapters, it would help us in understanding the features of this economy wide income tax.

We may proceed with understanding the implications of imposing an *income* tax as above through the solutions of the model introduced above.

Table VI-A: Price solutions with a tax imposition

r	g	P1	P2	P3	P4	P5	w
3.52	1.40	13.62	10.36	15.63	14.53	16.57	44.94

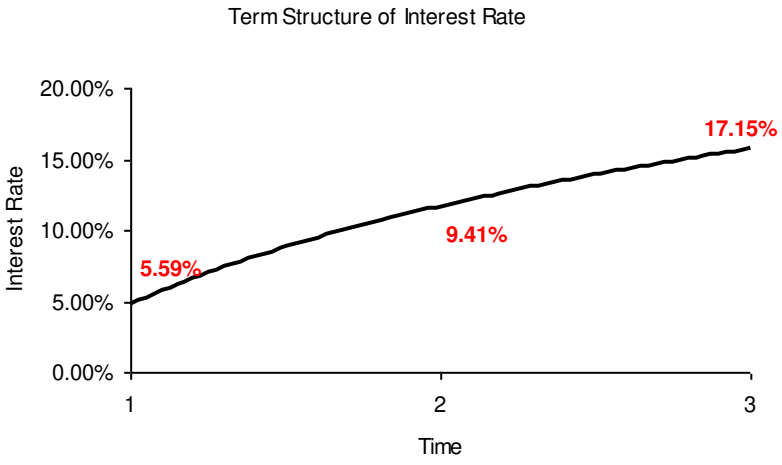
Table VI-B: Banking solutions with a tax imposition

i1	i2	i3	Loans	Deposits
5.59%	9.41%	17.19%	475.24	475.24

Table VI-C: Output solutions with a tax imposition

B1	B2	B3	B4	B5	NNP
31.90	50.16	59.16	58.58	51.18	2861

The above results are comparable to the results introduced in the previous chapter in equilibrium. It can be seen that the taxes have a relatively less evident impact on the prices in the economy. However non evident this effect may be, it must be seen and evaluated that it has an upward pressure on prices. Taxes constrain incomes and hence constrain demand; however if the incomes are reallocated by the governments effectively, it has a lesser evident impact on the prices. Since, the taxes are so to say, non-inflationary (and we are not saying anything new here; taxes are non-inflationary), they have lesser impacts on the value of capital and hence flight of capital in terms of their equity and debt compositions as well. After all, an income tax alteration does not send a stock market crashing throughout; though it may happen that adverse tax changes may send the market crashing on the budget day or only the budget hour, but not the entire budget fiscal year! Thus, the government and its fiscal policy have minimal role in the omni-presence of inflation. Hence, it may well be said that these fiscal implications may not have any effects on the interest rates in the economy. The term structure remains unaltered more or less! Thus it will still look like this:



The NNP in this economy and the one modeled in the previous chapter is more or less equal, implying that taxes may not have an income reducing effect, provided

that the entire tax amount is returned back to the economy in form of some public expenditure, public good or even plain vanilla deficit financing. These taxes but of course have a redistributive effect on the incomes in the economy. It may be noted that the in economy presented in the previous chapter, the total income received by the workers and capitalists can be determined and that these values are Rs. 1895 and Rs. 922. This is the factor distribution of the total NNP of Rs. 2817 approximately. It can immediately be inferred that in the previous economy without taxes, the income shares were 32% and 68% respectively of the capitalists and the workers. Post the imposition of taxes, the workers and capitalists now share 60% and 40% respectively with incomes of Rs. 1739 and Rs. 1205 respectively. This implies that the taxes introduce a redistributive effect in the economy; the richer class (here workers) would now transfer their incomes to the relatively poorer (here, capitalists) through the monies imposed by the state. This income redistribution is attained by the state through impositions of income taxes; these are income altering effects. The tax rate in this economy is 3.91% and the total public expenditure or the provision of public good is worth Rs. 115.38. Various forms of redistributive effects could be explained in this respect. These could take form of allocative efficiency as above with respect to incomes, productive efficiency with respect to changes in production/ capital reallocation or plain distribution based taxes to improve efficiencies in trade. The way this is done is fairly simple and depends on the type of tax the government chooses to levy on its subjects. There could be introduced capital input-based Value added taxes or product-based sales taxes. The incidence of taxation in respect of these two taxes has an impact on the pricing equations and hence on the balanced budget equation.

$$\alpha\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right) r + (1-\alpha)\sum_{t=1}^{b}\left\langle\left\{\left[\partial_t\left(\Psi_i p_i B_i + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij} p_j\right)\right] i_t\right\}\right\rangle + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij} p_j + wL_i = p_i B_i$$

In the case of a sales tax, the right-hand side is altered to look like $(p_i B_i)1-\tau$ and the budget equation would change similarly to $\left(1-\tau\sum_{i=1}^{m+n}(p_i B_i)\right) = X_p$. The government, as a provider of public goods, may resort to do so either entirely

(through deficit financing) or either entirely through resource mobilization from the public (through taxation). It is already discussed that the taxation has wealth redistributive effects and efficiency effects. However, the government also has to manage the total economic balance in the system. It should however, leave the agents with just the right amount of money so as to meet their all primary, secondary and tertiary requirements. This would in-turn lead to social harmony and peace. Nevertheless, the discussion around the provision of public goods through resources mobilized by the government via two extremes can be taken forward. We would introduce a solution between these two extremes. The government has an option of providing a public good partly through taxes and partly through government debt. The borrowings done by the various ministries in-charge of providing the public goods are after-all done so that the common man is not burdened with heavy taxes. Therefore, the government borrowings would have fiscal implications; government debt is an important internal policy tool for the government. The form of contractual debt agreements of the government and the banks may be of various natures; we are planning to introduce government borrowings in the same spirit as private borrowings. The government borrows funds of various maturities, of which the immediate period loans are always repaid and renewed whilst the other loans are only renewed.

$$\left(M_p + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} S_{ij}\,p_j\right) + \left(M_p + \sum_{i=1}^{m+n}\sum_{j=1}^{m+n} A_{ij}\,p_j\right) + L_{p1}(1+i_1) + \sum_{s=2}^{n} L_{ps} i_s + wL_p = X_p$$

This is the public good production equation. The borrowings are introduced in the form of term loans of varying maturities. Since there is also an element of borrowings included in the analysis, the budget equation would be slightly different; an augmentation for the sum of loans will be introduced in the budget equation.

$$X_p = \left(\tau\left(r^* E_k + I_b + \sum_{i=1}^{t}\sum_{i=1}^{t} \mu_t i_t D_t\right) + \left(r^* E_l + w^* L + \sum_{i=1}^{t}\sum_{i=1}^{t} (1-\mu)_t i_t D_t\right)\right) + \left(\sum_{i=1}^{m+n} AG_i p_i\right) + \sum_{s=1}^{n} L_{ps}$$

Thus, the total public expenditure is financed through deficit financing, tax revenues and government debt. The net national product at factor costs would now also include the interest incomes that accrue to the banks on the government

debt. However, under this case, the disequilibrium gap explained in the previous chapter takes a different form. The difference between the savings and the investment and between the NNP factor costs and NNP market prices are not equal to the disequilibrium wage gap. Instead, it is the following equation that holds at disequilibrium:

$$NNP_{fc} - NNP_{mp} = w(L - L_n) = saving - investment - Net\_government\_debt$$

In the other cases, the equation or the disequilibrium *identity* changes and does not carry the net government debt. It is imperative to explain here what is meant by new government debt. It is already explained that the government borrows term loans. Net debt in this regard would then be equal to the total debt less the debt (principal) repayments; thus it would be total debt less the immediate period debt since that is the only loan the government repays. Let us continue with the same economic example that we started off with.

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$p_1 + p_2 + p_3 + p_4 + p_5 + 25(1+i_1) + 25i_2 + 25i_3 + w = X_p$$

$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$

$$104.275 + 47.5(1+i_1) = 145(1+i_1)$$

$$11.608 + 65(1+i_1) + 80(1+i_2)^2 = 145(1+i_2)^2$$

$$14.979 + 20(1+i_2)^2 + 125(1+i_2)^3 = 145(1+i_2)^3$$

$$853 = p_4(B_4 + Ap_4)$$

$$848 = p_5(B_4 + Ap_5)$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73 + Ap_1) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96 + Ap_2) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68 + Ap_3) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

$$X_p + 25(1+i_1) + 25i_2 + 25i_3 = \tau(Y_k + Y_l) - 75 + \sum A_{ig}$$

The last equation above is important. It is the budget equation and it balances the total debt and the interest obligations on the same.

The price-wage-profit solution for this economy is presented below.

The prices in this economy may tend to fall due to an important aspect in a government debt situation. The borrowings by the government tend to reduce the taxes and as a result, may leave more incomes in the hands of the people.

Table VI-D: Price solutions in presence of government borrowings

r	g	P1	P2	P3	P4	P5	w
3.61	1.57	12.74	9.65	14.22	13.4	15.03	37.76

In this sense, since more incomes would induce more consumption and increased post tax incomes; this may lead to reduced prices and hence overall inflationary situations.

Table VI-E: Banking solutions in presence of government borrowings

i1	i2	i3	Loans	Deposits
5.70%	9.54%	17.07%	470.00	470.00

The level and the slope of term structure remains unaltered in this case, since it is assumed that the government borrows at the market rate of interest.

Table VI-F: Output solutions in presence of government borrowings

B1	B2	B3	B4	B5	NNP
31.32	50.12	59.54	54.11	47.82	2565

18. In a monetary theory of value, the role of monetary policy becomes even more important. In this chapter, we plan to introduce this role of monetary policy and assess its impacts on the overall values in the economy. In the process, we would introduce a central bank making these policy decisions. It would however, be assumed that the central bank would make its policy decisions at all times in the economy. Hence, it could well be said that in a monetary economy, government and monetary authorities have a prominent role to play; that they are always central to the functioning of the economy. To begin with, monetary policy can be defined as the measures taken by the monetary authorities to influence the quantity of money or the rate of interest with a view to achieving stable prices, full employment and economic growth. As mentioned, the Reserve Bank tries to influence the quantity of money and/or interest rates with a view to achieving price stability, full employment and economic growth. This implies that there must be some link (or links) between monetary variables (such as the quantity of money and interest rates) and macroeconomic variables (such as the price level, the level of employment and the gross domestic product (GDP)). These links are called the monetary transmission mechanism, that is, the way in which monetary changes affect the real economy. We would study these mechanisms in the view of our model in a short while. There are various views about the monetary transmission mechanism. Some economists, for example, see a direct link between changes in the quantity of money (M) and changes in the price level (P) but no link between changes in M and changes in real GDP. Other economists

emphasize the link between interest rates (i) and investment spending (I) in the economy. They regard interest rates as the outcome of the interaction between the money demand and the money supply. For example, if the money supply increases, interest rates will tend to fall. At the lower interest rates more investment projects will become profitable, therefore investment (I) will increase. This, in turn, will result in an increase in GDP. That is why observers often call on the Reserve Bank to lower interest rates in an attempt to stimulate economic growth and employment. There is always a danger, however, that lower interest rates and a concomitant greater money supply will simply serve to increase the inflation rate. It would be a useful digression to begin our analysis with a survey of existing systems and instruments of leading central banks across the globe. The Eurosystem has a number of monetary policy instruments which it uses to achieve its monetary policy objectives. Here you will find information on the main components of this set of instruments: open market operations, standing facilities and minimum reserves. The main refinancing operations which are offered weekly and which run for one week are at the centre of these open market operations. In addition, the Eurosystem offers a longer-term refinancing operation once a month (which has a maturity of three months) and quick tenders. Each September the ECB publishes the dates for the open market operations in an indicative calendar for the following year. The two standing facilities - the marginal lending facility and the deposit facility - are designed to provide or absorb liquidity until the next business day. Furthermore, the Eurosystem prescribes the minimum reserves which the banks are required to hold order to increase the structural liquidity requirements of the banking system. The Czech National Bank also does use similar instruments of monetary control. It mainly uses Open market operations, Automatic facilities and Minimum reserves. The Federal Reserve System has three main policy tools, as well as two additional tools, at its disposal. Each of these is listed and described below. However, the first instrument, open market operations, is by far the most commonly used. Open market operations are the most useful and important of the Fed’s policy tools. Open market operations are the purchase or sale of government securities by the

Federal Reserve System. Each purchase or sale of securities directly affects the volume of reserves in the banking system, and therefore the whole economy. Purchases of government securities increase reserves and ease credit while sales decrease reserves and tighten credit. With a purchase of securities, the System pays for the purchase by crediting the reserve account of the seller's depository institution. The System can then loan out the reserves and increase the supply of money. Conversely, sales of securities reduce reserves and tighten credit because the System charges the reserve account of the buyer's bank, decreasing the reserves available for loans. Open market operations are either "dynamic" or "defensive." Dynamic operations are those taken to increase or decrease the volume of reserves to ease or tighten credit. Defensive operations are those taken to offset effects of other factors influencing reserves. Through their "discount windows," Reserve Banks act as a safety valve in relieving reserve market pressures. By lending funds against acceptable collateral, the System provides essential liquidity to financial institutions, while helping to assure the basic stability of money markets and the banking system. Commercial banks once borrowed from Reserve Banks by bringing bonds and other asset documents to a teller's cage or "window." The amount loaned was the face value of the asset, minus a "discount." Today, financial institutions still borrow from Reserve Banks. However, the term "discount window" is simply an expression for Fed loans that are repaid with interest at maturity, arranged by telephone, and secured by pledged collateral. The discount rate is the interest rate charged to depository institutions on loans from the Federal Reserve's credit facility, the discount window. Changes in the discount rate are initiated by the boards of directors of the individual Reserve Banks and must be approved by the Board of Governors. This coordination generally results in almost simultaneous changes at all Reserve Banks. The discount rate is changed infrequently, albeit some crisis n the economy and the current American sub-prime crisis has been an exception to this rule of infrequent discount rate changes. Changes in the discount rate affect credit conditions and therefore the economy. An increase in the discount rate, for example, makes it more costly for depository institutions to borrow from Reserve

Banks. The higher cost discourages depository institutions from using the discount privilege. It may force depository institutions to screen their customers' loan applications more carefully and slow the growth of their loan portfolios. Apart from these direct impacts, changes in the discount rate can affect expectations in financial markets. If, for example, the market interprets an increase in the rate as the beginning of a sustained program to tighten credit, lenders will cut back commitments, waiting for more attractive rates. Potential borrowers will try to borrow before the expected higher rates materialize. These actions by lenders and borrowers will produce the expected tight credit. Reserve requirements are the percentages of deposits that depository institutions must hold as cash in their institution or at the Fed. The reserve requirement affects monetary and financial conditions. For example, a reduction in the reserve requirement decreases the amount of reserves that banks must hold and therefore banks can make more loans. The larger volume of loans creates money and stimulates the economy. Raising the reserve requirement has the opposite effect. Although the reserve requirements are a potentially powerful tool, the Board of Governors seldom changes these requirements in the conduct of monetary policy. Reserve requirements are used more to regulate banks to provide security and stability in the banking system. In addition to these main tools, the Fed has two additional policy tools at its disposal. Margin requirements are the percentage of cash down payment a purchaser must make when borrowing to buy securities. In some instances, the Board of Governors establishes margin requirements. Although margin requirements could be used actively as a policy instrument, the Board rarely changes the requirements. The People's Bank of China applies instruments like the reserve requirement ratio, central bank base interest rate, rediscounting, central bank lending, open market operation and other policy instruments specified by the State Council. The South African Reserve Bank uses various instruments in its attempt to influence the quantity of money and/or interest rates in South Africa. In contrast to the direct measures applied in earlier decades, the emphasis nowadays is on market-oriented policy measures which seek to guide or encourage financial institutions to take certain actions on a voluntary basis. In

other words, the authorities create incentives to encourage private enterprise, and hence financial variables, to move in a desired direction. The monetary authorities create such incentives through their own buying and selling activities in the financial markets or by varying the terms on which they are prepared to offer credit. A good South African example of such a policy instrument is the repo rate established by the repurchase tender system of the Reserve Bank. The repo rate is the rate at which the Reserve Bank grants assistance to the banking sector and therefore represents a cost of credit to the banking sector. When the repo rate is changed, the interest rates on overdrafts and other loans extended by the banks also tend to change. In this way the Reserve Bank indirectly affects the interest rates in the economy. The repo rate forms part of the Reserve Bank's accommodation policy. Another instrument of monetary policy in South Africa is the Reserve Bank's open-market policy which consists of the sale or purchase of domestic financial assets (mainly Treasury bills and government securities) by the Reserve Bank in order to exert the desired influence on interest rates and the quantity of money. Open-market policy is based on the inverse relationship between interest rates and bond prices (see Section 48). For example, when the Reserve Bank wishes to increase the quantity of money, it buys government securities on the open market. To persuade market participants to sell the securities, the price of bonds has to be raised. This, in turn, will lead to lower effective interest rates, as explained earlier. When the Reserve Bank wishes to reduce the money supply, it will do exactly the opposite, that is, sell bonds at a cheaper price than the ruling price, thereby raising effective interest rates. An important element of the current monetary policy in South Africa is the use of inflation targets. In February 2000 the South African government and the South African Reserve Bank officially announced an inflation target as part of monetary and anti-inflation policy in South Africa. Supporters of inflation targeting argue that such an approach helps to reduce inflation by keeping the public informed about future inflation trends, providing an anchor for inflation expectations, increasing the transparency of monetary policy, improving the accountability of the monetary authorities, increasing stability in nominal interest rates, reducing

inflation expectations by reorienting them towards the future, reducing the degree of money illusion in the economy and providing stability in the value of money, which enhances growth prospects. A major theme of this discussion is that each central bank performs a set of monetary operations called as monetary policy using a set of defined instruments with a unified view- defined economic stability. However, all these effects are ex-post through a theoretical monetary transmission mechanism, though not to deny that it happens! However, it would be prudent to have a construct to analyze the effects of various monetary instruments at the beginning of the policy period instead at the end of it. This is the only motivation of introducing this chapter. In an appropriately articulated monetary system, it becomes easier to compare various scenarios and draw conclusions even without actually rolling out the policy. In such simulated environments, we propose to conduct our monetary policy using two important instruments of policy control, namely the reserve requirements and the Open Market Operations. Cash reserve ratio (CRR) is a tool more frequently used by the Reserve Bank of India to control liquidity and affect interest rates. We aim to demonstrate that our model of the economy can be generalized adequately to incorporate the impact of the CRR and thereby can be used for policy purposes as well. Imposition of CRR reduces the supply of available deposits and tightens the liquidity position. As a result, there are more loans now chasing lesser deposits and hence, interest rates in the economy rise. With key interest rates rising, there is more savings in the economy and consumption falls to that effect. This causes prices to fall. This is one side of the theory. On the other side, as key interest rates rise, producers' cost of borrowing increases which causes overall cost of production to increase. Prices increase in this case. The elasticity of consumption function and the elasticity of the production function together net each other out and ultimately, if prices fall, it should be said that consumption effect dominates the production effect; else the converse is true. All said, the imposition of CRR causes the level and at most of the times, the slope of the term structure to change. Real business cycle at the point of imposition of CRR also has an impact on the interest rate schedule. In case of a depressionary economy, the imposition of CRR may lead to inverting

the term structure. Bankers would feel safer to lend more in terms of current period and lend lesser in terms of future periods. Short term interest rate may rise. Hence, the use of this tool, though the cheapest to administer, should be used with caution in tandem with the level of economic activity and also certain fiscal control initiatives. We would demonstrate the same in a later chapter as we aim to bring this synthesis to an end. For the moment, we would return to our economy without public good and hence taxation. In this simple case economy, we would demonstrate the effect of CRR on interest rates and other real and monetary variables of interest. Consider the following model of the economy:

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$

$$104.275 + 47.5(1+i_1) = 145(1+i_1)$$

$$11.608 + 65(1+i_1) + 80(1+i_2)^2 = 145(1+i_2)^2$$

$$14.979 + 20(1+i_2)^2 + 125(1+i_2)^3 = 145(1+i_2)^3$$

$$853 = B_4 p_4$$

$$848 = B_5 p_5$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

In this case, let us first note down the solutions obtained from the previous chapter

Table VI-G: Banking solutions

i1	i2	i3	Loans	Deposits
5.57%	9.38%	17.09%	476	476

This is the solution to the banking system of equations. The real equations or the production-price equations and the solution to the output system is as under:

Table VI-H: Price solutions

R	g	P1	P2	P3	P4	P5	w
3.41	1.43	13.58	10.33	15.68	14.53	16.63	45.75

Table VI-I: Output Solutions

B1	B2	B3	B4	B5
31.71	50.12	59.29	58.78	51.01

These solutions hold in the case of a zero CRR in the economy. Let us begin by imposing a CRR of 5% in this economy. A 5% CRR implies that of the 475 of deposits, 23.75 worth of deposits will not be available for making loans. Interest rates in this economy would rise. Ultimately, only 452 worth of deposits are disbursed as loans. In effect, however, the amount of loans outstanding is however 476. This pushes the interest rates upwards. The new interest rates are per under:

Table VI-J: Banking solutions after CRR

i1	i2	i3	Loans	Deposits
5.61%	9.45%	17.27%	452	476

Due to the imposition of CRR, loans worth only 452 are disbursed and hence, interest rates of all maturities rise. The next line item happens to be the real sector. The prices are seen to fall here marginally. Imposition of CRR in this economy does not affect the real outputs as will also be presented here. Hence, the increment in interest rates causes prices to fall; with interest cost going up and producers unable to raise sales revenues, prices have to fall.

Table VI-K: Price solutions after CRR

R	g	P1	P2	P3	P4	P5	w
3.30	1.43	13.12	9.98	15.15	14.04	16.06	44.18

What remains to be commented upon is the level of real wages in the economy. It should be noted that the real wages, w/p_4 and w/p_5 remain unchanged. The level remains constant at 3.15 and 2.75. There are marginal variations in the values pre and post imposition of the CRR; however, monetary policy changes like these do not produce greater real impacts in the economy. The rate of profits also falls in the economy with a fall in prices. It should be noted that this fall is a result of increasing interest costs and relatively constant sales revenues. There are no significant changes in the outputs as can be observed from the following table:

Table VI-L: Output solutions after CRR

B1	B2	B3	B4	B5
31.70	50.13	59.29	58.77	51.01

With no changes in outputs, the growth rate in the economy remains relatively unchaged. In short, it can be concluded that imposition of CRR impacts only key interest rates in the economy and provides a tool for abslute price control. However, in terms of real wages or outputs, there is no impact of the CRR. CRR per-se therefore becomes a tool in the hand of the banking system for controling discretionary price rises. However, if there have to be real effects accompanied by the fall in prices, or any other monetary impact that CRR generates, an adequate backing of fiscal policy is necessary. Similar results are seen when the conditions are reversed. A decrement in CRR causes a fall in interest rates, rise in prices and profit rates with no major real impacts. Assuming that the CRR is now reduced to 1%, comparisons of results can now be done to -case without CRR (in this case, the results will be akin to that of imposition of CRR) and secondly to the previous case where CRR was 5% (this presents and completes the case for a fall in CRR- we would do this comparison). Consider the following results for the monetary part- the interest rates.

Table VI-M: Banking solutions with new CRR

i1	i2	i3	Loans	Deposits
5.59%	9.41%	17.17%	470	476

Comparing the results with the case of 5% CRR, it can be seen that interest rates decline, prices rise (following table) however outputs and real wages remain constant.

Table VI-N: Price solutions with new CRR

R	g	P1	P2	P3	P4	P5	w
3.36	1.43	13.39	10.19	15.47	14.33	16.40	45.12

The following table summarizes the results of the output system

Table VI-O: Output solutions with new CRR

B1	B2	B3	B4	B5
31.70	50.13	59.29	58.77	51.01

Thus, monetary variable of CRR is able to produce greater monetary effects than *real* effects. Used mostly for control of liquidity, CRR is also at times used for inflationary control. There is yet another tool at the disposal of the banking system. This refers to the OMO- the open market operations. OMO or open market operations refers to purchase and sell of securities from the open markets for controlling important policy variables-at certain times it is used for price controls and at certain other times, it is used for liquidity and credit control. In terms of an established banking system, the banks sell or purchase securities to or from the government thereby reducing or increasing liquidity in the system. A sale of security by the GOI to the RBI is normally referred to as a debt- a public debt and the GOI repays its debt by repurchasing the securities back from the RBI or the banking system. Open Market Operations (OMO) imply that the RBI undertakes to buy and sell Government Securities from participants in the financial markets. The operations could be undertaken on an outright basis or repurchase agreements. The objective of OMO is to absorb or provide liquidity in the market. However, OMO are conducted as an instrument of monetary policy

and not with respect to considerations of changes in the portfolio. Nevertheless, OMO have an impact on the balance sheet of the RBI. On certain occasions, when there are capital inflows which need to be absorbed, larger OMO are warranted to sterilize such flows. There is a cost to OMO, but, since the objective is to achieve monetary control, they are not undertaken on consideration of profitability. Therefore, continuing our model, we would introduce the OMO through these purchase and sell of securities-any purchase by the government reducing the liquidity and hence increasing the interest rates and the converse being true for any sale of securities. As a result, we introduce two new parameters in the model: $z_i G$ and $z_i R$ where $z_i G$ denotes a public debt financed by the government- in short a sale of government securities to the reserve bank and $z_i R$ denotes a public debt financed by the Reserve bank-in short sale of government securities by the reserve bank to the government. While $z_i G$ captures the phenomena of sale of securities by government to the RBI, $z_i R$ captures the case of purchase of securities by the government from the RBI. All this activity to obtain the funding for a loan which is a pre-decided amount. We call this loan as $L_t G$ - shorthand for loan taken by the government. What we demonstrate now can be put up in a single sentence: an increase of $z_i G$ leads to decreasing liquidity in the banking system and hence, creating a shortage of funds. This would push the interest rates upwards and lead to similar results of that of imposition of CRR. What needs to be explored is whether this activity has any *real* effects. Let us begin so by introducing sale of securities by the government to the reserve bank. It would be prudent as always to study the results of this system with a OMO- in the form of sale of GOI securities to mop up excess liquidity in the system- from the solutions to the interest rate equations[57].

Table VI-P: Banking solutions with OMO Case I

i1	i2	i3	Loans	Deposits
5.6%	9.42%	17.21%	476	476

[57] It should be remembered that each time a solution is presented, the level of deficit financing is adjusted so as the show the picture of *actual equilibrium* devoid of any *effortless freedom*.

It thus can be seen that with the sale of GOI securities, the interest rates in the economy are jacked up. The extent of the rate increases depends upon the level of monetary activity carried out by the government. In this case, we have assumed the level to be worth 15 (rupees, say) and the overall money supply is 525. Therefore, the extent of activity can be said to be approx. 3% of the level of free money supply. Assuming this level is increased to approx. 5%. In this case, the interest rates become 5.62%, 9.46% and 17.30% respectively for the three maturities. The elasticity of the loan demand and the refinancing requirement together determine the extent of rate hike or rate reduction. The following table summarizes the results of the production-price system.

Table VI-Q: Price solutions with OMO Case I

R	g	P1	P2	P3	P4	P5	w
3.32	1.43	13.28	10.10	15.34	14.21	16.28	44.91

It should be therefore seen that the results are per expected. But the level of real wages remains relatively unchanged at 3.15 and 2.75 approximately. In absolute terms, there can be seen an overall price reduction and this may be attributed to overall reduction in liquidity causing lesser demand patterns. However, again on the output side, the sales revenue fall; absolute outputs do not change to greater extent.

Table VI-R: Output solutions with OMO Case I

B1	B2	B3	B4	B5
31.70	50.13	59.29	58.77	51.01

Thus, the OMO also has no real effects. The striking difference between the CRR and OMO therefore is while CRR reduces/increases individual banks' reserves; OMO reduces/increases the overall liquidity in the system.

We would now consider the case of purchase of government securities by the GOI from the central bank, therefore providing liquidity in the system. As expected, the interest rate equations would indicate a reduction in the interest rates.

Table VI-S: Banking solutions with OMO Case II

i1	i2	i3	Loans	Deposits
5.45%	8.89%	14.08%	476	476

It thus can be seen that with the purchase of GOI securities, the interest rates in the economy are decreased. The extent of the rate decrement depends upon the level of monetary activity carried out by the government. In this case, as the previous case, we have assumed the level to be worth 15 (rupees, say) and the overall money supply is 525. Therefore, the extent of activity can be said to be approx. 3% of the level of free money supply. Assuming this level is increased to approx. 5%. In this case, the interest rates become 5.36%, 8.5% and 12.31% respectively for the three maturities. The elasticity of the loan demand and the refinancing requirement together determine the extent of rate hike or rate reduction. The following table summarizes the results of the production-price system. From the two results for the interest rate movements, it should be seen that upward movements of the interest rate schedule are slower whereas the downside movements are faster. Somehow, the modeled equations make the interest rate table inelastic for higher values and relatively elastic for lower values of interest rates. Convexity of the yield curve, and hence the level of economic activity therefore plays an important role in selecting a policy variable. Secondly, it may also turn out to be an important property of a monetary economy that interest rate movements on the upward side also have their limits which this exploration can only remark. Studying and detailing out those limits can be left for a better thesis. The results of the production-price system also yield expected results. In fact, it so turns out that there are insignificant changes in the absolute prices compared to the case of

Table VI-T: Price solutions with OMO Case II

R	g	P1	P2	P3	P4	P5	w
3.35	1.43	13.29	10.11	15.34	14.21	16.28	44.91

an OMO where there was a sale of securities. There is either a marginal increase or constancy of the level of absolute prices. In real economies, we expect the level

of absolute prices to increase. The scale of the problem presented here is minuscule to mimic the true operations of a full-blooded economy. The last part is the solution to the output system. Monetary activities have very insignificant impact on the level of absolute outputs or the level of growth. The result is validated even in the case of OMO.

Table VI-U: Output solutions with OMO Case II

B1	B2	B3	B4	B5
31.70	50.13	59.29	58.77	51.01

19. To conclude this chapter, it may therefore be added that CRR or OMO are devices aimed for price stabilities and control of inflation. In the case of deficit financing, we have already shown that it has more *real* effects than monetary effects.

A valid question that may pose us in the analysis could be the following: can there be interplay of monetary and fiscal activities and what mix of policies can be used to determine the macro-economic equilibrium/ stability of the whole economic system? The simple answer to the first part of this question is obviously in the affirmative. The interplay of real (fiscal) and monetary variables is often observed in the real world and most of the economies are susceptible to not recognizing this interplay. Take the classic case of the Zimbabwean economy where the inflation rate has hit stratospheric levels. Or the case of the American economy when the Fed rates were tumbling as if the interest rate was the only variable the US could think of. In fact, in economically strategic economies, a combination of monetary and fiscal policies is often resorted to improve the micro-economic (prices and inflation) or the macroeconomic (interest or growth) situations. In either case, the impact on employment, output and the level of government activity must be ascertained before hand. In this short note, we would demonstrate the impact of using a mix of these instruments- deficit financing (fiscal), borrowings (fiscal), CRR (monetary) and OMO (monetary) and hence, to illustrate the idea of monetary and fiscal mix. Let us start with the classic case economy where the CRR, the amount of government borrowings and level of OMO are all zero. In

this case, the only option the government has is to provide adequate levels of deficit financing as observed before to clear the disequilibrium gap.

Table VI-V: Deficit financing and interplay

DF	Tax	CRR	i1	i2	i3	Ms	P4	P5	W	W/P4	W/P5
103	3.87%	0%	6	9	17	526	15	17	45	3.08	2.70

In this hypothetical economy, the deficit financing volume (indicated by DF) is around103 units of the currency (if the economy were Indian, it would have been rupees!). At this level, the tax rate on personal incomes is 3.87%. The rates of interest are indicated by i1, i2 and i3 above. The columns of interest are w/p4 and w/p5. These columns indicate the level of real price (wage) and hence, the real wages in terms of consumption goods. In isolation, these may not make much of a sense; however when we do a comparative analysis in a short while, these can be used as valuable benchmarks. Consider a juncture in the process of this economy where the government decides to decrease its level of deficit financing. In order to meet the conditions of economic equilibrium, it would be imperative for the monetary agents of the economy to behave in a fashion rational enough, so as to influence the economic equilibrium. Consider this: the decrease in deficit financing reduces the volume of economic activity in the system, further to this, it also reduces the amount of money supplied in the economy. As a consequence, there are more deposits in the economy than the money supplied and hence the savings rate in the economy is higher compared to the level of output. This pushes the monetary authorities to make projects attractive by initiating actions that reduce the rate of interest in the economy, thereby attracting (private) investments and hence bridging the disequilibrium gap. This can be attained by a hike in the CRR. This is exactly what the central bank would pursue, the moment it sees a shortfall in economic activity by the government.

Table VI-W: Deficit financing & interplay- II

DF	Tax	CRR	i1	i2	i3	Ms	P4	P5	W	W/P4	W/P5
90	3.81%	10%	5	8	9	518	12	14	38	3.04	2.67

One question worthwhile a pause is this: why would the government reduce the level of deficit financing? Two answers are available from the above solutions. Number one, have a look at the last two columns- w/p4 and w/p5. Each of these columns registers a decline if one compares with the previous "benchmark" table above. Well, to reduce real wage inflation could be one objective of the government; at the same instant, the government succeeds in raising its source of revenues as well through an increase in the tax rate. Thus, by depriving the economy by a stimulus, the government is able to send enough signals to the tax-payers that its kitty is declining and has to make up for it through increased tax collections. This way, through a decline in the level of deficit financing, the government alters the consumption behaviour- positively by making goods cheaper through decline in real wages, and adversely by increasing the tax rate. One the other side, it also influences the savings behavior by altering the interest rates directly. This activity obviously reduces liquidity in the system and the money supply (Ms in table above) falls to 518. One more solution providing full power in the hands of monetary authorities can be exercised. Assume a case where the central monetary authority intends to suck out the entire liquidity from the system, more than in the example above[58].

[58] One need to note the difference between the two examples- in the first case, the government initiates an action of reducing the level of deficit financing and the monetary authorities respond by reducing the CRR. In the second case, it is the central monetary authority that induces the reduction in CRR (significantly) and the fiscal authorities follow to bridge the gap as warranted. These two distinctions are important and press the need to understand the cooperation rather than competition between monetary and fiscal authorities.

Table VI-X: Deficit financing & interplay- III

DF	Tax	CRR	i1	i2	i3	Ms	P4	P5	W	W/P4	W/P5
57	3.71%	38%	5	6	6	503	8	9	25	3.04	2.66

In this example, the volume of deficit financing reduces to 57, which is significant as compared to 103 in the benchmark case. However, the government is able to achieve this and also reduce the tax rate in the economy due to a significant reduction in money supply (Ms=503); what this does is this reduces the inflation in the economy as well through a reduction in real wages. This is why the monetary authorities reduce the CRR. Thus, an equilibrium interplay can be used to create multiple policy prescriptions for the state and the central monetary authorities.

Chapter VII: Conclusions

20. Section I: Comparisons with Keynesian and Patinkin Syntheses

1. As the build-up and the analysis of monetary theory of value come towards a conclusion, it would be prudent to bring out certain observations made during the course of this study. While it is clear that the Patinkinisque system is dependent upon the relationship between nominal money balances, real money balances, nominal money supply and the equilibrium attained by these forces through equilibrating the labour, money, bond and commodity markets. While Patinkin sought to restore these equilibria in all the markets primarily through the operation of the real balance effect, this leads one into falling in the trap of money in the demand (read utility) functions. *"It is obvious from equation.. that if we were to abandon our oversimplified form of labour demand function and instead represent it as dependent also on real balances…."* In itself, this captures the essence of Patinkin's thought process. He sought a macro-economic equilibrium thorough the operation of the real balance effect. In the proposed model, no such effect has been used nor is the equilibrium *derived* using any such effects. As a result, in the Patinkinisque case, the demand functions are utility based and hence, money or wealth appears in the demand functions as utility is said to be dependent upon the money/ wealth/ real balances. As a consequence, it would be only trivial and also faulty to consider a real balance effect in the operation of equilibrium. Therefore, in the theory presented, the demand functions are free from the issues of real balances, nor do commodity, money or labour supplies need to be dependent on such a (trivial) force. It is thus important to note this fact that the equilibrium attained in the presented theory is not through the operation of real balance effect. While we are discussing the nature of demand functions, a point worth a mention is this: Patinkinisque demand functions are utility based whereas the demand functions introduced here have an empirical nature and are not utility based. This is the point where the whole idea of real balance drops off.

2. Another point about Patinkinisque demand functions is that Patinkin used the tool of aggregating demand functions and was hence subject to the famous Hahn critique. However, the demand functions employed in the theory presented here are of a social nature and can be thought of to be an aggregated demand function; however, no such explicit assumption is made or needed. The demand functions are merely non-utility based, do not have wealth/ money in the arguments nor do they aggregate implying homogeneity of individuals or the like. However, for the moment let us assume otherwise; that the presented theory would have allowed for money as an argument in the demand functions. In this case, as money balances rose, real wealth would have increased. Now, since demand equates supply, all debtor-creditor relationships remain balanced and hence, if consumers' real balances increase. Consequently, due to the demand supply balancing, the increase in consumers' real balances would also reduce the real wealth of creditors who may have financed the consumers. Eventually, this reduction in real wealth of creditors would reduce investment demand. Therefore, though consumption demand has increased due to increase of consumers' real wealth, the investment demand reduces due to decrease in creditors' (or any other counter party's) real wealth. The net effect on social income is zero. Thus, the mere presence of money in the demand function may also not activate real balances to have a significant effect on the incomes of the society. This not only provides the rationale and the justification for leaving the real balance out of the presented theory but also substantiates that we do not even need it.
3. Now that we are in the ambit of comparing and drawing (dis)similarities between the theories of the *standard neo-classical world* and the theory *presented here*, we may not go too far, before we recognize the nature of inter-temporal equilibrium expressed in the presented theory. *"The usual analysis bars this possibility (*of demanding unlimited amounts of commodities each week) *by assuming that there is some imperfection in the capital market which prevents an individual from borrowing all he wants at the going rate of interest. This is undoubtedly a realistic assumption. However, since it is desired to keep the analysis as simple as possible, we shall not employ it here. Instead, we shall accomplish the same result*

by assuming that the individual must formulate his present and future market plans under the additional restriction that on the final Monday of the month, his planned holding s of bonds must be zero.[59]*"* Multiple comparisons and valid contradictions can be inferred from the paragraph just quoted. In Patinkinisque world, all markets are fully specified in terms of commodities and derivative markets. In fact, all spot and future markets are fully specified. There is an exact equilibrium in all markets at all current and future dates. This is one feature of the Arrow- Debreu world as well. Hence, money has no role in such an economy- contrary to this, in fact it should be stated that money is not required in this economy! However, in our theory, we deny the existence of all future markets thereby creating the role for money as a standard of and store of value. We deal only in all spot markets. Hence, role of money is set in through equilibrium requirement in all spot markets of time T_0. All (terminal) money balances are only responsible in pushing the economy to time T_1, where new spot markets are created. Hence unlike Patinkin, in our world, the terminal balances of all (money) holdings cannot become zero.

4. Patinkin also argues that the presence of money implies that there exist (capital) market imperfections. These imperfections, for these to be corrected, the (economic) agents need to be paid a premium. This premium is what Patinkin regards as *interest.* In the presented theory, we do not explain interest or any other aspect of the economy via imperfection. In fact, imperfections are assumed away by creating near perfect markets. It is worthy a mention that in Patinkinisque world, the sum of excess demands equates the sum of money- the Walras' law operates in Patinkin. This however creates a problem for Clower as he says that if the value of excess demands for factors matches the value of excess supplies for commodities, then money in fact may be rendered redundant. Therefore, Clower proposed a dichotomization with excess demand for commodity being made equal to M while excess demands for factors being made equal to some M^1. The problem here with this is that the velocity of circulation of money would always be equal to 1. This aspect also is absent from our theory and we do not require the

[59] Patinkin, Don (1965): *Money, Interest & prices: An integration of monetary & value theory* (MIT Press)

velocity of money to be equal to one. Finally, Patinkin had stated *"Thus, shifts in tastes, technology, and the like are in the domain of value theory. Changes in quantity of money and –as we shall see- shifts in liquidity preference are in the domain of monetary theory*[60]. The presented theory clearly is an objection to what Patinkin had said in this regard. In fact, it detests all economics that states the dichotomization of economy into real and monetary sectors. The essence of the stated theory is a unification of both- the real and the monetary forces.

5. Continuing the chain of comparison and logical reasoning, it must be recognized that the General theory of interest, employment and money was also a Keynesian attempt at unifying the monetary and value theories. Starting with the first of them all, Keynes recognized that the rate of interest is a result of three most important forces defining the reasons (or motives) for money demand- namely the transactions, precautionary and speculative motive of demand for money. These demands in the Keynesian *synthesis* are stated expressly. We do not have the role for speculative motive for money in our theory. We do not provide for presence or absence of explicit stock markets nor do our producers or agents speculate on the volume of inventories with debt capital.
6. Standard theory, including the Keynesian one, has always presented mechanism for equating rate of profits and rate of interest. We do not have any such equilibration expressly brought out. However, in our theory, we also have a lot of assets and a lot of interest rates.
7. Like the Patinkin case, in the Keynesian system, there is an uncertainty in the bond markets. This uncertainty has a role in explaining the interest rate in Keynesian synthesis. However, this uncertainty is an imperfection to an otherwise perfect economy of Keynes. We, since are in a pursuit of perfectly competitive economy, we do not ascribe the interest rate determination to any imperfection in the economy.
8. Unlike the Patinkin story, we do not have to bother about the neutrality of money. Money is not neutral, either in short run or the long run. The presence of money

[60] Patinkin (1965) *Ibid,* pp 181

has far reaching effects on the economy and money affects output, prices, employment, interest, government and monetary policies equally.

9. In the Keynesian world, as Clower pointed out, there is no auctioneer and it was this absence of the auctioneer to which Clower ascribed the imperfections in the Keynesian model. To Clower, the lack of auctioneer caused coordination failures and hence, markets failed to clear giving rise to imperfections. This was the main reason for the Keynesian result of market disequilibrium. However, in our theory, we do not have an auctioneer as well. However, we as well face the situation of disequilibrium in the markets- a result that Keynes obtained which Clower attributed to the absence of an auctioneer.
10. The presented theory also makes no room for money wage rigidity and liquidity trap. In fact, while (money) wages are perfectly flexible, as liquidity declines, the rate of interest declines. In our model, unlike the Keynesian case, we do not have the operation of Walras' law as an operative equation for the equilibrium. in our case, the sum of values of outputs less the replacement demand, new demand and consumption demand does not equate zero. In this case, we have introduced deficit financing and Walras' law is brought about and not used as an operative condition as mentioned earlier.
11. We do not use the logic of quantity theory of money as well in the synthesis presented here. In quantity theory, the terminal value of money holdings is known always. However, we only have the initial value of money. The terminal value of money cannot be known *apriori*. To put the quantity theory to use therefore, we will have to fix the value of an unknown quantity, which is not possible! Even if it were so, irrelevant solutions are obtained. Further, changes in money have tow parts- one is endogenous and the other is from savings; hence if only savings part is taken, then irrelevant solutions are expected. Also, if quantity theory is used in the price system the solutions to the price system would be available; however the full economic equilibrium cannot be determined on the shoulders of quantity theory.
12. Finally, Hahn pointed out that a fully specified non-discontinuous demand function based model would have equilibrium. Even if Hahn is honoured in this

case and we provide a working model of the Hahn specifications, we do not reach equilibrium.

21. Section II: Monetary and Value Theory

13. The theory of prices so far developed clearly spells out the following- the theory of prices can be determined without money. Prices technically mean exchange ratios- it does not matter whether these ratios are measured in relation to other commodities as relative prices or as a relation to numeraire good (read money) as absolute prices. Even as we move from the world of micro-price determination, and as we enter the realm of income distribution, the role of money can be silent still. Prices are nothing but exchange ratios. Barter is efficient even without money. The moment one moves into the theories of income and employment determination, money cannot be ignored. The role of money becomes all the more pronounced for employment and income determination. Keynes navigated his entire synthesis through the facets of money, interest and employment. It must be noted that output is aggregate demand. Aggregate demand would involve aggregate consumption demand, aggregate investment demand and aggregate expenditure. The level of aggregate investment would depend upon the level of interest rate in the economy. In essence, for all market principles, the rate of interest would depend on the level of money demand and money supply in the economy. It would be therefore not inept to say that the level of aggregate output depends on the money balances in the economy. Employment depends on the level of aggregate output in the economy. The level of output thus depends on the interest and money and in turn employment depends on the level of output and the wage cost of entrepreneurs.
14. It must be also noted that it is therefore not necessary to have an explicit relationship between money and prices- like the quantity theory one. What is necessary and important is that there be a relation between the growth rates of absolute outputs and money. It thus implies that the real and monetary dichotomy, then, of course is a false one. Money affects output and employment. The

relationship between rate of profits and rate of growth is precisely this one relationship that forms the cornerstone of the integration of monetary and value theories. The equation

$$r = \frac{g\left(\left(e_w + e_k\right)\left(\sum_{i=1}^{n+m}\sum_{j=1}^{n+m} S_{ij}\,p_j + \sum_{i=1}^{n+m} k_i\,p_i B_i\right)\right) - \left(k_e^w\left(1-\beta\right)wL\right)}{\left(k_e^w\left(1-\beta\right)e_w\left(\sum_{i=1}^{n+m}\sum_{j=1}^{n+m} S_{ij}\,p_j + \sum_{i=1}^{n+m} k_i\,p_i B_i\right) + k_e^k\left(1-\beta\right)e_k\left(\sum_{i=1}^{n+m}\sum_{j=1}^{n+m} S_{ij}\,p_j + \sum_{i=1}^{n+m} k_i\,p_i B_i\right)\right)}$$

is the most fundamental equation of this synthesis. Whilst the first parenthesis in the numerator term describes the monetary aspect, the second one is the savings block out of the workers incomes. This explicitly models the relationship between the rate of growth of absolute outputs, money and the rate of profits in the economy. Nowhere in the theory are wages assumed to be rigid. The assumption of a perfectly mobile labour (that fits in with the theory with perfect markets) does not fit in with the assumption of rigid wages. Labour is always not a growable stock as well. The economy has to employ the available stock of labour if it were to maintain its growth momentum. Therefore, effective demand has been abandoned in favour of full demand. It had to be abandoned. Given the level of employment, all people should work, "earn" money and hence "determine" output. A one line conclusion that this exploration leads to is this: Output grows, money does not constrain labour (it cannot) and prices do not constrain distribution; in effect, they all determine level of new money, new outputs, new interest, new employment, new prices and new income distribution. Individuals create wealth by being employed and hence contribute to savings, hence to investment and hence to growth. All this because they are in constant pursuit of at least maintaining their wealths. They are not the Walrasian wealth maximisers. In fact, individual wealth in a monetary economy is a by-product of national wealth/ income. In a monetary economy, money alone is able to make entrepreneurs produce and workers work. It is an enabler to the entire economic activity. It is like a catalyst in a chemical reaction.

15. In a monetary economy, a valid question is – does the interest rate get a liquidity trap? The answer could be "it may". But as we have pointed out in the course of analysis, in a monetary economy, liquidity trap may not have harmful prescriptions for the economic activity. The government and the central monetary authority would ensure that in this situation, enough support would be forthcoming such that it would have minimal implications for inflation. Finally, money is or can never be a veil in a monetary economy. Real balances cannot be an explanation for disequilibrium in a monetary economy.
16. A monetary economy will always face a disequilibrium if let loose. A regulator is required to manage the entire economic activity. Money calls for a truly integrated economic system with individual roles for producers, workers, monetary & fiscal authorities.

Limitations of the proposed theory:

Finally, as we conclude, it would only be imperative to present certain limitations of the presented model/ theory.

a. The ever predominant real balance effect plays no role in this system described so far. The real balance effect is seen to operate in the industrial equations where (real) money balances are held by entrepreneurs in the process of production; however, the consuming class does not have a money balance variable in the consumption functions. The reason for this dichotomization is obvious in the fact that the presented theory is fairly and to a large extent empirical in nature. This empiricism leads one to search for an empirical relationship for the consumption functions that involves real money balances. Such an empirical relationship is absent from the present economic literature.
b. Almost all the markets are explicitly states, except the labour market. By explicit statement, we mean the famous Marshallian cross here, where labour demand and labour supply interact to determine the price of labour. Such a formulation is absent from the theory. However, we have presented the labour market in a fairly subtle manner. The famous

$N_d = f\left[w/p\right], N_s = f\left[w/p\right]$ & $N_d = N_s$ is a macroeconomic formulation and applies where there is one good; however in a general equilibrium system N_d, i.e. labour demand would come from various sources. Every entrepreneur is employing/ retrenching labour. Therefore, the famous cross of partial economics is also absent. If one carefully looks at the growth-profit relation, L_s i.e. supply of labour is present and in the dual relations, individual L_d ie labour demand is present. Thus, L_s has an impact on the rate of profits, *r*, and L_d has an impact on the rate of growth, *g*.

c. The role of uncertainty and expectations is absent in the theory. However, whether one needs such a role is a question of epistemology in the current context. Even without providing for the assumption of uncertainty and expectations, it is shown that the desired results are obtained; those of presenting a disequilibrium in a monetary economy and the means of addressing the same. Even if we assume that such a role for uncertainty is provided for, a qualitative account of the scenario can be provided- in the face of uncertainty, people tend to hoard money balances. The end result of this would be that the Keynesian gap would increase and the result similar to increasing money demand would be obtained. As a consequence, no new result would be achieved by assuming for the role of uncertainty and expectations, except for the fact that if one assumes the same, the qualitative aspect would only be enhanced quantitatively.
d. Real balance and wealth effects are not considered in the theory; however, the theory is robust enough for someone who intends to consider the same. the theory also leaves out the principles of international values and is out of scope for the current work.
e. Finally, Graham had proposed a model of commodity reserve currency during the later stages of the American depression. However, owing to high transaction cost and supply conditions, such a model was not adopted. The exposition of such a currency in the theory is not been considered

Annexure to Chapter 1: Survey of Classical, Neoclassical & Monetary Theories

Section I: Theories other than Keynesian General Theory

Karl Marx's attempts at providing a theory of value had repercussions for a theory of money and (hence) a theory of business cycles that developed through it. The most important point to emerge from Marx's theory of money is the idea that money is a form of value. The difficulty with this idea is that we are more familiar with money itself than with value in other forms. But value does appear in forms other than money. For example, the balance sheet of a capitalist firm estimates the value of goods in process and of fixed capital which has not yet been depreciated, as well as the value of inventories of finished commodities awaiting sale. Each of these aggregations of commodities has a value, usually expressed as the equivalent of a certain amount of money, but it is clear that neither goods in process nor fixed capital is money. Marx views the value of commodities in this sense as analytically prior to money; money can be explained according to Marx only on the basis of an understanding of the value of commodities. Marx follows Smith in regarding value as the property of exchangeability of commodities. In a society where exchange is common, products come to have a dual character as use values and as values. They have two powers: first, to satisfy particular human needs and wants; and second, to exchange for other products. This second power can be thought of quantitatively, as an amount of exchangeability or command over other commodities. The classical economists viewed value as a real, though socially determined, entity, with its own laws of conservation and motion. Value in this sense bears the same relation to commodities as mass bears to physical objects. Marx regards value, the general power of exchangeability that resides in commodities, as an expression of the labor expended in the production of the commodities. Marx was clever in describing that it would not matter if one attributed this general exchangeability to any one commodity, say gold, and start treating it as money. The only caution that he had advised, which is noteworthy is that while attributing the *moneyness* to any one commodity, it should be borne in mind that the commodity under consideration itself has two values: one

its value in use and secondly its value in circulation. Whilst a commodity is used in circulation, it should never be used up in the process. This is the puzzle Marx sets himself to resolve in his discussions of the money form in the first pages of Capital, and in his Contribution to the Critique of Political Economy. How can gold simultaneously be a concrete commodity and the form of money? If we use the word "labor" for the more accurate phrase, "abstract, socially necessary, simple labor," this theory suggests that the value in aggregate collections of commodities is proportional to the quantity of labor expended in their production. This proportion is very important to the theory of money, because it implies that each unit of money value can be regarded as expressing a certain amount of labor time. I call this ratio the "value of money," the amount of social labor time expressed on average by a unit of money. (This idea should not be confused with the concept of the "value of the money commodity", which is the labor time embodied in a unit of a particular commodity that may be functioning as money.) The value of money is not the inverse of the wage rate in a capitalist system of production; it is the ratio of the total labor time expended to the total value added in the commodities produced. The average wage rate is the ratio of aggregate wages, which are only a part of the value added, to the total labor time. The integrity of the idea of value, however, requires us to think of exchange as a process which conserves value. This means that although one trader may gain and another lose in exchange; no value is either created or destroyed. The sum of the values they begin with is the same as the sum they end up with; what one gains the other loses. This law of the conservation of value is of the utmost importance in grasping Marx's use of the theory of value in analyzing capitalist production. When we apply the idea of value separate from price to transactions involving money, the concept of the value of money, the ratio of total labor time to total value added, plays a central role. Only with this convention for defining the value of money will we be able consistently to maintain the ideas that money is a form of value; that value is conserved in exchange; and that the expenditure of labor creates value. It is unfortunate that the general equivalent theory suggests that the value of money is always determined by the conditions of production of the money commodity. In the development of Marxist theory the problem of the determination

of the value of money separate from the value of the money commodity has not attracted much attention. Most Marxist theorists assume that the problem of the value of money has been settled by the general equivalent theory and the idea of the standard of price. They see no substantial difference between the value of money and the value of the money commodity. The moral of this thought is simple: the seeds of a quantity theory consistent with a Walras' law could be found in Marxian analysis of money. The law of conservation of value, in its modern parlance, assumes the form of a Patinkinsque or a Clowerian dual decision hypothesis that we shall touch upon sooner. What is lacking in Marx's theory of money is one crucial aspect: the role of credit or of money of the future periods. The value of money is not determined only due to exchange of commodities or circulation of money, but also due to an important property of money being a store of value. Marxian monetary system takes cognizance of money being a medium of exchange but not of its store of value function. The second issue with Marxian monetary theory is already pointed out above. Where Marx highlights that the two values: use and exchange value of commodities need to be distinguished, he himself is unable to provide a logical reasoning to overcome this predicament. Marx's discussion of this issue in the second chapter of the Contribution suggests that the value of money depends ultimately on the conditions of exchange between gold and other commodities at the point of production of gold. Thus arbitrage, minting, and melting of gold coin for export seem to be the mechanisms Marx has in mind for maintaining the relation between the value of the money commodity and the value of money. It is important to recognize that this arbitrage is costly, and works only up to a pointing any commodity-producing society; there is always some margin within which the value of money can vary in relation to the value of the money commodity. Thus there is always some further question as to the exact determination of the value of money.

Commodities have inherent in them a natural value to remain in existence for a definitive period of time. This is often regarded as their value in store. Though, as described above, Marx ignored this, Wicksell was apt in recognizing this in his monumental work[61]. Own rates of interest of a particular commodity was ingenious

[61] Wicksell, K (1898), *Interest and Prices* (Great Britain: R & R Clark Limited, Edinburgh)

and Wicksell could only have come up with that. Knut Wicksell's (1898, 1906) theory of the "cumulative process" of inflation remains the first decisive swing at the idea of money as a "veil" as well as Say's Law. The Quantity Theory still held in his system, but the dynamics of adjustment of prices to money supply, the "reason" for the Quantity Theory to hold, is fundamentally based on money having very real short-run effects. Recall that Fisher's Quantity Theory spoke of exogenous increases in supplies of money leading to "bidding wars" for commodities, as agents try to get rid of excess money holdings, thereby raising their prices. However, as Wicksell noted, there was nothing inherent in the neoclassical theories of value and output which implied any of this could make sense. In fact, he clearly recognized that Say's Law, which prevents aggregate demand for goods and factors from exceeding real aggregate supply under all circumstances, implied that the Quantity Theory mechanism was contradictory. *A general rise in prices is therefore only conceivable on the supposition that the general demand has for some reason become, or is expected to become, greater than supply. This may seem paradoxical, because we have accustomed ourselves, with J.B. Say, to regard goods themselves as reciprocally constituting and limiting the demand for each other. And indeed ultimately they do so; here, however, we are concerned with precisely what occurs, in the first place, with the middle link. Any theory of money worthy of the name must be able to show how and why the monetary or pecuniary demand for goods exceeds or falls short of the supply of goods in given conditions*[62]. We can see this differently. Say's Law says that real aggregate demand (Yd) is derived from real aggregate supply (Ys), thus Yd = Ys at all times. Yet, in a Walras' Law constraint, we must remember that (Yd - Ys) + (Md - Ms)/p = 0. where Md and Ms is money demand and supply respectively. Thus, by Say's Law, left side falls to zero, and thus Md = Ms at all times: there can never be excess or insufficient money supply necessary to make the Quantity Theory work. We can look at this in terms of investment and savings. Now, by definition, Yd = C + I + G where C is consumption, I is investment and G is government spending and Ys = C + S + T where S is savings and T is taxation, then assuming a balanced government budget, (G=T), to claim that Say's Law states that Yd = Ys at all times is

[62] Wicksell, K (1906): *Lectures on Political Economy*, Vol.2, pp.159-60

the same as saying that I = S, i.e. investment is equal to savings at all times. Our Walras's Law constraint becomes (I - S) + (Md - Ms)/p = 0. which is identical to our previous constraint. However, again, by Say's Law, I = S so that necessarily Md = Ms, i.e. money demand is always equal to money supply. This way we can see the force of Wicksell's criticism of Say's Law and its inoperability in a theory of money. Say's Law is in essence "dichotomy" as it separates the real and monetary sides completely - i.e. disequilibria in money markets cannot spill over into disequilibria in goods markets. But then, Fisher's whole story of the Quantity Theory arising from a "bidding war" for goods as a result of an excess supply of money is precisely why Fisher contradicted himself: as Wicksell claims, you cannot simultaneously assume Say's Law and the Quantity Theory. This fundamental insight of Wicksell's was resurrected in the Patinkin Controversy of the 1950s and 1960s. Wicksell's process has its roots in that of Henry Thornton (1802). Recall that the start of the Quantity Theory's mechanism is a helicopter drop of cash: an exogenous increase in the supply of money. Wicksell's theory claims, indeed, that increases in the supply of money leads to rises in price levels, but the original increase is endogenous, created by the relative conditions of the financial and real sectors. With the existence of credit money, Wicksell argued, two interest rates prevail: the "natural" rate and the "money" rate. The natural rate is the return on capital - or the real profit rate. It can be roughly considered to be equivalent to the marginal product of new capital, therefore let us simply call it r. The money rate, which we shall refer to as i, in turn, is the loan rate, an entirely financial construction. Credit, then, is perceived quite appropriately as "money". Banks provide credit, after all, by creating deposits upon which borrowers can draw. Since deposits constitute part of real money balances, therefore the bank can, in essence, "create" money. This idea was put simply in later years by Dennis Robertson. *By a wave, apparently, of the bank's magic wand the farmer and his men [the borrowers] have been enabled to live for six months at the expense of the rest of the community: the bank has give them a claim on the community's real income of food and clothing and tools and cinema shows. And for rendering this service to the farmer the bank charges him something called 'interest'. Our first impulse surely is to*

cry out on the whole proceeding as a piece of fraudulent legerdemain[63]. Indeed it might be considered a "sleight-of-hand". But, as Robertson and Wicksell go on to note, without this type of "fraud" one remains constrained by Say's Law - and this is inconsistent with the implied "bidding war" mechanism of the Quantity Theory. It is finance, Wicksell argued, which liberates investment from a given supply of saving to become the wild card that can take aggregate demand above (or below) aggregate supply - a maneuver which anticipates and influences Keynes. Wicksell's "cumulative process" works as follows. Put simply, the finance demand for money is set by the difference between the money and natural rates of interest. Let us propose that the natural rate is greater than the money rate (i.e. r > i). In short, the marginal product of capital is greater than its cost. Consequently, it will be to the advantage of every entrepreneur to borrow funds from the bank and invest it in capital. That means I > S, i.e. finance investment will rise above savings as the bank, by its "magic wand", can create the deposits upon which borrowers can draw. In short, the money supply increases as a result. Now one may accept that investment is independent of savings - at least initially. Banks, after all, give credit out first and then verify if the funds are available. Thus, like Keynes and unlike modern Neoclassical economics, Wicksell does not think investment is constrained by savings. But eventually, surely, the savings have to come eventually to equality - the goods market must eventually clear. Keynes had his multiplier to do this. What did Wicksell have? Wicksell actually had no self-correcting mechanism other than a reserve constraint. The logic works as follows: when r > i, then I > S. This extra investment demand then bears down on the capital goods industry. Assuming full employment, the extra demand for capital goods by loan-backed entrepreneurs cannot be met by the makers of capital goods. On the contrary, the extra volume of demand will have to be siphoned off by raising the price of capital goods. But just as they rise in the capital goods industry, so too must they rise elsewhere - including consumer goods and, as a result, wage demands by workers. A spiral ensues, a "cumulative process" whereas prices will rise and rise without limit as long as loan-backed entrepreneurs keep borrowing from the banks and coming to market. And they will continue doing so as long as the natural rate of

[63] Robertson, D. H. (1922): *Money*, *Volume 2 of Cambridge Economic Handbooks*, pp.71

interest (the marginal product of capital) remains above the money rate of interest (the loan rate). Thus, the demand for loans will continue accumulating, and the banking system's deposit creation forthcoming, indefinitely - with savings never really catching up. Money supply will expand endogenously without limit and prices will rise also without end. Nonetheless, adhering to Wicksell's main thesis, the disequilibrium engendered by real changes leads endogenously to an increase in the demand for money - and, simultaneously, its supply as banks try to accommodate it perfectly. Given full employment, (a constant Y) and payments structure (constant V), then in terms of the equation of exchange, MV = PY, a rise in M leads only to a rise in P. Thus, the story of the Quantity Theory, the long-run relationship between money and inflation, is kept in Wicksell. Finally, the endogenous creation of money, and how it leads to changes in the real market (i.e. increase real aggregate demand) is fundamentally a breakdown of the Neoclassical tradition of a dichotomy between monetary and real sectors. Money is not a "veil" - agents do react to it and this is not due to some irrational "money illusion". However, we should remind ourselves that, for Wicksell, in the long run, the Quantity Theory still holds: money is still neutral in the long run, although to do so, we have broken the cherished Neoclassical principles of dichotomy, money supply exogeneity and Say's Law.

Simon Newcomb's and Irving Fisher's Quantity Theory, as we noted, relies entirely on the idea of a stable transactions demand for money. This requires that money is desired only for its medium of exchange function and this is institutionally imposed. An alteration on this point was brought in by several Cambridge economists in the earlier part of this century. In particular, A.C.Pigou (1917), Alfred Marshall (1923), D.H. Robertson (1922), John Maynard Keynes (1923), R.G. Hawtrey and Frederick Lavington (1921, 1922). These were the joint creators of what has since become known as the "Cambridge cash-balance" approach. The proposition they advance is that money is desired as a store of value. The Cambridge story, then, is fundamentally different from the Fisher story. In Fisher, money is desired by agents in some fixed amount solely because it happens to be the medium of exchange. As Fisher noted, money yields no gains to the holder. However, in the Cambridge story, this is not the case. Money does increase utility in a way: namely, by enabling the divorce of sale

and purchase as well as a hedge against uncertainty. The first reason resembles that outlined by Adam Smith, W.S. Jevons (1875) and Carl Menger (1892) - where money is necessary to overcome transaction costs and coincidence of wants problems. As they note, in simultaneous, multilateral exchange with no transaction costs, the need for money by traders is not apparent. The advantage of money, in that it overcomes the need to obtain coincidence of wants; it implies that an agent can sell his good at one time for "money" and then extend his leisurely search for the best price, then trading his "money" for the goods he finally wishes to purchase. The Cambridge lesson is that the sale and purchase of commodities are not simultaneous and thus there is a need for a "temporary abode" of purchasing power, i.e. some temporary store of wealth. In particular, A.C. Pigou (1917) also allowed for money demand to involve a precautionary motive - with money holdings acting as a hedge against uncertain situations. As it is in its store-of-wealth and precautionary modes that money yields utility to the consumer, then it is demanded for itself in a way. How much of it is demanded depends partly on income and partly on other items, notably wealth and interest rates. The first part is obviously implied in transactions terms: the higher the volume of income, the greater the volume of purchases and sales, hence the greater the need for money as a temporary abode to overcome transactions costs. Thus, Cambridge theorists regarded real money demand as a function of real income, i.e. $M/P = kY$ where k is the famous "Cambridge constant". However, this is really misleading for the "constant" k is not constant at all. Rather, it relies on other components, such as interest (the opportunity cost of money) and wealth. We can compare this to Fisher's system by simply recognizing that real income (Y) and transactions (T) are, in equilibrium, identical. Of course there are transactions in wealth (e.g. the sale of existing assets such as a house) which do not count as part of income or output proper since they are only transferrals of ownership. The way around this is, as Pigou (1927) notes, is to recognize that, properly valued, the sale value of a home is really the discounted value of rents (which are income). Thus, the transactions in wealth represent transactions in discounted streams of income. Thus, we can claim that at least in some long-run, perfect world, $T = Y$. Therefore we can rewrite Fisher's equation as $M/P = (1/V)Y$, such that $k = 1/V$. Thus, in sum, one

equation can be implied from the other. However, the theories are quite different. Firstly, money is here conceived in store-of-value, uncertain, utility-yielding terms. In Fisher, it was just the institutional medium-of-exchange that enabled transactions. Secondly, they advanced the possibility that k (and thus V) is not necessarily instutitionally fixed but rather changing. However, the dichotomy between the real and monetary sectors cannot really be said to have been broken down by this given the ambiguity as to what is contained in k - and their creators' reluctance to make much of this (see Patinkin, 1974). More than anything else, they considered the issue of uncertainty and confidence entering k and thus leading to real fluctuations - an idea which had already been contained in Marshall (1890: 591-2). However, this explanation lacked deterministic power for they placed forth no theory of expectation formation in such circumstances - and therefore, as a theory of fluctuations, it can be regarded (however stretched) as a short-run phenomena. But this is not very interesting. Indeed, had not Fisher's (1911) credit cycle and his "dance of the dollar" demonstrated the breakdown of the Quantity Theory in the face of short-run adjustment costs? Nonetheless, the main points of the Cambridge approach were two: (1) neutrality remains but dichotomy is doubtful; (2) money yields services and is demanded by choice

Utility theory is an important value theoretic concept that had started evolving due to the likes of Marshall, Jevons, Walras during these times. Walrasian pure exchange refers to a price-mediated exchange process of endowments of goods, i.e. no production as initially outlined by Jevons. To put it simple: People are endowed with goods and have preferences over bundles of goods and so may desire to exchange the goods they are endowed with for other goods. People don't trade with each other (they don't even "look" at each other), but rather, they trade exclusively with an abstract entity called a "market". (i.e. if we want people to actually look at and try to trade directly with each other, we must turn to non-Walrasians exchange processes). People take the prices announced by the market as "given" and make their net demands and offers to the market in full confidence that these will be met at the stated prices (i.e. people do not make "strategic" offers or demands in an effort to get the market to change its prices). In order to demand goods from the market, they must offer it

goods which have the same monetary value (i.e. they must "sell" something to the market in order to get purchasing power to "buy" something from it). If the market cannot balance the offers of goods with the demands for goods it receives from consumers, then there is a disequilibrium. Under the process of tatonnement, there will be no trade and another list of prices will be announced by "the market" where the price of those goods that were in excess demand will be raised, and of those goods that were in excess supply will be lowered, and the process begins anew. (under non-tatonnement processes, as many trades as possible will be conducted before it becomes necessary to announce a new set of prices). If the market can balance the offers and demands so that they net out to zero, only then will the market fulfill the demands and pay for the offers. This is a Walrasian equilibrium. But again the question remains: where is money in the system? A general equilibrium monetary theory in the true modern or non-classical sense has this biggest limitation. That does not, in any manner, ask the question: *How to make money appear without making standard theory disappear?*[64] – or there are also statements of the fashion: *the most serious challenge the existence of money poses to the theorist is this- even the best developed models of the economy cannot find room for it*[65]. John Maynard Keynes attempted a formal theory of money first with his Treatise on Money and then with his General Theory. What Keynes tried to achieve was truly a "Monetary Theory of Production[66]". Keynes identified a monetary economy as a one in which expectations of the future influence decisions taken today, or, one in which money is a subtle device for linking the present and the future, or one in which production begins with money on the expectation of ending with more money later. *Finally, a monetary economy is also a one in which Say's law need not hold because of the existence of a non-produced sink-hole of purchasing power*[67]. Keynes was himself aware of the dichotomy the contemporary monetary theory presented. 4. The discussion around forces which determine physical output and the determination of price-level has

[64] Ostroy, J.M.(1973), "The informational efficiency of monetary exchange", *American Economic Review,* Vol 63 (No.4): pp. 597-610
[65] Hahn, F.H. (1982), "The Neo-Ricardians", *Cambridge Journal of Economics*, Vol. 6, pp. 353-374.
[66] See section II below for a survey of General Theory
[67] Wray, L.R. (1999), "Theories of Value and Monetary Theories of Production", WP 261 (Jerome Levy Economics Institute)

traditionally been regarded as separate departments in economics. In the later department, money has played the dominant role. The total volume of transactions effected with a given stock of money, M, in a given unit of time is T. The average velocity or rapidity of money circulation is V and P is the general index of prices which enter into the transactions T. Therefore, MV=PT. This famous and yet so simple identity (or equation?) is known as the Yale equation of the Quantity Theory of Money (QTM), in honour of Irving Fisher. The theory is also presented in the form of proportion, k, of the value of what Pigou called the 'total resources enjoyed by the community' which the public desire to hold in form of money. These total resources Pigou denoted by R, so that, M=kPR. This form of the QT equation is known as the Cambridge equation, in honour of Marshall and Pigou. Though the Yale and the Cambridge versions can be converted through algebraic manipulations in either form, the underlying concepts are rather different. Fisher and the Yale school thought of money as a means of effecting transactions; Pigou thought of money as a form of holding wealth necessary for effecting the ordinary transactions of life without trouble. Kahn has rightly pointed out that in either form, since the QTM recognizes that alternate liquid assets can well be used as substitutes to money this is my reason for maintaining that the only sense in which the so-called quantity theory can be given a casual is not really a quantity theory at all but an exercise in portfolio theory. No wonder, Kahn records that with respect to the various versions of QTM, the Yale equation is a truism, and the Cambridge equation a delusion. John Locke and Hume believed in this relation to an extent as well, primarily due to the reason that the monetary theory of their times was concerned with commodity money systems. Locke explains wrote Keynes that money has two values: its value in use given by the rate of interest and its value in exchange…but he was confused. Professor Arthur Leigh also maintains that Locke's theory of money's value in exchange contains all the elements of Fisher's equation. To interpret his theory of demand for money, the Cambridge equation is also useful. David Hume, sixty years later was not really a quantity theorist at all. In his treatment, there is a causal factor. It is an increasing a stock of money, which so long as the increase continues, raises the level of demand. In its modern form, the QTM was attributed by Marshall to J.S. Mill. Schumpeter

emphasizes Mill's claim to be the first strict quantity theorist in the strict sense. The following passage, quoted by Kahn, from Mill's Principles of Political Economy expands the doctrine as he saw it. the value of money[…] varies inversely as its quantity; every increase of quantity lowering the value, and every diminution raising it, in a ratio exactly equivalent. [….] If we assume the quantity of goods on sale, and the number of times those goods are resold, to be fixed quantities, the value of money will depend upon its quantity, together with the average number of times that each piece changes hands in the process…. And the quantity of money in circulation is equal to the money value of all the goods sold divided by the number which expresses the rapidity of circulation. Marshall was prompt and quick in establishing that the Mill's system had a weak link in the rapidity of money circulation. Marshall's version of the QTM is best examined through the eyes of Keynes; and to this account, Keynes' early writings are best evidences. We would return to this topic in a short while. Returning to the Cambridge versus the Yale debate, it was mentioned that the two equations can be algebraically translated into each other. However, even Keynes failed to take cognizance of the fact that mere ease of algebraic translation does not mean that the two equations are the same. In fact Keynes pointed out that it comes out to the same thing in the end and it is easy to pass from the above formula to Professor Fisher's. Pigou suggested the real advantage, because it brings us at once into relation with volition-an ultimate cause of demand. Dennis Robertson as well could not keep himself away from the most amazing debates of his times. In order to secure the symmetry between his exposition of the Yale and the Cambridge concepts, Robertson suggested a proportion of annual real turnover as an alternative to the proportion of real national income.

Section II: A Survey of General Theory

Economic thought, especially after the 1920s took a significant turn with the likes of Keynes, Marshall, Robertson, Fisher, Pigou and to an extent Sraffa becoming the fore-runners of the economic theory. Major changes were seen in the thought process of these great minds during the course of years to come after 1920s. To this fact, even

Keynes was no exception. His thought and works underwent significant changes through the years 1924-1939. There were several changes in the line of thought; more so, there were attitudinal changes especially post 1930s, as Keynes himself points it out. The General Theory of Employment, Interest & Money (GT) is undoubtedly the greatest efforts in the history of economic thought towards providing a general theory involving the three variables- employment, interest and Money. Evidences for this shift in attitude can be found right from the preface of the GT. In the preface, Keynes warns us that the GT is an attempt at dealing with the difficult questions of the theory and only in second place, test the applications of this theory to practice. Keynes goes ahead and makes another point clear in the preface itself: his distinction between the classicals and the neo-classicals. Having said this, it should therefore be noted that the GT is an attempt not to find that *if the orthodox economics is at fault, the error is to be found not in the superstructure, which has been erected with great care for logical consistency, but in lack of clearness and generality of premisses*[68]. This contention of Keynes should become clear in a while from now. Keynes himself was aware that *those, who are strongly wedded to what I shall call "the classical theory", will fluctuate, I expect, between a belief that I am quite wrong and a belief that I am saying nothing new*[69]. All this while, Keynes was perhaps hinting at an important point: that orthodox economics was good, but the exposition was just not good enough. However, this may not be true as well: Keynes himself attacked the postulates of classical economics in his first chapter in the GT. It is important to note however the historical context in which the GT was written. Wide-spread depression and chronic recession was the order of the day. Keynes was busy drafting the report of the Macmillan committee and also making his taxations dictums public. Also, he had just finished writing an epic putting in six years of his life: A Treatise on Money. Given this set-up, the GT surely achieved its purpose of providing prescriptions for the distressed economy. And to help him out in this distressed conditions, Keynes relied on the expertise of R. F. Kahn, Dennis Robertson, A.C. Pigou and Mrs. Joan Robinson to an extent. All of these eminent scholars have left considerable impact on

[68] Keynes, J.M. (1934), *General Theory of Interest, Employment & Money*, pp v (Cambridge University Press) pp v
[69] Ibid

the attitude of Keynes and significantly led to the publication of the GT. Since the times of the Treatise, Keynes was aimed at developing a pure theory of money. The organization of the treatise is no better an evidence of this statement. Keynes begins the treatise with a proper definition of money where in the various forms of money are explained. He then moves on to concentrate on the fact that there are primarily four types of money: commodity money, managed money, fiat money and bank money. Of these, Keynes (1930) suggests that the first three are money-proper and the fourth one is not money-proper but an acknowledgement of debts. *When acknowledgements of debts are used in this way, we may call them Bank Money- not forgetting however that they are not Money Proper. Bank Money is simply an acknowledgement of private debt expressed in the money-of-account which is used by passing from one hand to another, alternatively with Money-Proper, to settle a transaction*[70]. Here, Keynes recognizes that the amounts or transactions in the form of loans or debts are also to be regarded as money. The second chapter of Treatise talks about bank money, creation of bank money and other forms of bank money. This is an important chapter as it lays down the fundamental role of banking in an economy. To Keynes, creation of deposits by the bank is in a way accepting to honour a claim some time at a future date. The Treatise also lays down the fundamental properties of a banking system which can move ahead in an economy. The third chapter of the Treatise is an important chapter that details the analysis of bank money. This chapter carries some important bearings for this work as well. Keynes identifies three major reasons of the public to hold money and these three reasons give rise to three specific types of bank accounts. These accounts are income deposits, business deposits and savings deposits. A savings deposit also corresponds to what used to be called in theories of money, which were stated with primary reference to commodity money, the use of money as a store of value. This question of the value of money bothered Keynes significantly during the Treatise. The quantity theory of money was at the centre point in this botheration. As a result, taking actual data from business deposits and income deposits, Keynes aimed at ascertaining the "*velocities of circulation*[71]" of

[70] Keynes, J.M. (1930), *A Treatise on Money: The pure theory of money*, pp 6 (Macmillan)
[71] Ibid, p 49

income and business deposits. In the two chapters that follow, Keynes describes another fundamental (missing) link in the orthodox theory. It is concerned with measuring the value of money. Some kind of an index number normally would have been instrumental in providing this answer. The question however to Keynes was not the construction of such an index, but which index is accurate! Edgeworth supposedly is to blame for different types of price-levels. Edgeworth distinguished six different standards of leading types- the Capital Standard, the Consumption Standard, the Currency Standard, the Income Standard, the Indefinite Standard and the Production Standard. Forty years later, Edgeworth classified index numbers in three leading types- Index numbers representing welfare, un-weighted index numbers and the labour standard. This plurality of index numbers, or the value of money, or the purchasing power of money was one of the issues of orthodox economics that Keynes aimed at resolving. Keynes had devoted an entire chapter to the value of money in his Treatise. To Keynes, *the fundamental problem of Monetary Theory is not merely to establish identities or statical equations relating (e.g.) the turnover of monetary instruments to the turnover of things traded for money. The real task of such a Theory is the treat the problem dynamically, analyzing the different elements involved, in such a manner as to exhibit the causal process by which the price level is determined, and the method of transition from one position of equilibrium to another*[72]. As a matter of fact, to Keynes during the writings of Treatise, the natural doctrine of the orthodox theory was more appealing and hence, his monetary theory of the Treatise was more towards the investigation of the equilibrium price level or more so, in determining the (equilibrium) value of money. On the train to this journey, Keynes made significant discoveries and broke away from the shackles of the received doctrine: more so, in 18 months from publishing the Treatise, the GT had begun taking shape.

> *The utility of the wage when a given volume of labour is employed is equal to the marginal disutility of that amount of employment.* The GT sets out the context through the denials of the classical postulates. The one we aim to start off with is the second classical postulate that Keynes denies. The principal links in Keynes'

[72] Keynes, J.M. (1930) *Ibid*

argument are the following: a.) the classical theory recognizes only voluntary employment. It is necessary to concentrate on three key factors- how very widely Keynes defined voluntary employment; his concern was entirely with the residual category of involuntary employment. With regard to the definition of involuntary employment, Keynes followed up his definition of second postulate by noting that *disutility must here be understood to cover every kind of reason which might lead a man to withhold their labour rather than accept a wage which had to them a utility below a certain minimum.* The list of "every kind of reason" supplied by Keynes is very long. Most importantly here, the second postulate: *….is also compatible with "voluntary" unemployment due to the refusal of a unit of labour of slow response to change or of mere human obstinacy, to accept a reward corresponding to the value of the product attributable to its marginal productivity.* Leijonhufvud describes this definition of unemployment as *"income-expenditure" unemployment. It is not, I think, unfair to do so-Keynes' followers have had persistent difficulties in assigning a clear meaning to his definition of involuntary employment….. This to Keynes was a classical idea.* Leijonhufvud further quotes a relevant passage from the GT: *Thus writers in the classical tradition…have been driven inevitably to the conclusion…that apparent unemployment….must be due at bottom to a refusal by the unemployed factors to accept a reward which corresponds to their marginal productivity. A classical economist may sympathize with labour in refusing to accept a cut in its money-wage….; but scientific integrity forces him to declare that this refusal is, nevertheless, at the bottom of the trouble.* The essence of GT is therefore the denial of the second postulate of classical economics by Keynes. Keynes had two separate objections to the second Classical postulate and the denial of the possibility of involuntary employment that it implied. The first of this relates to the actual behavior of labour. It concerns the resistance to money wage cuts. *All that Keynes needed to assert is that the worker who is threatened with a lay-off will not offer to take any cut necessary to retain his job. Nor, having been laid off, will he immediately resign himself to shining shoes or selling apples.* With the train of thought towards understanding the GT rightly set out, it is important to

summarize the classical postulates that Keynes rightfully denied: a. that the real wage is equal to the marginal disutility of the existing employment b. that there is no such thing as involuntary unemployment in the strict sense and c. that supply creates its own demand. Having analyzed the second one and understanding the fact that Keynesian definition of involuntary employment is a residual definition of employment attempted by Keynes by lumping together frictional, seasonal and voluntary motives of job-seeking. The residual portion out of the totally able-bodied employable portion is the Keynesian involuntary unemployment (IU). Keynes in his GT has suggested that IU is chronic and present everywhere in every economy. *Men are involuntarily employed if, in the event of a small rise in the price of wage-goods relatively to the money-wage, both the aggregate supply of labour willing to work for the current money-wage and the aggregate demand for it at that wage would be greater than the existing volume of employment.* Keynes' theoretically fundamental objection to the classical theory of labour market is that it misrepresents the nature of wage bargain in presuming that it does not matter whether the analysis of wage determination is done is real terms or money terms; and that this point is pivotal to the current discussion around the scope, content and context of involuntary unemployment as well. Money wages do not affect the labour markets and instead it is the real wages that do so. Keynes recognized this early on and in his version of Pigou's theory of unemployment that real wages matter. *The fact that workpeople in fact stipulate, not for a real rate of wages, but for money-rate is not ignored; but in effect, it is assumed that the actual money-rate of wages divided by the price of wage-goods can be taken to measure the real rate demanded.* The attack on Pigou's theory of unemployment continues in the GT when Keynes is able to demonstrate that in the edifice of equations developed by Pigou, it is essential to assume that the labour is always in a position to determine its own real wage. This implies, as Keynes rightly points out, that the adjustments take place in the right spirit so as to preserve full employment. *Without this assumption Professor Pigou's analysis breaks down and provides no means of determining what the volume of employment will be….His title the "Theory of Unemployment" is, therefore*

something of a misnomer. The attack on Say's law follows directly upon the definition of involuntary unemployment. There are two prongs to the attack. *Both arguments dispute the same Classical notion: that excess supplies must have their counterpart somewhere in effective excess demands of the same total value.* The indictment of Say's law is a topic of central theme for the Keynesian analysis. This is also revalidated by Rogers through: *the distinction between a Say's law or a co-operative commodity money economy and a capitalist bank money economy proves to be fundamental to understanding monetary analysis. Needless to say, the distinction is lost in real analysis. The first odd feature of a Say's law economy is that individuals produce for themselves; hence they may demand their own outputs if they cannot sell it, and consumers and producers are identical. Therefore in terms of Say's law, productions buy productions. But, as both Marx and Keynes argued, this interpretation of production is not compatible with capitalist production. However, the important problem of Say's law when applied to a capitalist economy is that it implies that there is no limit to the profitable expansion of output.* This also therefore implies that output will expand therefore to a point of full employment. Therefore, denial of Say's law also implies denial of full employment and hence one flows from the other.

So long as economists are concerned with what is called the theory of value, they have been accustomed to teach that prices are governed by the conditions of supply and demand; and, in particular, changes in marginal cost and the elasticity of short-period supply have played a prominent part. But when they pass in volume II, or more often in a separate treatise, to the theory of money and prices, we hear no more of these homely but intelligible concepts and move into a world where prices are governed by the quantity of money, by its income-velocity, by the velocity of circulation relatively to the volume of transactions, by hoarding, by forced saving, by inflation and deflation et hoc genus omne; and little or no attempt is made to relate these vaguer phrases to our former notions of the elasticities of supply and demand. If we reflect on what we are being taught and try to rationalize it, in the simpler discussions it seems that the elasticity of supply must have become zero and demand proportional to the quantity of money; whilst

in the more sophisticated we are lost in a haze where nothing is clear and everything is possible. We have all of us become used to finding ourselves sometimes on the one side of the moon and sometimes on the other, without knowing what route or journey connects them, related, apparently, after the fashion of our waking and our dreaming lives. One of the objects of the foregoing chapters has been to escape from this double life and to bring the theory of prices as a whole back to close contact with the theory of value. The division of economics between the theory of value and distribution on the one hand and the theory of money on the other hand is, I think, a false division. The right dichotomy is, I suggest, between the theory of the individual industry or firm and of the rewards and the distribution between different uses of a given quantity of resources on the one hand, and the theory of output and employment as a whole on the other hand. So long as we limit ourselves to the study of the individual industry or firm on the assumption that the aggregate quantity of employed resources is constant, and, provisionally, that the conditions of other industries or firms are unchanged, it is true that we are not concerned with the significant characteristics of money. But as soon as we pass to the problem of what determines output and employment as a whole, we require the complete theory of a monetary economy. Quoting Keynes directly in this manner in this section would help us setting the motivation of this work right from the very beginning. A truly integrated theory of money and prices would therefore need and call for a role of money, not merely as a facilitator of exchanges between the individual agents but also help in determining the level of aggregate volume of outputs and the level of prices simultaneously. Whilst determining the level of prices, we are also determining the individual prices and hence, there seems to be an abrupt confusion to Keynes as well in regarding the classical dichotomy as genuine. The dichotomy however, as we will see further, had played an important role in the theory of value and it is to this role that we believe we can lay our finger on in distracting us from the point- an integration of monetary and value propositions. For when an economy operates, it never determines an absolute level first, then a monetary level is set only to determine the absolute level of prices- this is

ridiculous! Money has a far better role in the economy other than merely being a medium of trade. Keynes was late in seeing this; notwithstanding to say that finally he saw this. The first intimation that Keynes provided while declaring that he was publishing a new book came in the preface of Japanese edition of the Treatise, dated 5th April 1932. *I propose [….] to publish a short book on a purely theoretical character, extending and correcting the theoretical views as set forth in books III and IV below.* ['The Fundamental Equations' and 'The Dynamics of Price Level']. Such a book taking the *treatise* as its basis would be a waste of an attempt; more so the General Theory of 1935 was a much different book. Till 1932, Keynes had informed his mother: *I have written nearly a third of my new book on monetary theory.* Keynes' belief structure however was changing rapidly. Until 1929, Keynes delivered a set of university lectures titled 'Pure Theory of Money'. By the October term of 1932, he had changed it to Monetary theory of production'- an indication of the marked change in emphasis. With due help from Dennis Robertson, the true book that Keynes was also in search of saw the light of the day by 1936. During these formative years, Keynes had finally given up the classical idea of dichotomy, several classical concepts of wages and supply schedules and had truly integrated the monetary and real forces through marvelous designs like the multiplier, the principle of effective demand and the marginal efficiency of capital. However so, something was incomplete and we would provide a flavour of what it was. However, from a classical to a Keynesian, Keynes had to journey a lot- the final Keynes had given up the dichotomy and the general theory had capital, goods, bonds, labour all in the same model and everything determining everything else.

The discussion around forces which determine physical output and the determination of price-level has traditionally been regarded as separate departments in economics. In the later department, money has played the dominant role. The total volume of transactions effected with a given stock of money, M, in a given unit of time is T. The average velocity or rapidity of money circulation is V and P is the general index of prices which enter into the transactions T. Therefore, MV=PT. This famous and yet so simple identity (or

equation?) is known as the Yale equation of the Quantity Theory of Money (QTM), in honour of Irving Fisher. The theory is also presented in the form of proportion, *k*, of the value of what Pigou called the 'total resources enjoyed by the community' which the public desire to hold in form of money. These total resources Pigou denoted by R, so that, M=*k*PR. This form of the QT equation is known as the Cambridge equation, in honour of Marshall and Pigou. Though the Yale and the Cambridge versions can be converted through algebraic manipulations in either form, the underlying concepts are rather different. Fisher and the Yale school thought of money as a means of effecting transactions; Pigou thought of money as a form of holding wealth necessary for effecting the ordinary transactions of life without trouble. Kahn has rightly pointed out that in either form, since the QTM recognizes that alternate liquid assets can well be used as substitutes to money *this is my reason for maintaining that the only sense in which the so-called quantity theory can be given a casual is not really a quantity theory at all but an exercise in portfolio theory.* No wonder, Kahn records that with respect to the various versions of QTM, the Yale equation is a truism, and the Cambridge equation a delusion. John Locke and Hume believed in this relation to an extent as well, primarily due to the reason that the monetary theory of their times was concerned with commodity money systems. *Locke explains* wrote Keynes *that money has two values: its value in use given by the rate of interest and its value in exchange…but he was confused.* Professor Arthur Leigh also maintains that *Locke's theory of money's value in exchange contains all the elements of Fisher's equation. To interpret his theory of demand for money, the Cambridge equation is also useful.* David Hume, sixty years later was not really a quantity theorist at all. In his treatment, there is a causal factor. It is an increasing a stock of money, which so long as the increase continues, raises the level of demand. In its modern form, the QTM was attributed by Marshall to J.S. Mill. Schumpeter emphasizes Mill's claim to be the first strict quantity theorist in the strict sense. The following passage, quoted by Kahn, from Mill's Principles of Political Economy expands the doctrine as he saw it. *the value of money[…] varies inversely as its quantity; every increase of quantity lowering the value, and*

every diminution raising it, in a ratio exactly equivalent. [….] If we assume the quantity of goods on sale, and the number of times those goods are resold, to be fixed quantities, the value of money will depend upon its quantity, together with the average number of times that each piece changes hands in the process…. And the quantity of money in circulation is equal to the money value of all the goods sold divided by the number which expresses the rapidity of circulation. Marshall was prompt and quick in establishing that the Mill's system had a weak link in the rapidity of money circulation. Marshall's version of the QTM is best examined through the eyes of Keynes; and to this account, Keynes' early writings are best evidences. We would return to this topic in a short while. Returning to the Cambridge versus the Yale debate, it was mentioned that the two equations can be algebraically translated into each other. However, even Keynes failed to take cognizance of the fact that mere ease of algebraic translation does not mean that the two equations are the same. In fact Keynes pointed out that *it comes out to the same thing in the end and it is easy to pass from the above formula to Professor Fisher's.* Pigou suggested the *real advantage, because it brings us at once into relation with volition-an ultimate cause of demand.* Dennis Robertson as well could not keep himself away from the most amazing debates of his times. In order to secure the symmetry between his exposition of the Yale and the Cambridge concepts, Robertson suggested *a proportion of annual real turnover* as an alternative to the *proportion of real national income*.

I have called this book the General Theory of Employment, Interest and Money; and the third feature to which I may call attention is the treatment of money and prices. The following analysis registers my final escape from the confusions of Quantity Theory, which once entangled me. I regard the price level as a whole as being determined in precisely the same way as individual prices; that is to say, under the influence of supply and demand. Technical conditions, the level of wages, the extent of unused capacity of plant and labour, and the state of the markets and competition determine the supply conditions of individual products and of products as a whole. The decisions of entrepreneurs, which provide the incomes of individual producers and the decision of those individuals as to the

disposition of such incomes determine the demand conditions. And prices-both individual prices and the price-level-emerge as the resultant of these two factors. Money, and the quantity of money, are not direct influences at this stage of the proceedings […..] *The quantity of money determines the supply of liquid resources, and hence the rate of interest, and in conjunction with other factors (particularly that of confidence) the inducement to invest, which in turn fixes the equilibrium level of incomes, output and employment and (at each stage in conjunction with other factors) the price-level as a whole through the influences of supply and demand thus established*[73].. Towards the end of the *General Theory,* as Kahn rightly notes, Keynes provided a symbolic expression of four elasticities of response, which he wrote '*can be regarded as the generalized statement of the Quantity Theory of Money*'. Keynes added: '*I do not myself attach much value to manipulations of this kind* [….] *I doubt if they carry us any further than ordinary discourse can.'* From the days of treatise, Keynes' major predicament, as the documented literature points out to has been his long fight for the release from the shackles of the Quantity Theory. In the early drafts of the Treatise of Money, the Quantity Theory of Money continued for a time to dominate Keynes' thinking. Keynes' long struggle over a period of six years to produce a version of the Treatise worthy of publication was directed partly to an escape from the stranglehold of QTM in its crude form, Kahn notes. In the end Keynes was able to write that *The forms of quantity theory* [….] *are but ill adapted for this purpose* of exhibiting *the casual process by which the price level is determined, and the method of transition from one position to another.* [….] *they do not, any of them, have the advantage of separating out those factors through which* [….] *the casual process actually operates during a period of change.* Five pages later, Keynes wrote that the conclusions he drew from his Fundamental Equations *are, of course, obvious and may serve to remind us that all these equations are purely formal; they are mere identities; truisms which tell us nothing in themselves. In this respect they resemble all other versions of the quantity theory of money. Their only point is to analyze and arrange our material in what will turn out to be a*

[73] Keynes, J.M. (1939), General Theory, Preface to the French edition, dated February 1939

useful way for tracing cause and effect, when we have vitalized them by the introduction of extraneous facts from the actual world. Kahn quotes the following on the above passage: *Keynes did not explain how the introduction of facts could convert a truism into a causal relationship. This is the first occasion on which Keynes admitted that the QTM is a truism. Nevertheless, Keynes seems to have been so much under the spell of the QTM that he could write about his fundamental equations as though they were versions of the QTM; although, up to this point in his book, the QTM does not figure in them in any sense.* This documentation, we believe is sufficient to summarize that from 1924 to at least 1931 or so, Keynes had changed attitudinally. He had dropped the fascination of QTM (that cannot be missed by the reader of Treatise in chapter 14 of the book!) and a more *General Theory* had started taking shape in his minds. Keynes, in his treatise as well, had hinted of what was going to be the General theory of Interest: this was the liquidity preference theory- Keynes' attempt of reconciling the Treatise with the QTM. The liquidity preference theory explains how the quantity of money exercises a causative influence by helping to determine the rate of interest- or more generally *as we would put it now, the state of credit and the price-level of securities, both fixed-interest and equities.* Dating slightly back to the Keynesian *Tract on Monetary Reform*, Keynes noted that the QTM is fundamental. Four pages after his statement, Keynes *denied the validity of the QTM, in the form in which it is normally presented, except in the long run in which we are all dead.* The distinguishing feature of Quantity Theories is simply the idea that the most convenient method of analyzing income movements is to define a collection of assets, called money, and to organize the determinants of money income in terms of their effects on the supply of and the demand for money. One cannot require that the quantity theory should postulate either pure price-level adjustment or continuous constancy of velocity over time- *if these criteria were imposed on short run analysis, we might well find that history is devoid of pure quantity theorists*[74]. Keynes could not accept the assumption that

[74] Leijonhufvud A (1968), *On Keynesian economics and the economics of Keynes,*(Oxford University Press) pp. 27

aggregate real output can be unambiguously defined. The price-theoretic matter therefore in Keynesian constructs revolves around the inducement to invest and the marginal efficiency of capital. As will be seen shortly, Keynes more advocated quantity adjustments than price movements. The denial of the QTM or Keynes' struggle to get out of the theory therefore, does not sound surprising. Talking about the *General Theory*, Kahn notes that *there is no separate compartment labeled 'monetary theory'. The quantity theory of Money had finally been abandoned.*[75] Keynes, therefore had finally moved on from a quantity theory approach to a theory of flows of money. In his chapter on the General Theory of the rate of Interest, Keynes begins with saying that *whilst there are forces causing the rate of investment to rise or fall so as to keep the marginal efficiency of capital equal to the rate of interest, yet the marginal efficiency of capital is, in itself; a different thing from the ruling rate of interest. The schedule of the marginal efficiency of capital may be said to govern the terms on which loanable funds are demanded for the purpose of new investment; whilst the rate of interest governs the terms on which funds are being currently supplied. To complete our theory, therefore, we need to know what determines the rate of interest.* In his quest for ascertaining the factors determining the rate of interest, Keynes puts his first finger on the major causes of holding money. It is here where Keynes actually discovered that liquidity and more so, parting with the liquidity could be regarded as one of the important causes of the rise of interest rates. To Keynes, *thus the rate of interest at any time, being the reward for parting with liquidity, is a measure of the unwillingness of those who possess money to part with their liquid control over it. The rate of interest is not the 'price' which brings into equilibrium the demand for resources to invest with the readiness to abstain from present consumption. It is the 'price' which equilibrates the desire to hold wealth in the form of cash with the available quantity of cash;—which implies that if the rate of interest were lower, i.e. if the reward for parting with cash were diminished, the aggregate amount of cash which the public would wish to hold would exceed the available supply, and that if the rate of interest were raised,*

[75] Kahn R.F. (1984), *The making of Keynes' General Theory,* (Cambridge University Press), pp. 123

there would be a surplus of cash which no one would be willing to hold. If this explanation is correct, the quantity of money is the other factor, which, in conjunction with liquidity-preference, determines the actual rate of interest in given circumstances. Liquidity-preference is a potentiality or functional tendency, which fixes the quantity of money which the public will hold when the rate of interest is given; so that if r is the rate of interest, M the quantity of money and L the function of liquidity-preference, we have M = L(r). This is where, and how, the quantity of money enters into the economic scheme. Therefore, in the Keynesian construct of the liquidity preference, the analysis boils down to understanding *why such a thing as liquidity preference exists* as a leader to the question of what determines interest rate. Keynes here suggests us returning to the *ancient distinction between the use of money for the transaction of current business and its use as a store of wealth.* In the later macroeconomic literature, however, the term liquidity preference has become synonymous with 'demand for money'. However, in this regard, we therefore thought it is important and look back at what Keynes was suggesting. Similarly, Keynesian definition of money is much broader in the sense that it included money as well as non-money assets. In the reasoning for the liquidity preference, Keynes highlights the notions of the opportunity cost of funds, or the cost of moving from cash to other forms of non-money assets. Therefore, including the interest theory in this discussion around money and value provides completeness to the argument. However, of late, the money demand function is usually conceived as a stable relationship between the demand for cash balances and the observed rate of interest. Econometric analysis suggests this is true as well. However true it may be from the lines of best fitting lines and technical statistics, Keynes definitely predicts that this relationship will be unstable in the longer run: the demand for money at a given level of income *will not have definite quantitative relation to a given rate of interest of 'r;-what matters is not the absolute level of 'r' but the degree of its divergence from what is considered a fairly safe level of 'r'*[76]. Over time, as Leijonhufvud suggests, opinions of this fairly safe level will be revised in the light of experience. *In*

[76] Leijonhufvud A (1968), *Ibid*

Keynes' theory, such revisions imply shifts in money demand function commonly used in Keynesian macro-models. Yet again, the Keynesian exposition of the theory of interest rate points out that the general theory is an explanation provided without resorting to any rigidities. Wage-price flexibility, interest rate flexibility and quantity adjustments are Keynesian explanations towards the general theory of interest, employment and money. The principle of effective demand is a logical extension of the flexible adjustments provided by Keynes. Lack of quantity adjustments and hence, under-full employment leading to *wasteful* government spends to bridge the gap provides the theory for unemployment. Whilst wage-price flexibility leads to the denial of the classical postulates of upward sloping labour supply curves, interest rate flexibility tackles and establishes the link for the money market. Commodity and labour markets adjust in commodities through the multiplier.

An increase (or decrease) in the rate of investment will have to carry with it an increase (or decrease) in the rate of consumption; because the behaviour of the public is, in general, of such a character that they are only willing to widen (or narrow) the gap between their income and their consumption if their income is being increased (or diminished). That is to say, changes in the rate of consumption are, in general, in the same direction (though smaller in amount) as changes in the rate of income. The relation between the increments of consumption which has to accompany a given increment of saving is given by the marginal propensity to consume. The ratio, thus determined, between an increment of investment and the corresponding increment of aggregate income, both measured in wage-units, is given by the investment multiplier. Keynes claimed that additional expenditure on public works can be financed by creation of additional money, instead of borrowings from the public, though if the programme is heavy, some pumping may be resorted to from the banking system. An important point is that the increase in employment is a result of necessarily an increase in the amount of money, contrary to what Robertson believed. Keynesian theory of multiplier is based on an important principle of marginal propensity to consume. The marginal propensity relates to money income and psychological

reasons to consume. This implies that as income increases, the gap between income and consumption increases faster. The level of money income is determined simultaneously along with the system and hence, the dynamics of the Keynesian world can be ascertained using the variable, MPC. Changes in money income or the marginal propensities to consume lead to changes in income levels in a defined manner. Estimating the MPC for the world, for USA, for Orange County, for males, for females etc has been always the spirit of many econometrically driven economists. Empirical estimations of propensity however can provide only a leader to the entire process of economic *tatonnement*. The 'Widow's Cruse' and the 'Danaid Jar' fallacy are also peculiar extensions of the propensity to consume principle. *There is one peculiarity of profits (or losses) which we may note in passing, because it is one of the reasons why it is necessary to segregate them from income proper, as a category apart. If entrepreneurs choose to spend a portion of their profits on consumption[…] the effect is to increase the profit on the sale of liquid consumption goods by an amount exactly equal to the amount of profits which have thus been expended[….] Thus, however much of their profits entrepreneurs spend on consumption, the increment of wealth belonging to entrepreneurs remains the same as before. Thus profits, as a source of capital increment for entrepreneurs, are a widow's cruse which remains undepleted however much of them may be devoted to riotous living. Where on the other hand, entrepreneurs are making losses, and seek to recoup these losses by curtailing their normal expenditure on consumption, i.e. by saving more, the cruse becomes a Danaid Jar which can never be filled up.* The consumption thus lies at the bottom of entire analysis of the multiplier and therefore the determination of income. The general theory at this point truly achieves its definitive character of being a theory formalizing money and value.

So much for the story of John Maynard Keynes; so what went wrong? Or did we even ever ponder on that question. As students of economics, we were told that the GT was one of the greatest epics of the modern world. But even epics fail to achieve certain things. First, it would be prudent to point out the major limitations of the GT instead of heavily criticizing it. The book contains almost no reference

to international trade and the problem of acceptable balance of trade or payments with a high level of activity. And yet, problems of macroeconomics, national and international, engaged Keynes for the most of his life. Keynes however provided a flavour of this in his chapter on 'Notes of Mercantilism' wherein he has touched a variety of historical topics. Another point worthy of mention here is the formalization of the GT. Great minds like even Hicks tried to provide concrete boundaries, mathematical expositions, algebraic and geometric, but faced immense difficulties. Keynes' letter to Hicks' article on 'Mr. Keynes and the Classics' held a mild criticism though it had a friendly tone: *at one time I tried the equations, as you have done, with I (Income) in all of them. The objection to this is that it over-emphasizes current income. In the case of inducement to invest, expected income for the period of investment is the relevant variable.* Keynes' criticism clearly pointed towards the IS-LM model that Hicks had developed and claimed that it was a true exposition of the GT. The result has been that the elementary teaching of Keynesian economics has been a victim of IS-LM and related diagrams and algebra. *It is tragic that Keynes made no public protest when they began to appear*[77]. Also, as John Robinson put it, *modern teaching has been confused by Hicks' attempt to reduce the GT to a version of static equilibrium with the formula IS/LM. Hicks has now repented and changed his name from J.R. to John, but it will take a long time for the effects of his teaching to wear off.* Of late, in 1973, Hicks has pointed out however that, *the General Theory [.....] provides a model on which the academic economists can comfortable perform their accustomed tricks. Haven't they just? With ISLM I myself fell into the trap.* All said, the GT still awaits a more formalization of the conjectures pointed out by Keynes. Till date, *the general theory stands as a badly written book*. In his extreme hurry to bring out his propositions to the public, Keynes completely forgot and lost sight of the fact that what was going to come out was a strong integration of monetary and value theory. But many economists of his times believe that Keynes had a very little understanding of microeconomic tools. Though he made significant contributions to these through his index number

[77] R.F. Kahn (1984), *Ibid*

theories and theory of forward markets, it can only be understood as his effort to develop building blocks for his macroeconomic structure. Mrs. Robinson echoes to this fact by pointing out an old canard: *Gerald Shove used to say that Maynard had never spent the twenty minutes necessary to understand the theory of value.* The assumption that Keynes lacked an adequate working knowledge of the value theory grants the interpreter of the GT to read into in practically whatever he wants. To complete the confusion, L.R. Klein was found quoting: *as in the Treatise, Keynes did not really understand what he had written.* Keynesian literature has developed beyond the life and times of Keynes by people who claimed to understand Keynes and by even those who actually understood it. That literature is vast and ranges from Hicks to date. There is not enough space neither the need to document it here.

Annexure to Chapter 2: Sraffa's Economics

The analysis of the classical and the neo-classical theories of values can be put in two separate boxes. The classical theory of value is based more on the costs of production and class conflicts, which makes it an objectivist theory, which can be observed or economically measured using numbers. The marginalist notion of theory of value is merely a subjectivist notion, which cannot be observed and can only be indirectly measured. The fundamental logic for this distinction and a semantic shift in the notions of costs of production, or more generally the theory of value is that the two doctrines derive from two different views of nature and goals of economic theory. For the classical economist the goal was to discover the laws that determine the wealth of nations and determine income distribution among various social classes. For the marginalist the purpose is to determine the economic behavior of individual human agents and to determine equilibrium price of individual commodities. The fulfillment of the later goals requires the use of a subjectivist theory. The existing notions of cost calls for a relook or pre-fabrication in terms of the structure. In his two articles published around 1925-1926, Piero Sraffa was able to demonstrate the most important notions of his times: the relation between costs and quantity produces and the natural of extension of it- the laws of returns under competitive conditions. Coming to a point in his 1925 article, Sraffa highlights Clapham's 'empty economic boxes' and this is where he launches his attack on the mainstream economic thought. *What these circumstances might be, from the point of view of variation of costs in relation to the variations in quantity produced, has not been established, so that the curiosity of anyone wanting to see the empty economic boxes of constant, increasing and decreasing returns filled with concrete industries, remains more than ever unsatisfied.* Here, Sraffa is clearly hinting at the law of returns to scale but points out an important feature of the law- there are very few industries which in fact can be classified and may be well aligned to the law. Sraffa crisply in this article points out that this inability of true classification can be attributed easily to lack of data on costs, quantity or lack of genuine scholars to do so. However, it is

not the case. It is simply the fact that fundamentals of the topic on which the law is based are itself shaky. *In particular, it remains to be seen whether the 'fundamentum divizionis' is formed by objective circumstances inherent in the various industries, or instead is dependent on the point of view of the person acting as observer[…] or to put it other way, the increasing and decreasing costs are nothing other than different aspects of one and the same thing that can occur at the same time, for the same industry so that the industry can be classified arbitrarily in one or the other category according to the definition of the 'industry' that is considered preferable for each particular problem, and according to whether long or short periods are considered.* Sraffa aims at discussing these particular problems at length and the valid argument that he lays his thesis on is the fact that any industry at any point in time may be classified as an increasing cost industry or a decreasing cost one, depending upon at what point in time one views the industry. Sraffa points out that the classical believed in independence of costs and quantity produced; it is the neoclassical thought that put the issue of interdependence of costs and quantity produced in the front-line of economic thought. The idea of interdependence of costs and quantity produced is in fact a result of the change in the basis of the theory of value, from cost of production to utility. The fact remains that only after the studies of marginal utility had called attention to the relation between price and quantity (consumed), did there emerge by analogy the symmetrical concept of a connection between cost and quantity produced. Sraffa always hinted that that marginal notion of cost, profits, revenues and the like had weaker underlying foundations. Weaker still was the microeconomic device of *ceteris paribus* according to Sraffa. Weaker because of the fact that if one decides to analyze the price of coal, it would be very difficult to conduct the analysis without considering the impact on the demand for railways (say). The point that Sraffa made was under competitive conditions, it was *always* impossible to conduct the *ceteris paribus.* To Sraffa therefore, all commodities and all prices were related to one another. His belief was further strengthened by the works of Quesnay and to an extent von-Neumann. Sraffa, after his attack on Marshall's ideas of the microeconomic thought went

into complete economic seclusion as the Librarian at the university. During those days, Sraffa made the most of them by discovering the true David Ricardo through his correspondences. So strong was the Sraffian discovery that dedicated series on the works and correspondences of David Ricardo was entrusted with him by the university. As meticulous as he can be, the works stands today as one of the best edited collection in the history of any subject. During this, he came closer to various classical notions and like the maximum rate of profits of Marx and also the concept of a standard measure of value as a medium between two extremes primarily borrowed from Ricardo. It was during these times that he had started believing in the cyclical nature of production and consumption. Sraffa very well points out that *Tableau Economique* is a correct manifestation of a system of production and consumption as a circular process *and it stands in striking contrast to the view presented by modern theory, of a one-way avenue that leads from the 'Factors of production' to 'Consumption goods'.* Production of Commodities by Means of Commodities therefore is not a wild-card entry into the quintessential Sraffian literature. *In the Preface to Production of Commodities by Means of Commodities Sraffa begins by stating that the investigation [in the book] is concerned exclusively with such properties of an economic system as do not depend on changes in the scale of production or in the proportions of 'factors'. This standpoint, which is that of the old classical economists from Adam Smith to Ricardo, has been submerged and forgotten since the advent of the 'marginal' method. The reason is obvious. The marginal approach requires attention to be focused on change, for without change either in the scale of an industry or in the 'proportions of the factors of production' there can be neither marginal product nor marginal cost. In a system in which, day after day, production continued unchanged in those respects, the marginal product of a factor (or alternatively the marginal cost of a product) would not merely be hard to find—it just would not be there to be found. Thus, at the very outset Sraffa is pointing out that his investigations in the book are not of the usual nature discovering the causes of apparent phenomena, as a causal explanation can only be called for when there is a change. This could also point to the Humean notion of time, and thus an*

absence of time in his theory. As Hume argued, for the quality of the co-existence of parts belongs to extension, and is what distinguishes it from duration. Now as time is composed of parts, that are not coexistent; an unchangeable object, since it produces none but co-existent impressions, produces none that can give us the idea of time; and consequently that idea must be derived from a succession of changeable objects, and time in its first appearance can never be severed from such a succession. The second point to note here is that Sraffa attributes "this stand point" to classical economists from Adam Smith to Ricardo. This, however, should not be interpreted as complete endorsement of classical theory, as we shall see later. All that is acknowledged here is the absence of laws of returns and returns to scale as tools of analysis in classical theory. Chapter one of the book is entitled, 'Production for Subsistence'. This chapter deals with a simple subsistence economy with specialization. Thus, the production process requires distributions of commodities given by the requirements of the technology (for subsistence economy consumption is part of technical requirement) where as, commodities are concentrated in the hands of separate industries after the production process is over. In this case Sraffa finds that there is a set of exchange ratios or prices of commodities that spring directly from the methods of production which can restore the original distribution of the commodities and make it possible for the system to repeat itself at the same scale. Chapter Two complicates the world by considering the case of a system that produces more than its minimum requirements (A system that produces less than its minimum requirements is not considered by Sraffa since such a system cannot have historical viability). Once a 'surplus' is admitted in the system, it becomes, in Sraffa's words, "self-contradictory". The required distribution of the commodities after production is no longer entirely determined by the methods of production. The problem of distribution of the 'surplus' must be solved. He argues that the surplus cannot be distributed prior to the determination of prices because "the surplus (or profit) must be distributed in proportion to the means of production (or capital) advanced in each industry; and such a proportion between two aggregates of heterogeneous goods (in other words, the rate of

profits) cannot be determined before we know the prices of the goods" (p. 6). The upshot of the argument is that both the prices and the rate of profits must be determined simultaneously by the same mechanism. Accordingly, he adds a uniform rate of profits to his system of equations as an unknown, which gives him a system of n independent equations with n unknowns (n-1 prices and one rate of profits) that has an economically meaningful solution. One effect of the emergence of surplus is that commodities can be divided into two separate categories. There can now be some commodities that appear in the system only as outputs but do not enter the system as inputs. Such commodities can be characterized as non-basics whereas the commodities that enter the system both as inputs and outputs can be characterized as basics. Any change in the conditions of production of the basics would have an impact on the prices of all the commodities through its influence as input in the system. Whereas, any such change in the production of non-basics can affect only its own price. Sraffa further complicates the system by arguing that workers' remuneration may contain a part of 'surplus', thus adding another unknown to the system as wages. It is necessary to comment on some of the above propositions at this stage. Within the same Chapter we find that the measure of the 'surplus' has changed. In the beginning only profits were calculated as surplus whereas workers' remuneration was considered to be necessities. By the end of the Chapter, both profits and wages are counted as 'surplus'. So the question arises, what is this surplus and how is it determined? As a matter of fact the notion of surplus is not self-evident. It exists only in relation to the notion of 'necessity'. And the notion of necessity has definite meaning only from the subject's point of view. For a capitalist as a subject, the wages must constitute a necessity and only the profit over which s/he has total control can be taken as surplus. On the other hand, from a technical standpoint all the output over and above whatever has been used up in the production process must be characterized as surplus. From an entirely objective scientific point of view, however, there cannot be any surplus since there cannot be any effect without a sufficient cause or there cannot be any product without an equivalent cost. Thus, it appears that Sraffa takes a technical standpoint towards

his subject matter rather than either a class or a pure scientific standpoint. Secondly, Sraffa identifies his surplus producing system with a capitalist system by identifying the form of surplus appropriation with profits. But not only that. Without any further ado he claims that the rate of profits "must be uniform for all industries". Soon after that he goes on to say that "Such classical terms as 'necessary price', 'natural price' or 'price of production' would meet the case, but value and price have been preferred as being shorter and in the present context (which contains no reference to market prices) no more ambiguous". This has led to an almost unanimous opinion among Sraffa scholars that Sraffa's imposition of a uniform rate of profits on the system is an implicit acceptance of the notion of a centre of gravitation of classical economics. As is well known, the 'natural prices' of Smith and Ricardo and the 'prices of production' of Marx are the centres of gravitation around which the market prices fluctuate. The gravitational point or the 'centre of gravitation' comes about because of competition and mobility of capital, given that capital seeks the highest profit rate[78].

The cyclical nature of commodities was an observation made by earlier writers including the likes of Leontief and von Neumann. However, it was Sraffa who developed the model for portraying a system where production is carried out by the means. The aim of Sraffa was as clear as a crystal as was two-fold- one to provide a concise theory of value and two to provide a basic infrastructure for launching a full fledged critique of the economic theory. Sraffa intended to develop a device through which price movements and the issue of relative prices could be solved forever. This was the underlying basis for a theory of value. *The necessity of having to express the price of one commodity in terms of the other which is arbitrarily chosen as a standard complicates the study of price movements which accompany a change in distribution.* Here, Sraffa is searching for a measurable and an invariable standard for the understanding of the peculiarities of a system of which such a commodity is a part of. In so doing,

[78] Sinha, A. (2001): *Reading Sraffa: The Philosophical Underpinnings of Production of Commodities by Means of Commodities,* Gokhale Institute of Politics and Economics WP231

Sraffa explored various angles of the production relationships in the first place- a production where the economy is a subsistence economy, followed by a surplus bearing economy. In the later sections, Sraffa also extended the discussion to fixed, circulating capital and to the cases of joint and by-products. All of them highlighting one important fact-Sraffa's intriguing quest for an invariable standard of measure. It is this measure that Sraffa says to be the foundations and *if the foundation holds, a critique may be attempted later by the writer or by someone younger and better equipped to do the task*. The production-price equations of Sraffa would be the most logical starting point for the nature of work we intend to conduct. These sets of equations can be represented as:

$$\begin{aligned}
&\left(A_a p_a + B_a p_b + ...K_a p_k\right)(1+r) + L_a w = A p_a \\
&\left(A_b p_a + B_b p_b + ...K_b p_k\right)(1+r) + L_b w = B p_b \\
&..... \\
&\left(A_k p_a + B_k p_b + ...K_k p_k\right)(1+r) + L_k w = K p_b
\end{aligned}$$

In the above model, there are *K* commodities that are represented using as many production equations. On the left hand side of each equation, we have the aggregate value of inputs that determine the value of outputs produced. As the model is seen, a commodity enters the production of other commodities valued at its own prices that are represented as p_i with the subscripts representing the number of the commodity. An important definition is in the order. *Commodities that enter the production of every other commodity are called basic commodities and that which do not enter the production of other commodities are called non-basic commodities*. It is worthwhile to note this definition, as only the determination of basic commodity prices is important as these are by definition the capital good industries and the non-basic industries derive their prices from the basic prices. The producer of each commodity enjoys a competitive rate of profits *r* on the volume of capital invested. The labour terms L_i dictate a uniform wage rate the economy. In simple matrix notations therefore the above Sraffa model can be characterized by

$$Ap(1+r) + wL = Bp$$

This system involves usage of circulating capital only. Sraffa devotes a separate section in itself to analyze the characteristics of a system with fixed capital. The economy is seen to produce more than what is required for subsistence and there is a surplus to be distributed. Sraffa says that in this regard the system becomes self-contradictory. Sraffa has introduced wages on the same footing as the fuel for engines and feed for cattle. Sraffa assumes that the whole of this wage is variable and he does not intend to tamper with the traditional definition of wages. Sraffa suggests that such an assumption would have its own drawback and *that is it involves relegating the necessaries of consumption to the limbo of non-basic products. This is due to their no longer appearing among the means of production on the left-hand side of the equations: so that improvement in methods of production of necessaries of life will no longer directly affect the rate of profits and the prices of other products. Necessaries however are essentially basic and if they are prevented from exerting their influence on prices and profits under that label, they must do so in devious ways.* Sraffa, for labour assumes that the whole labour in the economy may be taken to be unity and that L_a, L_b etc would be annual quantities of labour defined as a fraction of total annual labour which is one. More so, it is assumed that $L_a + L_b + ...L_k = 1$.A uniform rate of profits is presented in the system, may be with a view to exhibit competition amongst industries. Prices and rate of profits are determined simultaneously in this system, for without knowing the one, the other cannot be known. The next item on the bill of enquiry for Sraffa is even more intricate. After the prices and other variables of interest can be discovered, the important question is how to determine the standard which is invariable to any economic fluctuations. Sraffa points out that for the standard to be truly invariant; there need be a ratio of the net product to the means of production of the system. *This ratio we shall call the standard ratio.* Thus, in the standard system, the ratio of net product to the means of production would remain the same whatever variations occur in the division of net products between wages and profits and whatever the consequent price changes. In so doing, we would have truly acknowledged Sraffa's *quest*. We ask the question as to how much replacements of each industry are required each period in order to

achieve the slated rate of profit. The answer that we get for each industry is what we call the output scalars or the multipliers. The problem for the standard system can be stated in general terms as: the problem of constructing a standard commodity amounts to finding a set of *k* suitable multipliers to be applied respectively to production of commodities *a,b,…k. The multipliers must be such that the resulting quantities of various commodities will bear the same proportions to one another on the right hand sides of the equations (as products) as they do on the aggregate of left hand sides (as means of production).* These by analogy determine the maximum rate of profits-that rate which corresponds to zero profits- of their respective industries and competition dictates that these be equal. Lastly the Sraffa postulates that the entire labour force in the economy be preserved as these transitions for adjustments happen and these are to be adjusted as per the output multipliers for each industry. One important point worth noting is that since the capital goods only will be replaced over time, only the basic good industries enter the dual relationship, or what we call the problem of output determination. Thus the Sraffa system simultaneously is a system of determination of price and output; a theory of value in its true spirit. Sraffa's system of output determination can be described as

$$\begin{aligned}
&\left(A_a q_a + A_b q_b + ...A_k q_k\right)\left(1+R\right) = Aq_a \\
&\left(B_a q_a + B_b q_b + ...B_k q_k\right)\left(1+R\right) = Bq_b \\
&..... \\
&\left(K_a q_a + K_b q_b + ...K_k q_k\right)\left(1+R\right) = Kq_b \\
&L_a q_a + L_b q_b + ...L_k q_k = L
\end{aligned}$$

In its general form the dual relationship is given in the following manner $A'q\left(1+R\right) = Bq$. This system is aptly described as Sraffa's system of output determination. From this, we obtain the necessary multipliers and apply it to the equations of the production system and transform it into a Standard system as follows:

$$q_a\left[\left(A_a p_a + B_a p_b + ...K_a p_k\right)(1+r) + L_a w\right] = q_a A p_a$$
$$q_b\left[\left(A_b p_a + B_b p_b + ...K_b p_k\right)(1+r) + L_b w\right] = q_b B p_b$$
.....
$$q_k\left[\left(A_k p_a + B_k p_b + ...K_k p_k\right)(1+r) + L_k w\right] = q_k K p_b$$

From these sets of equations, we can conveniently derive the standard national income. For the remaining course of Sraffa's book, he aims to use the standard national income as a unit of wages and prices in the original system of production. He has truly achieved his desired objective! The foundations surely seem rock solid.

Next, we consider the mathematics of the Sraffa system as a whole. Assuming *n* commodities in the system, there are *n* price equations and *n+2* variables. We can eliminate[79] one of the unknowns by fixing either one of the prices equal to unity (Walras, 1874), or by fixing the absolute wage rate equal to unity (Keynes, 1936), and then there will remain *n* equations in *n+1* unknowns. Thus there is an equation missing that would help in determining all the *relative* prices in the economy. The Sraffa system in its current form is incomplete and is open! In Sraffa's own terms, the system "*moves with one degree of freedom"*. We are one equation away from actually and mathematically solving it: not only that, we are just one equation away from determining a general production-price equilibrium in this Sraffian edifice. *A degree of freedom in the system implies that the system is indeterminate unless one variable is given from outside the system. As Hahn[80] has correctly pointed out, taking either wages or the rate of profits or a price given from outside can formally solve Sraffa's system. One could think of a price of a basic good being fixed by the government. Sraffa, however, considers only wages or the rate of profits as given from outside. Most likely this is because taking a price determined by the government could only give an arbitrary solution to the system. On the other hand, wages or profits have distinct status from the rest of prices given that they are income categories. Sraffa's position appears to*

[79] Note that the construct of the *numeraire* is used only for the Sraffa system and is dropped in the analysis of Money, by definition.
[80] Hahn, F.H. (1982), "The Neo-Ricardians", *Cambridge Journal of Economics*, Vol. 6, pp. 353-374.

be that the same complex socio-historical processes that have given the technical configuration and the surplus of the system also determine the income categories. Giving one income category is tantamount to determining the other income category simultaneously, given the surplus. In the classical tradition real wages were generally taken as given by the socio-historical forces at any given time. The classical economists (particularly Ricardo and Marx) took the standpoint of the capitalist in analysing the capitalist mode of production and identified surplus with non-wage incomes only. Sraffa's technical standpoint, on the other hand, leaves it open. As Sraffa later in the book argues, "The rate of profits, as a ratio, has a significance which is independent of any prices, and can well be 'given' before the prices are fixed. It is accordingly susceptible of being determined from outside the system of production, in particular by the level of the money rates of interest". This suggests that Sraffa's position could be that the rate of profits is conventionally determined in relation to the going rate of interest, which of course is uniformly given by the monetary authorities. As Sraffa wrote, "It is possible to conceive of it [the rate of profits] as being 'given' from outside the system of production, such as conforming to the pattern of money rates of interest determined independently by the banking system or the Stock Exchange" (PSP D3/12/78, quoted in Ranchetti, 1998). This may explain the introduction of a uniform rate of profits in his system. Unfortunately Sraffa did not elaborate on this crucial point. This notwithstanding, Sraffa's contention that the uniform rate of profits is "susceptible of being determined from outside the system of production" is yet another evidence against the 'centre of gravitation' interpretation. For, if the uniform rate of profits is the result of a gravitational mechanism then it cannot be conceived of being independent of the system of production, as it must depend upon the level of outputs in conformity with the effectual demand. A uniform rate of profits given from outside the system of production could, however, be applied to a system not necessarily in equilibrium. In this case disequilibrium would imply an unplanned fall or rise in the inventories of various sectors[81].

[81] Sinha A (2001), *Ibid*

The required missing degree of freedom between the equations and the variables can be also filled in by considering the composition of commodities which the individual agents desire to purchase; the demand equations for the *n* commodities. Walras' law dictates that only *n-1* of these will be independent, and that we shall use the empirical demand functions that designed are designed by Stone as $\alpha rK + \beta wL = B_j p_j$ where $K = \sum_{j=1}^{n}\sum_{i=1}^{n} A_{ij} p_i$ is the capital stock, *L* is the annual labour and the constants alpha and beta are propensities of capitalists and wage earners to consume or spend. Thus now we have *2n-1* equations in *n+1* variables, and the system is still over-determinate. Hence we now use the dual construct of Sraffa that shall help determine the outputs of each industry as well. We introduce *n* equations for determination of outputs and to do so absolutely we use what Sraffa calls the labour conservation equation, which adds new *n+1* equations to the system in *n+1* variables, the *n* outputs and the growth rate. Closing this system with the relation between the profit rate and the growth rate, we have fully *3n+1* equations in as many variables and this is what is explained as the complete Sraffa system. Demand and even the slightest hint of demand for a commodity is seen missing from Sraffa's analysis. A more specific reason amongst the many offered by a lot of economists is the fact that Sraffa's quest was towards developing a theory of value, truly capable of providing a standard of value as seen above. In this context, Sraffa also hence did not bother about closing the one degree of freedom that his system lay open. His intention was clear- to provide a device for the critique of the mainstream. More so, what we are doing is taking this device to its ultimate aim- develop a theory of value that now requires filling the gap and leaving no degrees of freedom. In so doing, we propose a logical method- introducing consumption commodity demand functions. We, as described above, would aim to use Stone's linear expenditure systems. A complete overview of this analysis can be analytically examined using a basic *closed Sraffa system* comprising of two commodities alone.

$$(A_{11} + B_{21}p_2)(1+r) + L_1 w = A$$
$$(A_{12} + B_{22}p_2)(1+r) + L_2 w = Bp_2$$
$$\alpha rK + \beta wL = A'(= A - A_{11} - A_{12})$$

These can be written in vector-matrix notation as a system of homogenous equations,

$$\begin{bmatrix} A - A_{11}(1+r) & -A_{21}(1+r) & -L_1 \\ -A_{12}(1+r) & -A_{22}(1+r) & -L_2 \\ A' - \alpha(A_{11}r + A_{12}r) & -\alpha(A_{21}r + A_{22}r) & -\beta L \end{bmatrix} \begin{bmatrix} 1 \\ p \\ w \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

A unique non-trivial solution to the above system exists if and only if the determinant of the matrix of coefficients is equal to zero. Setting it thus equal to zero gives us a characteristic polynomial equation in *r*. The lowest root of the polynomial[82] is the relevant solution. When this is substituted in the price equations, the solutions for the relative prices and wages can be obtained. The "Cambridge Equation" gives the relationship of the growth rate and the profits, and reads as $g = r(1-\alpha)$ [83]. The algorithm that yields the results to the above *closed Sraffa System* will be made clear in a while when we analyze the augmented Sraffa model to carry on our discussion of money and value theory.

[82] In Matrix language, it is called the lowest eigenvalue of the characteristic vector or the eigenvector and hence we can easily resort to Perron - Frobenius theorem

[83] Note that g=(B-A)/A and if we allow a proportion of profits to be consumed equal to alpha, then $g = \frac{B - A - \alpha rA}{A}$ and we get the equation as above.

Annexure to Chapter 3- A Model of Commodity Money

Money has dominated the economic systems for ages. Right from stone to gold to paper and plastic money, civilizations have been formed and destroyed because of money. Such a pivotal aspect to the economic systems yet not a single model is able to provide for the role that money is expected to perform in the real monetary economies. Before we can move any further, consider a situation that would prevail if there were no money. Suppose there were N commodities and T traders dealing in them. Suppose, without loss of generality that every trader deals in every commodity. Then there would be a total of TN (N-1) quotes that will have to be made for N commodities. For example, suppose there were 100 traders dealing in 1000 commodities. There would be 1000X999X100=99900000 price quotations in all; about 100 millions! Any individual willing to buy or sell a commodity would have to consider all of them to determine a.) Which trader to buy or sell them from and b.) What would be the sequence of commodity transactions? The choice of the trader will depend upon whether he is offering the lowest or the highest quote for the commodity depending upon whether the individual wishes to buy or sell. The choice of the sequence of commodity transactions is important too! There will be several routes for buying or selling the commodity using other commodities as intermediaries. There is always a possibility of making arbitrage profits by selecting a mispriced sequence of transactions. For example, suppose there are three commodities, wheat, milk and rice and their price quotes are 2 kg. Wheat =1 kg. Rice; 1 liter milk =1 kg. Wheat; 1 kg. Rice =1 liter milk. Suppose an individual has milk to sell and buys wheat. He will not clearly sell milk and buy wheat according to quote 2. It will be profitable for him to sell milk at quote 3, buy rice, sell rice at quote 1 and buy wheat and end up with 1 kg more wheat. Our individual will have to rummage through all such sequences of transactions to find the most profitable sequence for buying/selling. Of course there is an opposite side to this. No single trader will offer quotations, which permit arbitrage profits at his own cost to his customers. This requirement places two restrictions on the price quotations offered by each

trader. Ignoring trader margins for the sake of simplicity these restrictions are as follows: 1.) the quote for one commodity for the other must be equal to the reciprocal of the quote for the other commodity in terms of the former, i.e. $\frac{P_i}{P_j} = \frac{1}{\frac{P_i}{P_j}}$ for all i,j, i j. 2.) Every indirect quote must be equal to the direct quote, i.e. $(P_i/P_k)(P_k/P_j) \forall i, j, k, i \neq j \neq k$. The first set of restrictions are N (N-1)/2 in number, the second consists of (N-1)(N-2)/2 i.e. a total of $N(N-1)^2$ restrictions. Every time a price changes the trader will have to make out fresh set of N (N-1) quotations which will have to satisfy $(N-1)^2 N$ equations i.e. to say with our 1000 commodities example then 999X999=9980001 computations will need to be made every time price changes. The designation of one commodity as numeraire simplifies all this dramatically. For the N commodities that the trader deals in he need give only (N-1) quotes in terms of the numeraire commodity. He need not perform $(N-1)^2$ N computations at all. Designating a numeraire automatically ensures these. All arbitrage opportunities two, three or higher order sequences stand eliminated. [For each trader the number of quotes reduce from N(N-1)=1000 999=999000 to 999]. Of course different traders would quote differently so that there will be T(N-1) quotes in the market. However by means of a direct comparison of price quotes of different traders, inter-trader arbitrage will ensure uniform price quotes. The number of effective price quotes will be reduced to (N-1) which is dramatically lesser than TN (N-1). In mathematical terms the degree of complexity has been reduced from a power of three (cube) to a power of one. At the same time everybody's record keeping has become smoother. With all transactions valued in terms of the numeraire and with arbitrage possibilities being eliminated, the values e.g. profits do not vary with the choice of the commodity in which the accounts are kept and the inter-commodity quotes at which the transactions are made. Implicit in the above is the assumption that all traders accept one commodity as the numeraire. However, an important point of distinction between a commodity money economy and a barter economy

is in order. A barter, as described above permits all inter-commodity transactions and allows all pair-wise exchanges of goods and services. However, in the current set-up, in case of commodity money, all pair-wise exchanges of goods between themselves other than the money commodity (and not commodity money!) must be excluded. In precise terms, the following should hold. We may now proceed to build a model with commodity money, ascertain the process to equilibrium in such an economy and demonstrate criticalities of such an economy. Every individual when he goes to the market will have to carry all sorts of things with him to consummate his trades because the traders he comes across may not be willing to transact some commodities even if they quote for them (if only implicitly). Can those inventory keeping and transactions cost be minimized? Yes, provided the generally accepted numeraire commodity can itself be used as the medium of exchange. The properties that a commodity must possess to perform as the role of a numeraire are not at all stringent. Almost every commodity can serve as a numeraire. But to be a stable medium of exchange a commodity should possess a host of peculiar and self-contradictory properties. Firstly the commodity must itself be useful, yet it should not form too large a proportion of consumption, or have so many uses that it is actually consumed up. It must not be easily producible, yet it should be easily available as the needs of trade augment. It must be durable. The commodity must have a high value in relation to other commodities to keep its own storage and transport costs within limits. Yet it should be desirable without much wastage to facilitate small trades. In short the medium of exchange should have all properties of good medium, viz portability, divisibility, etc and the properties of a good store of value, viz durability, steady demand and supply conditions etc. it is no wonder that gold, silver and other metals served as money for long periods of time in history. The general use of a medium of exchange imparts an additional advantage, viz; the acts of sale of commodities and the acts of purchases of commodities can be separated in time. This separation bestows some economic freedom to individuals. It reduces the possibilities of their having to make forced sales/purchases. It gives them breathing space to search better prices. In the absence of money, every trader

would be required to carry in principle, some stock of N different commodities. (Strictly speaking commodities where denotes durable commodities). There would thus be TN separate hoards. In the presence of a generalized medium, each trader need only carry the money commodity (and not commodity money!). Consequently the number of hoards reduces to T. In terms of our numerical the number reduces from 100000 to 100. All this simplification due to the adoption of generalized medium or a money commodity. The introduced money commodity surely reduces the complications of barter and hence, provides a logical point in the theory of value. We need to analyze the theory of value in light of the commodity money that shall be introduced in this chapter.

We start with explaining a model of commodity money. We stick to the definition of commodity money as to be a unit of account and medium of exchange. The store of value function will be taken up later in order to keep away the complexities in the current system. By commodity money most economists mean one or other of the precious metals such as gold or silver, although shells or other scarce items have served as commodity money in some societies. Two characteristics of commodity money are that it is a commodity subject to the "laws" of production and that it is in relatively inelastic supply. For example, in a particular economy using gold as commodity money, at any point in time the quantity of gold is effectively fixed. The growths in the supply of commodity money is small in comparison to the existing stock and subject either to developments on the balance of payments or gold mining output if the economy happens to possess some gold mines. Commodity money introduced in this system is thus a produced means of commodity exchange. A basic Sraffa model extended by incorporating stock-flow variables and explained in the previous chapter is used here. Standard assumptions of the Sraffa system are thus retained with respect to uniformity of rate of profits and other symmetry conditions. However, the standard Sraffa system has an agrarian flavour in the sense that the production of commodities is carried by means of other commodities. It is rare that in an industrial economy and where (commodity) money is present, the role of capital has to be divided into fixed, circulating and current capital. The

circulating capital is what is meant by the daily expenses of production, material, wages and other administration expenses. The current capital is the current bank accounts, idle cash and reserve materials i.e. these constitute the stocks of various production materials (and money) and these along with the circulating capital comprises the stock-flow constituents of the production system that we would concentrate upon. In this entire analysis, we do not include factory sheds, plant and machinery etc that make up the fixed capital. All forms of the discussed capitals would be held in terms of the respective stocks, flows and the cash balances and liquid cash expenses would be met through commodity money. This commodity money and its properties would be revisited throughout the course of this chapter. As we started off, we noted that the commodity money of this chapter is a standard and a medium of exchange. However, the necessary properties that the system must bestow on this commodity to be truly money are: firstly that it should be commonly accepted as a means of exchange and any exchange without it should be made impossible. Secondly, it should be necessarily used in every activity of the economy, from production to consumption and investment. It is important albeit it is used in every activity, it should never be used up. Thirdly, it should have a value in exchange: the exchange value of money is defined in terms of its purchasing power. Lastly, the medium of exchange should be able to make trades possible and markets exist: it in itself should be a good hedge for inflation. We would aim to demonstrate that if the commodity to which the 'money-ness' is ascribed adheres to these properties. We assume a production economy with n industries producing n outputs. Capital and labour are perfectly mobile in this system and hence across industries, can be assumed to command a uniform rate of profits and a uniform wage-rate. The individual commodities command an exchange value in the market- this value in exchange of the individual commodities is measured through the prices of these commodities. Therefore, it is important to note that for the exchange of commodities, we assume a market to exist and it is in this market that the prices of commodities, the wage rate are valued, expressed and quoted in terms of the commodity money. In this economy as well, it is true that: *goods buy money,*

money buys goods but goods would not buy goods! In the production system thus described that assumes a commodity money, it is important to introduce a money commodity. This money commodity is a produced means of exchange and is governed by similar laws of production as other commodities. A system of equations or a model representing an economy with commodity money is therefore a logical starting point to this train of thought. We would resort to the stock-flow model of the type introduced in an earlier chapter. Assuming there are *n* basic commodities and *m* non-basic commodities, we can set out to determine the production price equations for this system.

$$(S_{11}p_1 + S_{21}p_2 + ... + Sk_1B_t)r + (A_{11}p_1 + A_{21}p_2 + ... + Ak_1B_t) + wL_1 = p_1B_1$$
$$(S_{12}p_1 + S_{22}p_2 + ... + Sk_2B_t)r + (A_{12}p_1 + A_{22}p_2 + ... + Ak_2B_t) + wL_2 = p_2B_2$$
$$.....$$
$$(S_{1n+m}p_1 + S_{2n+m}p_2 + ... + Sk_{n+m}B_t)r + (A_{1n+m}p_1 + A_{2n+m}p_2 + ... + Ak_{n+m}B_t) + wL_{n+m} = p_{n+m}B_{n+m}$$

These equations are the crux of the value theory that we aim to propose. They form the basis for determining the economic equilibrium and also most critical and relevant economic values such as prices, wage rate, profits, national income, employment and the like. Since the equations are similar to the stock-flow model introduced before, we do not feel the need to reiterate the explanation. However, a new entry in the price equations is the variable *k*. For the time being, it would suffice to know that it is an important variable in the commodity money system. Along with the equations for determination of outputs make up a system for determination of other values such as growth rate, outputs and industry sizes. The output system for this model that is developed from the production-price relations is given by

$$\left(S_{11}x_1 + S_{12}x_2 + ...S_{1n}x_n + \sum_{j=1}^{m} S_{1j}\right)g + \left(A_{11}x_1 + A_{12}x_2 + ...A_{1n}x_n + \sum_{j=1}^{m} A_{1j}\right) = B_1x_1$$

$$\left(S_{21}x_1 + S_{22}x_2 + ...S_{2n}x_n + \sum_{j=1}^{m} S_{2j}\right)g + \left(A_{21}x_1 + A_{22}x_2 + ...A_{2n}x_n + \sum_{j=1}^{m} A_{2j}\right) = B_2x_2$$

.....

$$\left(S_{n1}x_1 + S_{n2}x_2 + ...S_{nn}x_n + \sum_{j=1}^{m} S_{nj}\right)g + \left(A_{n1}x_1 + A_{n2}x_2 + ...A_{nn}x_n + \sum_{j=1}^{m} A_{nj}\right) = B_nx_n$$

$$L_1x_1 + L_2x_2 + ...L_nx_n = L$$

As Sraffa had noted, commodities that enter the production of other commodities are called as basic goods; we call them capital commodities. Commodities that do not enter the production of every other commodity shall be deemed as consumption gods; they are not used in the production of every other commodity. Also, a money commodity has to be introduced in this set-up. We call this commodity with a subscript *t* and labeled as B_t. It would soon be seen that this commodity does not have any price; it is a money commodity! All other transactions and exchanges would be quoted, expressed and conducted in terms of the commodity money- a commodity which has no price of its own (mathematically, this price is 1!). The equation for the commodity money industry has to be introduced. It is given by

$$\left(S_{1t}p_1 + S_{2t}p_2 + ... + Sk_tB_t\right)r + \left(A_{1t}p_1 + A_{2t}p_2 + ... + Ak_tB_t\right) + wL_t = B_t$$

Therefore, this system involves *m* capital goods and *n* consumption goods. The production of these commodities is carried out using current capital, circulating capital, wages and money. All the industries in the economy are Sraffian, enjoying a uniform rate of profits on their current capital- the stocks of commodities and money. The last term in the first parenthesis stands for the stock of money held by all the entrepreneurs in terms of the money commodity. Specifically, $Sk_{n+m}B_t$ represent the commodity money holdings of all the industrialists. The term k_{n+m} is referred to as the money-turnover ratio and is defined as the value of money holdings or desired money stocks divided by the value of the industrial output. There may be several reasons to keep money as a part of the commodity stocks. From mere balance sheet perspectives, these may

be understood as cash balances kept for meeting unforeseen business circumstances. Entrepreneurs are assumed to hold cash balances as a proportion to their current turnover levels. These can be also referred to as the money demands of the industrialists. These along with the stocks of other commodities make up the capital of the industrialists that earns profits. The term, $Ak_{n+m}B_t$, is used to represent the (flow) money commodity coefficients. It should however be noted that these flow coefficients in terms of the money commodity are necessarily non-monetary uses of the money commodity. Any flows of the money commodity are meant to be its pure value in use and not used for any payments or other purposes. Lastly, these production activities are assumed to generate employment to *L* labourers that earns an industry average wage rate. *We suppose labour to be uniform in quality or, what amounts to the same thing, we assume any differences in quality to have been previously reduced to equivalent differences in quantity so that each unit of labour receives the same wage*[84]. This wage rate is the actually received wage by the labourers for participating in production- also it is assumed that only those labourers that aim to work get the respective jobs[85]. Here, the concept of wages does not require measuring the workers' utility and disutility. These wages are same ex-post and ex-ante as well. *We shall also hereafter assume that the wage is paid post factum as a share of annual product, thus abandoning the classical economists' idea of a wage 'advanced' from capital*[86]. Thus, the total operating expenses, the wage bills, the material requirements in terms of flows and only the profits are assumed to make up the total expenditures of producing commodities. Notice that the stock matrix in the above set-up is post-multiplied with *r* only and not the Sraffian *(1+r).* This implies that producers aim to cover their margins on the total capital alone and that the capital thus introduced is a commodity that is hardly replenished or is hardly used-up in the production process. The terms on the right-hand side of the equation represent the

[84] Sraffa, P, *Production of commodities by means of commodities, 1960*
[85] This is different than the Keynesian version of involuntary employment. To Keynes, if the wages were not satisfactory, labourers would withdraw from production. However, there may be cases when labour would want to withdraw from production not only for wages. Personal reasons, choice and ego could just be a few reasons for not working.
[86] *Ibid*

outputs of individual industries valued at the going market prices. In order to determine demand for consumption goods, Stone's linear expenditure system is used. The advantage of using this system in the current set-up is that it provides measurable demand equations in terms of the variables involved in the model. Stone describes that the demand for any commodity is driven by the incomes, and if we know the incomes of all the individuals and the marginal propensity to consume, we would immediately come to know the total consumption expenditure. We follow the similar logic and start by making the assumption that only workers consume a defined proportion of from their incomes. This proportion appears in the demand equations through the parameter α. Using this parameterization, we obtain the demand equations given by $\alpha_i wL = p_m B_m$ where it is assumed that consumption takes place only out of wage incomes and entire profits are saved. The outputs are determined using Sraffa's system for multipliers or what Sraffa described as the *q-system.* Sraffa had used the maximum rate of profits, *R*, in his q-system; this we replace by the growth rate of the industry. The idea is this- production should be carried out in such a manner that it meets the above mentioned line items in its bill and also provides for its own existence. It should aim to maintain a consistency in size which can be through growths in its capital stocks. Growth in capital stocks implies an increase in the demand for capital (and money as well). This increase in demand for other commodities makes the economy grow as a whole. The story is similar when the demands for capital goods fall as well. Therefore, the model of the economy presented herein comprises of multiple technologies- the production technology, the consumption technology, investment technology and the implicit savings technology. These involve *m+n* production equations, *m* demand equations for consumption goods, *n* output equations for capital goods and 1 growth-profit closing equation[87]. Therefore, the model thus specified has *2m+2n+1* equations and unknowns. An important question worth a mention at the outset is this: is money commodity or the industry producing money commodity a basic industry or a non-basic one? The answer to this question is in the affirmative. Money enters in the production

[87] More on this later.

of every other commodity and hence is a necessary to the production activity. As a result, it assumes the form of a basic industry and hence is also a part of the q-system or the system of outputs[88]. Commodity money is the simplest form of money and an exposition of the same would be provided here in. Fixed values, consumer preferences, national income, growth rate and distribution of income along with the determination of absolute prices and price levels measured in terms of the adopted commodity money standard would provide the first step to the theory. The second step would be to test the comparative statics of the system and hence deduce properties with commodity money. The famous MV=PT or a similar relation has been explored with this system. However, the adoption of a quantity theory kind of an equation provides no solutions to this system and hence we have to conclude that resorting to QTM may not be possible in this system. We would also claim that the excess demands at each time do not necessarily equate the value of money or in other terms, the Walrasian law does not hold as well.

We now begin providing more flesh to the system. We would follow similar methodologies in subsequent chapters where we would introduce an economic model depicting the specific case and then follow it up with an illustrative economy and actual numbers. The more important point being since most of the theory we build can be tested in this manner; we would use the conclusions from these models for deducing the properties of the actual economies. A numerical example of an imaginary economy will be used to study the properties of the

[88] Clearly, it should be remembered here that the system of equations can be broken down into two fundamental sub-systems. One sub-system is the production-price system which is the primal of the economy. The dual of this economy is the output system or Sraffa's output system. Necessarily enough, the price system and the output system together comprise of the theory of value. Truly so, it would be difficult to analyze price and output together in a system where micro and macro economics divide no longer holds is indeed complicated. On top of that, we have introduced additional complication of commodity money.

greater and the actual economy with a commodity standard.

$$(3p_1 + 2p_2 + 10)r + (2p_1 + 5p_2 + 3) + 5w = 40p_1$$
$$(2p_1 + 5p_2 + 30)r + (5p_1 + 7p_2 + 5) + 5w = 60p_2$$
$$(2p_1 + 3p_2 + 50)r + (2p_1 + 5p_2 + 3) + 10w = 50$$
$$(3p_1 + 5p_2 + 90)r + (3p_1 + 2p_2 + 5) + 10w = 60p_4$$
$$(2p_1 + 3p_2 + 12.5)r + (2p_1 + 5p_2 + 7) + 10w = 50p_5$$
$$(2r + 2)p_1 + (3r + 5)p_2 + ???$$
$$0.45(40w + 20r) = 60p_4$$
$$0.45(40w + 20r) = 50p_5$$
$$(3q_1 + 2q_2 + 2q_3 + 5)g + (2q_1 + 5q_2 + 2q_3 + 5) = 40q_1$$
$$(2q_1 + 5q_2 + 3q_3 + 8)g + (5q_1 + 7q_2 + 5q_3 + 7) = 60q_2$$
$$(5q_1 + 3q_2 + 5q_3 + 11)g + (3q_1 + 5q_2 + 3q_3 + 12) = 50q_3$$
$$5q_1 + 5q_2 + 10q_3 = 20$$
$$321r = 660g - 2w$$

In this economy, invariably, the rate of profit and the rate of growth will be equal to one another; only due to the simplifying assumption that the capitalists save everything and workers consume everything. If we also allow capitalists to consume with a propensity of α, the growth-profit relationship would then be modified to $r = g(1-\alpha)$. We would soon look at this case as well. In the current context, it would be useful to study the properties of an economy where capitalist savings are absent. The production price equations are presented in the first five equations of the system. The production activities of the economy are carried out using stocks and flows as described. Along with commodity stocks and commodity flow coefficients, we also have stock and flow coefficients in terms of the money commodity. These represent the individual industries' money balances. The closing equation of this system is the pivotal equation. Talking about the sixth equation in the above system, this equation takes into account the (commodity) money flow in the system. Where a case of circulating money coefficients is observed, the quantity theory of money becomes invalid an equation to be used. In such a scenario where there are stocks of money and commodities and flows of money and commodities, it may not be prudent to circumscribe the economy within the quantity theory tradition. Needless to add, if

we superimpose this condition on the economy, the economic equilibrium is out of the window. The seventh and the eighth equation are the demand equations for the consumption goods industries. The demands for capital goods industries are accurately depicted in the production-price relations. The demands for money are also presented in the production price equations through the money-turnover ratios. Equations 9-12 form the output system or the system of determination of multipliers. The maximum rate of profits in Sraffa's output system has been translated into the growth rate here. A point of mention is the uniformity of rates of profits and rates of growth across all industry sectors. However, at the outset it is not so. At the outset, the own rates of growth and also the own rates of profits are unequal. Own rate of growth in the system is defined as $\left(B_i - \sum_{i=1}^{n}\sum_{j=1}^{n} A_{ij} \right) \Big/ \sum_{i=1}^{n}\sum_{j=1}^{n} S_{ij}$. By this definition, for industry one, the own rate of growth works out to be {[40-(2+5+2+3+2)]/[3+2+2+3+2]}=2.166. Similarly, for industry two, the own rate of growth is 2. For the money commodity industry, the rate of growth is 0.14. The own rates of growth apply only to capital goods or basic industries. These rates are called as growth rates because they provide signals whether in future periods, a particular industry is bound to expand or contract. Whilst industries with growth rates above 1 are expected to contract in size, industries with rates lesser than 1 are expected to expand. The demand pattern and the capital technology coefficients harmonize the growth rates across the system. As a matter of fact, this also is the first step towards obtaining the economic equilibrium of the system. At each step, we would first ten to equalize the own rates of growth across the system. This would help us determine the uniform rate of growth of the system as a whole. This rate of growth will be used as rate of profits since rate of growth is equal to the rate of profits. Along with the determination of rate of growth, the multipliers of the system are also determined simultaneously. These multipliers will also be applied to the production price system. At the initial stages, in the first step itself, the rate of growth of the system works out to be 0.306 and the capital goods industry multipliers are 0.352, 0.408 and 1.619 for industry 1, 2 and 3 respectively. This is the case since as described;

industry 1 and 2 had growth rates more than 1. Hence, these industries will shrink in size and the converse is true for the money commodity industry. These quantity adjustments will happen in the course of the algorithm. Industries which use relatively lesser capital or means of production will have a deficit and those with relatively higher usage of means of production have a surplus. This theorem is also a direct result of the standard Sraffa system. Having determined the multipliers for the capital goods industries, we would apply these to the respective industry sectors and move an inch closer to the equilibrium. This process of applying the multipliers to the respective industries was also advocated by Sraffa as a move towards developing the standard system. We would be doing this as a move towards developing a system where the rates of growth are equalized. This happens to be Sraffa's *standard ratio* as well. Pre-multiplying all the basic equations with the three multipliers described as above, we obtain a new set of the production-price system wherein the own rates of growth are equalized. What we have achieved in the process is elimination of any economic reason for flight of capital. As a result, this step also helps determine the equilibrium in the capital goods industries by matching the respective demands with the available supplies. All this while, the commodity money or the money commodity had been out of the discussion. It should be noted that the commodity money industry has its own rate of growth, is an influential member in the price determination process and participates in every economic activity. Having determined the growth rate and the associated multipliers for this economic system, the rate of profits becomes a known variable from the growth profit relation. The growth profit relation is hence a crucial closing equation of the system[89]. Thus, using the rate of profits as a known variable, we may proceed to determine the prices and the wage rate in the system. It should be noted that there are 5 prices and 1 wage rate to be determined. Of these, the price of the commodity money industry is known and assumed to be 1. Nevertheless, this price is also an unknown to the system as the

[89] Digressional to the current topic but worth a mention here is the fact that the system has four implicit closing equations- one closing the production-price equations, a labour conservation equation closing the output system of equations, a growth profit relation closing the loop between price and output relations and finally, an overall closing equation for the system-namely the demand equations. Every equation in its own right merits a special mention.

price of commodity money determines its value in circulation in terms of the purchasing power. It also provides the necessary benchmark for measuring and converting relative prices to absolute prices. The commodity money also helps resolve this issue of price determination and discovering other values in the process. The initial set of prices in this system is 0.612, 0.60, 1, 1.06 and 0.85 respectively for each of the five industries. Along with prices, the wage rate is also determined which is equal to 2.65. It is important to check whether at these prices, the markets clear or not. To validate market clearing, we would resort to using the commodity demand equations. The total initial income is (40w+20r)=112.12. Using the MPC coefficients of 0.45, the commodity demands turn out to be 50.454. Accordingly, it should be noted that there is excess supply in industry 4 where the supply is 60 and marginal excess demand in industry 5 where the supply is 50. There is an excess supply created altogether. As an important step towards the economic equilibrium, we move the supplies towards the demands. Replacing the right hand sides of the consumption goods industries by numbers 55.227 for industry 4 and 50.227 for industry 5, we have used bisected demands and created new consumption goods industry sub-systems. Since the RHS of the equations are altered, the LHS will be changed proportionately in terms of the new supplies. Consequently, the own rates of growth will again be thrown out of equality and the process has to start again from step one where the harmonization of own rates of growth had to be achieved. We start off there again, determine prices, excess demands and keep circulating in this closed loop till the markets clear and we have the sum of value of excess demands equal to zero. Market clearing situations dictate that the equilibrium is attained. The way the algorithm is designed, it is important only that the commodity markets clear since for each *iteration*, the remaining markets are made to definitionally clear. The following tables summarize the iterative history of the solutions.

Table: Results of commodity money system-A

Iteration	P1	P2	P3	P4	P5	w	r=g
1	0.612	0.6	1	1.06	0.85	2.65	0.306
10	0.604	0.602	1	1.074	0.834	2.54	0.327
25	0.604	0.602	1	1.07	0.83	2.53	0.329
38	0.604	0.602	1	1.076	0.833	2.531	0.329

Table: Results of commodity money system-B

Iteration	B1	B2	B3	B4	B5	NNP
1	14.08	24.49	80.99	55.02	56.2	171.2
10	14.13	25.48	80.54	47.46	60.99	166.95
25	14.09	25.45	80.58	47.06	60.79	166.41
38	14.09	25.45	80.58	47.05	60.78	166.406

Table A above summarizes the results of the production-price system where the prices are determined. The outputs determined through the output system are presented in table B. The price of commodity 3, P3, is seen to be one as expected since commodity 3 is a money commodity. Say, if this commodity were *bushels of wheat* for that matter now, the price of commodity one would be .612 *bushels of wheat* and on similar lines, the labour would be paid 2.65 *bushels of wheat.* It should be noted that after 38 iterations, all markets are said to be cleared and hence the general economic equilibrium of the system is determined. One point worthy of mention here is though this is the simplest case of commodity money, arranging equations or depicting the economy in this manner leads to determining the monetary equilibrium in the realms of value theory. We face no hurdles in so doing; expect for the fact that we leave out Quantity theory and the Walras' law. Important properties of the system can be ascertained by determining important values in this system. The gross national product is given by 205.71 (say *bushels of wheat)*. The capital stock given by the value of the stock coefficients is equal to 197.78. Accordingly, the capital-output ratio is equal to 0.961. The savings in this economy are equal to 65.134 and the ratio savings/GNP is equal to 0.3166. The ratio of savings to GNP divided by capital output ratio is equal to the 0.329, exactly equal to the system's growth rate and also happens to be the Harrod-Domar rate of growth. Being a Harrod-Domar rate of growth, it obeys all the principles of Harrod-Domar. The value of excess demands, right from iteration 1

which was equal to 10.32 did not have any other equivalent and hence, the Walras' law did not hold; at least it would not be wrong to state that the validation of Walras' law does not happen in this system. The velocity of circulation of money also is of greater economic significance. The transactions velocity is given by the ratio NNP/Money Supply and the income velocity is given by GNP/Money Supply. The GNP and the NNP are respectively given by $\sum_{i=1}^{n} B_i p_i$ and $\sum_{i=1}^{n} B_i p_i - \sum_{i=1}^{n}\sum_{j=1}^{n} A_{ij} p_j$. Using these, the transactions velocity happens to be 2.06 and the income velocity is equal to 2.55. The algorithm and the depiction of the economy in this fashion lead us to be able to determine all the relevant values and also the economic equilibrium. The real wage rate in terms of price of commodity 4 is 2.35 and in terms of commodity 5 is 3.038. These would be used to measure the price level in the economy. The commodity money supply at the outset in this system was 50. We can now think of altering this money supply and tracing out the effects. From accepted theory, a doubling of money supply is expected to double all prices such that the level of relative prices remains unaltered. This famous idea is called as the *Neutrality of Money* principle. However, if money were neutral and its only role in the economy was to enable determination of absolute prices, any commodity such as *bushels of wheat* of this chapter can do the job. However, we would propose an even shocking result: where money plays a dominant role in the economic activity, it is always non-neutral, be it any form of money. This non-neutrality implies doubling the supply of commodity money in this case, would change absolute prices for sure and not necessarily in the same proportion. The following tables summarize the results for an increase in money supply from 50 to 75:

Table: Increase of Commodity Money Supply: Table A

P1	P2	P3	P4	P5	w	r=g
0.757	0.761	1	1.386	1.025	3.171	0.4438

Table: Increase of Commodity Money Supply: Table B

B1	B2	B3	B4	B5	NNP
15.41	27.54	118.33	45.76	61.86	233.04

It should be noted here at once that the supply of commodity 3, which is the money commodity has been increased from 50 to 75. However, no definite movements happen in absolute prices. In terms of the real price levels, the real wage in terms of commodity 4 falls to 2.29 (base case 2.35) and in terms of commodity 5 increases to 3.09 (base case 3.03). It cannot be certainly said that this would happen always. However, it should be noted that commodity 4 is a cash-intensive industry and industry 5 is a relatively lesser cash intensive industry. However, having said this, it should also be noted that the increments in money supply would not get fully distributed to all the industries; in fact, all the industries are operating under conditions of fixed technological coefficients that would deny the possibility of increased money supply percolating via money demand equations to the respective industries, unless the money demand coefficients themselves change. However, this is also not the case. Comparing with the base case, however, it can be concluded that an overall inflationary condition is observed in this system. The rates of profits and growth both increase in this scenario compared to the base case system when commodity money supply was 50. The prices increase as well in absolute terms and the absolute level of output increases from 227 (tons, say) to 268 (tons, say). This causes the level of NNP to increase from 166 to 233 (say, *bushels of wheat*). Overall, it can be safely concluded that an increase in commodity money supply causes inflationary conditions in the economy. An increase in commodity money supply causes the initial own rate of growth to increase to 0.27 from 0.14 described above. This increased own rate of growth pushes the growth rate of the system upwards and hence, the rate of profits in the system increases. This rate of profits also increases

due to expansionary movements across the economy. An increased rate of profits further pushes the prices upwards and hence causes an inflationary condition. Another aspect worth an enquiry is the case when all commodity money demands are decreased. The controlling variable for commodity money demand happens to the money-turnover ratios. In the base case, these money turnover ratios were equal to 0.25, 0.5, 1, 1.5 and 0.25 respectively for each of the industries. We now aim to reduce these commodity money requirements or commodity money demand to new values of 0.2, 0.5, 0.5, 1 and 0.05. An immediate result of decreasing the commodity money demand would be an increase in the own rate of growth and hence, an increase in the system's overall rate of growth. This would also therefore cause inflationary conditions in the economy. The new set of prices is given below.

Table: Decrease commodity money demand: Results table A

P1	P2	P3	P4	P5	w	r=g
0.676	0.618	1	1.205	0.817	2.612	0.582

Table: Decrease commodity money demand: Results table B

B1	B2	B3	B4	B5	NNP
17.02	30.13	76.8	43.34	63.88	169.86

The inflationary condition is similar to the one caused by increasing commodity money supply. It can therefore be concluded that money cannot be neutral and impacts every sector of the economy. Commodity money also is not merely a veil enabling the solution to absolute prices but is a commodity which has a value in use and also a value in circulation. Also, it can be noted that a reduction in the demand for money commodity leads to contraction in its size. As a result, compared to the base case, the quantity of the commodity money in circulation reduces from 80.58 to 76.8 as above. Also, the income velocity increases due to its reduction in demand for commodity money. It should also be noted therefore, that changes in commodity money demand also has an impact on the real variables along with the monetary variables. Monetary commodity is said to have a value in exchange and also a value in use itself. Its use value is given by the

coefficients A_{it} where the subscript *i* refers to the industry where the money is used and the subscript *t* refers to the index for commodity money, as before. A good case may be presented and is worth an exploration- the case where the non-monetary uses of commodity money are eliminated. These uses specifically are for non-monetary purposes and hence, they may be easier to eliminate. What would happen in this case is that the flow money coefficients are easily removed since then industries would depend only on the non-money commodities for meeting their flow requirements. By eliminating the non-monetary uses of commodity money, its demands in terms of flow requirements are reduced, following which its amount in circulation would increase. An increased money circulation leads to a increase in its velocity of circulation as well. Reduction or elimination of non-monetary uses of commodity money causes a fall in the prices of basic goods industry. A common reason for this is elimination of non-monetary uses of commodity money translates into elimination of any expenditure on this account as well. This causes the overall cost of production to decline leading to a possible fall in the prices of commodities. The consumption goods industries behave in a manner depicted by the demand equations and non-monetary uses of commodity money have little impact on those. The following tables summarize the results of a system where non-monetary uses of commodity money are eliminated. The production price system takes the following form in this case:

$$(3p_1 + 2p_2 + 10)r + (2p_1 + 5p_2) + 5w = 40p_1$$
$$(2p_1 + 5p_2 + 30)r + (5p_1 + 7p_2) + 5w = 60p_2$$
$$(2p_1 + 3p_2 + 50)r + (2p_1 + 5p_2) + 10w = 50$$
$$(3p_1 + 5p_2 + 90)r + (3p_1 + 2p_2) + 10w = 60p_4$$
$$(2p_1 + 3p_2 + 12.5)r + (2p_1 + 5p_2) + 10w = 50p_5$$

The own rate of growth of commodity money increases to 0.26 due to elimination of non-monetary uses of the standard.

Table: Elimination of non-monetary uses of commodity money-Table A

P1	P2	P3	P4	P5	w	r=g
0.516	0.549	1	1.131	0.657	2.214	0.4572

Table: Elimination of non-monetary uses of commodity money-Table B

B1	B2	B3	B4	B5	NNP
15.42	28.02	78.67	39.13	67.38	173.37

Elimination of non-monetary uses is tantamount to reduction of commodity money demand. As a result, it has consequences similar to those under reduction of commodity money demand. The overall volume of commodity money in circulation increases due to its relative reduction in size. Hence, its velocity would increase. The income velocity increases to 2.20 from 1.96 under the bases case scenario. The real wages in terms of commodity 4 reduce and in terms of commodity 5 increases. Overall, it can be said the inflationary conditions may be experienced in the economy. As a conclusion to this chapter, we may say that a monetary and value theory can be integrated in a manner depicted in the system proposed here. Such an integrated theory can be tested for various other conditions like changes in technology of production and consumption, changes in outputs etc. The theory developed so far is robust to generalizations.

Annexure to Chapter 3: A Model of Currency Money with deficit financing

We would now present the picture of such an economy and then characterize and analyze the properties of this system, post the deficit financing.

$$(S_{11}p_1 + S_{21}p_2 + ... + k_1 p_1 B_1)r + (A_{11}p_1 + A_{21}p_2 + ... + A_1 G) + wL_1 = p_1 B_1$$
$$(S_{12}p_1 + S_{22}p_2 + ... + k_2 p_2 B_2)r + (A_{12}p_1 + A_{22}p_2 + ... + A_2 G) + wL_2 = p_2 B_2$$
.....
$$(S_{1n+m}p_1 + S_{2n+m}p_2 + ... + k_{n+m} p_{m+n} B_{n+m})r + (A_{1n+m}p_1 + A_{2n+m}p_2 + ... + A_{n+m} G) + wL_{n+m} = p_{n+m} B_{n+m}$$

The additional flow terms are the terms introduced to depict deficit financing and provide a complete model of currency money economy. The prices post the provision of deficit financing tends to increase; the deficit financing tends to create a demand effect. It creates additional demand and by creating additional demand tends to employ the unemployed labour in the economy. We would now present the revised initial system below:

$$(3p_1 + 0.4p_1 + 2p_2 + 5p_3)r + (2p_1 + 5p_2 + 3p_3) + 1.5p_1 + 5w = 40p_1$$
$$(2p_1 + 5p_2 + 1.5p_2 + 3p_3)r + (5p_1 + 7p_2 + 5p_3) + 1.5p_2 + 5w = 60p_2$$
$$(2p_1 + 3p_2 + 6p_3 + 5p_3)r + (2p_1 + 5p_2 + 3p_3) + 1.5p_3 + 10w = 50p_3$$
$$(3p_1 + 5p_2 + 6p_3 + 0.6p_4)r + (3p_1 + 2p_2 + 5p_3) + 1.5p_4 + 10w = 60p_4$$
$$(2p_1 + 3p_2 + 5p_3 + 2.5p_5)r + (2p_1 + 5p_2 + 7p_3) + 1.5p_5 + 10w = 50p_5$$
$$(12.4p_1 + 19.5p_2 + 30p_3 + 0.6p_4 + 2.5p_5)(1 + g) = 1493$$
$$0.45(40w + 20r) = 60p_4$$
$$0.45(40w + 20r) = 50p_5$$
$$(3q_1 + 2q_2 + 2q_3 + 5)g + (2q_1 + 5q_2 + 2q_3 + 5) = 40q_1$$
$$(2q_1 + 5q_2 + 3q_3 + 8)g + (5q_1 + 7q_2 + 5q_3 + 7) = 60q_2$$
$$(5q_1 + 3q_2 + 5q_3 + 11)g + (3q_1 + 5q_2 + 3q_3 + 12) = 50q_3$$
$$5q_1 + 5q_2 + 10q_3 = 20$$
$$321r = 660g - 2w$$

The terms introduced following the parenthesis of flow variables are the new policy variables in the revised model- the level of deficit financing. While iterating for equilibrium, the final levels of necessary deficit financing are determined by the system in such a manner that the employment gap and the

distortionary gap between NNP market prices and factor costs is eliminated. This revised system re-attains equilibrium with a different set of prices:

Table: Results of complete Currency Economy Model-Table A

P1	P2	P3	P4	P5	r	g	w
9.56	7.40	12.32	9.76	12.12	1.35	1.27	28.38

In this economy, the real wage rate is 2.91 and 2.34 respectively in terms of commodity 4 and 5. Thus, this provision of deficit financed expenditures creates inflationary conditions in terms of the purchasing power of the wage rate. However, in terms of relative prices, there is an overall decrease of the prices. The increase in real wages tends to attract more labour to close the disequilibrium gap. A new final equilibrium can thus be attained through the process of deficit financing. More so, there is also a change in the rate of profits and rate of growth. An increase in deficit financing is necessary when the labour demand is less than the labour supply. In this case, deficit finance is necessary to bridge this gap. The profits and the rate of growth are 1.35 and 1.26. As purchases by the government in terms of the own commodities are introduced in the model, the own rate of growth of all the industries reduces. This causes a fall in the overall growth rate and hence, a fall in the rate of profits. This fall in the rate of profits causes the prices in absolute terms as well to reduce. There can be a case where there is excess government expenditure as well. This case would also merit some discussion. During such cases where there is excessive deficit financing activity in the economy, the labour demand would exceed the labour supply. In this connection, we would see a reverse gap; the NNP market prices would exceed the NNP factor costs. Let us consider a case where excess government expenditure through the way of deficit financing is seen in the economy. In such a case, there would be over-employment in the economy. There would be, say, 48 resources employed but only 40 resources are being paid-a fraud of a second nature. In such a case, the prices would be much lower than the economy with equilibrium level of deficit financing. The real wages in this economy are 3.55 and 2.83 and to reduce the volume of employment to restore it to the level of 40, there has to be a

reduction in real wages. This can be forthcoming through reduction in the volume of deficit financing.

Table: Special case- Excess government expenditure

P1	P2	P3	P4	P5
6.89	5.36	9.10	7.35	9.21

In general, the increase in deficit financing leads to increase the real wage rate and hence increase the level of employment in the economy. This increased volume of employment leads to closing the gap between the valuations of NNP at market prices and factor costs. Reverting back, it should be noted that the government has this tool at its disposal to correct any employment gap and eliminate any abnormalities in the pricing process. It should be noted that initially as we begin with the economy, the own rates of growth were 1.97, 1.77 and 0.85 respectively for industry 1, 2 and 3. As the prices and wages are determined, the income levels in the economy would be determined. It is observed that in the first iteration, there is excess supply in both the consumption goods industries. As a result, in the next iteration the prices of consumption goods industries fall and their demand changes accordingly. However, it is seen that there is now an excess demand in industry 4 and an excess supply in industry 5. Quantity adjustments keep on happening till appoint where all excess demands and supplies are cleared through changes in wealth, income and other price variables. The level of deficit financing has to be accurately determined by governments in such a manner that the gap is exactly eliminated. This also turns out be an important feature of monetary economy- it in itself provides for a role of government. In proper equilibrium, when all distortions are cleared from the system, the NNP of the economy is 2028. This value, when compared to the value 1875 when no deficit financing is used looks higher. The reason for this is that deficit financing creates additional demand and income so that more labour is actually employed in the system. In a system where no deficit financing was provided for, the income velocity of money was 0.79. Due to provisioning of deficit financing, two

monetary effects are seen: one, the level of currency in the system increases from 1470 to 1497; secondly, due to this increase, the velocity of circulation of money reduces to 0.73. This also explains why prices fall. The level of deficit financing at equilibrium is 190.93. The growth rate of the system is also the Harrod-Domar growth rate. In all the cases, there would exist always an inverse relationship between rate of profits and wages: as wages rise, profits necessarily fall and the converse is true. As we can conclude this section, it would be prudent to provide the iterative solutions of the above economy with deficit financing, providing for the accurate role of the state.

Table: Iterative results of a currency money economy: Price System

Iteration	P1	P2	P3	P4	P5	w	r
1	17.13	13.25	21.98	17.34	21.51	48.19	1.308
5	9.52	7.37	12.27	9.72	12.08	28.29	1.351
20	9.55	7.40	12.32	9.76	12.12	28.37	1.352
27	9.55	7.40	12.32	9.76	12.12	28.37	1.352

Table: Iterative results of a currency money economy: Quantity System

Iteration	B1	B2	B3	B4	B5	g
1	28.96	47.02	62.30	58.73	48.81	1.289
5	29.01	47.06	62.25	60.42	49.94	1.267
20	29	47.04	62.27	60.29	49.83	1.268
27	29	47.04	62.27	60.29	49.83	1.268

Table: Iterative results of a currency money economy: Other parameters

Iteration	Savings	NNP	Currency	Capital/output	Per Capita Income
1	919.85	3572	1580	0.1234	90
5	836.69	2023	1496	0.1857	51
20	837.36	2028	1497	0.1854	50
27	837.38	2028	1497	0.1854	50

A few derived variables can be ascertained. The real wages in terms of commodity 4 and 5 respectively at equilibrium are 2.91 and 2.34. The currency velocity defined as the ratio of NNP to total currency is 1.35.

The economic properties of this system could be analyzed in greater details through various simulations that we plan to introduce. The effect of parameters of the system on the equilibrium properties of the system have to be analyzed in the context of currency money. Let us begin by changing the parameters of the system one by one and trace the direction of impact on the economic variables. It is important to note that the parameters in this system are currency demand functions (or the money turnover ratios), propensities to consume, propensities to save asset-wise (propensity for currency and equity) and the wealth of capitalists and workers. Let us begin by changing the easiest of all- the wealth of capitalists and workers. We would increase the wealth of capitalists and workers. Also, we would at each time compare the results of our economic simulations after adjusting for the appropriate deficit financing level so that we at each time are comparing economic systems across the equilibrium positions. Let us begin by changing the wealth of capitalists and workers to 1000 and 400 from previous levels of 800 and 200. This implies disproportionate change in the wealth parameters- while capitalist wealth is increased by 25%, the workers wealth is increased by 50%. The prices would change and increase due to changes in the equity holdings which are a proportion of the workers' and capitalists' individual wealth. Also, the absolute wage rate increases. The rate of profits and rate of growth increases as well.

Table: Impact of increase in wealth- Table A

P1	P2	P3	P4	P5	r	g	w
10.42	8.07	13.44	10.65	13.24	1.35	1.26	31.03

The real wage rate decreases marginally in this scenario to 2.91 and 2.34 in terms of commodity 4 and commodity 5. These comparisons are performed against the case of complete model of currency money with deficit financing. The value of real wages was similar compared to the base case. The NNP of this economy is 2212, higher than the NNP of the base-case economy of 2028. An increase in the overall incomes and a reduction in absolute prices is an immediate wealth effect

in this economy. The value of the commodity-wise outputs also changes in this system. The new outputs are as below

Table: Impact of increase in wealth-Table B

B1	B2	B3	B4	B5
29.00	47.05	62.27	60.28	49.81

It can be seen that due to an autonomous increase of wealth, profits decline and wages increase. Also, the prices increase relatively and the outputs decline. This would happen because with an increased wealth, consumption may not increase in the same proportion and in fact, given the savings propensities, the individual commodity demands increase. It should be noted here that the volume of deficit financing in this economy is relatively higher at 208.11 compared to the level in the base case economy of 190. In general, changes in wealth coefficients do not cause major changes in real variables of the economy. The absolute outputs, growth rate and real wages remain do not change to a greater extent. However, reallocations of wealth and hence capital cause profits and level of absolute prices or change. It should be noted here therefore that, changes in wealth and any attempts to alter social wealth of all the economic agents may lead to only increments in prices without any real impact.

We would now restore the wealth coefficients to the previous level and make changes the marginal propensity to consume of the workers. The current economic system assumes a workers' MPC of .90. We would decrease this to 0.60. An immediate result of the decrease in the MPC would be that the demands and the sizes of the consumption goods industries would reduce. This would cause the rate of profits and the rate of growth to reduce and real wages to increase. Also, a reduction in the MPC increases the savings in the economy and the rate of capital formation. Overall, a reduction in the NNP would be seen due to a fall in the MPC of the workers.

Table: Impact of changes in MPC-Table A

P1	P2	P3	P4	P5	r	g	w
9.38	7.30	12.41	10.04	12.59	0.95	1.27	36.01

In net effect, the outputs of the individual capital goods industries do not change much, compared to the outputs of the consumption goods industries.

Table: Impact of changes in MPC-Table B

B1	B2	B3	B4	B5
29.00	47.05	62.27	59.35	50.53

In value terms, the outputs of the consumption goods industries increases to 1232.04 from 1193.92, measured in terms of the currency. An important impact of the reduction in MPC can be presented here. As the MPC in the economy reduces, thereby causing a decrease of the total demand as indicated by a fall form 1166 to 1041, the level of employment in the economy also falls considerably. Therefore, with this decline in the MPC by the workers, the government has to step in the system again and tweak its policy variable, the volume of deficit financing. There is an increase in deficit financing from 190 to 450. If this increase is not resorted to, there would be under-employment in the economy and an overall shortfall of (aggregate) demand. The government therefore would increase its deficit financing in the event of an economy wide reduction in consumption demand.

The above results should be compared to a system where the level of deficit financing is kept at previous levels and the MPC decreases. In this case, the real wage rate is lower, the level of absolute prices is lower and also, the profit and growth rate is lower.

Table: Results of decrease in MPC without adequate deficit financing

P1	P2	P3	P4	P5	r	g	w
9.38	7.30	12.41	10.04	12.59	0.95	1.27	36.01

The government aims to stimulate demand and hence, at current levels, the sizes of individual industries are also smaller. Accordingly, in this system, the level of NNP is also around 1794 and the full effect of a decline in the MPC is not seen in its totality- one due to the uniqueness of the labour and secondly, due the nature of the algorithm which clears only the commodity markets.

A classic case simulation would be seen if the money turnover ratios are changed in this economy. These specifically are the currency demand functions. In the as-is conditions, the currency demand function are as under:

Table: As-is money-turnover technology

K1	K2	K3	K4	K5
0.01	0.025	0.12	0.01	0.05

These, when multiplied with the respective outputs give the exact currency requirements of the form $k_i p_i B_i$. We would now change these K_is. We would aim to present two cases- one where the K_is increase and the other case where in the K_is decrease. Let us begin with the following assumption for the K_is:

Table: Simulation money-turnover technology

K1	K2	K3	K4	K5
0.02	0.05	0.15	0.02	0.1

The immediate impact of this would be the volume of currency circulating in the economy reduces from 1293 to 1255, providing lesser liquidity to the people to make their purchases of commodities. This reduces the income velocity of money circulation to 0.75 from 0.78 under the base case scenario. As a result, the NNP in the economy reduces considerably to 1587. An autonomous demand gap is therefore created which needs to be eliminated by stimulating further demand. Hence, the amount of deficit financing increases. The volume of deficit financing in this economy is slightly lower at 183 from the volume of deficit financing in the base case economy of 190.

Lastly, we would now change the asset-wise propensities to save of the workers, keeping the aggregate savings propensity equal to the base case economy. The following table should make the assumption for this simulation clear.

	Kwc (Currency propensity to save)	Kpe (Equity Propensity to save)
Base Case	0.5	0.5
New	0.4	0.6

As indicated, we have reduced the propensity to hoard currency and increased the propensity to add to the equity. The immediate effect should be that there would be more capital available and hence the outputs would be higher. This would now create a situation of excess demand and the government would now aim to reduce its expenditure in order to eliminate the situation of over-employment. The

volume of deficit financing reduces to 153 from the base case scenario of 190. The level of NNP reduces as well. The effect on prices is certain; and a result of this reallocation of savings by the workers in the various assets in favour of the equity capital causes prices to reduce. There is more capital stock leading to a reduction in the rate of profits; the profit rate reduces from 1.33 to 1.31.

P1	P2	P3	P4	P5	r	g	w
8.24	6.39	10.66	8.46	10.52	1.31	1.27	25.14

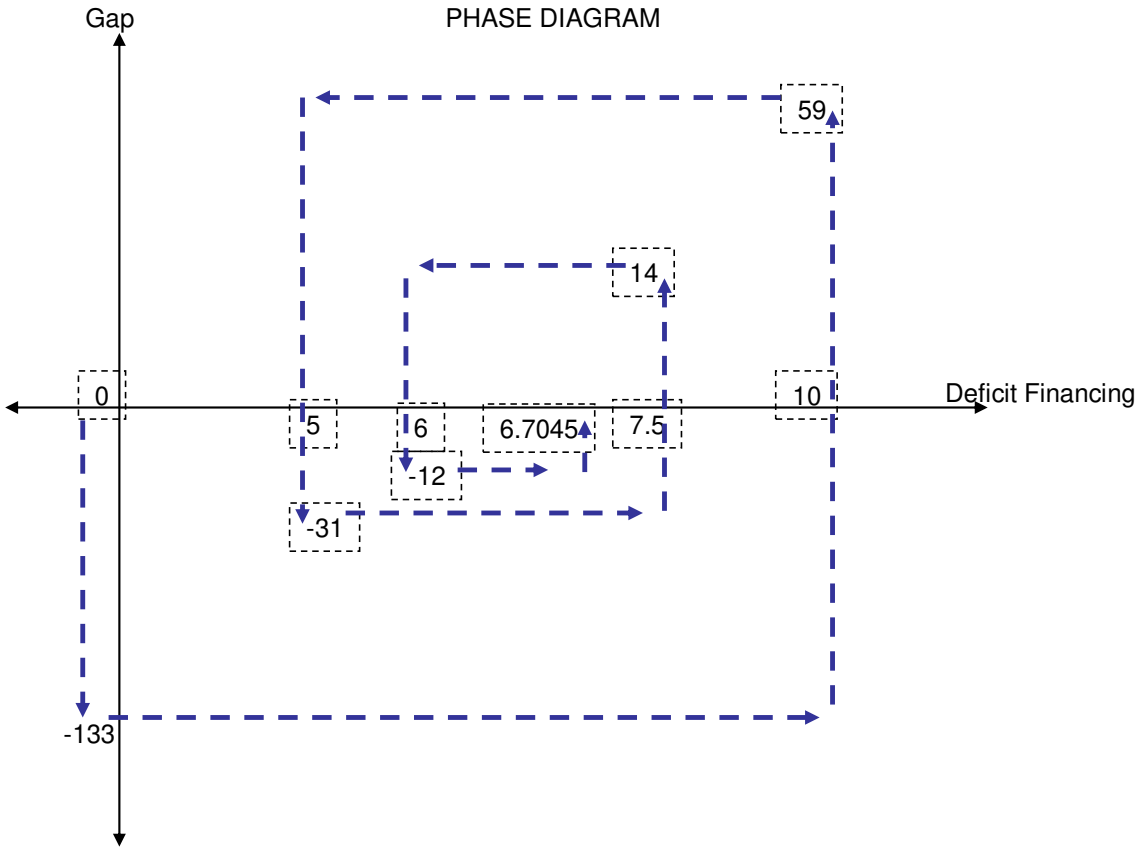
The wages increase marginally and the outputs of the individual industries do not change drastically. The growth rate as a result of minuscule changes in outputs remains unchanged.

In summary, the following can be presented as marquee observations in a currency money system.

Impact variable	**Simulations**			
	Increase of (absolute) wealth of agents	Decrease MPC of workers	Increase Money Demand	Reallocate asset-wise MPS
Prices	Increase	Decrease	Increase	Unchanged
Profit rate	Increase	Decrease	Increase	Unchanged
Wage rate	Increase	Decrease	Decrease	Unchanged
NNP	Increase	Increase	Decrease	Increase
Deficit Financing	Increase	Increase	Increase	Decrease
Absolute outputs	Increase	Increase	Increase	Increase
Real wages	Decrease	Increase	Increase	Increase
Growth Rate	Increase	Unchanged	unchanged	Unchanged

The above table illustrates the impact of changes in certain key parameters in the economy on the economic variables. It can be concluded that changes in any parameters leading to a demand reduction in the economy would entail an increment in the deficit financing and the impact on the remaining variables of interest can be traced out accordingly. Also, a point worth noting is this: in a currency money economy, all the markets ***may not clear*** autonomously without any external corrections. An externally introduced agent, system or even a catalyst like money is enough to disturb the processes of various markets, if the market for any of the economic variables fails to exist. Another point worth note

is that we have left out the labour and the money market out of analysis not by choice but by reasoning and economic consistency of the system. In a system where labour enters production on the same footing as capital and money, there may not be a separate device to identify its price; in fact it will always be determined as a part of the production process. In effect, it should be concluded that in a currency money system, deficit financing plays a dominant role in closing the system. However, deficit financing and its use is necessary only in a system where an external form of a monetary commodity is introduced. What may need elaboration at the end of this chapter therefore is the device of pulling the economy out of disequilibrium phases. It should be noted that we had started off with an economy where the level of deficit financing was zero and hence had experienced a distortionary gap of -133. We would now increase the coefficients attached to the deficit financing, $A_i G$ to 10; this leads to sign reversal in the gap and the gap increases to 59. This implies that the value of deficit financing has to be between 0 and 10. We now take the value to be 5. At 5, the gap reduces to -31 indicating that the level of deficit financing should lie between 5 and 10; we try 7.5. At 7.5, the gap increases to 14 and hence, the level of deficit financing has to be between 5 and 7.5; we try a value 6. At a value 6, the gap is -12 indicating the



value of deficit financing has to be between 6 and 7.5; the accurate value happens to be 6.7045. This is crude and a rudimentary method of finding equilibrium of the system. It should be noted that whilst we are aiming to reduce the gap to zero, in the process we are also aiming to eliminate the gap between NNP valuations at factor costs and market prices. This implies a correction of outputs, prices and employment brought simultaneously with the help of deficit financing i.e. currency money. Thus, this process of eliminating the gap is the core process of a monetary economy.

Annexure[90] to Chapter 5: The failure of Quantity Theory Equation as a closing equation

In this brief note, the conceptual properties of the system introduced in chapter 3 remain intact. However, we would like to demonstrate the failure of using a quantity theoretic equation in determining the solutions to an economy with money in the system. It should be remembered that quantity theory formed the backbone of the entire monetary synthesis and was thought of as a means to determine the "absolute" prices- though what it determined was an absolute "level" of prices and not the individual commodity prices. Nevertheless, the use of such an equation of the quantity theory nature in any of the neoclassical frameworks is missing and where used, it is only found to provide contradictory results. This emphasizes the only point- the quantity theory equation cannot be used as a closing equation for the price system- in the sense that such an equation will not provide "meaningful" solutions to the system[91]. The quantity theory of money says that the value of transactions in an economy is restricted by the volume of money circulating in the economy. We would use a similar equation in this note to demonstrate the failure of the quantity theory. In the economy presented in the chapter 3, money was held as capital stock with a relationship with the turnover. The money-turnover ratio Ψ_i of chapter 5 is the actual money holding in the economy. To introduce the quantity theory equation in the system, we need to introduce an exogenously given money supply- say we fix this at 2,500. In this case, the closing equation would take the following form $\sum_{i=1}^{m+n} \psi_i p_i B_i (1+g) = 2500$. In this regard, Ψ_i can also be regarded as the inverse of velocity of circulation of money, to an extent. Thus, the equations would change

[90] Though it reads "Annexure to chapter 5", the conclusions derived in this note also apply to economic system with only currency money- those of chapter 3. The only difference is mentioned in the end of this note

[91] Notice the use of the adjective "meaningful". We will clearly see the context in which this is being said in a while. However, it is important to state here that though we replace the closing equation in the price system of chapter 3 with the equation of quantity theory of the type to be introduced in this note, it may lead to "closing" the system *mathematically* still- however, the economic logic of such a system will be lost!

in the following

manner

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1 + i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1 + i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1 + i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1 + i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1 + i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$(0.25p_1(1 + g) + 0.5p_2(1 + g) + 1p_3(1 + g) + 1.5p_4(1 + g) + 0.25p_5(1 + g)) = 2500$$

$$104.275 + 47.5(1 + i_1) = 145(1 + i_1)$$

$$11.608 + 65(1 + i_1) + 80(1 + i_2)^2 = 145(1 + i_2)^2$$

$$14.979 + 20(1 + i_2)^2 + 125(1 + i_2)^3 = 145(1 + i_2)^3$$

$$853 = B_4 p_4$$

$$848 = B_5 p_5$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

The only change above that we have made is in equation 6, which is the closing equation for the price system. The entire algorithm of arriving at solutions of the system remains entirely similar to the one detailed in chapter V. However, the results of this system are much different than the one in chapter V. In the first place, this system does not solve itself fully since we obtain one or a few economic variables as negative values. Since a change is made in the closing equations for price system, invariably these negative values occur either for prices, wages or rate of profits or any combination of these three variables. As the prices become negative, the value of debt also becomes negative and interest rates become bizarre. Lastly, if such an equation be used in the system with currency money only, it should be noted that we do not encounter negativity of economic variables; however the disequilibrium gap still exists- only to reiterate that

solutions with quantity theory equation are also not possible for a monetary economy!

Annexure to Chapter 6: Inter-temporal Equilibrium

Previous sections detailed out the process of equilibrium within the purview of a monetary theory of value. In effect, we studied the properties of a system where money in its various forms was involved. It was observed that in this type of an economy, deficit financing provided the only measure to clear any sort of disequilibrium noted. This effect behaves exactly akin to the impacts Keynes had predicted in his general theory with respect to *wasteful spending*. Two important points worth to be noted before we can proceed any further: in this capitalist monetary economy, any form of debt, external or fiat money will cause a disequilibrium gap to exist and deficit financing would have to be introduced as the only alternative if equilibrium has to be restored. Secondly, in this economy, the standard quantity theory does not turn out to be an operative equation-in fact if introduced it defies its *own* purpose- the much debated "determination of absolute prices". Also, the sum of excess demands even at equilibrium does not equate the excess demand for money- a direct violation of the Walras' law. More specifically, these two requirements of a general equilibrium theory of money are seen to be the root causes of general disequilibrium with money. In essence, equilibrium can be restored by parting with these necessities. Having done so, it is important to note that all this while, we were assuming a one period analysis. The true Walrasian auctioneer was present on every Monday morning crying out quotes and matching demands and supplies to seek the value-more so the money value of goods and services. What needs to be explored is the behaviour of the system outside the realm of this one-period analysis. We would therefore present an analysis of inter-temporal equilibrium beginning with an economy with only deposit money and currency of the previous chapters.

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$

$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$

$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$

$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$

$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$

$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$

$$104.275 + 47.5(1+i_1) = 145(1+i_1)$$

$$11.608 + 65(1+i_1) + 80(1+i_2)^2 = 145(1+i_2)^2$$

$$14.979 + 20(1+i_2)^2 + 125(1+i_2)^3 = 145(1+i_2)^3$$

$$853 = B_4 p_4$$

$$848 = B_5 p_5$$

$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73) = 40q_1$$

$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96) = 60q_2$$

$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68) = 50q_3$$

$$5q_1 + 5q_2 + 10q_3 = 20$$

We had already presented the results of this system under conditions of market clearing i.e. with deficit financing. The only difference is in this case a using a different numerical example as compared to the one used in before. We would start at with the solution for this economy at period 1.

i1	i2	i3	Loans	Deposits
5.71%	9.61%	14.08%	20.93	20.93

r	g	P1	P2	P3	P4	P5	w
0.46	0.29	0.266	0.204	0.298	0.245	0.318	0.695

B1	B2	B3	B4	B5
54.18	65.90	67.89	80.39	62.13

The period one solution is presented above. It is important to pause for a moment and understand that the process of period 1 equilibrium also has had serious

impacts on the economy in the sense of market clearing. Whilst all market aim to attain equilibrium, the shape of the economy is considerably changed. Demand equations change the production equations significantly, that causes prices, profits, wages and hence incomes to change. As these significant variables change, deposits and loans also change drastically. Hence, it would be worthwhile to look at the shape of this changed economy before we can explain the path to period 2.

$$(0.25p_1 + 3p_1 + 2p_2 + 5p_3)r + (0.66p_1 + 0.40p_2 + 1.02p_3)(1+i_1) + (0.66p_1 + 0.40p_2 + 1.02p_3)i_2 + (0.66p_1 + 0.40p_2 + 1.02p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 5_w = 40p_1$$
$$(2p_1 + 0.5p_2 + 5p_2 + 3p_3)r + (0.40p_1 + 1.12p_2 + 0.61p_3)(1+i_1) + (0.40p_1 + 1.12p_2 + 0.61p_3)i_2 + (0.40p_1 + 1.12p_2 + 0.61p_3)i_3 + (5p_1 + 7p_2 + 5p_3) + 5_w = 60p_2$$
$$(2p_1 + 3p_2 + 1p_3 + 5p_3)r + (0.40p_1 + 0.61p_2 + 1.22p_3)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.22p_3)i_2 + (0.40p_1 + 0.61p_2 + 1.22p_3)i_3 + (2p_1 + 5p_2 + 3p_3) + 10_w = 50p_3$$
$$(3p_1 + 5p_2 + 6p_3 + 1.5p_4)r + (0.61p_1 + 1.02p_2 + 1.22p_4)(1+i_1) + (0.61p_1 + 1.02p_2 + 1.22p_4)i_2 + (0.61p_1 + 1.02p_2 + 1.22p_4)i_3 + (3p_1 + 2p_2 + 5p_3) + 10_w = 60p_4$$
$$(2p_1 + 3p_2 + 5p_3 + 0.25p_5)r + (0.40p_1 + 0.61p_2 + 1.02p_5)(1+i_1) + (0.40p_1 + 0.61p_2 + 1.02p_5)i_2 + (0.40p_1 + 0.61p_2 + 1.02p_5)i_3 + (2p_1 + 5p_2 + 7p_3) + 10_w = 50p_5$$
$$(15.31p_1 + 23.12p_2 + 31.25p_3 + 1.875p_4 + 0.312p_5) = 725$$
$$6.2661 + 1.05(1+i_1) = 6.9782(1+i_1)$$
$$0.5705 + 3.9495(1+i_1) + 3.0287(1+i_2)^2 = 6.9782(1+i_2)^2$$
$$0.734 + 1.9712(1+i_2)^2 + 5(1+i_2)^3 = 6.9782(1+i_2)^3$$
$$2.67 = B_4 p_4$$
$$2.67 = B_5 p_5$$
$$(3.25q_1 + 2q_2 + 2q_3 + 5.73)g + (2q_1 + 5q_2 + 2q_3 + 5.73) = 40q_1$$
$$(2q_1 + 5.5q_2 + 3q_3 + 9.18)g + (5q_1 + 7q_2 + 5q_3 + 7.96) = 60q_2$$
$$(5q_1 + 3q_2 + 6q_3 + 12.59)g + (3q_1 + 5q_2 + 3q_3 + 13.68) = 50q_3$$
$$5q_1 + 5q_2 + 10q_3 = 20$$

With this as the final state of the economy at the end of period 1, all which is left now is explanation of the process of equilibrium. From the final equilibrium condition, the economy before it goes into the markets for the next period grows in size in the first place. It grows per the growth rates attributed to capital and consumption goods industries. Thus, new stock, flow matrices are created using the growth rate obtained. As an example, while moving from one time period to

the next, the following augmentation has to be performed on the production-price relations.

$$\left\{\begin{array}{l}\varepsilon_{11}(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)r + (\delta_{11})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(1+i_1) \\ +(\delta_{12})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_2) + ...(\delta_1)(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_t) \\ +(\delta_{1t})(\psi_1 B_1 p_1 + S_{11}p_1 + S_{12}p_2 + ...S_{1n}p_n)(i_t) + A_{11}p_1 + A_{12}p_2 + ...A_{1n}p_n + L_1 w\end{array}\right\}(1+g^*)$$
$$= B_i p_i (1+g^*)$$
$$\forall i = 1...m+n$$

Here, g^* is the equilibrium growth rate of the previous period. As a consequence of this alternation, the attained equilibrium of the previous period gets distorted. A new equilibrium has to be restored. In the process, the demand for loans and the money holdings also get altered. There is a new set of loan demands that now has to be matched to deposits. It is important to point out here that the discussion on parameters introduced earlier had exhibited the savings process in this economy as well. With given savings proportions spread over asset holding preferences, new deposits are determined using these ratios and the new equilibrium incomes of capitalists and workers. The savings are a part of incomes and are distributed across deposits and equities. Thus, new levels of deposits are determined. These new deposits are matched to the new loan demands from the producers. A new set of interest rate equations are determined using the probability matrix. With these new interest rates, the production-price equation determines the new set of prices, rate of profits and wages. New level of currency is also determined in the process. Demands are recalibrated and outputs are determined; the process continues till equilibrium has been restored in period 2. We have solved out the process of this inter-temporal equilibrium until eight periods (for want of space; nonetheless the process can be continued to eternity) of economic analysis and we present the results below. In effect, it can be added that the model presented above has similar properties across and within time.

Period	P1	P2	P3	P4	P5	R	g	w
1	0.2664	0.2045	0.2982	0.2449	0.3182	0.4585	0.2911	0.6945
2	0.2653	0.2037	0.2988	0.2455	0.3192	0.4398	0.2919	0.7184
3	0.2644	0.203	0.2991	0.2459	0.3198	0.4265	0.2924	0.7356
4	0.2637	0.2025	0.2993	0.2461	0.32	0.4174	0.2928	0.7474
5	0.2633	0.2022	0.2994	0.2462	0.3205	0.4114	0.2933	0.7549
6	0.2629	0.2019	0.2994	0.2463	0.3206	0.4069	0.2934	0.7609
7	0.2628	0.2017	0.2994	0.2463	0.3207	0.4042	0.2936	0.7642
8	0.2625	0.2017	0.2994	0.2463	0.3208	0.4022	0.2938	0.7667

These are the solutions of the real economy where it can be seen that this system has properties of long-term convergence. All the key variables tend to converge to their long term values over a course of time. It should be noted that the real wage rate in terms of commodity 4 and 5 increase from 2.83 and 2.18 respectively to 3.11 and 2.39 respectively over the course of the eighth iteration. There is therefore seen that there is a relatively booming economy. In terms of the interest rate equations, the following is seen:

Period	i1	i2	i3	Deposits/Loans
1	5.71%	9.61%	14.08%	20.940
2	5.82%	9.81%	14.47%	26.690
3	5.92%	9.98%	14.73%	34.190
4	6%	10.12%	14.91%	43.949
5	6.07%	10.23%	15.08%	56.616
6	6.13%	10.32%	15.21%	73.030
7	6.17%	10.41%	15.37%	94.370
8	6.21%	10.46%	15.40%	122.010

It should also be pointed out that the amount of “gap”, which we had pointed out while explaining the nature of monetary disequilibrium, increases over a period of time. The level of deficit financing accordingly required for clearing the “gap” increases over the period of time. The value of deficit financing changes from 1.577 in the first period to 9.057 indicating that as the economy grows in size, the level of deficit financing increases. Thus, our model of a monetary economy has general equilibrium property of inter-temporal equilibrium and long tern stability. As we draw towards the closure of this synthesis, it becomes imperative to study the inter-temporal properties through simulated changes in parameters of the model. We may begin with changes in tastes and preferences represented by changes in consumption propensities for the consumption goods industries. At the

current levels, the current observations, the workers are assumed to consume 0.80 of their incomes and the capitalists consume 0.10 of their incomes. We would begin by reducing these propensities. A reduction in demand would reduce prices and thereby affect the real and the monetary variables. An overall reduction in the size of the economy at the end of the eighth iteration can be expected. Changes in propensity to consume, here an overall reduction in MPC, reduces the demand in each period and at the same time increases savings. A reduction in demand causes prices to fall whereas an increase in savings either in form of equities or deposits increases the supply of loans. At new loan supplies, the loan demands not being unchanged, eases the pressure on interest rates. As a consequence, interest rates decline. Rate of profits also decreases due to reduction in economic activity and more wages have to be paid to labour since a substitution happens between cheap capital and labour. We now present the results of the system for the first few iterations post the changes in the MPC

Period	P1	P2	P3	P4	P5	R	g	w
1	0.2641	0.2029	0.3020	0.2488	0.3224	0.409	0.2914	0.7675
2	0.2629	0.2020	0.3023	0.2492	0.3230	0.3931	0.2917	0.7888
3	0.2621	0.2014	0.3025	0.2494	0.3235	0.3828	0.2921	0.8011
4	0.2617	0.2011	0.3025	0.2495	0.3237	0.3763	0.2927	0.8093
5	0.2614	0.2009	0.3026	0.2496	0.324	0.3715	0.293	0.8155
6	0.2612	0.2007	0.3027	0.2497	0.3241	0.3683	0.2933	0.8198

The monetary economy necessarily is impacted with the changes in the MPC. Changes in MPC impact the savings behavior of the economy and hence affect interest rates through changes in deposits and thereby related investments. Since the consumption expenditure is replaced with savings, the NNP of the economy does not change drastically. The real wages increase from 3.09 to 3.28 over six iterations in terms of fourth commodity and from 2.37 to 2.53 in terms of commodity five. Due to overall price reduction that is seen, the real purchasing power of money is seen to increase. This causes the level of deficit financing to reduce. It in fact falls to 4.177 as compared to 7.864 in sixth iteration of the economy with not MPC changes. Interest rate movements are also not absurd. The following table summarizes the monetary side of the economy.

Period	i1	i2	i3	Deposits/Loans
1	5.71%	9.60%	14.05%	20.940
2	5.82%	9.81%	14.45%	26.797
3	5.93%	9.98%	14.73%	34.421
4	6.01%	10.12%	14.94%	44.3125
5	6.08%	10.25%	15.07%	57.18
6	6.13%	10.34%	15.17%	73.88

The important observation while concluding this is as follows: a change in MPC in any period affects the long term equilibrium of the economy by reducing prices and interest rates, thereby reducing profit rates and increasing real wages. These effects are sustained and they do not affect the long term equilibrium- the system moves to another level of inter-temporal equilibrium.

The next step in our simulations we take is changes in the technological matrix. By technological matrix, we would mean to change only the production-price equations by changing the stock-flow coefficients, labour and output coefficients. There may be alternate ways to produce similar products; this fact we have seen in a previous chapter and the choice of technology shall depend upon the cost of producing that particular product. However, here, we would explore the long term properties of a system where in changes in technology takes place and as a result, a new level of equilibrium is attained. The following represents the results of the system when there is a technology improvement- lesser input coefficients are required to produce the same level of physical output. A general feel before we present the results is that an improvement in technology would increase the level of prices overall and increase the rate of profits. The following table presents the results for the production-price system with improvements in technology:

Period	P1	P2	P3	P4	P5	R	g	w
1	0.3639	0.2605	0.3846	0.3096	0.4251	0.7779	0.4498	0.8220
2	0.3605	0.2589	0.3874	0.3124	0.4279	0.721	0.4514	0.8935
3	0.3585	0.2580	0.3888	0.3139	0.4296	0.6883	0.4529	0.9348
4	0.3574	0.2575	0.3897	0.3148	0.4306	0.669	0.4539	0.9594
5	0.3565	0.2571	0.3900	0.3152	0.4309	0.6569	0.4545	0.9745
6	0.3558	0.2568	0.3901	0.3153	0.4311	0.6496	0.4549	0.9837

Changes in technology also require debt component in the capital stock. However, with prices increasing, the value of national income in real terms increases and hence more savings are forthcoming at same propensities. With increased savings and increased deposits, the interest rates relatively decline though there is an increase in the deposits. In fact, the banking equilibrium or the monetary equilibrium occurs at higher level of deposits and loans but relatively lower interest rates. The following table presents the interest rate solutions in this economy:

Period	i1	i2	i3	Deposits/Loans
1	5.59%	9.36%	13.67%	21.21
2	5.75%	9.69%	14.25%	29.75
3	5.89%	9.91%	14.55%	42.27
4	6.02%	10.12%	14.85%	60.59
5	6.10%	10.26%	15.03%	87.35
6	6.17%	10.37%	15.18%	126.12

One point is important to mention here: though there is a change in technology and a technical improvement is introduced in the economy, the real wages remain unchanged at 3.11 and 2.29. Changes in technology therefore do not affect the purchasing power of money in short term as well as in long term.

Before we conclude this chapter, we would present the results of changing the monetary variables-namely by changing the money-turnover ratios thereby affecting money demand. We would present the results by increasing the money turnover ratios. In essence, this increases the money holdings, especially the current account deposits are increased. An increase in money supply thus, in form of current deposits, causes marginal increases in prices-a standard theorem of money supply increase. But it should be noted that there may not be an increase in prices in proportion to the changes in money supply. However, for sure even in short and long run equilibrium of the system, it remains true that an increase in money supply increases absolute prices, relative prices remain reasonably unchanged. The following table presents the *real* solutions of the system when money turnover ratios i.e. demand for current deposits by the capitalists have been increased.

Period	P1	P2	P3	P4	P5	R	g	w
1	0.2663	0.2047	0.2984	0.2449	0.3180	0.4610	0.2898	0.6924
2	0.2656	0.2041	0.2995	0.2460	0.3196	0.4414	0.2908	0.7186
3	0.2651	0.2036	0.3001	0.2467	0.3207	0.4274	0.2915	0.7374
4	0.2647	0.2033	0.3006	0.2472	0.3214	0.4183	0.2921	0.7499
5	0.2645	0.2032	0.3009	0.2475	0.3220	0.4119	0.2926	0.7586
6	0.2644	0.2030	0.3011	0.2477	0.3223	0.4075	0.2930	0.7645

The interest rates are also impacted with changes in money supply in this manner. As money supply increases, the interest rate reduces in the economy as expected. The following presents the solutions to the interest rate equations:

Period	i1	i2	i3	Deposits/Loans
1	5.44%	9.15%	13.42%	21.44
2	5.59%	9.42%	13.89%	27.22
3	5.73%	9.65%	14.25%	34.74
4	5.85%	9.85%	14.51%	44.49
5	5.95%	10.02%	14.77%	57.18
6	6.03%	10.15%	14.95%	73.67

As money supply increase, the level of deficit financing also reduces to 3.42 as compared to 10.77 in the base case economy that we set out with at the beginning of this chapter.

In conclusion, it may be said that the long term monetary equilibrium exists and it can be verified from the various simulations above and the values of prime variables as presented. As the economy moves through time, the variables tend to converge to some definite long term values. Also, the short term and the long term properties of the system are consistent with important results from standard theory. These simulations and an understanding of the economic behaviour under various conditions presented so far would be important in developing the train of thought for the process of achieving macro-economic stabilization through interplay of monetary and real variables.

References

Chick, Victoria, (1982), "*A comment on 'IS-LM: An Explanation*", Journal of Post Keynesian Economics, Vol IV, No 3, pp 439.

Clower, R W (1965): "The Keynesian Counterrevolution: A theoretical appraisal" in F. H. Hahn and F. Brechling (eds.), *The Theory of Interest Rates*

----------(1967), "A Reconsideration of the micro foundations of monetary theory", *Western Economic Journal,* December

Friedman, M (1969): *The Optimum Quantity of Money* (New Brunswick, New Jersey).

G.C. Archibald and R.G. Lipsey (1958): "Monetary and Value Theory: A Critique of Lange and Patinkin", *Review of Economic Studies,* Vol. XXVI

Grandmont, J M (1985): *Money and Value: A Reconsideration of Classical and Neoclassical Monetary Economics* (Econometric Society Monographs).

Haberler, G., (1937): *Prosperity & Depression,* 3rd Edition, Geneva, League of Nations.

Hahn, F.H,(1971): *Trading out of Equilibrium, a Pure Exchange Economy.*

---------- (1965): "On some problems of proving the existence of an equilibrium in a monetary economy" in F. H. Hahn and F. Brechling (eds.), *The Theory of Interest Rates*

----------(1982), "The Neo-Ricardians", *Cambridge Journal of Economics*, Vol. 6, pp. 353-374.

Hansen, A H (1949): *Monetary Theory and Fiscal Policy* (New York: McGraw-Hill).

Harrod, R, (1937), "*Mr. Keynes and the traditional theory",* Econometrica, Vol 5.

Hickman, W.B., (1950), *"The determinacy of absolute prices in classical economic theory",* Econometrica.

Hicks, J, (1937), *"Mr Keynes and the classics; A suggested reinterpretation"*, Econometrica, Vol 5 No 2, pp 147.

Jean-Michel Grandmont and Yves Younes (1972), "On the Role of Money and the Existence of a Monetary Equilibrium", *Review of Economic Studies*

Kahn R.F. (1984), *The making of Keynes' General Theory,* (Cambridge University Press), pp. 123.

Keynes, J.M. (1930), *A Treatise on Money: The pure theory of money*, pp 6 (Macmillan).

---------- (1934), *General Theory of Interest, Employment & Money*, pp v (Cambridge University Press) pp v.

---------- (1939), General Theory, Preface to the French edition, dated February 1939.

Kurihara, K. ed. (1954): *Post-Keynesian Economics.*

Lange, O, (1938), "*The rate of interest and the optimum propensity to consume*", Economica, Vol 5, pp 12-32.

Leijonhufvud, A (1968): *On Keynesian economics and the economics of Keynes,*(Oxford University Press) pp. 27.

Leontief, W., (1950), "*The consistency of the classical theory of money & prices",* Econometrica.

Marx, K (1972): *Das Kapital.*

Meade, J, (1937), "*A simplified model of Mr. Keynes' System*", Review of Economic Studies.

Metzler, L, (1951), *"Wealth, saving & the rate of interest",* Review of Political Economy, vol59, pp. 93.

Ostroy, J.M.(1973), "The informational efficiency of monetary exchange", *American Economic Review,* Vol 63 (No.4): pp. 597-610

Parchure, R. (2008), "The Sraffa System for Continuous Industrial Production", *GIPE working paper series*, November

---------- (2007), *"A Reconstruction of the interest rate theory"*, GIPE Working Papers Series.

Patinkin, Don (1965): *Money, Interest & prices: An integration of monetary & value theory* (MIT Press).

Pigou, A.C., (1943), "*The classical stationary state*", Economic Journal.

Phipps, C.G., (1950), "*A note on Patinkin's "Relative Prices*"", Econometrica.

Robertson, D. H. (1922): *Money*, *Volume 2 of Cambridge Economic Handbooks*, pp.71.

Samuelson, P. A. (1968), "What Classical and Neo-Classical Monetary Theory Really Was ", *Canadian Journal of Economics*, (1), pp. 1-15.

---------- (1943), "*Dynamics, Statics & the stationary state*", The Review of Economics & Statistics.

Scitovsky, T., (1941), "*A note of welfare propositions in economics*", Review of Economic Studies, pp. 69.

Sinha, A. (2001): *Reading Sraffa: The Philosophical Underpinnings of Production of Commodities by Means of Commodities,* Gokhale Institute of Politics and Economics WP231

Smith, A (1776): *The Wealth of Nations.*

Steve, Keen (2001): *Debunking Economics: The Naked Emperor of the Social Sciences* (Palgrave Macmillan).

Sraffa, P, (1960): *Production of commodities by means of commodities.*

Wicksell, K (1898): *Interest and Prices* (Great Britain: R & R Clark Limited, Edinburgh).

---------- (1906): *Lectures on Political Economy*, Vol.2, pp.159-60.

Wray, L.R. (1999), "Theories of Value and Monetary Theories of Production", WP 261 (Jerome Levy Economics Institute)