EFFICIENCY WAGE ANALYSIS IN NON WALRASIAN FRAMEWORK

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by

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Certified that the Thesis entitled

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CHAPTER - 1

INTRODUCTION AND THE RELEVANCE OF THE STUDY

1.1 Background and Relevance of the Study

The idea that workers' productivity and real wages might be positively related over some range was clearly recognized by Alfred *Marshall (1920)*, who observed that 'highly paid labour' is generally efficient and therefore not 'dear labour'. Much later, the efficiency wage idea reappeared in the literature relating to developing economics (*Leibenstein (1957)*). Higher real wages improve labour efficiency in developing countries by reducing malnourishment and providing higher nutrition. Moreover one of the major groups of the New Keynesian explanations of real wage rigidity is the efficiency wage theory. The soul conjectures of the main proponents of this theory or so called standard efficiency wage models (or *SEWM*) (*Solow (1979), Salop (1979), Weiss (1980), Akerlof (1982), Shapiro and Stiglitz (1984)* etc.) entirely by the properties of the effort function. Unemployment in these models is only due to high efficiency real wage and the possibility of disequilibrium in the commodity market does not arise as commodity price is assumed to be flexible in nature.

If commodity price is considered to be exogenously fixed in the efficiency wage structure, the firm may face demand constraint in the commodity market and take this constraint into account while setting optimum solutions of efficiency wage and employment. Commodity demand condition would then play a significant role in determining the optimum solutions and the policy conclusions in *SEWM*.

The role of such commodity demand constraint is analyzed extensively in a wide range of literature involving non – Walrasian or disequilibrium macro models (defined as standard non – Walrasian model or *SNWMM*) by *Patinkin (1956, 1965), Clower (1965), Barro – Grossman (1971), Malinvaud (1977), Benassy (1982, 1986) etc..Benassy (1986)* takes into account of the fact that at exogenously fixed commodity price and wage, there

may be the possibilities of either excess demand or excess supply in the commodity market resulting in the situations of i) Keynesian Unemployment (KU), having excess supply in both commodity as well as labour market, ii) Classical Unemployment (CU), with excess supply of labour and excess demand for goods, iii) Repressed Inflation (RI) having excess demand for both goods and labour. However, in the extended version of *Benassy (1986)*, prices are also assumed to be asymmetrically flexible where prices may be flexible upward but rigid downward. This has been considered to be more realistic, as it is widely accepted that prices display some downward rigidity but in the case of excess demand they will increase until excess demand has disappeared. Thus the scope of excess demand is absent under the assumption of asymmetric price flexibility and consequently the above regime classification gets altered.

However, based on non – Walrasian framework, *Picard (1995)* has considered a simple overlapping generation model with efficiency wage and examined the impact of fiscal policy. Moreover he has also explored the role of employment subsidies and commodity taxation policies in a general equilibrium model with a dual labour market and efficiency wage. But it has been observed that in the static non – Walrasian structure of *SNWMM* as mentioned above do not take into account of the fact that there may be some endogenous relationship between efficiency of the workers and their wages; rather they take wages as exogenously given or linked to price. Again, the perusal of the literature suggests that the efficiency wage theory with effective demand playing a critical role is still lacking in the literature. The objective of the present thesis stems from this observation.

Thus one can think of integrating the two literatures; the *SEWM* and the *SNWMM* by introducing the possibility that wages are endogenously determined in a static non – Walrasian macro model (based on *Benassy (1986)*) having some relationship with the efficiency of the workers (based on *Solow (1979)*).

1.2 Objective of the Study

Given the above background and relevance, the objectives of the present study have been specified as follows.

- The present study tries to integrate the literature of standard efficiency wage model with that of standard non -Walrasian macro model in a static structure and attempts to generalize; a) the existing theory of efficiency wage model by incorporating the fact that there may be lack of commodity demand at exogenously fixed (or asymmetrically flexible) price and hence the producer face constraint in the commodity market while making their optimum decision and b) also the existing literature of non - Walrasian macro model by considering the fact that the firm sets optimum real wage taking into account of the efficiency of labour.

- The relevant policy implications in the present study can therefore be compared and contrasted with that of the standard efficiency wage models on the one hand and also with that of the standard non –Walrasian macro model on the other.

- Role of the policies that affect the factors (other than real wage) which produce exogenous change in effort or efficiency of the workers can be explored in the non – Walrasian framework which is missing in standard non- Walrasian macro model where efficiency wages consideration is absent.

The present analysis is ***purely theoretical in nature*** and tries to contribute the existing literature in three basic directions as given below.

1.3 Plan of the Study

In order to address different problems, three broad plans are taken up which form the three broad chapters of the present thesis.

Plan I of the present study has two broad parts. In the ***first part***, a simple aggregative monetary macro model is being constructed where commodity price is exogenously given in line with static non - Walrasian framework of *SNWMM* of *Benassy (1986)*.But in contrast to *Benassy (1986*), in the present model, the producer determines optimum real wage on the basis of efficiency consideration following *SEWM* of *Solow (1979)*.This allows the situation where the firm may face commodity demand constraint at the exogenously given price while determining real wage on the basis of efficiency wage; scope of such a situation is absent in *SEWM* of *Solow (1979)*.Again the present static non - Walrasian framework generalizes *SNWMM* of *Benassy (1986)* where wage is assumed to be exogenously fixed and efficiency wage consideration is missing. Different classical and Keynesian policy implications are then examined and compared with that of S*NWMM* (*Benassy (1986)*) and *SEWM* (*Solow (1979)*).

Again one can observe a number of studies based on standard efficiency wage framework (*Yellen (1984), Johnson and Layard (1986), Shapiro and Stiglitz (1984) and Pisauro (1991)* [1] *etc.*) that examine the impact of incidence of pay roll taxes[2] such as labour taxations (ad valorem tax (wage tax) and (specific tax (employment tax).But none of these studies take into account of the fact that that the firm may face commodity demand constraint at the exogenously given price. Relevantly it may be mentioned that the effect of such labour taxations have not been observed in the models with fixed – price standard non - Walrasian framework. Thus there is immense scope to reexamine the impact of these taxation policies in the present generalized model.

In ***second part*** we have constructed fixed - price non –Walrasian models with efficiency wage in presence of ad valorem and specific tax .These models would help to i) explore the role of ad valorem and specific tax that is pay roll taxes in non – Walrasian framework, ii) observe how the impact of such taxations on optimum solutions in the present set up differ from that of *SEWM* (specifically of *Yellen (1984)* having same

[1]In the existing efficiency wage literature dealing with labour taxation, only in '*rudimentary efficiency wage model*' due to *Yellen (1984)*, effort is expressed as a function of real wage similar to the present model , while the others have included effort to be dependent on number of other factors like unemployment rate, expected alternative income, unemployment benefit etc. In *Pisauro (1990)* effort depends on wage, unemployment rate, and unemployment benefit and detection rate while shirking; In *Shapiro and Stiglitz (1984*) effort depends on wage, unemployment rate and expected alternative income; In *Johnson and Layard (1986)* effort depends both on wage and expected alternative income

[2]A note on pay roll taxes is provided in Appendix 1.

properties of the effort function as that of the present model), iii) identify the impact of classical and Keynesian policy measures in presence of ad valorem and specific tax .

In both the parts of Plan I (that is with and without labour taxation), the impact of exogenous shift in effort of the workers are also being examined. Impacts of such shifts cannot be found in *SNWMM* (*Benassy (1986)*) as the efficiency wage relationship is absent there.

The above mentioned issues are addressed in Chapter 3 of the present thesis.

Plan II of the present study is considered in Chapter 4. Here the plan is to formulate an IS – LM model by allowing the non - Walrasian feature (*Benassy (1986*) which assumes asymmetric price flexibility (that is commodity price is flexible upward but rigid downward) and incorporates efficiency wage relationship. However in the existing non – Walrasian IS – LM model of *Benassy (1986)* both wage and commodity price are assumed to be asymmetrically flexible. Thus excess demand does not appear in the goods market and there are three relevant regimes in IS – LM model of *Benassy (1986),* i) excess supply in commodity and labour market, ii) excess supply in labour market with goods market cleared, iii) both the markets clear.

Since efficiency wage consideration is absent in the IS – LM model of *Benassy (1986)*, the present IS – LM framework extends the non – Walrasian model of *Benassy (1986)* where efficiency wage consideration is absent. The model further considers how the conclusion regarding different policy implications change if we allow the possibility that the firm sets real wage by taking into account efficiency wage relationship based on *Solow (1979)* and *Yellen (1984)*.

For such type of model the aim is to i) examine the impact of monetary and fiscal policies and compare the results with that of the *SEWM* (mainly *Solow (1979)* and *Yellen (1984)*[3]) and *SNWMM* (*Benassy (1986*)), ii) explore the impact of the policies that produce exogenous shift in the effort of the workers in the present IS – LM framework; such

[3]There are a number of studies in efficiency wage framework with nominal /real (or both) rigidity that deals with impact of increase in money supply such as *Gottfries and Westermark (1998), Stiglitz (1986), Summers (1988), Ball and Romer (1990), Lin and Lai (2001) , Carter (2005)* etc., But it is only in *Solow (1979)* and *Yellen (1984)* , effort depends only on real wage (and not on other variable factors like unemployment rate, alternative wage etc.) similar to the present model. And hence the impact of money supply in the present model is compared with that of *Solow (1979)* and *Yellen (1984).*

policy implementation is however missing in IS – LM model of *Benassy (1986*), iii) further the model is also extended assuming partial wage rigidity (in line with *Lin and Lai (1998)*) and impact of different policy implications are then explored.

In **Plan III** a simple non - Walrasian two country open economy macro model (following *Benassy (1986*)) with efficiency wage is to be formulated. In *Benassy (1986)* simple non – Walrasian two country open economy macro model, the homogenous good is exchanged, the price of which clears the world market and wage is exogenously given in each country. In this context the effects of various policies on the country pursuing them and their repercussion on the other country has been studied under flexible and fixed exchange rate regimes. However, while framing such model *Benassy (1986)* did not introduce efficiency wage relationship. Again there are some extensions of the efficiency wage model in a open economy framework like *Wilson (1990)*, *Lai (1990, 1992, 1993)* etc. ,but it has been observed that there is a dearth in the studies on two country open economy model in non – Walrasian framework with efficiency wage, but one can hardly observe any study on two country open economy model in non – Walrasian framework with efficiency wage.

Based on the above observation , a two country open economy model is thus constructed where it is assumed that real wage is set on the basis of efficiency wage consideration only in country 1 (home country), while in country 2 wage is exogenously given. There is a unique homogenous commodity produced in each country; price of which is flexible and determined on the basis of exchange rate as assumed by *Benassy (1986*).This particular model has been structured on the basis of flexible and fixed exchange rate. The present model thus extends the simple non – Walrasian two country open economy macro model of *Benassy (1986)* where efficiency consideration is absent in both the countries.

In the present open economy model with efficiency wage, i) the efficacy of different Keynesian and income policy implications in both the countries are thought to be examined under fixed and flexible exchange rate. The results are then compared with *Benassy (1986)* where wage is assumed to be fixed exogenously in both the countries, ii) moreover since in country 1, the firms determine real wage while considering efficiency wage; policies that are responsible for exogenous shift in effort of the workers has strong impact on the global economy. Hence impact of such policies undertaken by

country 1 is being thoroughly investigated but it is clear that such policy implementation is irrelevant in country 2 where efficiency wage is absent. Since in *Benassy (1986)* wage is exogenously fixed in both the countries, exogenous shift in effort of the workers has no relevance in *Benassy (1986).*

Plan III is analysed in Chapter 5.

1.4 The Structure of Present Study

This study executes the above plans in the context of efficiency wage analysis in non – Walrasian framework. The structure of the present dissertation is as follows:

- **Chapter 1** contains the introduction and relevance of the present study.
- **Chapter 2** surveys the existing literature highlighting the models related to standard efficiency wage models (*SEWM*) and models dealing with different policy implications in *SEWM*. In this chapter, literature related to standard non – Walrasian macro models (*SNWMM*) are also surveyed.
- **Chapter 3** provides the basic non - Walrasian fixed - price model with efficiency wage and also examines the incidence of pay roll taxes such as labour taxations namely ad valorem tax and specific tax. Impact of positive shift in effort function is examined in both pre and post labour taxation structures.
- **Chapter 4** presents a non - Walrasian IS - LM model with asymmetric price flexibility and efficiency wage where impact of fiscal and monetary policies are examined and compared with the same in *SEWM* and *SNWMM*. Consequence of positive shift in effort function is also studied in this IS – LM framework.
- **Chapter 5** proposes a two country non – Walrasian open economy model with efficiency wage. Efficacy of different policy implications including positive shift in effort function are considered in flexible and fixed exchange rate.
- **Chapter 6** offers the summary and conclusion of the whole study.

CHAPTER - 2

SURVEY OF LITERATURE

2.1 Introduction

The survey of literature in the present case involves studies i) incorporating different types of models with efficiency wage consideration and the associated policy implications and ii) on non – Walrasian macro models.

In the next section of this chapter, major studies related to efficiency wage models and the relevant policy implementations (both pioneering and extended models) are being considered. Section 2.3 deals with survey of literature in connection with non – Walrasian or disequilibrium macro models. In the final section, the discussion on the gaps in the existing literature and their link with the present theses is made.

2.2 Efficiency Wage Models

The soul conjectures of the models of the New Keynesian explanation of real wage rigidity based on efficiency wage theory is that, it is not in a firm's interest to lower real wages because the productivity (effort or efficiency) of workers is not independent of the wage, rather real wages and workers' effort are interdependent.

Marshall (1920), observed that 'highly paid labour is generally efficient. Much later, the efficiency wage idea reappeared in the literature relating to developing economics (*Leibenstein (1957)*). Higher real wages improve labour efficiency in developing countries by reducing malnourishment and providing higher nutrition.

Solow (1979) provides the basic structure of efficiency wage models. In Solow's model, it is employer's interest to keep wage downward rigid, because lowering wage would lower productivity and raise cost. The representative firm seeks to maximize its real

profits where the firm's output depends on the number of workers it employs and their effort. The effort is assumed to be an increasing function of real wage. The optimum efficient wage is determined at the point where elasticity of effort with respect to wage is unity that is marginal cost is at its minimum. The firm accordingly hires labour up to the point where its marginal product is equal to the minimum marginal cost. Efficiency wages can give rise to involuntary unemployment as real wage is determined only on the basis of effort function and does not depend either on the level of employment or shifts in aggregate demand.

Though, higher wages reducing the malnourishment of the currently unemployed, may lead to a rise in aggregate output in the underdeveloped economy (*Dasgupta and Ray (1986), Bardhan (1993*)), but in the developed countries where most workers have adequate nutrition, a different reasoning for efficiency wage is needed. Hence the concept of wage stickiness is extended by a number of modern efficiency wage models related to the issues of selection and incentives.

Whatever be the rationale, the firm's optimum decision to set efficiency wage above the market clearing level certainly leads to persistent involuntary unemployment. Hence the role of different policy implications in this efficiency wage structure needs to be analysed. A number of studies have been carried out investigating the impact of fiscal policies related to labour taxation, corporate tax, commodity tax etc. Moreover efficiency wage theory is the source of New Keynesian explanation of non-neutrality of money owing to real wage rigidity. Hence a number of literatures have also dealt with the impact of real effects of money in this particular structure.

As *Dickens, Katz and Lang (1985)* pointed out that efficiency wages cannot be rejected on a priory theoretical ground and evidence is needed. The validity of efficiency wages can only be resolved empirically; side by side an enormous literature has been developed to test empirical validity of efficiency wage hypothesis.

However in the present chapter we restrict the survey on the theoretical studies of different aspects of efficiency wage analysis.

This chapter has been structured in a way that, next sub section explains different theoretical efficiency wage models which includes both pioneering studies as well as some extensions, in the following two subsections a number of studies regarding the impact of different fiscal and monetary policies are surveyed, next subsection mentions the gap in the literature which the present study intends to address.

2.2.1 Theoretical Formulation of Efficiency Wage Models

In this section a number of theoretical models considering efficiency wage relationship have been reviewed. Initially the pioneering studies on efficiency wage hypothesis and then some extended studies based on the pioneering studies has been considered.

2.2.1.1 Pioneering Studies

A number of studies in efficiency wage model can be considered as the pioneering in this field which can be classified into three broad categories.

a) Nutritional based models

The conventional nutritional based models are given by *Leibenstein (1957), Mirrlees (1976), Stiglitz (1976), and Bliss and Stern (1978).*

Leibenstein (1957), in the literature relating to developing economies refers that higher wages increase the physical well-being of workers through higher nutrition, and by reducing malnourishment. *Leibenstein* is the first person to explore the theoretical implication of productivity – consumption link.

In this context thorough investigations had been made by *Mirrlees (1976)* and *Stiglitz (1976).*Based on productivity consumption link on wages, *Stiglitz (1976) was* concerned with the consequences of the efficiency wage hypothesis for the distribution of income in the rural sector and considered the effect of increase in rural population on rural output and inequality. The broad conclusions drawn by him are,

"*i) there are important conflicts between equality and efficiency, ii) complete equality is not feasible for sufficiently poor firms, iii) maximisation of family welfare may entail some degree of inequality, iv) the social marginal product of an individual is negative in the egalitarian and utilitarian farms, v) In the plantation economy, working individuals have a positive marginal product, and receive a wage equal to that marginal pro- duct; but there may be considerable unemployment"*

Bliss and Stern (1978) further extended the theoretical implications of *Mirrlees (1976)* and *Stiglitz (1976)* and also tried to provide the empirical implications of some findings in their later version and concentrated the study only on agricultural labour. According to them, there is an efficiency wage which will always be paid to the landless marginal labourers regardless any other wage determining factors .Further since productivity - consumption link is stronger in the long run than in the short run, wages in the long term contract would be higher and hence advantageous than the short term contracts. Moreover theoretical solution implies the fact that at the optimum, landless labours receive more wage than the labourers with land.

In the above models, workers are paid wage higher than their reservation level which would s increases their consumption and maximise their productivity.

b) Modern efficiency wage models

Apart from nutritional based efficiency wage models ,the modern efficiency wage models can be identified into four categories i) the labour turnover model, ii) the adverse selection model, iii), the fairness model, and iv) the shirking model.

i) The labour turnover model

A reason why firms may offer an efficiency wage in excess of market – clearing wage is to reduce costly labour turnover. Such an idea is based on the pioneering work of *Phelps (1968) and Phelps et al. (1970)* on natural rate of unemployment and search behaviour. *Stiglitz (1974)* presented the labour turnover model as an explanation of the gaps between wages and unemployment of rural and urban areas. The concept, that the workers' willingness to quit a job will be significantly reduced if a firm pays above existing wage

rate, was established by *Salop (1979).*In his model, labour market equilibrium ensures involuntary unemployment as all firms try to raise workers' wage in order to avoid the idea of quitting. If unemployment increases the wage premium necessary to avoid labour turnover will fall.

ii) The adverse selection model

In the labour market, asymmetric information is predominant. Firms have imperfect information about the productivity level of the workers, whereas workers have more information about their abilities. The firm may hire low productive labour and need to fire them when revealed but before that the firm may have already invested considerable resources in training these unproductive employees. Thus, to avoid this problem, the firm offers high wage so that higher wage attracts productive applicants. Based on this concept, *Weiss (1980)* presented a model where the wage offered by a firm influences both the number and quality of job seekers.

iii) The Fairness Model

In a series of papers, *Akerlof (1982) and Akerlof and Yellen (1984, 1990)* tried to establish the fact that in order to maintain feeling of equity and fairness within the labour market, the firm restrain themselves to offer too low wages. Gift exchange models of *Akerlof (1982, 84)* is based on "*a fair day's work for a fair day's pay"* as effort is a positive function of workers' moral. *Akerlof and Yellen (1990)* formulated a *"fair wage – effort hypothesis"* where firms face *a fair wage constraint*; here optimum fair wage exceeds market clearing wage level and involuntary unemployment is ensured.

iv) The Shirking model

It has been thought that it is costly for the firm to collect information about workers productivity and also to monitor them .Hence the firm pay efficiency wage above the market clearing level with an idea that this may deter the workers to shirk. In the *Shapiro and Stiglitz (1984)* model a *no shirking constraint (NSC)* is considered which shows the minimum wage level corresponding to each level of employment below which shirking

will take place. In case of imperfect monitoring, the optimum outcome ensures involuntary unemployment.

c) Relative wage theory

Summers (1988) suggests relative wage theory in efficiency wage set up in which workers productivity depends primarily on their relative wage which provides the best available apparatus for understanding actual unemployment and its fluctuation. According to this study productivity depends on the relative attractiveness of opportunities inside and outside the firm. By laying at this simple relative wage model this paper firstly describes the determination of equilibrium unemployment, where the level of employment is determined on the basis of efficiency (productivity), and workers' outside opportunities which depend positively on the utility of leisure, the value of unemployment benefits and negatively on the duration of unemployment. Secondly this paper explains why unemployment outcomes are sensitive to small amounts of insider power and shows how efficiency wage models can be extended to account for cyclical unemployment fluctuations once the role of relative wages in influencing worker productivity is recognized. Finally this paper provides the explanation why firm choose to adjust wages slowly and fire workers when adverse shocks come, with the help of misperception idea.

2.2.1.2 Extensions of the Pioneering Studies

Based on the different pioneering studies on efficiency wage model, as stated earlier a number of extensions have been formulated adding some important propositions to the literature.

Rodgers (1975) argued that since nutrition affects productivity with lag, one should expect to see long term contracts .He even found that nutritionally determined wage is also insensitive to demand.

Dasgupta and Ray (1986) have examined the nutrition based efficiency wage model in a general equilibrium setting. In such a model with different amount of wealth, wealthier

workers have an advantage in the labour market. This is because for any given wage they consume more nutrients and are more productive.

Carmichael (1990), made a survey on efficiency wage literature and concluded that efficiency wage models fail to explain wage rigidity or persistent involuntary unemployment.

Lai (1990) applies the efficiency wage theory to evaluate the effect of currency devaluation in an open economy. It is found that currency devaluation will depress the domestic output in the presence of the efficiency wage consideration. This framework is viewed as a theoretical structure in explaining the empirical findings of contractionary devaluation.

Kimball (1993), analysed equilibrium dynamics in the Shapiro and Stiglitz model.

Lin and Lai (1994) set out an intertemporal optimizing model embodying the efficiency wage hypothesis and examined whether the Solow condition is valid or not and has shown that, unless the turnover costs are absent and the voluntary quitting rate is independent from wage offer, the effort-wage elasticity is less than unity.

Based on the study of *Lin and Lai (1994), Faria (2000)* also examined Solow condition in an intertemporal model that combines efficiency wages involving shirking and turnover models with managerial supervision. It is shown that the Solow condition does not hold when shirking and turnover costs are considered. The Solow condition can be a possible outcome when managerial productivity offsets shirking and turnover costs.

Rebitzer and Taylor (1995) extended the *Shapiro-Stiglitz* (1984) by considering the probability of detecting a shirker to be inversely related to the size of the workforce (in the Shapiro - Stiglitz model the probability of detecting a shirker follows a Poisson process) but assume that supervisory capacity is fixed.

Eric Toulemonde (2003) developed a simple model based on insider –outsider theory which explains why labour turnover costs cause the insiders to earn high wages than outsiders. Following efficiency wage theory, higher wages increases insiders' productivity which raises the cost of replacing insiders by low productive outsiders. This

in turn increases insiders' wage further. Thus the link between effort and wages reinforces the effects of labour turnover costs on wages.

By using an extension of efficiency wage model *Skott* (2005) in this paper explains the existence and persistence of over education .He calibrated to fit the amount of over education found in empirical studies. The result indicates that there exists inverse relationship between the relative wage and relative employment rate of high skilled workers with aggregate economic activity. Due to rise in relative supply of high skill labour, low skill unemployment rises where aggregate employment is kept constant.

Based on the rules of *Shapiro - Stiglitz's (1984)* shirking model, *Guerrazzi (2008)* provided a general equilibrium efficiency wage model. In this framework effort decisions undertaken by the individual worker are endogenised in a continuous manner which resolves the indeterminacy in a model with exogenous effort. This model also shows that higher (lower) unemployment rates results in higher (lower) effort levels.

2.2.2 Impact of Fiscal Policies in Efficiency Wage Models

Considering different variations in efficiency wage structures, involuntary unemployment being an obvious outcome due to persistent imbalance in the labour market, studies regarding different policy instruments have been evolved. Moreover in most countries, pay roll wage and employment tax are used to finance Social Security, Medicare and Unemployment Insurance expenditure. Both pay roll ad valorem or wage tax and specific or employment tax are imposed to the firms on the basis of the wage bill of their employees and their employment level respectively. This increases labour cost and the firm lowers wage to pass on the share of the tax to the employee. The extent of sharing however depends on the elasticities of labour demand and supply schedule that is on the nature of the labour market. The process also affects the optimum employment level of the firm. Since efficiency wage creates imperfection in the labour market; there are a wide range of studies that tested the impact of such pay roll tax on wage and employment. The results however differ based on distinct assumptions regarding the properties of effort function in each model. Some efficiency wage literature has also

studied the impact of tax policy on employment in a two sector general equilibrium framework. However, few more literatures evolved actually in connection with optimum tax policy in efficiency wage theory. In the following two sub sections some pioneering and extended studies regarding fiscal policy in efficiency wage models are surveyed respectively.

2.2.2.1 Pioneering Studies dealing with Fiscal Policies in Efficiency Wage Models

In *Yellen's (1984) rudimentary efficiency wage model*, effort function is expressed only as a function of real wage and as the optimum real wage rate is determined solely by the nature of the effort function, after tax real wage remains unchanged due to imposition of ad valorem tax. Thus, the firm lowers employment at the optimum solution for profit maximisation where the higher level of marginal productivity of effective employment now equals higher marginal cost arising due to incidence of ad valorem tax. The effect of employment tax or specific tax however leads to an increase in after tax wage but will definitely put a negative effect on employment.

In the moral hazard model of *Shapiro - Stiglitz (1984)*, the effect of the two taxes would produce exactly the same impact, a decrease in the after tax wage at a lesser degree and a decrease in employment.

Johnson and Layard (1986) used a moral hazard or shirking model and show that incidence of ad valorem tax keeps employment unaffected but reduces after tax wage. The tax burden will entirely borne by the workers. While incidence of specific tax may either lower or raise the after tax wage but definitely lowers employment. This is a completely reverse case of *rudimentary efficiency wage model by Yellen (1984).*

In the paper *'The Effect of Taxes on Labour in Efficiency Wage Models'* due to *Pisauro (1990)*, the effect of labour taxation on wage and employment in a moral hazard efficiency wage model has been tested, where effort is a continuous variable and workers are risk averse. This paper identifies that the specification of utility i.e. i) additive separability between effort and consumption, ii) linearity in effort, iii) concavity in

income, enables to obtain an explicit solution for the effort function. The assumption about attitude toward risk i.e. linearity or concavity in consumption determines the choices of the firm. It has been observed that if workers are not risk neutral in consumption under reasonable assumptions, specific tax will cause an increase in net - of – tax real wage, which is just an opposite result related to ad valorem tax where net real wage falls. However employment would fall with the imposition of both ad valorem and specific tax.

2.2.2.2 Impact of Fiscal Policies in the Extended Version of the Pioneering Models

Other than the impact of pay roll taxes, some extended studies have also been evolved related to various tax systems in the efficiency wage framework. In this section, a brief over view of such studies are offered.

In *Wilson (1990)*, the purpose of the study is to explore the optimal system of taxes and subsidies on capital for an open economy efficiency wage model. In this model different wages are paid to the similar workers. A positive marginal tax on capital investment in the high – wage sector is being justified where there are informational asymmetries between government and private firms.

Agell and Lundborg (1992) considered a two sector model on the basis of fair wage hypothesis and therefore allowing involuntary unemployment. Following the gift exchange model developed by *Akerlof (1982),* they examined the effects of various policy instruments, such as taxation and unemployment benefits on income distribution, resource allocation and unemployment. *Agell and Lundborg (1995)* with the *general equilibrium cum fair wage model* identifies the fact that when workers' effort depends on the relative remuneration of capital and labour , reduction in equilibrium unemployment is achieved by any tax policy that increases the wage rental rate and thus unambiguously lowers the rate of unemployment.

Ching – Hueii Chang (1995) however took up the welfare aspect and stated that wage tax affects adversely after tax wage and employment while commodity tax should not have

such harmful effects and thus proposed a tax policy that government must reduce the rate of tax on labour and rise revenue primarily from taxes on commodities.

Christopher A. Pissarides (1997) modeled and simulated the effects of employment tax cuts on unemployment and wages in four equilibrium models: competitive, union bargaining, search and efficiency wages. He found that if the ratio of unemployment compensation to wages is fixed, the effect of the tax cut is mainly on wages. But if income out of work is fixed in real terms, there are substantial employment effects. When wages are determined by bargaining, revenue neutral reforms that make the tax more progressive also reduce unemployment. Thus, policy towards unemployment compensation and tax structure are key influences on the effect of taxes on unemployment.

Delipalla and Sanfey (1998) identified that there are different versions of efficiency wage models which examined the relative effects of ad valorem and specific labour taxes on wage and employment study related to different commodity taxes on the labour market .is missing. Hence they examined the effects of two types of commodity taxation, specific and ad valorem, on wages and profits using two types of models one with efficiency wage setting and one with bargaining between a union and a firm. In the efficiency wage model revenue-neutral shift from specific to ad valorem taxation leads to an increase in both employment and wages, and a reduction in profitability. However in bargaining case the effect on wages and profits may be reversed: predominantly ad valorem taxation raises employment but lowers wages, and under certain circumstances, the net effect can lead to an increase in profits.

Burnside, Martin and Fisher (2000) focused on the exogenous fiscal shock that leads to persistent movements in government purchases and average marginal tax rates. They analyzed the ability of a particular general equilibrium efficiency wage model in order to test the actual responses of hours worked and real wages to a fiscal policy shock. Their key finding is that the model does not work without the assumption of constant marginal tax rates.

Gupta and Gupta (2001) had made a dynamic analysis of the effects of various tax policies on the unemployment of an economy with a labour efficiency function which shifts overtime. Efficiency of the workers varies positively with the stock of knowledge in addition to wage and unemployment. The comparative steady state effects on unemployment with respect to change in various tax rates are analyzed assuming that the production of public good (educational output) is financed by the tax revenue.

Lang (2003) considered that in a standard competitive model, a tax change will affect a group of workers which has high inelastic supply and their earnings will fall by the entire nominal employer share of the tax increase. Under market clearing assumption the range of possible outcomes broadens .However if there exists excess labour in equilibrium as in efficiency wage models, supply of labour is perfectly elastic and earnings increases more than the worker's nominal share.

V.T. Rapanos (2006) assuming identical effort functions across two sectors of a simple general equilibrium model examined the effects of corporate and consumption tax on income distribution, prices, and unemployment .Effort function depends on unemployment, a corporate income tax may lead to a reduction of unemployment depending on the labour intensity of taxed sector and the level of unemployment. On the other hand consumption tax lowers unemployment as long as it is imposed on the capital intensive commodity.

However efficiency wage models are often considered as a source of non-neutrality of money, the next section deals with different models related to real effects of money.

2.2.3 Impact of Monetary Policy in Efficiency Wage Models

In the New classical models developed by *Lucas, Sargent and Barro* during 1970s, it has been observed that any anticipated monetary disturbance will cause an immediate jump of nominal wages and prices to their new equilibrium keeping output and employment unaffected. Hence the assumption of continuous market clearing, in these models explains neutrality of money. But in contrast, new Keynesian models (*Akerlof and Yellen*

(1985a), Mankiw (1985), Parkin (1986), Rotemberg (1987) suggest prices and wages to be rigid rather than flexible due to the persistence of market imperfections and hence under similar new classical theoretical framework money becomes non – neutral.

In New Keynesian system of non-neutrality of money, i.e. money supply effecting real variables of the economy, arises because of either nominal rigidities (of money wage or price) or real rigidities (of real wage). *Fischer (1977)* had considered temporary nominal wage rigidity in the form of long term wage contracts with flexible prices to explain short run non – neutrality of money. *Mankiw (1985)* explained nominal price rigidity, where a monopolistically competitive firm facing menu cost has little incentive to adjust price with any fluctuation in aggregate demand causing a large fluctuation in output.

2.2.3.1 Pioneering Studies dealing with the impact of monetary Policy in Efficiency Wage Models

Since efficiency wages cause rigidities and since non neutrality of money arises due to rigidity, efficiency wage models are used to explain real effects of money. This fact was first identified by *Akerlof and Yellen (1985a)* who demonstrated that, when imperfect competition in the product market is combined with efficiency wages in the labour market , aggregate demand disturbances those caused by monetary shocks will have real effects on production and employment.

2.2.3.2 Extensions regarding the impact of Monetary Policy

After *Akerlof and Yellen (1985a),* a number of efficiency wage models have come up to explain money's real effects. *Stiglitz (1986), Summers (1988), Ball and Romer (1990), Gottfries and Westermark (1998)* by using efficiency wage models presented the fact that monetary shocks raise output and employment.

In *Stiglitz (1984)* output falls with increase in employment if real wages are held constant i.e. cost of labour rises leading to a fall in output. If effort is being more sensitive to employment output is sure to fall otherwise output rises very little relative to employment. Moreover with nominal wage rigidity both output and employment

increases with any positive monetary shock, (*Stiglitz (1986)*).In *Summers (1988)*, incentive for adjustment to nominal wage with certain monetary shock is very small and hence the firm has no incentive to adjust price with unchanged cost. Moreover less the workers put weight on unemployment, incentive to adjust wages is smaller, thus positive monetary shock has positive impact on output and employment.

Since rigidities in real prices are not sufficient to create rigidities in nominal prices and real effects of nominal shocks. *Ball and Romer (1990)* considered that substantial nominal rigidity can arise from a combination of real rigidities and small nominal frictions. They have shown the connection between real and nominal rigidity given the presence of nominal frictions both where two sources of real rigidity one arising from goods market imperfection and the other from labour market imperfections.

Lai (1992), contrasted *Fleming (1962)* which explains the fact that when capital is highly mobile, fiscal policy is more effective under fixed exchange rate, on the other hand monetary policy is more effective under flexible exchange rate. *Lai (1992)* by using efficiency wage relationship in an open economy structure shows that fiscal policy will be more effective under flexible exchange rate and monetary policy will be more effective under fixed exchange rate.

Lai (1993), applies the efficiency wage theory to reevaluate the robustness of the Mundell proposition. It is found that, under a flexible regime with perfect capital mobility, an expansion in government expenditure will contribute a positive impact on domestic output, while an expansion in money supply is totally ineffective in changing the domestic output. The paper finally indicates that the traditional Mundell assertion is not robust, if the firm sets its wage offer according to the rule suggested by the efficiency wage theory.

Gottfries and Westermark (1998) explained the fact that aggregate demand shocks have large effects on output and employment because prices and wages adjust slowly to the shocks. Thus skillful policy activism can be used where government can react to information that was not known when wages were set. Moreover slow price adjustment

on the macroeconomic level is a reflection of persistence. The more persistence there is, the slower price adjusts after permanent change in the money supply.

Lin and Lai (1998), with partial wage rigidity considering flexible component as lump sum tax, in an efficiency wage model explained non- neutrality of money. The model compares the situation of *Solow (1979)* and *Yellen (1984)* considering real wage rigidity with no impact of economy employment on productivity, where money has no real effects on real wage and employment.

The question that was thrown by *Carter (2005)* in this regard was whether output rise or fall with money in efficiency wage models. According to him in the basic efficiency wage models with nominal wage rigidities dealing with real effects of money like *Stiglitz (1986)*, *Summers (1988), Ball and Romer (1990), Gottfries* and *Westermark (1998)*, the impact of employment on the efficiency of the workers is absent or in some cases negligible. Carter specified using published empirical results that in the presence of strong negative impact of employment on efficiency, output may fall when monetary shocks cause employment to rise

2.3 Major Non –Walrasian Models

Since in the last few decades there has been a vast development in the so called disequilibrium model. Contributions by *Don Patinkin (1956, 1965)*, *Clower (1965)*, *Barro – Grossman (1971)* and *Benassy (1975, 1982, 1986)* in particular represent important attempts to reconstruct the macroeconomic theory within an explicitly disequilibrium context.

Patinkin (1956) presented a theory in which involuntary unemployment of labour can arise as a consequence of disequilibrium, in particular due to excess supply in the market for current output. Patinkin hence explained that if the firm fails to realize their desired level of supply, demand for labour is no longer determined by the level of wage rate. And hence too high a real wage is not the cause of the lower employment and reduction in the real wage is only a superficial cure. The real cause of the problem is the lack of

commodity demand and output which produces unemployment with corresponding excess supply of labour. It is however possible to cure this problem through demand management policy by which demand for output can be raised. In Patinkin's case a rise in real wage may accompany the recovery of output and employment. This disequilibrium analysis suggests that real wages may move pro cyclically. This result differs from the conventional view that employment and real wages must be inversely related. The limitation of Patinkin's analysis however, is that in his theory the causality relationship seems from the excess supply in the labour market but the impact of excess supply in the labour market on the demand for commodity is not considered. His analysis is therefore partial rather than general equilibrium in nature.

Clower (1965) develops a theory emphasizing the possibility of reverse influence of that of Patinkin, where the labourers fail to sell their desired labour service and as a consequence there occurs a spillover effect on the output market. Where as in Classical optimization problem, optimum labour supply, demand for commodity and the demand for real balance depend mainly on price variable, according to Clower's demand for commodity as well as for real balance depends on the amount of labour supply that the household can actually sell, i.e. his actual labour income .In fact, to describe such situation Clower introduced the concept of dual decision hypothesis which shows how the consumption function could have two different functional forms depending on whether the consumer was rationed in the labour market or not. Clower called this constrained demand as effective demand. Clearly, the effective demand differs from 'notional demand' where the former depends on the quantity constraint along with prices and endowment. The functional form of the resulting demand i.e. effective demand function is very much similar to the Kyenesian consumption function. Thus Clower represents a micro foundation of the Kyenesian consumption in which he interprets the relationship between consumption and income as a manifestation of disequilibrium in the labour market. Like Patinkin, Clower's analysis is also partial equilibrium in nature because the model takes into account the effect of excess supply of labour on demand for goods, and does not consider the feedback effect from excess supply in the goods market on the demand for labour. Patinkin's market and Clower's analysis are thus complementary to each other.

Barro-Grossman (1971) identifying Patinkin and Clower's analysis essentially complementary to each other combined the two analyses to get a complete picture of the determination of output and employment in a closed economy. As the prices are assumed to be rigid in the short run, there can be excess supply or excess demand in both markets. Therefore in Barro-Grossman we can have two possible types of equilibrium a) excess supply in both the markets for goods and labour, b) excess demand in both the markets for goods and labour. The traditional Keynesian model is thus a special case of more general framework. One of the interesting properties of these types of market disequilibrium model is that the regime switching can occur if the values of the parameter changes in some particular fashion. If this happens the behavioral relationship will be different for different regimes. As a consequence, the impact of traditional policy instruments will depend on the regime that is being considered. In these models while for mutating the effective demand for goods the agents in any market takes into account the constraint that operates in the other markets. There is thus interdependence between markets. It should be noted that one disequilibrium situation which has not being analyzed on Barro–Grossman is the case of excess demand for goods and excess supply of labour. However, Barro - Grossman considered this regime in their subsequent book.

In a disequilibrium situation an agent cannot realize his notional demand and supplies because while maximizing utility he perceives some physical constraint operating on the system, which prevents the agent to realize his notional demand and supply. Therefore, one can ask the question as to whether there exits some allocation for which all the agents will be satisfied in the sense that no individual would intend to deviate from the allocation. The effort of trying to answer this question ultimately resulted in formalization of the concept of Non-Walrasian equilibrium. The important concept of Non - Walrasiasn equilibrium was due to *Drèze (1975), Benassy (1975),*and *Malinvaud and Younes (1977).*

Malinvaud (1977) was first to apply the concept of *Benassy (1975)* equilibrium to formulate a Non – Walrasian macro model. He thus emphasized the role of quantity signals in obtaining different types of unemployment. In this context he showed that starting from a general framework we can classify the model into different regimes –

Keynesian unemployment, Classical unemployment, and the Repressed inflation, depending on the type of rationing scheme prevailing in the economy. If the consumers are rationed in the labour market and the producers are rationed in the commodity market then we get a situation known as *Keynesian unemployment* with excess supply of both labour and output, *Classical unemployment*, corresponding to the situation where the consumers are rationed in both the commodity and labour markets so that there exists excess supply of labour and excess demand for goods. *Repressed inflation* occurs if the producers are rationed in the labour market and consumers are rationed in the commodity market so that there exists excess demand for both the goods and labour. The other possibility that the producers are rationed in both the commodity and labour market implying that there exists excess demand for both the commodity and labour market implying that there will be excess supply of goods and excess demand for labour does not arise in the model with no inventory. However *Muellbauer and Portes (1978)* considered a model with inventory and have shown that one can get this fourth regime of excess supply of commodities and excess demand for labour and they termed this regime as *regime of under consumption.* Interesting point about these models is that the effect of some policy changes on output, employment will depend on the particular regime in which it is operating at that point of time. However, the problem with Malinvaud's analysis is that he discussed all these results in terms of a specific and not in general utility function.

Benassy (1982, 1986) generalized the model of *Malinvaud (1977). Benassy (1986)* also extended the above disequilibrium model by considering asymmetric price flexibility as well as wage indexation and hence tested the effectiveness of employment policies in each case. Further he also formulated a two - country open economy model under the disequilibrium framework. Finally, *Benassy (1986)* also went ahead and introduced the dynamic concept into the above framework.

Picard (1995) has considered a simple overlapping generation model with efficiency wage based on non – Walrasian framework. He assumed that individuals live and consume for two periods, but work only for the first and hold savings in the form of money balances. The firms and workers will not use same price system to define real

wage. Production real wages are determined by the prices prevailing during the duration of the contract, while consumption real wages should be calculated by deflating money wages by an intertemporal price index. Here the impact of fiscal policy that changes real aggregate demand have significant repercussions on employment level with small variations in real wage. Moreover he also explored the role of employment subsidies and commodity taxation policies in a general equilibrium model with a dual labour market and efficiency wage. Individuals working in the primary sector receive higher real wages than those employed on the secondary market. This model thus shows that an employment subsidy policy does not generally allow recovery of the first – best optimum and describes the second –best Pareto – optimal policy.

2.4 Gaps in the Literature

The perusal of the above literature as surveyed above regarding efficiency wage model and non – Walrasian macro model has not considered the following aspects of the problem,

- The static standard efficiency wage model (*SEWM*) like *Solow (1979), Yellen (1984) etc.* assume perfect commodity price flexibility and do not allow the possibility that there may be lack of commodity demand at the exogenously fixed prices and the producer in fact takes the constraint into account while setting the optimum real wage and employment. At the same time the existing literature on static non – Walrasian macro model (*SNWMM*) such as by *Patinkin (1956, 1965), Clower (1965), Barro – Grossman (1971), Malinvaud (1977), Benassy (1982, 1986) etc.* do not take into account that the firm can set real wage considering efficiency wage relationship. Thus there is enough scope to integrate these two models and can have a generalized model.
- One can observe a number of studies based on standard efficiency wage framework (*Yellen (1984), Johnson and Layard (1986), Shapiro and Stiglitz (1984) and Pisauro (1991) etc.*) that examine the impact of incidence of pay roll taxes such as labour taxations (ad valorem tax (wage tax) and (specific tax

(employment tax). However while studying the effect of these policies the authors did not take into account of the possibility that the firm may face commodity demand constraint at the exogenously given price. Thus there is enough scope to revisit the impact of these taxation policies in the generalized model as proposed above. Relevantly it may be mentioned that the effect of such labour taxations have not been observed in the models with standard non - Walrasian framework.

- One can also consider how the conclusion of the present non – Walrasian model regarding the effect of other policies changes from the existing non –Walrasian model without efficiency wage relationship like *Benassy (1986)* , if we allow the possibility that the firm sets real wage by taking into account efficiency wage relationship.
- In the existing non – Walrasian IS – LM framework of *Benassy (1986)* with asymmetric price and wage flexibility where he has studied the efficacy of monetary and fiscal policy, there is no role of efficiency wage relationship. Hence one can reconsider an extended version of this non – Walrasian IS – LM model where the firm sets the real wage taking into account the efficiency wage relationship (based on *Solow (1979)* and *Yellen (1984)*) but commodity price is asymmetrically flexible. Further, on the one hand, impacts of fiscal and monetary policies are examined and compared with *SNWMM of Benassy (1986)* and *SEWM* of *Solow (1979)* and *Yellen (1984).*
- The literature suggests that effort of the workers may be affected due to some exogenous factors (other than real wage) like access to and quality of health care, the quality and affordability of education and training , investment on infrastructure , quality of job environment etc. Thus it will be interesting to consider the effect of exogenous shift in one or more than the above factors leading to change in effort of the workers in the generalised model (with and without labour taxation) and also in the extended IS – LM non – Walrasian framework with efficiency wage. There is dearth in the literature dealing with such type of study.
- In *Benassy (1986)* a simple non – Walrasian two country open economy macro model has been formulated in which one homogenous good is exchanged, the

price of which clears the world market and wage is exogenously given in each country. In this context the effects of various policies on the country pursuing them and their repercussion on the other country has been studied under flexible and fixed exchange rate regimes. However while framing such model *Benassy (1986)* did not introduce efficiency wage relationship. Hence a non – Walrasian two country open economy model can be formed by extending the model of *Benassy (1986)* assuming that the real wage is set by the firm endogenously on the basis of efficiency wage relationship. Again there are some extensions of the efficiency wage model in a open economy framework like *Wilson (1990)*, *Lai (1990,1992,1993)* etc. ,one can hardly observe any study on two country open economy model in non – Walrasian framework with efficiency wage.

The present thesis tries to overcome the limitations of the existing literature as mentioned above.

CHAPTER 3

NON - WALRASIAN FIXED - PRICE MODEL WITH EFFICIENCY WAGE: INCIDENCE OF LABOUR TAXATION

3.1 Introduction

In the standard efficiency wage model *SEWM* (*Solow (1979), Salop (1979), Weiss (1980), Akerlof (1982), Shapiro and Stiglitz (1984)*) where optimum wage is determined on the basis of effort function alone, gives rise to involuntary unemployment. However, in these models since commodity price is assumed to be flexible, the firm while obtaining the optimal solution of employment and real wage does not take into account of the state of the demand condition prevailing in the economy, that is the scope of commodity demand constraint does not arise. In contrast to *SEWM*, if commodity price is assumed to be exogenously fixed, the possibility that the firm may face commodity demand constraint cannot be ignored.

Moreover, in this conventional efficiency wage set up several studies (*Yellen (1984), Johnson and Layard (1986), Shapiro and Stiglitz (1984), Pisauro (1990)*) have also evolved regarding the impact of pay - roll taxes[1] such as labour taxations namely ad valorem tax (wage tax) and specific tax (employment tax)[2]. But while determining the impact of these taxations, the possibility of commodity demand constraint, arising due to exogenously fixed price, is not been considered in the above models. However, under the assumption of exogenously fixed price, there is a scope of such constraint to prevail in the commodity market and hence the impact of these labour taxation policies in the above efficiency wage models can also get affected.

The role of perceived constraints in the commodity market are being considered extensively in the Standard non–Walrasian (*SNWMM*) or so called disequilibrium macro

[1]Detail explanation of pay roll taxes is given in Appendix 1.

[2] Some literature has also studied the impact of tax policy on employment with efficiency wage relationship in a two sector general equilibrium framework (*Agell and Lundborg (1995*), *Rapanos (2004*)) etc..

models (*Patinkin (1956, 1965), Clower (1965), Barro – Grossman (1971), Malinvaud (1977), Benassy (1975, 1982, 1986)*). In *SNWMM* of *Benassy (1986)* under a highly aggregative framework and at exogenously given wage and price there may be the possibilities of either excess demand or excess supply in the commodity market resulting in the following situation, i) excess supply of commodities and excess supply of labour (Keynesian Unemployment regime), ii) excess demand for commodities and excess supply of labour (Classical Unemployment regime) and iii) excess demand for both commodities and labour (regime with Repressed Inflation). Though it has been observed that, *Picard (1995)* considered an overlapping generation model based on non – Walrasian framework with efficiency wage; but in the *SNWMM* as mentioned above, wages are either set exogenously or linked to price (in the extended framework of *Benassy (1986)*) but are not determined by the firm on the basis of efficiency consideration of the worker. In the above context, the present chapter has two parts.

The objective of the first part of the present chapter is to i) construct a simple static aggregative monetary macro model where commodity price is exogenously given in line with non -Walrasian framework (*Benassy (1986)*). ; but in contrast to *Benassy (1986*) in the present model the producer determines optimum real wage on the basis of efficiency consideration (based on *Solow (1979)*), ii) examine different classical and Keynesian policy implications which are compared with that of *Benassy (1986)* and iii) investigate the impact of the policies that result in exogenous shift in effort function; relevantly such policy implication is missing in *SNWMM.*

The objective of the second part is to i) construct similar non – Walrasian fixed price models with efficiency wage in presence of pay roll taxes such as labour taxations (ad valorem tax (wage tax) and (specific tax (employment tax), ii) investigate the role of ad valorem and specific tax that is pay roll taxes in non – Walrasian framework, iii) observe how the impact of such taxations on optimum solutions in the present set up differ from that of *SEWM* (specifically of *Yellen (1984)* having similar properties of the effort function as that of the present model), iv) identify the impact of classical and Keynesian policy measures in presence of ad valorem and specific tax and v) explain how

the impact of the policies that result in exogenous shift in effort functions gets affected with the introduction of these taxes

The chapter is furnished as follows: Section 3.2 presents the basic model. Section 3.3 discusses regime classification of the present generalized non- Walrasian structure in comparison to *Benassy (1986)*. In sections 3.4 and 3.5 two relevant regimes that is, regimes without and with commodity demand constraint are explained respectively. Further subsections examine the impact of different policy implications in each regime. Section 3.6 highlights the role of pay roll taxes like labour taxations namely ad valorem and specific tax in the present generalized non – Walrasian framework. In subsections 3.6.1 and 3.6.2, models with ad valorem and specific tax are formulated respectively which also deals with the impact of different relevant policy implications. Finally, section 3.7 draws the conclusion of the study in this chapter.

3.2 The Basic Model

The model assumes an aggregate monetary economy with three representative agents; a firm, a household and also the government. Since the aim of the present thesis is to generalize the non – Walrasian model where the firm sets real wage by taking into account efficiency wage relationship, it is likely that, effect of such operation by the firm will in the first instance have an impact on wage, employment and hence on wage income and thereby it will affect aggregate demand in the economy. Thus in order to trace out the impact of efficiency wage on wage income and hence on aggregate demand, we will introduce two classes in the household: wage and profit earner having different marginal propensities to consume as supported by the literature like *Kaldor(1955)* [3].Note that if on the contrary we assume the propensities to consume of the worker to be same as that of profit earner ,the effect of change in wage income on the aggregate demand cannot be clearly felt. Relevantly it may be noted that *Benassy (1986)* while formulating non – Walrasian macro model did not assume the difference between marginal propensities of

[3]*Kaldor* made a distinction between wage-earners and profit- earners, noticing that the propensity to save of the first group can be assumed to be smaller than that of the second group (see *Kaldor (1955)* pp. 95).

wage and profit earner and in such model one cannot separate out the effect of the change in wage income on aggregate demand.

Each household thus consists of two representative classes having different marginal propensities to consume, i) the wage earner who sells labour and earns wage and ii) the profit earner who earns profit. There are three types of goods, consumption good, labor and money; two markets, goods and labour. The real wage rate is determined by the profit- maximizing firm in line with efficiency wage theory (*Solow (1979*)).

Price is assumed to be exogenously fixed. Equilibrium supply and demand can be generated through ***quantity signals*** as in non - Walrasian model by *Benassy (1986).*Transaction settles at the minimum level of total supply and demand (short side of the market rule) and determines aggregate effective demand and supply. The model allows determination of the levels of optimum real wage, employment and output.

The behaviour of each of the agent is explained in the following sub sections. The working of the firm and the household is analyzed on the basis of constrained and unconstrained cases. Constrained and unconstrained cases are defined as the situations where the firm may or may not face constrained in the commodity market respectively.

3.2 .1 The Firm

As in *SEWM* of *Solow (1979)*, firm's output depends on both the number of workers it employs and on their efforts; hence the short run production function is,

$$Y = F(eL), \qquad F'(eL) > 0 \qquad F''(eL) < 0 \tag{3.1}$$

Where *Y* is the output produced; *L*and e denote the amount of labour hired and worker's effort respectively.

Effort function takes the form,

$$e = e\,((W/P), \theta), \quad e' > 0\,, e'' > 0, \quad e_\theta > 0 \tag{3.2}$$

$$e' = de/d(W/P) > 0 \quad \text{and} \quad e'' = d^2e/d(W/P)^2 < 0$$

As in *Solow (1979)*, e depends on real wage (W/P)[4] implying the fact that productivity depends on workers wage.

Further, in the present framework we assume that effort of the workers also gets affected due to change in parameter θ, which signifies the change in exogenous factors like access to and quality of health care ,the quality and affordability of education and training , investment on infrastructure , quality of job environment etc.[5] Exogenous policy measures that improve one (or more than one) of these above factors would increase the value of the parameter θ leading to upward shift in effort function in (3.2).

The firm in fact can face two types of problems where it is either unconstrained or constrained in the commodity market. In the next two broad subsections behaviour of constrained and unconstrained firm are considered.

3.2 .1.1 Unconstrained Firm

If at the given price, P, the firm can realise its profit maximising supply of output then it is unconstrained in the commodity market.

Optimum real wage, $(W/P)^*$ and employment, L^M is the solution of the following problem where π be the real profit of the firm,

$$\text{Maximise } \pi = Y - [(W/P)\, L] \tag{3.3}$$

$$\text{s.t} \quad Y \leq F(eL)$$

The optimum real wage and employment is determined by solving the first- order conditions for (W/P) and, L , that is by setting $d\pi/d((W/P)) = 0$ and $d\pi/\delta L = 0$[6].

$$e'((W/P),\theta) = 1/F'\left(e\left((W/P),\theta\right)L\right) \tag{3.4}$$

[4]There are literatures justifying inclusion of unemployment rate as an argument of effort function (*Shapiro and Stiglitz (1984)*, *Summers (1988)* etc.), which can easily be incorporated in the extended version of the present study.

[5]Impact of these factors on efficiency of the workers is explained in the studies in *NBRI,* http://www.nbrii.com, http://www.tutor2u.net *etc.*

[6]Second order conditions are assumed to be satisfied.

$$F'\left(e((W/P),\theta)L\right) = (W/P)/[e\left((W/P),\theta\right)] \quad (3.5)$$

The above two equations, yield elasticity of effort function with respect to real wage,

$$\mu_W = \frac{e'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1 \text{ (Solow condition}^7\text{)} \quad (3.6)$$

Here, optimum real wage, $(W/P)^*$ is determined on the basis of the effort function alone satisfying the above Solow condition.

Following (3.5), employment in efficiency unit,

$$[e\left((W/P)^*,\theta\right)L]^M = F'^{-1}\left((W/P)^*/[e\left((W/P)^*,\theta\right)]\right) \quad (3.7)$$

Therefore, optimum employment,

$$L^M = [F'^{-1}\left((W/P)^*/[e((W/P)^*,\theta)]\right)]/[e((W/P)^*,\theta)] \quad (3.8)$$

Optimum output,

$$Y^M = F(F'^{-1}\left((W/P)^*/[e((W/P)^*,\theta)]\right)) \quad (3.9)$$

Condition (3.6) implies that the optimum real wage, $(W/P)^*$ is determined at the point where effort elasticity with respect to real wage equals unity, $(\mu_W = 1)$. This corresponds to the point where the slope of the effort function signifies maximum effort – real wage ratio, $e/(W/P)$ or minimum wage cost per efficiency unit, $(W/P)/e$, which is also the minimum marginal cost, *MC*.

Further, employment in efficiency unit, $[e((W/P)^*,\theta)L]^M$ is determined where corresponding marginal productivity of employment in efficiency unit, MP_{eL} is equal to minimum MC (following (3.5)). Once optimum real wage, $(W/P)^*$ and corresponding effort, $e((W/P)^*,\theta)$ is known, actual employment, L^M is solved from optimum employment in efficiency unit, $[e((W/P)^*,\theta)L]^M$ (as in (3.8)).

[7] *Akerlof and Yellen (1986)* termed this condition as Solow Condition.

The above equilibrium signifies the standard efficiency wage model (SEWM) by Solow (1979) where commodity market is always in equilibrium due to price flexibility and the firm faces no commodity demand constraint.

However, for the unconstrained firm of the present model, though commodity price is exogenously fixed unlike *Solow (1979)*; the assumption is that the price is fixed in such a way that there exists either excess demand or equilibrium in the commodity market and thus the firm faces no commodity demand constraint and realizes the profit maximizing level of supply. Hence the system of equations in the present optimization problem of the unconstrained firm is similar to that of *Solow (1979).*

The above optimization solution can be described with the help of four paneled diagram[8] in Figure 3.1.

In panel (1), e represents effort curve showing the relationship between effort of the workers and real wage .Higher the real wage, greater the effort of the workers. Initially increase in real wage entails more than proportionate increase in effort of the workers. Effort per unit of real wage, $e/(W/P)$ is maximum at point 'M' where slope of the effort function, ON is tangential to the effort function. This point corresponds to $\mu_W = 1$ (as in (3.6)) where $(W/P)^*$ implies optimum real wage that results in maximum $e/(W/P)$ in panel (1). Since wage cost per efficiency unit, $(W/P)/e$ is inverse of $e/(W/P)$; as $e/(W/P)$ increases, $(W/P)/e$ falls and vice versa.

In panel (2) relationship between $(W/P)/e$ and (W/P) is shown. Since $(e/(W/P))$ is maximum at point 'M' with efficiency wage,$(W/P)^*$; $((W/P)/e)$ is minimum at point 'E' with $(W/P)^*$ in panel (2).

Panel (3) depicts marginal productivity of employment in efficiency unit, $MP_{(eL)}$. Level of optimum employment in efficiency unit,$[e\,((W/P)^*, \theta)L]^M$ is determined at point 'G' in panel (3) where the corresponding marginal productivity equals the minimum MC in panel (2) (depicting equilibrium condition in (3.5)).

[8]While explaining the working of standard efficiency wage model of *Solow (1979*), *Snowdon and Vane (2005)* used the diagrammatic representations of wage cost per unit of effort, $[(W/P)/(e\,(W/P))]$ curve that is marginal cost curve and the corresponding effort curve. However they have not considered this four quadrant diagrammatic representation as developed in the present paper.

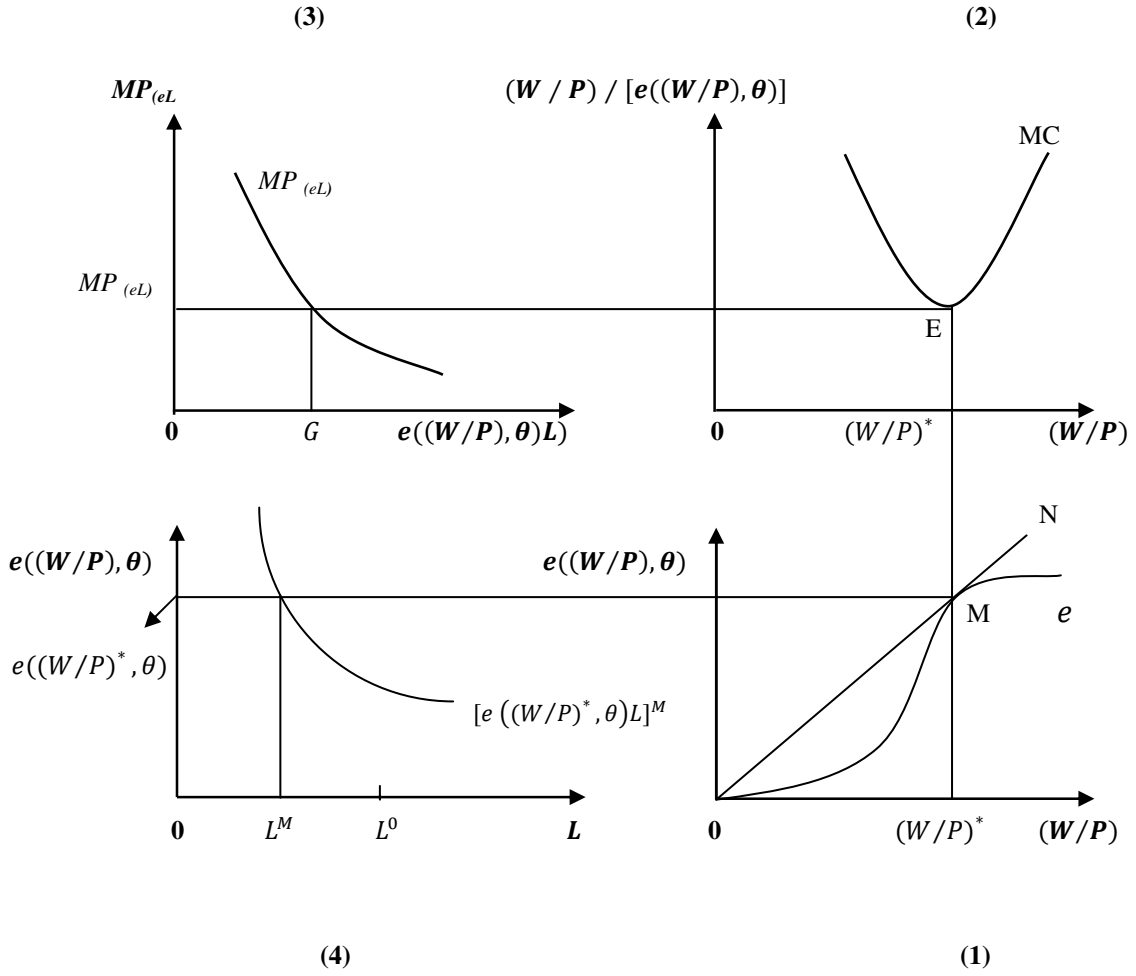


Figure 3.1 Determination of optimum real wage and employment in the unconstrained case

Panel (4) represents employment in efficiency unit, (eL) curve, which is a rectangular hyperbolic curve in effort, e and employment, L plane. Different combinations of e and L provide fixed level of $[eL]$. As optimum effort $e((W/P)^*, \theta)$ corresponding to optimum real wage, $(W/P)^*$ and optimum employment in efficiency unit, $[e((W/P)^*, \theta)L]^M$ are already known, the resulting optimum actual employment can easily be determined and is set at L^M in panel (4).

If the profit maximizing level of optimum employment, L^M is less than the Walrasian full employment output L^0, that is, $L^M < L^0$, there is involuntary unemployment.In that case, profit maximising level of output, $Y^M <$ Walrasian full employment level of output, Y^0.

If $(W/P)^0$ be the real wage corresponding to Walrasian full employment output L^0, then involuntary unemployment persists when $(W/P)^*$ as set on the basis of the given effort function is greater than the Walrasian market clearing level of real wage, $(W/P)^0$, that is $(W/P)^* > (W/P)^0$.

If, $(W/P)^* = (W/P)^0$, optimum employment will be the full employment one and there will be no involuntary unemployment.

However, if $(W/P)^* < (W/P)^0$, the firm will be forced to pay $(W/P)^0$ till labour demand equals labour supply.[9] Thus excess demand for labour cannot exist in the present structure.

In the *SEWM* (*Solow (1979)*), optimum efficiency real wage, $(W/P)^*$ is generally assumed to be set above the market clearing level, $(W/P)^0$ and hence there is persistence involuntary unemployment. Thus in the present case too optimum real wage, $(W/P)^*$ is found to be higher than $(W/P)^0$ creating involuntary unemployment. $(L^0 - L^M)$ is the resulting involuntary unemployment in panel (4) of Figure 3.1.

3.2 .1 .1.1 Impact of Exogenous Shift in Effort Function

The impact of exogenous upward shift in effort function can be explained with the help of Figure 3.2.

As the parameter, θ increases with the improvement of the exogenous factors like access to and quality of health care, the quality and affordability of education and training, investment on infrastructure etc.; the effort curve in panel (1) shifts upward to e_1.

From panel (1) it is clear that the maximum effort – real wage ratio $(e/(W/P))$ corresponding to new e_1 increases as compared to initial e. This implies the fact that the worker can now exert more effort at the lower level of real wage. The point associated with maximum effort – real wage ratio (where $\mu_W = 1$) shifts leftward and optimum real

[9] See *Abel and Bernanke (2001).*

wage, $(W/P)^*$ falls to $(W/P)^*_1$. Now $(W/P)^*_1$ is the real wage which corresponds to the maximum $e/(W/P)$ with respect to new effort function, e_1[10].

Accordingly minimum wage cost per efficiency unit, $((W/P)/e)$ falls as depicted in panel (2), where the minimum point of new MC curve (A_1) is now at 'E_1'. At the optimum, corresponding MP_{eL} falls and employment in efficiency unit, $[e((W/P),\theta)L]$ increases to point 'F' as shown in panel (3). With the rise in $[e((W/P),\theta)L]$, profit maximising level of output increases (say from Y^M to Y^M_1).

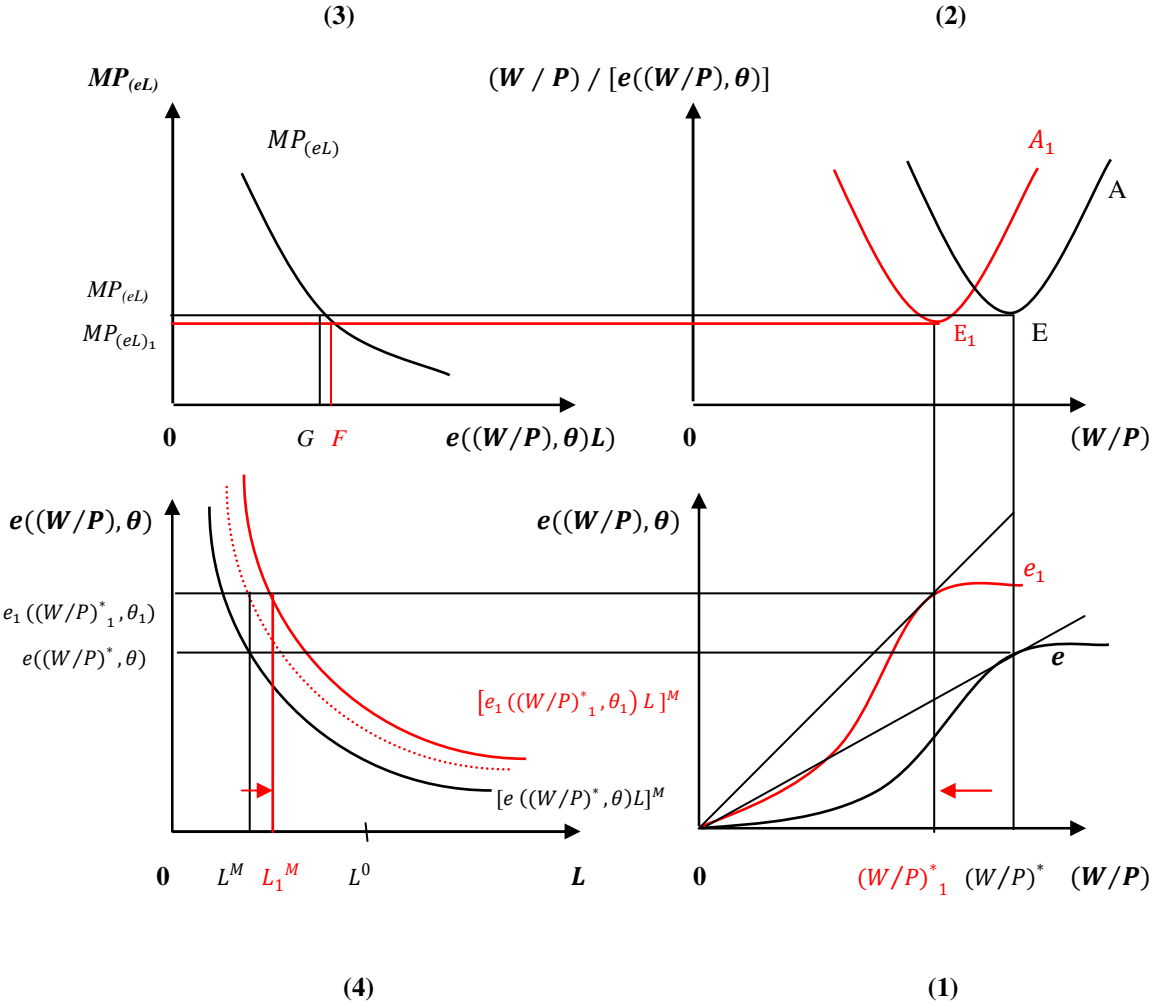


Figure 3.2 Impact of exogenous shift in effort function on real wage and employment in the unconstrained case

[10] Upward shift in effort function is shown in *Snowdon and Vane (2005)* where unemployment rate is the exogenous factor that affects effort of the workers and rise in which shifts effort function upward.

Finally the impact on actual employment is shown in panel (4). As employment in efficiency unit, $[e\,((W/P)^*, \theta)\,L\,]^M$ curve shifts upward to $[e((W/P)^*_1, \theta_1)L]^M$ in panel (4) and at the same time since effort, $e\,((W/P)^*, \theta)$ increases to $e((W/P)^*_1, \theta_1)$; change in employment L depends on the magnitude of the shift in employment in efficiency unit $[e((W/P), \theta)L]$[11], as compared to increase in effort. If the magnitude of the shift in $[e((W/P), \theta)L]$ is higher/lower or equal to increase in $e((W/P), \theta)$, employment, L increases/falls or remains unchanged.

In panel (4) ,profit maximising level of actual employment, L^M rises to $L^M{}_1$ when shift in $[e((W/P), \theta)L)]$ is higher than the rise in $e((W/P), \theta)$ but remains unchanged when both the shifts are equal (dotted employment in efficiency unit curve).

Here, $(W/P)^*$ is determined only on the basis of the given effort function. However, since effort function shifts upward with the rise in parameter, θ, $(W/P)^*$ falls to $(W/P)^*_1$ .Thus $(W/P)^*$ is sensitive to θ. Again minimum wage cost per efficiency unit, $(W/P)^*/[e\,((W/P)^*,\,\theta)]$ falls with the rise in θ but profit maximising level of employment, L^M may rise/fall or remain unchanged. Hence optimum real wage, actual employment and output are functions of θ only.

Real wage, $(W/P)^* = \omega(\theta),\ \omega_\theta < 0$ (3.10)

Wage cost per efficiency unit, $(W/P)^*/[e\,((W/P)^*,\,\theta)] = g(\theta),\ g_\theta < 0$ (3.11)

Optimum output, $Y^M = S(\theta)\ ,\ \ S_\theta > 0$ (3.12)

Optimum actual employment, $L^M = \alpha(\theta),\ \alpha_\theta \gtreqless 0$ (3.13)

[11]Increase in employment in efficiency unit, $[e((W/P), \theta)L)]$ depends on the shape of the marginal productivity curve in panel (3).

Proposition 1

At the given price when the firm is unconstrained in the commodity market, exogenous shift in effort function would lower optimum real wage, increase output supply but the impact on employment is ambiguous.

3.2 .1.2 Constrained Firm

If the exogenously given price, P is such that there exists excess supply situation in the commodity market, the firm faces demand constraint and fails to sell the profit maximizing level of supply due to deficient demand.

Demand for commodity, $Y^d <$ Profit maximising level of supply, Y^M and Walrasian full employment output Y^0

As there is no inventory, due to short side rule based on quantity signal (as in *SNWMM*), the output production, Y is equal to demand for output Y^d

$$Y = Y^d \tag{3.14}$$

Thus, $Y^d = F\,(e((W/P),\theta)L)$ (3.15)

The optimum solution of real wage and employment of the constrained firm is determined by the following program

$$\text{Maximise} \quad \pi = Y - [(W/P)\,L] \tag{3.16}$$
$$\text{s.t} \quad Y = F\,(e((W/P),\theta)L)\,,\; Y = Y^d$$

The above problem can be solved by maximising the following Lagrangean

$$\Lambda((W/P), L, \lambda) \equiv F\,(e((W/P),\theta)L) - [(W/P)\,L] + \lambda\,[\,F(e((W/P),\theta)L) - Y^d] \tag{3.17}$$

First order condition with respect to (W/P), L and λ of the above problem implies[12]

$$d\Lambda/d\,(W/P) = F'\,(e((W/P),\theta)L)e'((W/P),\theta)L - L + \lambda\,[F'(e((W/P),\theta)\,L)e'((W/P),\theta)L] = 0 \quad (3.18)$$

$$d\Lambda/d\,L = F'(e((W/P),\theta)L)[\,e\big((W/P),\theta\big)] - (W/P) + \lambda\,[F'(e((W/P),\theta)L)\,e\big((W/P),\theta\big)] = 0 \quad (3.19)$$

$$d\Lambda/d\lambda = F(e((W/P),\theta)\,L\,) - Y^d = 0 \quad (3.20)$$

Solving equations (3.18) and (3.19) we get

$\mu_W = \frac{e'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1$ (Solow Condition satisfies)

Optimum real wage,$(W/P)^*$is still determined at the same point where $\mu_W = 1$, as in the unconstrained case,(in equation (3.6)).Thus optimum real wage in the constrained case is exactly equal to the optimum real wage corresponding to the unconstrained one and depends only on parameter θ.

Here again, $(W/P)^* = \omega(\theta),\ \ \omega_\theta < 0$

From commodity demand constraint in (3.20)

$$F\left(e((W/P),\theta)\,L\right) = Y^d \quad (3.21)$$

Optimum employment in efficiency unit,

$$[e((W/P)^*,\theta)\,L]^{\,d} = F^{-1}\,(Y^d) \quad (3.22)$$

Actual value of optimum employment

$$\bar{L} = [F^{-1}\,(Y^d)]/[e((W/P)^*,\,\theta)] = \alpha(\theta, Y^d) \quad (3.23)$$

Here actual optimum employment depends both on shift parameter θ as well as on prevailing commodity demand, Y^d.Since, $Y^d < Y^M$ corresponding employment in efficiency unit, $[e\,((W/P)^*,\theta)\,L]^{\,d}$is less than the profit maximizing level, $[e\,((W/P)^*,\theta)L]^M$. Again as optimum real wage, $(W/P)^*$remains unchanged, effort,

[12]Second order conditions are assumed to be satisfied.

$e((W/P)^*, \theta)$ does not get altered. Thus the lower level of employment in efficiency unit as compared to the profit maximizing one is possible only by lowering the actual employment in the demand constrained situation. This follows that, the optimum actual employment, $\bar{L}$ in the constrained situation (in (3.23)) is less than profit maximizing level L^M, that is, $\bar{L} < L^M$.

The above optimization problem is explained with the help of Figure 3.3

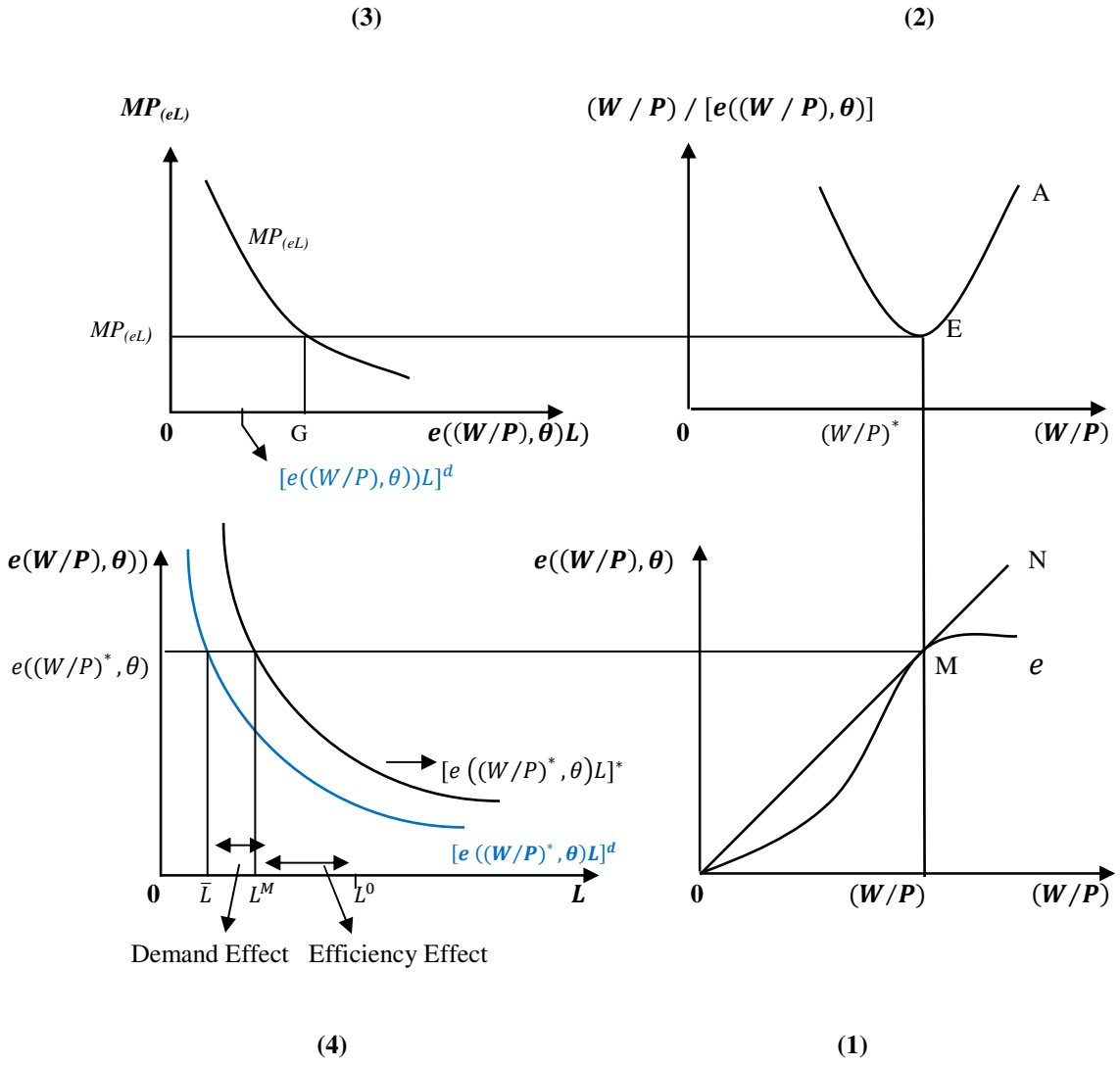


Figure 3.3 Determination of optimum real wage and employment in constrained case

In Figure 3.3, the relationship in panel (1), panel (2), panel (3) and (4) resembles that of Figure 1. As is clear from the above optimization problem, optimum real wage is still determined at the point where $\mu_W = 1$; hence in panel (1), effort – real wage ratio, $e/(W/P)$ is maximum at $(W/P)^*$ and the corresponding wage cost per efficiency unit, $(W/P)^*/e$, that is *MC* is also at its minimum at the same level of real wage as in panel (2).

As explained earlier in section 3.2 .1.1, when the firm is unconstrained in the commodity market, the profit maximising level of employment in efficiency unit, $[e\,((W/P)^*, \theta)L]^M$ is determined at point 'G' in panel (3) (where $MP_{(eL)}$ equals the minimum *MC*).But in the present case as the firm faces constraint in the commodity market, supply of output is demand determined. Hence employment in efficiency unit, $[e((W/P)^*, \theta)L]^d$ is also set on the basis of prevailing demand and is less than the profit maximising level, $[e\,((W/P)^*, \theta)L]^M$(as shown in panel (3) of Figure 3.3).

Actual optimum employment, $\bar{L}$ in the constrained situation is thus determined in panel (4), at the given level of employment in efficiency unit, $[e((W/P)^*, \theta)L]^d$ and optimum effort level, $e((W/P)^*, \theta)$ (corresponding to optimum real wage, $(W/P)^*$in panel (1)).

As is clear from panel (4) of Figure 3.3, $(L^0 - \bar{L})$ is the net unemployment in the present case of which $(L^M - \bar{L})$ is due to demand effect and $(L^0 - L^M)$ is due to efficiency effect. $(L^0 - L^M)$ is the level of unemployment in the unconstrained case which is only due to high efficiency real wage whereas the extra unemployment $(L^M - \bar{L})$ is created due to deficient commodity demand. Thus in the present situation unemployment is both due to demand and efficiency effect and is larger as compared to unconstrained situation (*SEWM*) where unemployment arises only due to efficiency effect. However, unemployment here is also higher than the KU regime of *SNWMM* (*Benassy (1986)*) where only demand effect is prevalent but efficiency effect is absent.

Proposition 2

- *At the given price, if the firm faces constraint in the commodity market, optimum efficiency real wage remains unchanged and is set at the same level as in the unconstrained case.*
- *Resulting unemployment is higher in the constrained situation (which arises both due to demand and efficiency effect) as compared to both SEWM (Solow (1979)) where only efficiency effect works, and KU regime of SNWMM (Benassy (1986)) where only demand effect is prevalent.*

3.2 .2 The Household

The consumption demand of the representative household is generated both by ***wage and profit earners*** having positive marginal propensity to consume, c_w and c_π respectively.

3.2 .2.1 Consumption Demand of the wage earner

The representative wage earner sells L of labour, at real wage, (W/P) which is assumed not to exceed the constant level, L^0. He has an initial money holding, $\bar{m}_w/P$, earns real wage income,$[(W/P)\,L]$ creates consumption demand, $\check{C}_w$ and has a final money holding, m_w/P. τ_w be the total real tax on wage income.

The budget constraint of the wage earner is,

$$C_w + m_w/P = \bar{m}_w/P + [(W/P)\,L] - \tau_w$$

And has a utility function, $U_w(C_w, [m_w/P])$

The wage earner has no utility for leisure so that his labour supply is constant, that is L^0.

Effective consumption demand of wage earners in the household is determined in the *constrained and unconstrained case.*

3.2 .2 .1.1 The Unconstrained Case

When the firm is unconstrained in commodity market it determines optimum real wage, $(W/P)^*$ and employment, L^M.

Therefore total wage income earned by the wage earner, $[(W/P)^* L^M]$

The representative wage earner creates consumption demand by solving the following program

$$\text{Maximise } U_w(C_w\ ,\ [m_w/P]\ ) \text{ s. t.}$$

$$C_w + m_w/P\ =\ \bar{m}_w/P\ +\ [(W/P)^* L^M]\ -\ \tau_w$$

The effective consumption demand of the wage earner in the unconstrained case,

$$\breve{C}_w = C\ (\ [(W/P)^* L^M]\ ,\ [\bar{m}_w/P],\ \tau_w) \tag{3.24}$$

3.2 .2 .1.2 The Constrained Case

If the firm faces constraint in the commodity market it employs optimum employment, $\bar{L}$ which is less than unconstrained profit maximising level of employment, L^M at the same level of real wage,$(W/P)^*$.

The wage earner is constrained in the labour market as, $\bar{L} < L^M$, that is the resulting wage income in the constrained case is lower than that of the same in unconstrained case, $[(W/P)^* \bar{L}\ ] < [(W/P)^* L^M]$

The representative *wage earner* creates consumption demand by solving the following program

$$\text{Maximise } U_w(C_w\ ,\ [m_w/P]) \text{ s. t.}$$

$$C_w + m_w/P = \bar{m}_w/P + [(W/P)^* \bar{L}] - \tau_w$$

$$[(W/P)^* \bar{L}] < [(W/P)^* L^M]$$

The general form for effective consumption demand in the constrained case

$$\breve{C}_w = \min [C([(W/P)^* L^M], [\bar{m}_w/P], \tau_w), C([(W/P)^* \bar{L}], [\bar{m}_w/P], \tau_w)$$

$$= C([\bar{m}_w/P], \tau_w, (W/P)^* \min(L^M, \bar{L}))$$

$$\breve{C}_w = C([(W/P)^* \bar{L}], [\bar{m}_w/P], \tau_w) \quad (3.25)$$

3.2 .2.2 Consumption Demand of the profit earner

A representative profit earner in the household has an initial money holding, $\bar{m}_\pi/P$, earns nominal profit, Π , which is being totally distributed by the firm. C_π and m_π/P is the consumption and final holding of the profit earners respectively where τ_π be the real tax on profit income collected by the government.

The budget constraint of the profit earner in the household is,

$$C_\pi + \bar{m}_\pi/P = \bar{m}_\pi/P + \Pi/P - \tau_\pi$$

And his utility function be, $U_\pi(C_\pi, [m_\pi/P])$.

The profit earner will not always be able to realise his notional profit at the exogenously given price. Thus he may or may not face constraint in the commodity market.

If the firm is unconstrained in the commodity market, it can enjoy notional profit,

$$\Pi/P = \Pi^M/P = F(e((W/P)^*, \theta) L^M) - (W/P)^* L^M$$

If the firm faces constraint in the commodity market, it will earn constrained profit,

$$\bar{\Pi}/P = Y^d - (W/P)^* [F^{-1}(Y^d)/[e((W/P), \theta)]$$

In the constrained case, the firm produces the prevailing commodity demand, Y^d, and employ labour, $\bar{L} = F^{-1}(Y^d)/[e((W/P), \theta)]$.

3.2 .2.2 .1 The Unconstrained Case

In the unconstrained case the representative consumption demand of the profit earner is determined by solving the following program

$$\text{Maximise } U_\pi(C_\pi, [m_\pi/P]) \text{ s. t.}$$

$$C_\pi + (m_\pi/P) = \bar{m}_\pi/P + \Pi^M/P - \tau_\pi$$

The consumption demand of the profit earner of the household in the unconstrained case

$$\breve{C}_\pi = C([\Pi^M/P], [\bar{m}_\pi/P], \tau_\pi) \tag{3.26}$$

3.2 .2.2.2 The Constrained Case

In the constrained case the representative consumption demand of the profit earner is determined by solving the following program

$$\text{Maximise } U_\pi(C_\pi, [m_\pi/P]) \text{s. t.}$$

$$C_\pi + [m_\pi/P] = \bar{m}_\pi/P + \bar{\Pi}/P - \tau_\pi$$

The consumption demand of the profit earner in the household in the constrained case

$$\breve{C}_\pi = C([\bar{\Pi}/P], [\bar{m}_\pi/P], \tau_\pi). \tag{3.27}$$

3.2.2.3 Aggregate Consumption Demand

The aggregate consumption demand, $\breve{C}$ is generated both by wage and profit earner in the household. As already discussed, different marginal propensities to consume for the wage earner and profit earner in the household following *Kaldor (1955)* are being assumed in the present model. Hence the aggregate consumption demand can be determined my combining (3.24), (3.25), (3.26) and (3.27) and is expressed as

$$\breve{C} = \breve{C}_w + \breve{C}_\pi = c_w[(W/P)L] - \tau_w] + c_\pi[\pi - \tau_\pi] + \beta[\bar{m}/P] \tag{3.28}$$

Where, c_w and c_π be the marginal propensities to consume for the wage earner and profit earner respectively, π be the real profit. $\bar{m} = \bar{m}_w + \bar{m}_\pi$. $c_w > 0$, $c_\pi > 0$, $\beta > 0$ and $c_w > c_\pi$ (following *Kaldor (1955)*)

In the above equation, $[(W/P)L] = [(W/P)^* L^M]$ in the unconstrained case, whereas $[(W/P)L] = [(W/P)^* \bar{L}]$ when the constraint is binding.

Again $\pi = (\Pi^M/P)$ when the producer does not face any constraint in the commodity market and $\pi = (\bar{\Pi}/P)$ where the producer in fact face the constraint.

3.2 .3 The Government

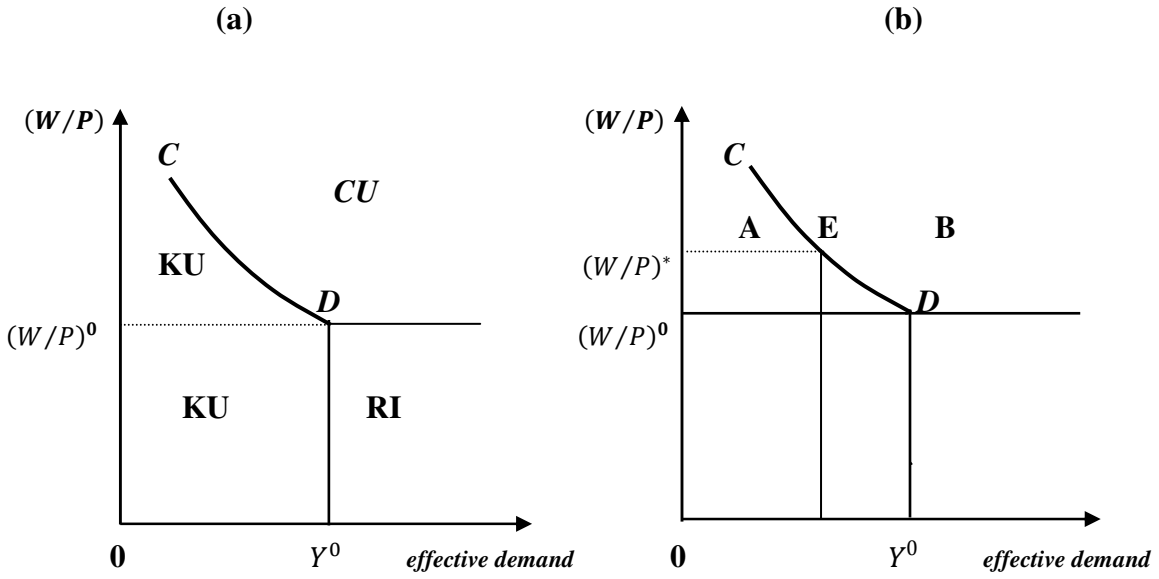
The government collects income tax, τ_w and τ_π and has an expenditure demand, $\hat{g}$. Apart from income tax the government also has the scope of collecting pay roll taxes in the form of ad valorem or wage tax and specific tax or employment tax (the incidence of which is discussed later in this chapter).

The aggregate demand (Y^d) function in the economy is

$$Y^d = c_w[(W/P)L] - \tau_w] + c_\pi[\pi - \tau_\pi] + \beta[\bar{m}/P] + \hat{g} \quad (3.29)$$

3.3 Regime Classification

Panel (a) and (b) of Figure 3.4 show the regime classification of *Benassy (1986)* and the present generalised model respectively. Regimes in both the cases are classified in (W/P) and effective demand plane. Point 'D' represents Walrasian equilibrium where Y^0 is that level of commodity demand which always equals the supply of output, and optimum real wage, $(W/P)^0$ is such that employment matches labour supply, L^0.



Representation of three regimes in *Benassy (1986)* **Representation of regimes in this present model**

Figure 3.4 Regime Classification

In *Benassy (1986)* (in panel (a)) both nominal wage and price are exogenously given. Thus at the given level of real wage, KU implies the region where effective commodity demand Y^d is lower or to the left of Y^0. Here unemployment is solely due to lower effective demand and creates a situation where there is excess supply in both commodity and labour market. RI is the region where the given real wage is less than $(W/P)^0$creating excess demand for labour and as effective demand lies above Y^0, there is excess commodity demand. Finally, in the CU region, real wage is above, $(W/P)^0$ but effective demand is to the right of Y^0 creating excess supply of labour and excess demand for commodity respectively. Here unemployment is solely due to high real wage and not due to deficient demand.

In contrast to *Benassy (1986)*, in the present model, the firm endogenously sets real wage on the basis of efficiency wage relationship at the exogenously given price. As already discussed (in section 3.2.1.1), optimum efficiency real wage is set either at the Walrasian level, $(W/P)^0$ or above it and hence the scope of excess demand for labour is absent. Thus the region below $(W/P)^0$ in panel (b) that is both RI region and the part of KU

which lies below $(W/P)^0$ in *Benassy (1986)* is not relevant in the present set up. In the present non – Walrasian framework with efficiency wage, only regions above $(W/P)^0$ in panel (b) of Figure 3.4 is consistent.

In the present model optimum real wage is set by the profit maximizing firm at any point above $(W/P)^0$ in panel (b) and accordingly excess supply in the labour market is persistent. But at the exogenously given price, commodity demand may or may not be equivalent to the profit maximizing level of output.

Curve CD in panel (b) represents the situation where profit maximizing level of output is equal to demand (which may be lower than Walrasian level, Y^0) but excess supply in labour market exists as real wage is set above $(W/P)^0$. Point 'E' on CD represents the situation where optimum efficiency real wage, $(W/P)^*$ is set above $(W/P)^0$ but profit maximizing level of output is equal to demand, that is, there is equilibrium in the commodity market .In Region B there is still excess supply of labour (real wage being higher than $(W/P)^0$) but excess demand for commodity persists (effective demand being larger than the profit maximising level of output that is to the right of curve CD) . Both region B and curve CD can be considered as the unconstrained situation in the present framework where the firm does not face any commodity demand constraint and unemployment is due to high efficiency real wage only. Here classical measure (that is lowering real wage) would only be operative to cure unemployment.

Region A in panel (b) represents the situation where there is excess supply in both labour and commodity market. Firm sets optimum efficiency real wage (which is above $(W/P)^0$) and at the same time faces constraint in the commodity market due to deficient demand (as effective demand is less than the profit maximising level of output ,which is to the left of curve CD). Unemployment here is both due to high efficiency real wage and low commodity demand. Here both classical and Keynesian policies act to increase employment and output.

The non – Walrasian fixed price model with efficiency wage thus involves two unemployment regimes (i) Regime without commodity demand constraint (RWODC) involving either excess demand (region B) or equilibrium in the commodity market (curve CD) and (ii) Regime with commodity demand constraint (RWDC)(region A).

Next two sections explain the working of the above two regimes and the impact of relevant policy implications in each regime.

3.4 Regime without Commodity Demand Constraint (*RWODC*)

In *RWODC*, the exogenously given price, P is such that commodity demand is either greater or equal to the profit maximising level of supply, Y^M .In both the cases the firm is unconstraint in the commodity market and can freely determine optimum solution of real wage using profit maximisation problem similar to *SEWM* (as shown in section 3.2 .1.1). There is thus either excess demand or equilibrium in the commodity market and excess supply in the labour market due to high efficiency real wage.

In the unconstrained case the firm sets optimum real wage, $(W/P)^*$at $\mu_W = 1$ and produces the profit maximising level of output as in (3.6) and (3.9) respectively. Hence optimum real wage, employment and supply of output depend solely on shift parameter θ, relating to effort function only.

$$(W/P)^* = \omega(\theta), \ \omega_\theta < 0$$

The profit maximizing level of actual employment and output (as in (3.8) and (3.9)),

$$L^M = [F'^{-1}((W/P)^*/[e((W/P)^*, \theta)])]/[e((W/P)^*, \theta)] = \alpha(\theta), \ \alpha_\theta \gtreqless 0$$

$$Y^M = F(F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]) = S(\theta), \ S_\theta > 0$$

The aggregate demand in *RWODC*, Y^c is derived from (3.29),

$$Y^c = c_w[[(W/P)^* L^M] - \tau_w] + c_\pi[[\Pi^M/P] - \tau_\pi] + \beta[\bar{m}/P] + \hat{g} \quad (3.30)$$

Where, wage income,

$(W/P)^* L^M = \vartheta(\theta)$, but $\vartheta_\theta \gtreqless 0$

$\Pi^M/P = Y^M - (W/P)^* L^M = \gamma(\theta), \quad \gamma_\theta \gtreqless 0$

Unlike *SNWMM*, in the present model, commodity demand is sensitive to the shift parameter of effort function, θ.

In the commodity market in *RWODC*,

$$Y^c(\theta, \tau_w, \tau_\pi, \hat{g}, P) \geq Y^M \tag{3.31}$$

In *SNWMM*, (*Benassy (1986)*), profit maximizing level of output, $Y^M{}_B$ in classical unemployment regime (that is the regime where the firm does not face any commodity demand constraint) is a function of nominal wage and price.

$Y^M{}_B = F(F'^{-1}(W/P)) = S_B(P, W)$, $S_{BP} > 0$, $S_{BW} < 0$

Thus, classical measure of reduction in real wage via either fall in nominal wage or rise in price (where nominal wage and price is exogenously given), can increase production and employment. But in the present model optimum real wage is set on the basis of effort function alone and is rigid at $(W/P)^*$.With the rise in commodity price, *P*, the firm adjusts nominal wage in order to keep the real wage unchanged. Hence ***complete indexation of wage exists due to the presence of efficiency wage consideration.*** As real wage remains unchanged, output and employment remains unchanged with any exogenous rise in P.

Thus in the present model since supply of output,

$Y^M = F(F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]) = S(\theta)$

change in output supply with respect to price, $S_P = 0$,where $(W/P)^*$ is set on the basis of effort function and depends only on parameter, θ.

Reduction in real wage via exogenous rise in price fails to increase output and employment in RWODC of the present model unlike in CU regime of SNWMM.

The profit maximizing level of output and employment in *RWODC* is a function of shift parameter θ only (as in (3.12) and (3.13) in section 3.2 .1.1.1). Moreover, as already discussed in section 3.2 .1.1.1, when the firm faces no constraint in the commodity market, a rise in θ, increases level of output but the impact on employment is ambiguous. Thus in *RWODC,* policies that influence the exogenous factors like access to and quality of health care, the quality and affordability of education and training, investment on infrastructure, quality of job environment etc., increases ,leading to an upward shift in the effort of the workers may actually play an expansionary role in *RWODC* whereas the classical measure of lowering real wage via rise in nominal price fails to act in the present regime due to the presence of efficiency wage.

In this regime, policies like decrease in taxes (τ_w, τ_π) and increase in government expenditure would either create excess demand (when commodity market is in equilibrium) or increase the extent of excess demand (when excess demand persists in commodity market).

Proposition 3

- *Optimum real wage, employment and supply of output depend only on the shift parameter θ relating to effort function.*

- *Since complete indexation of wage exists due to fixed efficiency real wage, classical measure of lowering real wage via exogenous shift in nominal price (as in CU regime of SNWMM) becomes ineffective in RWODC of the present model.*

- *Policies resulting in the upward shift of effort of the workers lowers real wage and has positive impact on output in RWODC though the impact on employment is ambiguous. Such an impact is not considered in SNWMM.*

- *Impact of such upward shift of effort of the workers on both wage and profit income is ambiguous.*

If there exists excess demand in *RWODC*, that is

$$Y^c(\theta, \tau_w, \tau_\pi, \hat{g}, P) > Y^M$$

The transaction in commodity market is then settled on the basis of proportional rationing scheme similar to *Benassy (1986).*

3.4 .1 Proportional Rationing Scheme

As already pointed out aggregate effective consumption demand of the household in the unconstrained case,

$$C^* = c_w[(W/P)^* L^M - \tau_w] + c_\pi[(\Pi^M/P) - \tau_\pi] + \beta\,[\overline{m}/P]$$

In a proportional rationing scheme, agents on the short side of the market realise their demand or supply; agents on the long side receives a transaction proportional to their demand or supply.

In the present context the agent from the supply side is the firm, the agent from the demand side are the government, the wage earner and the profit earner. The government is assumed to be the priority sector and hence its demand is always satisfied, that is, $g^* = \min(\hat{g}, Y^c)$

Thus the supply available after government demand is satisfied is $Y^M - \min(\hat{g}, Y^c)$, with the rationing coefficient, $[Y^M - \min(\hat{g}, Y^c)]/Y^c$.

Let C_w^*, C_π^* and C^* be the realised value of transaction for the wage earner, profit earner and in aggregate respectively, then

$$C_w^* = \check{C}_w \times ([Y^M - \min(\hat{g}, Y^c)]/Y^c)$$

$$C_\pi^* = \check{C}_\pi \times ([Y^M - \min(\hat{g}, Y^c)]/Y^c)$$

$$C^* = C_w^* + C_\pi^*$$

3.5 Regime with Commodity Demand Constraint (*RWDC*)

At the exogenously given commodity price, P, this case corresponds to the situation of excess supply on the markets of both labour and output. Here the firm fails to sell the profit maximizing level of output and hence while determining optimum real wage and employment faces constraint in the commodity market.

As explained earlier (in section (3.2.1.2)) in presence of the demand constraint, the firm still maintains the same level of efficiency real wage $(W/P)^*$ (at $\mu_W = 1$) as in *RWODC*.

But optimum employment, $\bar{L}$ in the constrained case is lower than that of the profit maximising level, L^M in the unconstrained case. This is because the level of output supplied, Y is equivalent to commodity demand, Y^d prevailing in the economy (short side of the market rule) and since Y^d is less than Y^M the profit maximising level of output; employment in efficiency unit corresponding to Y^d, $[e((W/P)^*, \theta)L]^d$ is less than the profit maximising level, $[e((W/P)^*, \theta)\, L]^M$. Thus actual employment has to fall as real wage, $(W/P)^*$ and associated effort level, $e((W/P)^*, \theta)$ remains unchanged. Hence, employment in the constrained case, $\bar{L} <$ profit maximising level of employment, L^M in unconstrained case.

The optimum employment in *RWDC* (as in constrained case in (3.23)),

$$\bar{L} = [F^{-1}(Y)/(e\,((W/P)^*, \theta)]$$

Total effective demand, E can be derived from (3.29) in *RWDC* by substituting the expressions for π and $\bar{L}$ and also by denoting $(W/P)^*/[e((W/P)^*, \theta)] = g(\theta)$,

$$E = [c_w - c_\pi]\, g(\theta)F^{-1}(Y) + c_\pi Y - c_w\tau_w - c_\pi\tau_\pi + \beta\,[\bar{m}/P] + \hat{g} \qquad (3.32)$$

$$= Z(Y, \theta, P, \tau_w, \tau_\pi) + \hat{g}$$

Here, wage income, $(W/P)^*\,[F^{-1}(Y)\,/(e\,((W/P)^*, \theta)] = g(\theta)F^{-1}(Y)$

The solution of Y can be determined, where aggregate demand (E) curve crosses the 45^0 line in $Y - Y$ plane.

$$dE/dY = \left[\, c_w - c_\pi\right] g(\theta)F'^{-1}\left(Y\right) + c_\pi > 0 \qquad (3.33)$$

$$d^2E/dY^2 = -\left[c_w - c_\pi\right]g(\theta)F''^{-1}\left(Y\right) < 0 \quad (3.34)$$

Where, $F''^{-1}(Y) < 0$, due to diminishing marginal productivity.

From (3.33) and (3.34) it is clear that the aggregate demand function is concave in nature. In SNWMM with equal marginal propensities to consume for wage and profit earners, aggregate demand function is always linear but in the present study in presence of efficiency wage with different marginal propensities to consume, aggregate demand function is nonlinear and concave in nature.

In Figure 3.5 optimum equilibrium output, Y^k is determined at the point where aggregate demand curve, *E* intersects the 45° line.

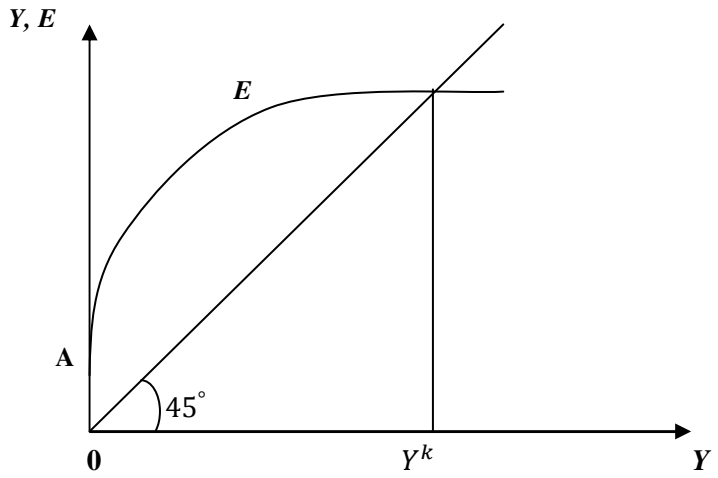


Figure 3.5 Determination of equilibrium output in *RWDC*

Solution of equilibrium output in this regime is,

$$Y^* = Y^k = [[c_w - c_\pi]g(\theta)\,F^{-1}\left(Y^*\right) - c_w\tau_w - c_\pi\tau_\pi + \beta\,[\bar{m}/P] + \hat{g}]\,/[1 - c_\pi] \quad (3.35)$$

$$= K(\theta, \tau_w, \tau_\pi, \hat{g}, P)$$

In this regime, $K(\theta, \tau_w, \tau_\pi, \hat{g}, P) \leq \min\left[S(\theta), Y^0\right]$

In presence of commodity demand constraint, the firm still maintains the same level of efficiency real wage $(W/P)^*$ (at $\mu_W = 1$) as in *RWODC*.

Following (3.23), optimum employment,

$$L^* = \frac{F^{-1}(Y^*)}{[e((W/P)^*,\theta)]} \tag{3.36}$$

This situation is represented by Region A of panel (b) of Figure 3.4 depicting regime classification in the present model.

Here, $(W/P)^* > ,(W/P)^0$ and output, $Y^* < Y^M < Y^0$.

3.5.1 Impact of Exogenous Shift in Effort Function in *RWDC*

Impact of exogenous shift in effort function in *RWDC* is explained with the help of Figure 3.6.

Parameter θ increases due to the exogenous policy implementation which improves the factors like access to and quality of health care, the quality and affordability of education and training, investment on infrastructure, quality of job environment etc.. This shifts the effort function upward to e_1, implying the fact that higher effort of workers can now be achieved at the lower level of real wage.

The point with maximum effort – real wage ratio (corresponding to new effort function, e_1) increases and the point where $\mu_W = 1$ shifts leftward and optimum real, $(W/P)^*$ falls to $(W/P)^*_1$ but effort increases to $e\left((W/P)^*_1, \theta_1\right)$ in panel (1). Minimum wage cost per efficiency unit, $(W/P)^*_1/[e((W/P)^*_1, \theta_1)]$ at 'E_1' corresponding to new *MC* curve is lower than the initial level at 'E' in panel (2).

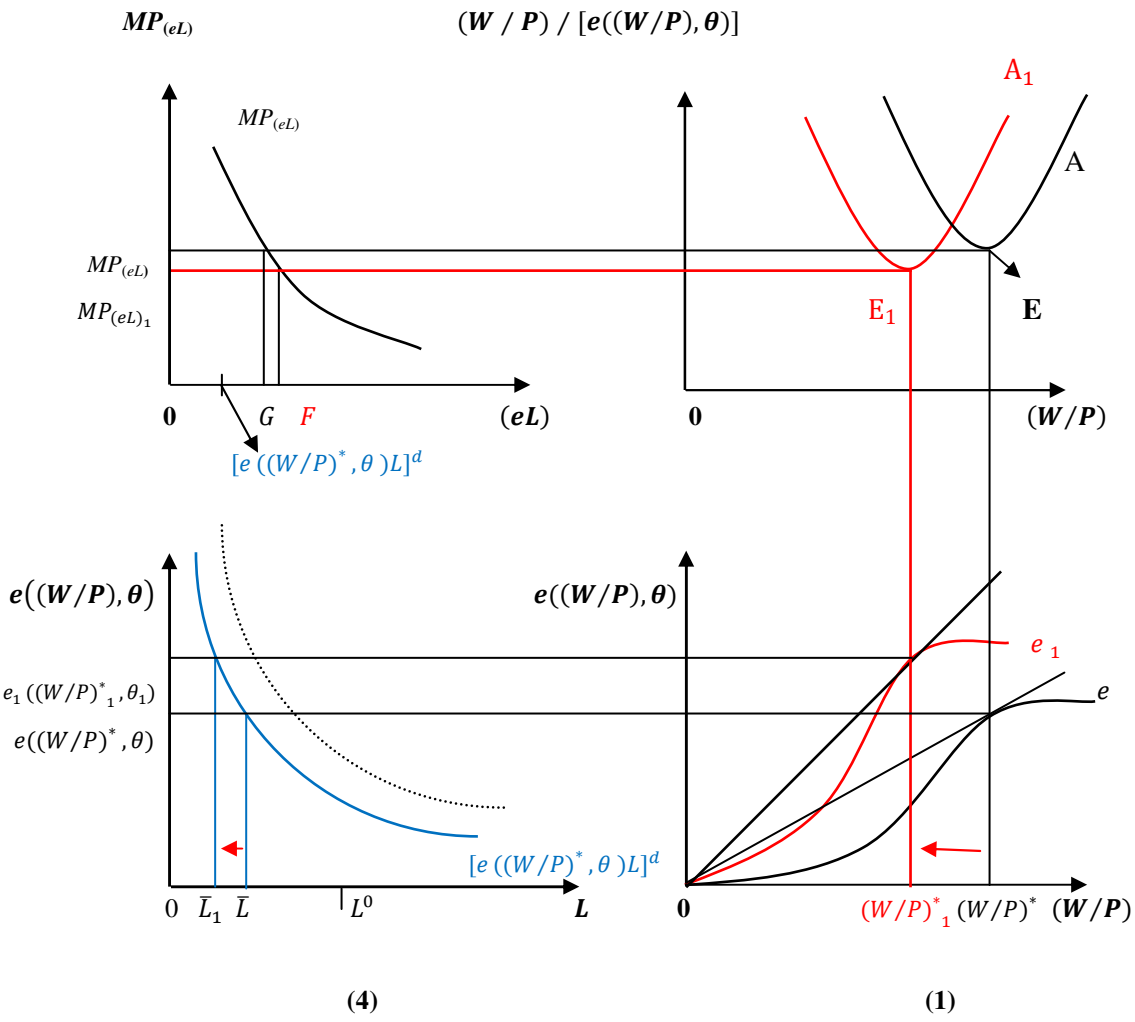


Figure 3.6 Impact of Exogenous shift in effort function in *RWDC*

At the given price, P, output is determined on the basis of commodity demand, and employment in efficiency unit, $[e((W/P)^*_1, \theta_1)L]^d$ is accordingly set (as shown in panel (3)). With upward shift in effort function, effort increases to, $e((W/P)^*_1, \theta_1)$ (in panel (1)); given, $[e((W/P)^*_1, \theta_1)L]^d$, employment , $\bar{L}$ falls to $\bar{L}_1$ in panel (4). Thus both fall in real wage and employment leads to fall in wage income due to rise in θ.

Since it is assumed that marginal propensity to consume for the wage earner is larger than that of the profit earner in the household, that is $c_w > c_\pi$, aggregate demand and hence output , Y^* falls with the fall in wage income.

From (3.35) impact of rise in θ can be determined as,

$$\boldsymbol{dY^*/d\theta} = \frac{-[\boldsymbol{c_w} - \boldsymbol{c_\pi}]\boldsymbol{g_\theta F^{-1}(Y^*)}]}{\boldsymbol{1 - c_\pi - [c_w - c_\pi]\, g(\theta) F'^{-1}(Y^*)}} < 0 \qquad (3.37)$$

Here,$1 - c_\pi - [c_w - c_\pi]\, g(\theta)F'^{-1}(Y^*) > 0$, implying responsiveness of net savings of the household with respect to income to be positive.

Here wage income, $g_\theta F^{-1}(Y^*)$ falls with rise in θ, where $g_\theta < 0$.

In the numerator of (3.37), net demand from wage income falls with unit rise in θ, that is, $[[c_w - c_\pi]g_\theta F^{-1}(Y^*)] < 0$ as $c_w > c_\pi$, and hence, $dY^*/d\theta < 0$.

Proposition 4

- *In RWDC, impact of policies that lead to any exogenous upward shift in effort function, lowers wage income which would have negative impact on effective demand, output and employment.*
- *In RWODC, exogenous upward shift in effort function increases output whereas in RWDC similar shift produces negative impact on output via demand effect.*
- *Though impact on employment due to such shift is ambiguous in RWODC, employment unambiguously falls in RWDC.*
- *Impact of exogenous shift in effort function on effective demand is absent in SNWMM.*

3.5.2 Impact of Demand Management Policies

The traditional multiplier formulas in KU regime of *SNWMM* (*Benassy (1986*) related to demand management policies like expansion in government expenditure and fall in wage and profit income tax differ in the present case owing to the presence of efficiency wage consideration and the assumption of different marginal propensities to consume for wage and profit earners. From (3.35) we get

Expansion in government expenditure

$$\frac{d\,Y^*}{d\hat{g}} = \frac{1}{1 - c_\pi - [c_w - c_\pi] g(\theta) F'^{-1}(Y^*)} > 0 \tag{3.38}$$

Impact of wage and profit income tax

$$\frac{d\,Y^*}{d\tau_w} = \frac{-c_w}{1 - c_\pi - [c_w - c_\pi] g(\theta) F'^{-1}(Y^*)} < 0 \tag{3.39}$$

$$\frac{d\,Y^*}{d\tau_\pi} = \frac{-c_w}{1 - c_\pi - [c_w - c_\pi] g(\theta) F'^{-1}(Y^*)} < 0 \tag{3.40}$$

Here, $1 - c_\pi - [c_w - c_\pi] g(\theta) F'^{-1}(Y^*) > 0$, responsiveness of net savings of the household with respect to income to be positive.

In *SNWMM* (*Benassy (1986*)), government expenditure and tax multiplier in KU regime

$$\frac{d\,Y^*}{d\hat{g}} = \frac{1}{[1 - c_Y]} \tag{3.41}$$

$$\frac{d\,Y^*}{d\tau} = \frac{c_\tau}{[1 - c_Y]} \tag{3.42}$$

Where, $c_\pi = c_w = c_Y$ and $\tau = \tau_w = \tau_\pi$ is the income tax

The magnitude of the net *mps* of the household in the present model is sensitive to the shift parameter of effort function, θ, which affects the wage income and is apparent due to the assumption of different marginal propensities to consume for wage and profit income. Thus government expenditure multiplier and income tax multipliers are sensitive

to θ unlike KU regime of *SNWMM* of *Benassy (1986)*), where marginal propensities to consume for wage and profit income are assumed to be equal and efficiency wage relationship is absent.

Proposition 5

- *Demand management policies like rise in government expenditure and fall in price has expansionary impact in RWDC.*
- *In contrast to KU regime of SNWMM of Benassy (1986) here the magnitude of government expenditure and income tax multipliers are sensitive to parameter θ and marginal propensities to consume for wage and profit earners.*

3.6 *RWODC* and *RWDC* in presence of Ad valorem and Specific Tax

Impacts of labour taxation such as ad valorem and specific taxes are examined in a number of efficiency wage models with different properties of effort function (*Yellen (1984), Shapiro and Stiglitz (1984), Johnson and Layard (1986), Pisauro (1990) etc.)*. Imposition of both these taxes put either negative or no impact on optimum employment whereas the effect on after tax wage is ambiguous across these models depending on different properties of the effort function[13].None of these studies considered the possibility of commodity demand deficiency at exogenously fixed price which would consequently influence the results regarding the impact of these labour taxations. Most significantly, there is dearth in studies related to non – Walrasian macro framework which examined the impact of such pay roll taxes in the form of labour taxation.

[13]Imposition of ad valorem tax in *Yellen (1984)* lowers employment but keeps real wage unchanged, in *Pisauro (1990)* and *Stiglitz (1984)* incidence of such taxation lowers both real wage and employment but in *Johnson and Layard (1986)* post tax employment remains unchanged and real wage falls. However imposition of specific tax in *Yellen (1984)* optimum after tax employment falls and real wage increases, in *Pisauro (1990*), after tax real wage rises when workers resort to risk aversion with decreasing marginal productivity but remains unchanged with constant marginal productivity, in *Johnson and Layard (1986)* movement of after tax real wage is ambiguous and in *Shapiro and Stiglitz (1984)* after tax real wage falls.

Thus in this section the impact of labour taxation namely ad valorem and specific taxes are being considered in fixed price non – Walrasian framework where real wage is endogenously determined on the basis of efficiency wage relationship. Hence equilibriums are being derived where the firm determines optimum real wage in presence of ad valorem and specific tax facing no commodity demand constraint in *RWODC* and some constraint in *RWDC* at the exogenously fixed price. The post – tax solutions of real wage and employment can then be compared with *SEWM* of *Yellen (1984),* where the property of the effort function is same as assumed in the present study (though shift parameter θ has no role in affecting effort in *Yellen (1984)*).Moreover labour taxation policies would affect wage and profit income of the household which would in turn alter the prevailing commodity demand (where marginal propensities to consume for wage and profit earners are assumed to be different).Thus the present study one can also reveal the impact of these taxes on the prevailing effective demand; however it has been observed that none of the studies in *SEWM* and *SNWMM* as mentioned earlier, has examined the impact of ad valorem and specific tax on commodity demand.

Apart from the impact of labour taxations, impact of other demand management policies and shift in effort function (with the change in θ) are also examined in the post-tax situation.

The following two sub sections consider how the equilibrium and different policy implications in both *RWODC* and *RWDC* gets affected with the incidence of ad valorem tax or wage tax and specific tax or employment tax.

3.6.1 Incidence of Ad valorem Tax

3.6.1.1 Incidence of Ad valorem Tax in *RWODC*

Ad valorem tax or wage tax is imposed to the firms on the basis of the wage bill. Firm however tries to share the burden of the tax with the employee by setting the optimum post tax real wage and employment. If the representative firm faces no commodity demand constraint at the given price, P (that is in *RWODC*), in presence of ad valorem

tax, t_a, it determines optimum post tax real wage and employment by solving the following problem,

$$\text{Maximise, } \pi = Y - (W/P)[1 + t_a]\, L$$

The optimum real wage and employment is determined by solving the first - order conditions for (W/P) and L, that is by setting $d\pi/d((W/P)) = 0$ and $d\pi/\delta L = 0$[14]

$$e'((W/P),\theta) = [1 + t_a]/[F'\,(e((W/P),\theta)L)\,] \tag{3.43}$$

$$F'\,[e((W/P),\theta)L] = [(W/P)[1 + t_a)]\,/[e((W/P),\theta)] \tag{3.44}$$

From (3.43) and (3.44) we have

$$\mu_W = \frac{e'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1 \tag{3.45}$$

$$(W/P)^* = \omega(\theta)\,, \quad \omega_\theta < 0$$

Thus on the basis of (3.44) optimum post tax employment in efficiency unit,

$$[e((W/P)^*,\theta)\, L]^M{}_a = F'^{-1}([(W/P)^*\,[1 + t_a]]/[e((W/P)^*,\theta)]\,) \tag{3.46}$$

And hence optimum post tax actual employment,

$$L^M{}_a = [F'^{-1}([(W/P)^*\,[1 + t_a]]/[e((W/P)^*,\theta)])\,]\,/[e((W/P)^*,\theta)] \tag{3.47}$$

$$= \alpha\,(\theta, t_a)$$

Accordingly, optimum level of post - tax output produced,

$$Y^M{}_a = F'^{-1}([(W/P)^*\,[1 + t_a]]/[e((W/P)^*,\theta]) = S(\theta,\ t_a) \tag{3.48}$$

In (3.45) Solow Condition is still satisfied (as in (3.6)) implying the fact that optimum efficiency real wage in the pre-tax situation, $(W/P)^*$ remains unchanged with the imposition of ad valorem tax and still depends only on shift parameter, θ. The firm thus

[14]Second order conditions are assumed to be satisfied.

lowers optimum employment in order to meet the extra cost related to ad valorem tax and hence post tax output too falls.

The post - tax profit maximizing unconstrained level of employment, ${L^M}_a$ and output, ${Y^M}_a$ are sensitive to ad valorem tax, t_a (as in (3.47) and (3.48) respectively) which are less than the pre - tax optimum employment, L^M and output, Y^M in (3.7) and (3.8) respectively in section 3.2.1.1.

Figure 3.7 explains the process of determination of post- tax optimum solutions in *RWODC*.

With the imposition of ad valorem tax, marginal cost (*MC*) or $(W/P)/e$ curve shifts upward to $[[1 + t_a]\,(W/P)]/e$ that is (A_1) in panel (2). Since optimum real wage is still determined on the basis of Solow condition, it remains unaltered with the introduction of ad valorem tax at point 'E' in panel (2). Minimum wage cost per efficiency unit corresponding to new *MC* curve increases and at the optimum $MP_{(eL)}$ increases. Thus employment in efficiency unit falls at point 'F' as compared to point 'G' in pre-tax situation in panel (3) (as can be compared between (3.46) and (3.7) in post and pre - tax situation respectively).

Hence ${[e((W/P)^*, \theta)\, L]^M}_a$ be the post - tax employment in efficiency unit curve which lies below the pre - tax level, $[e((W/P)^*, \theta)\, L]^M$ in panel (4). However as optimum real wage, $(W/P)^*$ remains unchanged, the corresponding effort level, $e(\,(W/P)^*, \theta)$ too does not alter in panel (1). Since $[e((W/P)^*, \theta)\, L]^M$ falls but $e((W/P)^*, \theta)$ remains unchanged, post - tax actual employment level falls to ${L^M}_a$ as compared to L^M in pre – tax situation in panel (4) (employment level in relation (3.47) as compared to the same in (3.8)).

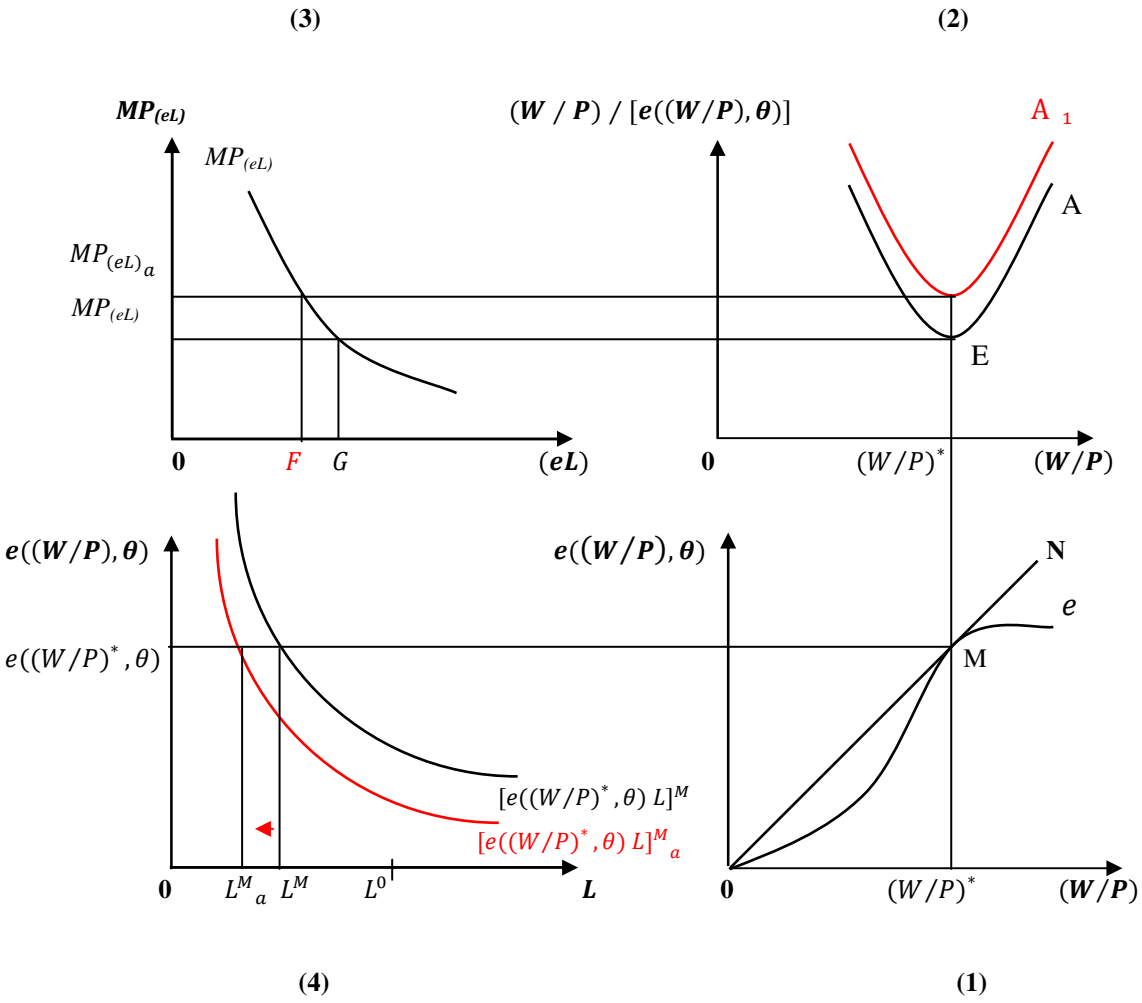


Figure 3. 7 Determination of optimum efficiency wage and employment in presence of ad valorem tax in R*WODC*

In RWODC optimum real wage remains unchanged but employment falls with the imposition of ad valorem tax. Since at the exogenously given price, the firm faces no commodity demand constraint, the impact of the imposition of ad valorem tax in RWODC on real wage and employment is same as in SEWM, based on the rudimentary efficiency wage model by Yellen (1984) where effort is the function of real wage as assumed in the present structure.

However in the present structure, the post - tax solution in this regime affects aggregate demand in the economy via change in wage and profit income.

3.6.1.1.1 Impact on Wage and Profit Income

In *RWODC* since optimum real wage, $(W/P)^*$ remains unchanged but actual employment, L^M falls with the imposition of ad valorem tax, ***post - tax wage income falls.***

The profit income after imposition of ad valorem tax, $\pi = Y - [1 + t_a][(W/P)L]$

Again as post – tax profit - maximizing level of output, ${Y^M}_a$ is less than the pre- tax level, Y^M, profit income falls, though with the fall in wage income, cost expenditure to the profit earners falls leading to rise in profit income. Hence, ***post - tax profit income may rise/fall or remain unchanged.*** Change in both wage and profit income affects the aggregate demand in the economy.

3.6.1.1.2 Post – Tax Aggregate Demand

Thus post tax aggregate demand of the economy, Y_a^c,

$$Y_a^c = c_w\,[(W/P)^M\,{L^M}_a] - \tau_w) + c_\pi[\pi_a^M - \tau_\pi] + \beta\,[\bar{m}/P] + \hat{g} \qquad (3.49)$$

$$= Y_a^c\,(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_a)$$

Where, optimum post- tax profit income

$\pi_a^M = \Pi_a^M/P = {Y^M}_a - [(W/P)^M\,{L^M}_a][1 + t_a]$ and post - tax wage income is $[(W/P)^M\,{L^M}_a]$

As long as the value of parameters are such that the economy is in *RWODC* , post - tax commodity demand is greater or equal to the post tax profit maximizing level of output.

Thus, $Y_a^c\,(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_a) \geq {Y^M}_a$ (3.50)

Proposition 6

- *Imposition of ad valorem tax in RWODC keeps real wage unchanged but optimum employment falls.*

- *Since post tax optimum real wage remains unaltered (Solow Condition still holds and real wage depends solely on θ), complete indexation of wage exists; Classical measure is ineffective.*

- *With the imposition of ad valorem tax, wage earners get adversely affected as wage income falls but impact on profit income is ambiguous.*

- *Impact of the policies that shift effort of the workers upward in RWODC in presence of ad valorem tax is similar to that of the pre- tax situation.*

3.6.1. 2 Incidence of Ad valorem Tax in *RWDC*

At the exogenously given commodity price, P the firm in presence of ad valorem tax, t_a may face commodity demand constraint.

Here, level of output produced,

$$Y = \min [K(\theta, \tau_w, \tau_\pi, \hat{g},\ P\ ), S(\theta,\ t_a), Y^0]$$

Thus in *RWDC*, the firm fails to supply the post - tax profit maximising level of output, $S(\theta,\ t_a)$ in presence of ad valorem tax. It produces the level of output, Y, just necessary to produce the prevailing effective demand in this regime, $Y^d = K(\theta, \tau_w, \tau_\pi, \hat{g},\ P)$.

Similar to the pre - tax situation in *RWDC*, the optimum solution of optimum real wage and employment in presence of ad valorem tax is determined by solving the following problem.

$$\text{Maximise} \quad \pi = Y - (W/P)[1 + t_a]L$$

$$\text{s.t} \quad Y = F(e((W/P), \theta)\, L)\ ,\ Y = Y^d$$

The above problem can be solved by maximising the following Lagrangean,

$$\Lambda\ ((W/P), L, \lambda) \equiv F(e((W/P), \theta)\, L) - [W/P]L\ [1 + t_a] + \lambda\ [F(e((W/P), \theta)\, L) - Y^d] \quad (3.51)$$

First order condition with respect to (W/P), L and λ of the above problem implies[15]

$$d\Lambda/d\ (W/P) = F'(e((W/P), \theta)\, L)e'((W/P), \theta)\, L - [1 + t_a]L + \lambda\ [F'(e((W/P), \theta)\, L)e'((W/P), \theta)\, L] = 0 \quad (3.52)$$

$$d\Lambda/d\ L = F'\ (e((W/P), \theta)\, L)e((W/P), \theta) - (W/P)\ [1 + t_a]\ +\ \lambda\ F'\ (e((W/P), \theta)\, L)e((W/P), \theta) = 0 \quad (3.53)$$

$$d\Lambda/d\lambda = [F(e((W/P), \theta)\, L) - Y^d] = 0 \quad (3.54)$$

Solving equations (3.52) and (3.53) we get

$$\mu_W = \frac{e'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1$$

Similar to the pre - tax solution, optimum real wage, $(W/P)^*$ remains unaltered (as Solow condition is still satisfied) in *RWDC*.

From (3.54), optimum employment in efficiency unit,

$$[e(((W/P)^*, \theta)\ L]^{\ d} = F^{-1}\ (Y^d) \quad (3.55)$$

Actual optimum employment,

$$\bar{L} = [F^{-1}(Y^d)/(e\ ((W/P)^*, \theta)] \quad (3.56)$$

As the level of commodity demand, Y^d or output in the post – tax situation in *RWDC* is same as that of the pre - tax situation; level of employment in efficiency

[15]Second order conditions are assumed to be satisfied.

unit, $[e((W/P)^*, \theta)\, L]^d$ too remains unchanged in pre and post - tax situation (as in (3.55) and (3.7)). Moreover since optimum real wage and hence effort of the workers, $e((W/P)^*, \theta)$ remains unaffected with the imposition of ad valorem tax, optimum employment too remains unaltered in the post - tax situation. Impact of imposition in ad valorem tax is explained in Figure 3.8.

Similar to *RWODC,* imposition of ad valorem tax shifts *MC* or wage cost per efficiency unit curve upward to A_1 in panel (2) .But optimum real wage, $(W/P)^*$ remains unchanged where $\mu_W = 1$ that is Solow condition is satisfied. But the minimum wage cost per efficiency unit corresponding to new *MC* increases in panel (2).

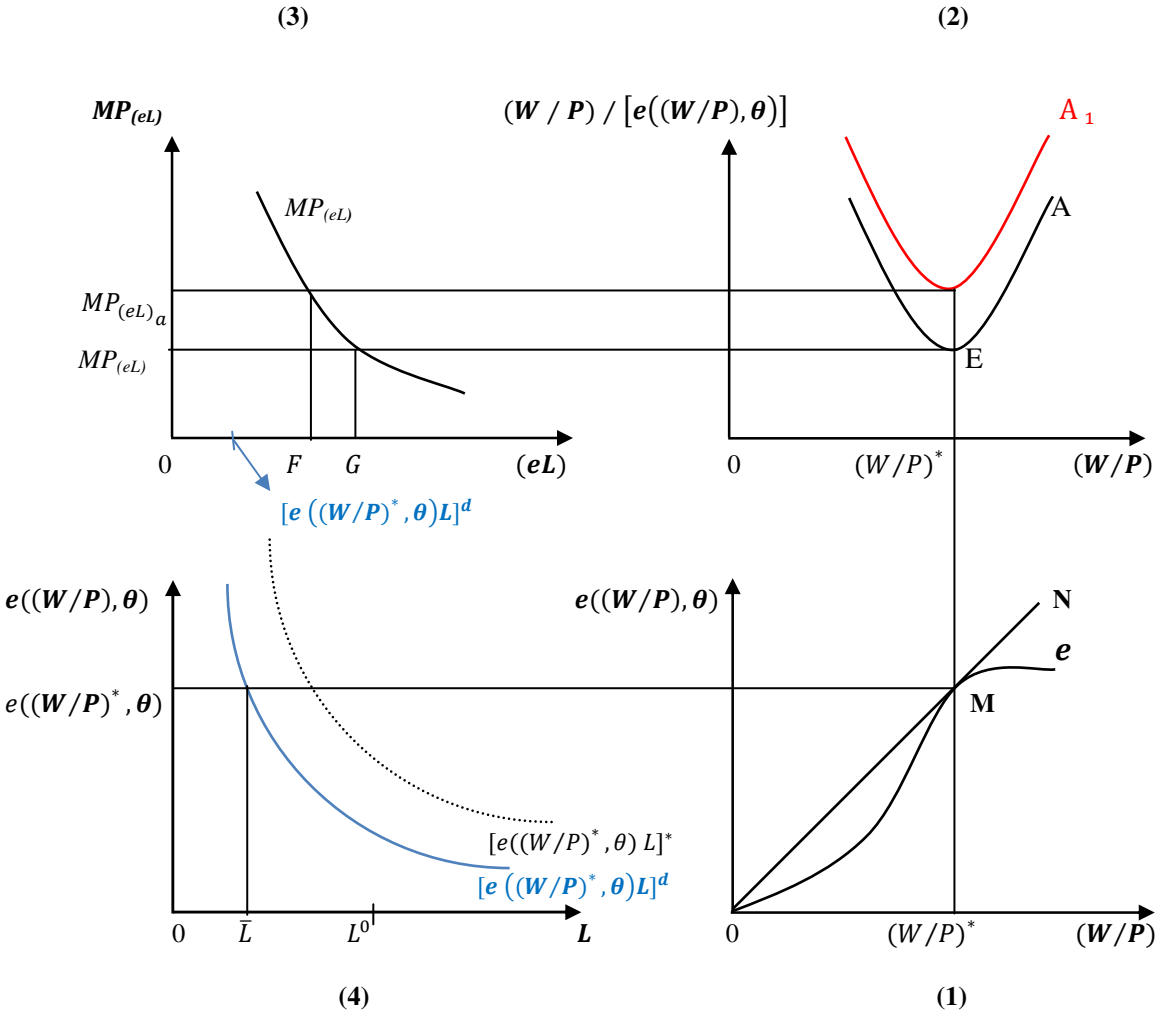


Figure 3.8: Determination of optimum efficiency wage and employment with the incidence of ad valorem tax in *RWDC*

However employment in efficiency unit$[e((W/P)^*, \theta)\, L]^d$ is determined on the basis of prevailing commodity demand which is less than both pre and post profit maximising level of output at 'G' and 'F' respectively in panel (3). Since both optimum effort, $e((W/P)^*, \theta)$(associated with unchanged optimum real wage,$(W/P)^*$) and employment in efficiency unit, $[e((W/P)^*, \theta)\, L]^d$ does not get altered in the post - tax situation, optimum employment too remains unchanged in panel (4).

3.6.1.2.1 Impact on Wage Income and Profit Income

Both optimum real wage and employment are unaffected with the incidence of ad valorem tax in RWDC, thus ***post tax wage income remains unaltered.***

But after tax profit income, π_a^* gets altered due to incidence of ad valorem tax,

$\pi_a^* = \overline{\Pi}_a/P = Y - [(W/P)^* \bar{L}] - [(W/P)^* \bar{L}]\, t_a$, where, $\overline{\Pi}_a/P < \overline{\Pi}/P$

Post tax profit income thus falls.

As post tax wage income remains unaltered with the incidence of ad valorem tax in *RWDC*, the burden of the tax entirely falls on the profit earner. This affects the budget constraint and hence the consumption demand of the profit earner.

The new budget constraint of the profit earner is

$C_\pi + \overline{m}_\pi/P = \overline{m}_\pi/P + \overline{\Pi}_a/P - \tau_\pi$

3.6.1.2.2 Post – Tax Aggregate Demand

The pre - tax effective demand, Y^d thus gets affected with new consumption demand, and let E_a be the new level of effective demand in the post ad valorem tax situation,

$E_a = c_w[[(W/P)^* \bar{L}] - \tau_w] + c_\pi [\overline{\Pi}_a/P - \tau_\pi] + \beta [\overline{m}/P] + \hat{g}$

Total effective demand, E_a can be rewritten by substituting the expressions for $[\overline{\Pi}_a/P]$ and $\bar{L}$ and also by denoting $(W/P)^*/[e((W/P)^*, \theta)] = g(\theta)$,

$$E_a = [c_w - \ c_\pi]g(\theta)F(Y) + \ c_\pi Y - \ c_\pi t_a g(\theta)F(Y) - \ c_w\tau_w - \ c_\pi\tau_\pi + \beta\,[\overline{m}/P] + \hat{g}$$

(3.57)

The optimum solution of post - tax output, ${Y^k}_a$ can be determined, where aggregate demand (E_a) curve intersects the 45^0 line in $Y - \ Y$ plane.

$$dE_a/dY = [c_w - \ c_\pi]g(\theta)F'^{-1}(Y) + \ c_\pi[1 - t_a g(\theta)F'^{-1}(Y))] > 0$$

$$d^2E_a/dY^2 = [[c_w - \ c_\pi] - \ c_\pi t_a]\, g(\theta)F''^{-1}(Y)$$

Since, $F''^{-1}(Y) < 0$, $d^2E_a/dY^2 \gtreqless 0$ depending on $t_a \gtreqless [c_w - \ c_\pi]/\ c_\pi$

Aggregate demand curve in presence of ad valorem tax may take three different shapes as shown in Figure 3.9[16].

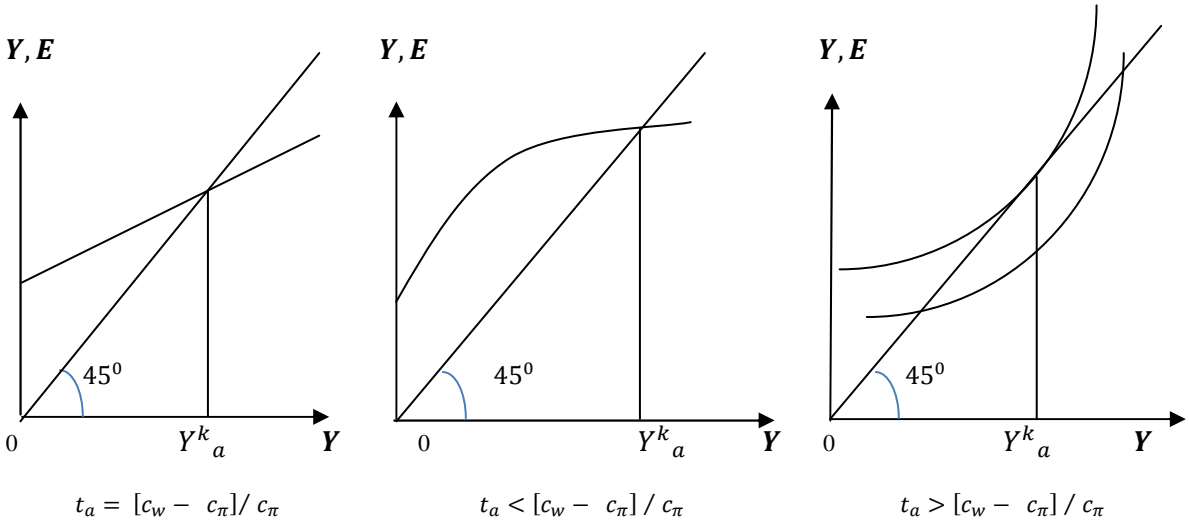


Figure 3.9 Different shapes of aggregate demand curves and corresponding equilibrium output in presence of ad valorem tax in *RWDC.*

It may be linear similar to *SNWMM* (*Benassy (1986)*) when the value of ad valorem tax imposed, $t_a = [c_w - \ c_\pi]/c_\pi$.However aggregate demand curve may have concave shape similar to the pre – tax situation of *RWDC* of the present model (explained in section 3.3.2) when $t_a < [c_w - \ c_\pi]/\ c_\pi$.In both these cases there is a unique solution for

[16]The reasons for different shapes of aggregate demand curve in presence of ad valorem tax are given in Appendix 2.

equilibrium output. The aggregate demand curve may also be convex in nature when, $t_a > [c_w - c_\pi]/c_\pi$ where one may or may not have any unique solution for equilibrium output. However, to keep the analysis simple, in the present case we are disregarding the probability of non unique solution; that is we are not considering those values of the parameters like t_a, c_w and $c_\pi$which generate non unique solution.

Based on the values of ad valorem tax, t_a, marginal propensities to consume for wage, and profit earners that is c_w and c_π respectively, equilibrium post tax output is determined where E_a curve intersects the 45° line at different points.

The equilibrium output,

$$Y^*{}_a = Y^k{}_a{}^* = E_a = [[c_w - c_\pi]/[1 - c_\pi]]\, g(\theta)F^{-1}(Y^k{}_a{}^*) - [c_\pi/[1 - c_\pi]]\, t_a g(\theta)F^{-1}(Y^k{}_a{}^*) - [c_w \tau_w]/[1 - c_\pi] - [c_\pi \tau_\pi]/[1 - c_\pi] + [\beta\,(\bar{m}/P)]/[1 - c_\pi] + \hat{g}/[1 - c_\pi] = \boldsymbol{K_a}(\boldsymbol{\theta}, \boldsymbol{\tau_w}, \boldsymbol{\tau_\pi}, \hat{\boldsymbol{g}}, \boldsymbol{P}, \boldsymbol{t_a}) \quad (3.58)$$

Where, $K_a(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_a) \leq \min [S(\theta), S(\theta, t_a), Y^0]$

Optimum actual post tax employment**,**

$$Y^*{}_a = \frac{F^{-1}(Y^*{}_a)}{[e((W/P)^*, \theta)]} \quad (3.59)$$

3.6.1.2.3 The Ad valorem Tax Multiplier

From (3.58) ad valorem tax multiplier can be derived as,

$$dY^*{}_a/dt_a = \frac{-\boldsymbol{c_\pi}\, \boldsymbol{g(\theta)}\, \boldsymbol{F^{-1}}(Y^*{}_a)}{\boldsymbol{1 - [c_w - c_\pi] g(\theta)\, F'^{-1}}(Y^*{}_a) - \boldsymbol{c_\pi}\,[\boldsymbol{1 - t_a g(\theta)\, F'^{-1}}(Y^*{}_a)]} < 0 \quad (3.60)$$

Here, $1 - [c_w - c_\pi] g(\theta)\, F'^{-1}(Y^*{}_a) - c_\pi\,[1 - t_a g(\theta)\, F'^{-1}(Y^*{}_a)] > 0$, implying responsiveness of net savings of the household with respect to income to be positive.

As t_a increases, profit income falls (as explained in section 3.6.1.2.1) and hence the consumption demand out of it falls, that is, $-c_\pi\, g(\theta)\, F^{-1}(Y^*{}_a) < 0$.This leads to the fall in $Y^*{}_a$ in (3.60).

Proposition 7

- *In the regime with demand constraint, imposition of ad valorem tax has negative effect on effective demand, output and employment.*

- *Though in SEWM like Yellen (1984) (as in RWODC), ad valorem tax has similar effect on output and employment but it is solely due to efficiency effect and not demand effect. In the present regime impact of ad valorem tax on output and employment is due to demand effect.*

- *The ad valorem tax multiplier is sensitive to i) shift parameter of the effort function,θ, ii) magnitude of ad valorem tax imposed and iii) mpcs of wage and profit earners.*

- *Unlike RWODC ,imposition of ad valorem tax in RWDC keeps wage income unaltered but profit earners are adversely affected due to fall in post tax profit income.*

- *None of the studies in SEWM or SNWMM as mentioned in the present model have examined the impact of ad valorem tax on commodity demand.*

3.6.1 .2.4 Impact of Exogenous Shift in Effort Function in presence of ad valorem Tax in *RWDC*

The impact of exogenous shift in effort function as identified with the increase in parameter θ can be derived from (3.58)

$$dY^*{}_a/d\theta = \frac{[[c_w - c_\pi] - c_\pi t_a] g_\theta F^{-1}(Y^*{}_a)]}{1 - [c_w - c_\pi] g(\theta)\, F'^{-1}(Y^*{}_a) - c_\pi\,[1 - t_a g(\theta)\, F'^{-1}(Y^*{}_a)]} \gtreqless 0 \qquad (3.61)$$

Where, $1 - [c_w - c_\pi] g(\theta)\, F'^{-1}(Y^*{}_a) - c_\pi\,[1 - t_a g(\theta)\, F'^{-1}(Y^*{}_a)] > 0$

With the increase in θ, wage income, $g(\theta)F^{-1}(Y^*_a)$ falls in *RWDC* (as explained in section 3.5.1).Hence, $g_\theta F^{-1}(Y^*_a) < 0$, where $g_\theta < 0$. Net consumption demand from wage income falls, that is $[c_w - c_\pi]\, g_\theta F^{-1}(Y^*_a) < 0$.

Again, tax expenditure of the firm falls with the fall in wage income and hence profit income and the commodity demand out of it increases, thus $c_\pi t_a g_\theta F^{-1}(Y^*_a) > 0$.

Thus, net change in commodity demand becomes ambiguous with the rise in θ, where wage income falls but profit income increases in presence of ad valorem tax. This is clear in the numerator of (3.61), where

$[[c_w - c_\pi] - c_\pi t_a] g_\theta F^{-1}(Y^*_a)] \gtreqless 0$ and hence

$dY^*_a/d\theta \gtreqless 0$ in (3.61), depending on $t_a \gtreqless [c_w - c_\pi]/\, c_\pi$

Impact of exogenous shift in effort function on effective demand or output in presence of ad valorem tax is ambiguous and depends on the relative magnitudes of the ad valorem tax imposed and the marginal propensities to consume for wage and profit earners.

Proposition 8

- *Unlike the pre - tax situation, impact of exogenous shift in effort function is ambiguous in presence of ad valorem tax.*

- *The sign condition of the impact of the shift in the effort function depends on the magnitude of the imposed tax rate as well as on the marginal propensities to consume for wage and profit earner.*

3.6.1 .2.5 Government Expenditure, Wage and Profit Income Multiplier in presence of Ad valorem Tax

The government expenditure multiplier and wage and profit income tax multipliers can be derived from equation (3.58) as,

Expansion in government expenditure

$$dY^*{}_a/d\hat{g} = \frac{1}{1-[c_w - c_\pi]g(\theta)\,F'^{-1}(Y_a{}^*) - c_\pi\,[1-t_a g(\theta)\,F'^{-1}(Y_a{}^*)]} > 0 \quad (3.62)$$

Wage and profit income tax multiplier

$$dY^*{}_a/d\tau_w = \frac{-c_w}{1-[c_w - c_\pi]g(\theta)\,F'^{-1}(Y_a{}^*) - c_\pi\,[1-t_a g(\theta)\,F'^{-1}(Y_a{}^*)]} < 0 \quad (3.63)$$

$$dY^*{}_a/d\,\tau_\pi = \frac{-c_\pi}{1-[c_w - c_\pi]g(\theta)\,F'^{-1}(Y_a{}^*) - c_\pi\,[1-t_a g(\theta)\,F'^{-1}(Y_a{}^*)]} < 0 \quad (3.64)$$

Here, $1-[c_w - c_\pi]g(\theta)\,F'^{-1}(Y_a{}^*) - c_\pi[1 - t_a g(\theta)\,F'^{-1}(Y_a{}^*)] > 0$,

The government expenditure and income tax multipliers (in (3.62)**,** (3.63) and (3.64)) are sensitive to shift parameter of effort function, θ, value of ad valorem tax imposed, t_a and the *mpcs* of wage and profit earners that is $c_w$and c_π respectively. Such multipliers in presence of ad valorem or wage tax are missing in *SNWMM* (*Benassy (1986)*).

Proposition 9

- *In the RWDC with ad valorem tax, demand management policies like increase in government expenditure and fall in income taxes has positive impact on aggregate demand and employment.*
- *Magnitude of these multipliers depends on the shift parameter of effort function,θ, value of ad valorem tax imposed, t_a and the marginal propensities to consume for wage and profit earners, c_w and c_π respectively. Such policy multipliers* in presence of ad valorem or wage tax are missing in *SNWMM (Benassy (1986).*

3.6.2 Incidence of Specific Tax

3.6.2 .1 Incidence of Specific Tax in *RWODC*

Similar to ad valorem tax, the representative firm determines post tax real wage and employment with the imposition of specific tax, t_s and does not face any commodity demand constraint and maximizes profit

$$\text{Maximise, } \pi = Y - [(W/P) + t_s]L$$

The optimum real wage is determined by the condition, $d\pi/d\big((W/P)\big) = 0$

$$e'((W/P),\theta) = 1/F'\,(e\,((W/P),\,\theta)\,L) \tag{3.65}$$

The optimum employment is determined by the condition, $d\pi/dL = 0$

$$F'(\,e\,((W/P),\,\theta)\,L) = [(W/P) + t_s)]\,/[e((W/P)\,,\,\theta)] \tag{3.66}$$

Second order conditions are assumed to be satisfied.

Thus from (3.65) and (3.66) we have ,

$$\mu_W = \frac{(W/P)}{[(W/P) + t_s]} < 1 \tag{3.67}$$

Optimum post tax employment in efficiency unit,

$$[e\,(W/P)^*{}_s\,,\theta)L]^M{}_s = F'^{-1}([(W/P)^*{}_s + t_s]/[e((W/P)^*{}_s\,,\theta)]) \tag{3.68}$$

Optimum post tax actual employment,

$$L^M{}_s = [F'^{-1}\,([(W/P)^*{}_s + t_s]/[e((W/P)^*{}_s\,,\theta)]\,/[e\,((W/P)^*{}_s\,,\theta)] \tag{3.69}$$

Here Solow condition ($\mu_W = 1$) is no longer satisfied as effort elasticity with respect to real wage in post - tax situation is less than unity (as in ((3.67))). Hence optimum real wage increases with the imposition of specific tax (in (3.66) as compared to (3.6)). Since

specific tax is a fixed cost of employing a worker[17], the firm wants to increase efficiency of the works in order to neutralize the fixed cost. To do so, the firm has to increase real wage.

Because of the imposition of specific tax, the firm no longer operates at the minimum level of MC; but is set at a higher level. In order to maintain optimality condition (in (3.68)), MP_{eL} has to increase and hence optimum employment in efficiency unit (eL) falls. But we have already noticed that imposition of specific tax increases real wage which in turn increases effort level, e of the worker. The resulting effect will be a fall in actual employment, L (in (3.69) as compared to (3.8)).

Here ${L^M}_s < L^M$(pre - tax profit maximising level of employment) and ${Y^M}_s < Y^M$ (the pre - tax profit maximising level of output).

The above optimization problem can be described with the help of Figure 3.10.

Since specific tax is the fixed cost of employing a worker, wage cost per efficiency unit, (MC) no longer remains at its minimum at point 'E' but increases at point 'D' as shown in panel (2), optimum real wage thus increases at ${(W/P)^*}_s$. To maintain optimality condition, MP_{eL} increases and optimum employment in efficiency unit falls at point 'F' as compared to point 'G' in the pre - tax situation in panel (3). Employment in efficiency unit curve shifts downward to ${[e\,({(W/P)^*}_s, \theta)L]^M}_s$ in panel (4), but as effort increases to $e(({(W/P)^*}_s, \theta)$ due to the rise in real wage in panel (1), optimum employment falls to ${L^M}_s$ where L^M is the pre - tax optimum employment in panel (4).

[17]See Appendix 1

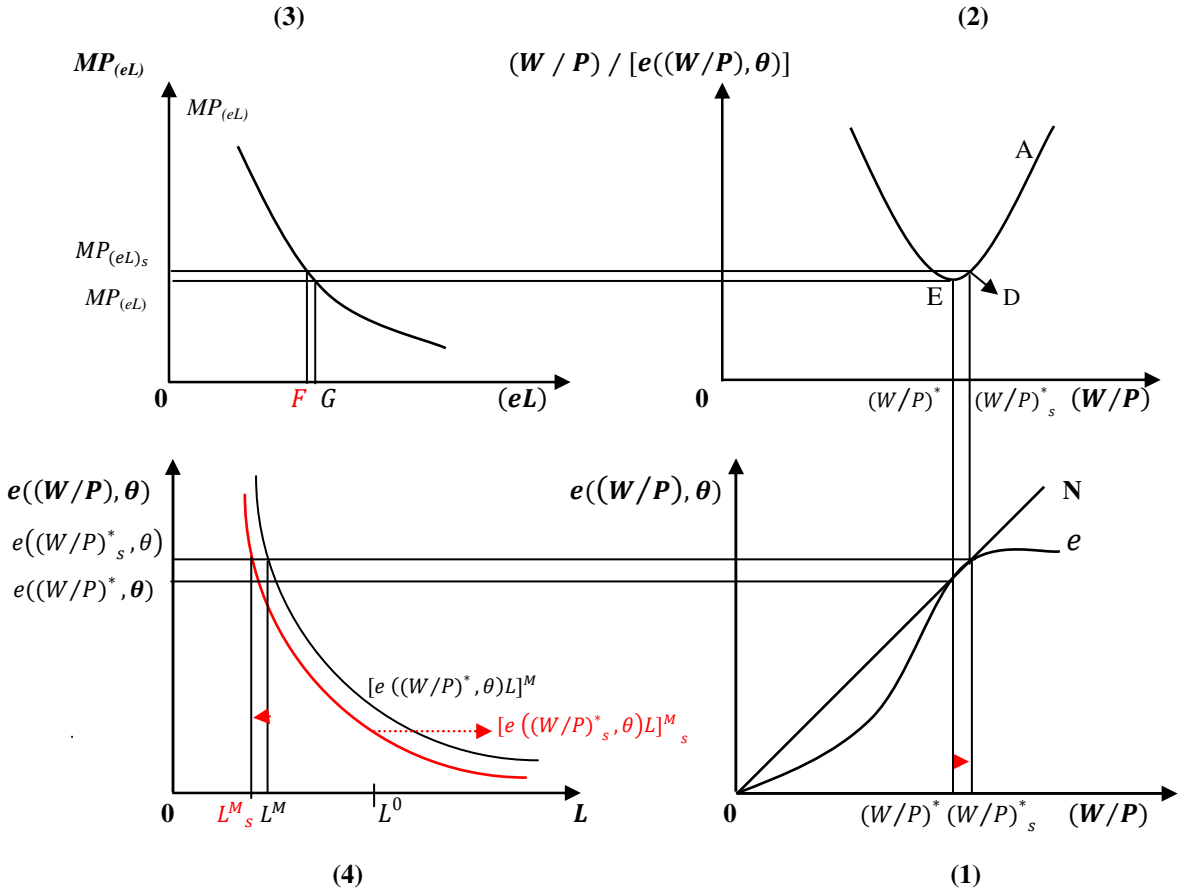


Figure 3.10: Determination of optimum efficiency wage and employment in presence of specific tax in *RWODC*

This system represents *the rudimentary efficiency wage model* by *Yellen (1984)* where effort is assumed to be the function of real wage similar to the present structure.

Optimum real wage (as determined on the basis of equation (3.67)) depends on the real value of specific tax, t_s.Thus any rise in exogenously given price, P will affect value of real wage via fall in t_s. Hence post tax real wage is sensitive to price and ***complete indexation of wage is absent in presence of specific tax***[18].

Here post tax real wage, employment and output are sensitive to the parameter θ, exogenously given price, P and the value of specific tax imposed, t_s.

[18]Similar result can be obtained when any other types of fixed cost like hiring and training cost, traffic fees, housing outlays etc. are involved in employing a worker (*Lin and Lai (1998)).*

$$(W/P)^*_s = \omega(\theta, P, t_s), \quad \omega_\theta < 0,\ \omega_P < 0,\ \omega_{t_s} > 0$$

$$L^M{}_s = \alpha(\theta, P, t_s), \quad \alpha_\theta \gtreqless 0,\ \alpha_P > 0,\ \alpha_{t_s} < 0$$

$$Y^M{}_s = S(\theta, P, t_s),\ S_\theta > 0, S_P > 0, S_{t_s} < 0$$

3.6.2 .1.1 Impact on Wage income and Profit income

Since after tax real wage falls and employment increases with the imposition of specific tax, ***post- tax wage income is ambiguous.*** Moreover even if post - tax output falls, since impact on wage income is ambiguous, ***impact on profit income too is ambiguous***.

3.6.2.1.2 Post – Tax Aggregate Demand

Post - tax aggregate demand of the economy, Y_s^c,

$$Y_s^c = c_w[[(W/P)^*_s L^M{}_s] - \tau_w] + c_\pi[\pi_s^M - \tau_\pi] + \beta(\bar{m}/P) + \hat{g}$$
$$= Y_s^c(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_s)$$

Where, π_s^M is post tax profit income and $[(W/P)^*_s L^M{}_s]$ is post tax wage income.

In *RWODC*, commodity demand is still equal or greater than supply,

$$Y_s^c(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_s) \geq Y^M{}_s$$

Since in presence of specific tax, complete indexation of wage is absent where post tax real wage is sensitive to price, classical measure of lowering real wage via exogenous increase in price would have positive impact on employment and output.

Proposition 10

- *Complete indexation of wage does not exist in presence of specific tax in RWODC.*

- *Classical measure of lowering real wage via exogenous rise in nominal price (as in CU regime of SNWMM (Benassy (1986)) becomes effective in RWODC of the present model.*

- *Impact of the policies that shift effort of the workers upward, is similar to that of the pre - tax situation.*

- *Impact on both wage and profit income is ambiguous with the imposition of specific tax in RWDOC.*

3.6.2 .2 Incidence of Specific Tax in *RWDC*

In *RWDC*, the firm produces the level of output, Y^d, just necessary to produce the prevailing effective demand in this regime.

Here, level of output produced, $Y = \min [K(\theta, \tau_w, \tau_\pi, \hat{g},\ P), S(\theta, P, t_s,), Y^0]$.

Thus in *RWDC*, the firm fails to supply the post - tax profit maximising level of output, $S(\theta,\ t_s)$ in presence of ad valorem tax. It produces the level of output, Y, just necessary to produce the prevailing effective demand in this regime, $Y^d = K(\theta, \tau_w, \tau_\pi, \hat{g},\ P)$.

Optimum solution of real wage and employment in presence of specific tax is determined by solving the following problem.

$$\text{Maximise } \pi = Y - [(W/P) + t_s]\, L \qquad (3.70)$$
$$\text{s.t } \ Y = F(e\,((W/P), \theta)L)\ ,\ Y = Y^d$$

The above problem can be solved by maximising the following Lagrangean

$$\Lambda\,((W/P), L, \lambda) \equiv F(e\,((W/P), \theta)\,L) - [(W/P) + t_s]L] + \lambda\,[F(e\,((W/P), \theta)L) - Y^d]$$

First order condition of the above problem implies[19]

$$d\Lambda/d\,(W/P) = F'(e\,((W/P),\theta)\,L)\,e'\,((W/P),\theta)L - L + \lambda\,[F'\,(((W/P),\theta)L)e'\,((W/P),\theta)L] = 0 \quad (3.71)$$

$$d\Lambda/d\,L = F'\,(e((W/P),\theta))L)\,e\,((W/P),\theta) - (W/P)t_s + \lambda\,[F'(e((W/P)\,,\theta)L)\,e((W/P),\theta)] = 0 \quad (3.72)$$

$$d\Lambda/d\lambda = [\,F(e\,((W/P),\theta)\,L) - Y^d] = 0 \quad (3.73)$$

From equations (3.71) and (3.72) we have,

$$\mu_W = (W/P)/[(W/P) + t_s] < 1 \quad (3.74)$$

As specific tax t_s is fixed cost of employing an extra unit of labour, the firm no longer operates at the minimum *MC* (where, $\mu_W = 1$).The firm increases optimum real wage to increase efficiency of the workers to meet the fixed cost at the new optimum where $\mu_W < 1$ that is Solow Condition does not satisfy. The optimum real wage is set at the same level, $(W/P)^*_s$ and the corresponding effort being $e((W/P)^*_s,\theta)$ similar to *RWODC*.

Thus optimum real wage, $(W/P)^*_s = \omega\,(\theta, P,\, t_s)$

From (3.73), optimum employment in efficiency unit,

$$[e\big((W/P)^*_s,\theta\big)\,L]^{\,d} = F^{-1}\,(Y^d) \quad (3.75)$$

Optimum post tax actual employment,

$$\bar{L}_s = F^{-1}(Y)/[(e\,((W/P)^*_s),\theta)] \quad (3.76)$$

As the firm faces commodity demand constraint; employment in efficiency unit,$[e((W/P)^*,\theta)\,L]^{\,d}$ is set on the basis of Y^d (as in (3.75) similar to (3.22) in the pre - tax situation). Since $(W/P)^*_s$ is set at a higher level in presence of specific tax as compared to pre - tax situation, the corresponding effort level, $e\,((W/P)^*_s,\theta)$ is also

[19]Second order condition is assumed to be satisfied.

higher. $[e((W/P)^*, \theta)\, L]^d$ being unchanged at the given commodity demand level, as effort, $e((W/P)^*, \theta)$ increases ,actual employment, L will fall in the post - tax situation.

The above optimization problem can be described with the help of Figure 3.11.

Due to the similar reason as in *RWODC*, optimum real wage increases to $(W/P)^*_s$ with the imposition of the specific tax and consequently the wage cost per efficiency unit (*MC*) increases to point 'D' as compared to point 'E' in the pre - tax situation in panel (2) of Figure 3.11 .

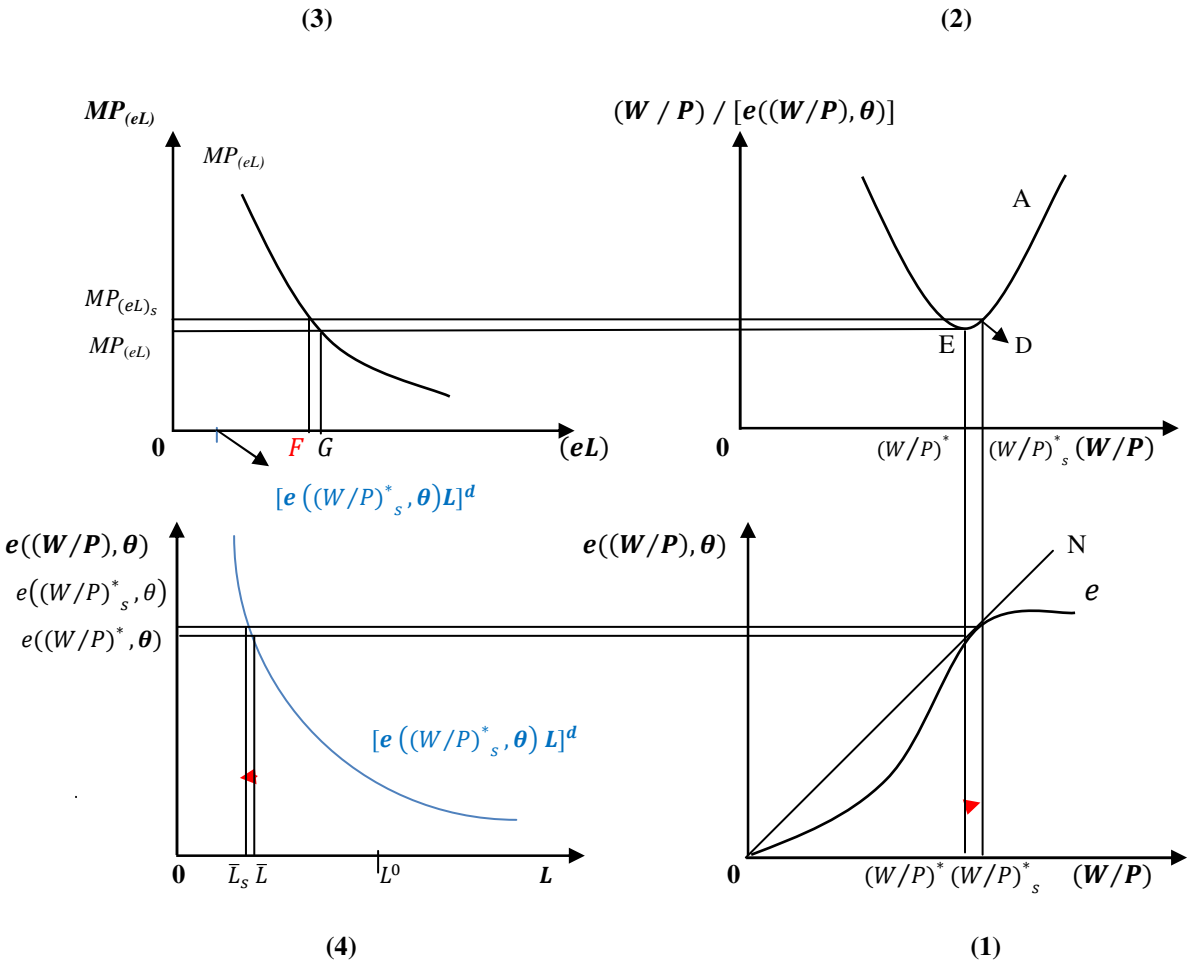


Figure 3.11 Determination of optimum efficiency wage and employment in presence of specific tax in *RWDC*

However, optimum employment in efficiency unit, $[e((W/P)^*_s, \theta)L]^d$ is determined on the basis of prevailing effective demand in panel (3). With unchanged

$[e\left((W/P)^*_s, \theta\right)L]^d$ in panel (3), as effort increases to $e\left((W/P)^*_s, \theta\right)$ with rise in real wage to $(W/P)^*_s$ in panel (1), employment falls to $\bar{L}_s$.

3.6.2 .2 .1 Impact on Wage Income and Profit Income

As, $(W/P)^*$ increases with the imposition of specific tax, corresponding effort, $e((W/P)^*, \theta)$ increases; but at the given, Y^d, since employment in efficiency unit, $[e\ ((W/P)^*, \theta)L]^d$ is fixed, rise in effort is equivalent to fall in employment.

Moreover, at the optimum, $\mu_W < 1$, implying rise in effort is less than the rise in real wage; hence rise in real wage is larger than fall in employment. ***Post tax wage income thus increases***.

Post tax profit income, $\pi_s = \bar{\Pi}_s/P = Y - (W/P)^*_s \bar{L}_s - \bar{L}_s t_s$

As post tax wage income increases with the imposition of specific tax, profit income falls. Moreover imposition of specific tax on the one hand directly increases cost at the given employment level but on the other hand with the fall in post - tax employment, tax expenditure falls which would lower the cost and put positive impact on profit income. ***Change in post - tax profit income is thus ambiguous.***

3.6.2.2.2 Post-Tax Aggregate Demand

The pre - tax effective demand, Y^d thus gets affected with new consumption demand, and let E_s be the new level of post - tax effective demand,

$$E_s = c_w[(W/P)^*_s \bar{L}_s] - \tau_w] + c_\pi[\pi_s - \tau_\pi] + \beta[\bar{m}/P] + \hat{g}$$

Substituting the expression for $\bar{L}_s$ and π_s in the above equation and denoting $(W/P)^*_s / [(e\,(W/P)^*_s, \theta)\,] = j(\theta, P, t_s)$, we can rewrite

$$E_s = [c_w - c_\pi]\, j(\theta, P, t_s) F^{-1}(Y) + c_\pi Y - c_\pi [F^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s - c_w \tau_w - c_\pi \tau_\pi + \beta[\bar{m}/P] + \hat{g} \quad (3.77)$$

The solution of $Y^k{}_s$ can be determined, where aggregate demand (E_s) curve touches the 45^0 line in $Y - Y$ plane. Thus,

$$dE_s/dY = [c_w - c_\pi]\, j(\theta, P, t_s) F'^{-1}(Y) + c_\pi \left[1 - [F'^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s\right] > 0$$

$$d^2E_s/dY^2 = -[c_w - c_\pi]\, j(\theta, P, t_s) \left[F''^{-1}(Y)\right] + c_\pi [F''^{-1}(Y)] / [e((W/P)^*_s, \theta)]\, t_s$$

Since, $F''^{-1}(Y) < 0$

Here, $\boldsymbol{d^2E_s/dY^2 \gtreqless 0}$ depending on $\boldsymbol{t_s \gtreqless \frac{[c_w - c_\pi](W/P)^*_s}{c_\pi}}$

The shape of aggregate demand functions and hence the equilibrium post tax output $Y^k{}_s$ differs depending on magnitude of ad valorem tax based on above condition[20].

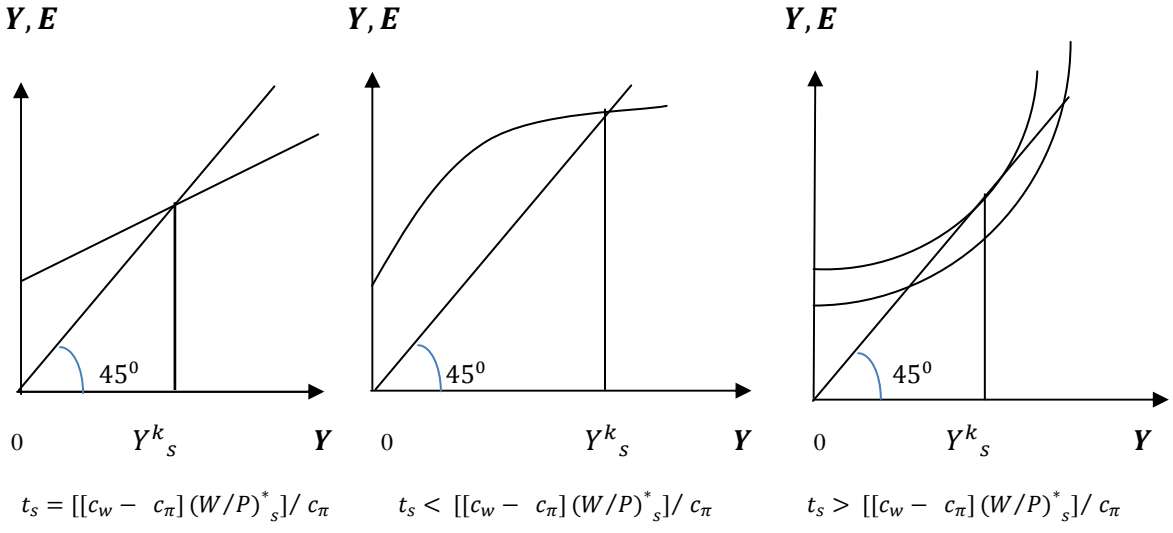


Figure 3.12: Different shapes of aggregate demand curves and corresponding equilibrium output in presence of specific tax in *RWDC*

[20] The reasons for different shapes of aggregate demand curve in presence of specific tax are given in Appendix 3.

This case is similar to the situation with the imposition of ad valorem tax where aggregate demand function may be linear when $t_s = [[c_w - c_\pi](W/P)^*_s]/c_\pi$, concave when $t_s < [[c_w - c_\pi](W/P)^*_s]/c_\pi$ or convex when $t_s > [[c_w - c_\pi](W/P)^*_s]/c_\pi$ in Figure 3.12.

However if the shape of the aggregate demand function is convex one may or may not find any unique solution. Due to the same reason as explained in section (3.6.1.2.2) with respect to ad valorem tax; we disregard the probability of non - unique solution; that is we do not considering value of $(W/P)^*_s$ and the values of parameters like t_s, c_w and c_π which generate non unique solution.

Thus the equilibrium output,

$$\begin{aligned} \boldsymbol{Y^*_s} &= \boldsymbol{Y^k{}^*_s} = \boldsymbol{E_s} \\ &= [[c_w - c_\pi]/[1 - c_\pi]]\, j(\theta, P, t_s) F^{-1}\left(Y^k{}^*_s\right) - [c_\pi/[1 - c_\pi]]\; F^{-1}\left(Y^k{}^*_s\right)/\left[\left(e\,(W/P)^*_s, \theta\right)\right] t_s - \\ &\quad c_{\tau_w}\tau_w/[1 - c_\pi] - c_{\tau_\pi}\tau_\pi/[1 - c_\pi] + [\beta\,(\bar{m}/P)]/[1 - c_\pi] + \hat{g}/[1 - c_\pi] \\ &= \boldsymbol{K_s(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_s)} \end{aligned} \tag{3.78}$$

Where, post- tax wage cost per efficiency unit,

$$(W/P)^*_s / [(e\,(W/P)^*_s, \theta)] = j(\theta, P, t_s)$$

$$(W/P)^*_s = \omega\,(\theta, P, t_s)$$

Here, $K_s(\theta, \tau_w, \tau_\pi, \hat{g}, P, t_s) \leq \min [S(\theta), S(\theta, t_s), Y^0]$

Optimum post - tax actual employment**,**

$$L^*_s = \frac{F^{-1}(Y^*_s)}{[e((W/P)^*_s, \theta)]}$$

3.6.2 .2.3 Specific Tax Multiplier

Specific tax multiplier can be derived from (3.78),

$$\boldsymbol{dY^*_s/dt_s} = \frac{[[c_w - c_\pi][d(W/P)^*_s/dt_s][1-\mu_{(W/P)}]\ [F^{-1}(Y^*_s)/[(e(W/P)^*_s,\theta)] - c_\pi\,[1-\mu_{(W/P)}\omega_t]\,[F^{-1}(Y^*_s)/[e\,((W/P)^*_s,\theta]]}{1-[c_w-c_\pi]\,j(\theta,P,t_s)F'^{-1}(Y^*_s) - c_\pi[1-t_s\,[F'^{-1}(Y^*_s)/e\,((W/P)^*_s,\theta)]]} \gtreqless \mathbf{0} \quad (3.79)$$

Where,

$\omega_t = \left[d(W/P)^k_s/dt_s\right].[(W/P)^k_s/t_s]$, that is, elasticity of real wage with respect to specific tax.

The denominator of (3.79) is positive as responsiveness of net savings of the household with respect to income to be positive. Hence,

$$1 - [c_w - c_\pi]\,j(\theta,P,t_s)F'^{-1}\left(Y^*_s\right) - c_\pi[1 - t_s\ [F'^{-1}\left(Y^*_s\right)/[e\,\left((W/P)^*_s,\theta\right)]] > 0 \quad (3.80)$$

In the numerator of (3.79),

$$\text{i)}\ \ [c_w - c_\pi][F^{-1}(Y^*_s)/[e\,\left((W/P)^*_s,\theta\right]]\ [d\,(W/P)^*_s/dt_s]\left[1-\mu_{(W/P)}\right] > 0 \quad (3.81)$$

Where, $d\,(W/P)^*_s/dt_s > 0$ and $\mu_{(W/P)} < 1$

As, wage income increases with increase in specific tax, that is $[F^{-1}(Y^*_s)/[e((W/P)^*_s,\theta)]]\,[d\,(W/P)^*_s/dt_s]\left[1-\mu_{(W/P)}\right] > 0$;

Net consumption demand out of it increases as, $[c_w - c_\pi] > 0$, that is

$$[c_w - c_\pi][F^{-1}(Y^*_s)/[e((W/P)^*_s,\theta)]]\ [d\,(W/P)^*_s/dt_s]\left[1-\mu_{(W/P)}\right] > 0$$

$$\text{ii) But}\ -c_\pi\,[F^{-1}(Y^*_s)/[e((W/P)^*_s,\theta)\,]]\left[1 - \mu_{(W/P)}\omega_t\right] \gtreqless 0 \quad (3.82)$$

Where, $\left[1 - \mu_{(W/P)}\omega_t\right] \gtreqless 0$

Since, change in profit income with rise in specific tax is ambiguous, that is $[F^{-1}(Y^*_s)/[e((W/P)^*_s,\theta)\,]]\left[1 - \mu_{(W/P)}\omega_t\right] \gtreqless 0$, change in demand from profit income too becomes ambiguous.

Change in profit income thus depends on the factor $[1 - \mu_{(W/P)}\omega_t]$,

Where, $\mu_{(W/P)}\omega_t = \mu_t$[21] , implying elasticity of effort with respect to specific tax.

If $\boldsymbol{\mu_t \geq 1}$,elasticity of effort with respect to specific tax is equal or larger than unity, which implies rise in effort is larger or equal to the rise in specific tax, that is $[1 - \mu_{(W/P)}\omega_t] \leq 0$

At the given level of output, employment falls as effort increases with specific tax, t_s; thus when $\mu_t \geq 1$, employment falls more than or at the same amount of rise in t_s.Fall in tax expenditure due to fall in employment is larger or equal to the rise in cost due to rise in t_s.

Thus profit income would increase and so as the demand out of it in (3.82) that is

$$c_\pi \left[F^{-1}(Y^*_s)/e((W/P)^*_s, \theta)\right]\left[1 - \mu_{(W/P)}\omega_t\right] \geq 0 \qquad (3.83)$$

Thus net demand out of wage income increases (in (3.81)) and profit income increases or remains unchanged in (3.83) with the incidence of specific tax, that is the numerator in (3.79),

$$[\boldsymbol{F^{-1}}(Y^*_s)/[(\boldsymbol{e}\,(\boldsymbol{W/P})^*_s, \boldsymbol{\theta})]\ [[\boldsymbol{c_w} - \boldsymbol{c_\pi}]\left[\boldsymbol{d}\,(\boldsymbol{W/P})^*_s/\boldsymbol{dt_s}\right][\boldsymbol{1} - \boldsymbol{\mu_{(W/P)}}] - \boldsymbol{c_\pi}\left[\boldsymbol{1} - \boldsymbol{\mu_{(W/P)}\omega_t}\right] > 0$$

And hence aggregate demand or output increases with the imposition of specific tax, $\boldsymbol{dY^*_s/dt_s} > 0$.

If $\boldsymbol{\mu_t} < 1$, effort increases less than the rise in t_s, that is $[1 - \mu_{(W/P)}\omega_t] > 0$

Fall in expenditure due to fall in employment is less than the rise in cost due to rise in t_s.Thus profit income falls and the corresponding demand out of it in (3.82) that is

$$-c_\pi[F^{-1}(Y^*_s)/e((W/P)^*_s, \theta)]\left[1 - \mu_{(W/P)}\omega_t\right] < 0 \qquad (3.84)$$

[21] $\mu_{(W/P)}\omega_t = \frac{de((W/P)^*_s,\theta)}{d(W/P)^*_s}\frac{(W/P)^*_s}{[e((W/P)^*_s,\theta)]}.\frac{d(W/P)^*_s}{dt_s}\frac{t_s}{(W/P)^*_s} = \frac{de((W/P)^*_s,\theta)}{dt_s}\frac{t_s}{[e((W/P)^*_s,\theta)]} = \mu_t$, effort elasticity with respect to specific tax.

As net demand out of wage income increases in (3.81) but demand from profit income falls in (3.84).The numerator in (3.79),

$$[\boldsymbol{F^{-1}}(Y^*_s)/[(\boldsymbol{e}\,(\boldsymbol{W/P})^*_s, \boldsymbol{\theta})]\ [[\boldsymbol{c_w}\ -\ \boldsymbol{c_\pi}]\left[\boldsymbol{d}\,(\boldsymbol{W/P})^*_s/\boldsymbol{dt_s}\right][\mathbf{1}-\boldsymbol{\mu}_{(W/P)}]\ -\ \boldsymbol{c_\pi}\left[\mathbf{1}-\boldsymbol{\mu}_{(W/P)}\boldsymbol{\omega_t}\right]\Big] \gtreqless \mathbf{0}$$

Hence, $\boldsymbol{dY^*_s/dt_s} \gtreqless \mathbf{0}$ depending on

$$\frac{[\boldsymbol{c_w}-\ \boldsymbol{c_\pi}][\boldsymbol{d}(\boldsymbol{W/P})^{\boldsymbol{k}}_{\boldsymbol{s}}/\boldsymbol{dt_s}]}{\boldsymbol{c_\pi}} \gtreqless \frac{[\mathbf{1}-\boldsymbol{\mu}_{(W/P)}\boldsymbol{\omega_t}]}{[\mathbf{1}-\boldsymbol{\mu}_{(W/P)}]} \tag{3.85}$$

Aggregate demand and thus optimum output increases/falls or remains unchanged based on the above condition.

Proposition 11

- *Aggregate demand or optimum level of output increases with the per unit rise in specific tax when effort elasticity with respect to specific tax is greater or equal to unity.*
- *Increase in specific tax thus has an employment generating role in RWDC.*
- *This is a strong contrast to the existing studies in SEWM, similar to RWODC that is in the situation of no demand constraint where imposition of specific tax always lowers employment.*
- *However if effort elasticity with respect to specific tax is less than unity, impact of rise in specific tax on optimum output is ambiguous and depends on*

a) *the magnitudes of the specific tax imposed,*

b) *effort elasticity with respect to specific tax ,*

c) *effort elasticity with respect to real wage*

d) *and also on marginal propensities to consume for both wage and profit earners*

- *Imposition of specific tax in RWDC has positive impact on wage income while impact on profit income is ambiguous.*

3.6.2 .2.4 Impact of Exogenous Shift in Effort Function in presence of Specific Tax in *RWDC*

Impact of increase in θ on optimum output, Y^*_s can be derived from (3.78),

$$\frac{dY^*_s}{d\theta} = \frac{-[c_w - c_\pi]\, j_\theta\, [F^{-1}(Y^*_s)] + c_\pi\, de/d\theta\, t_s [F^{-1}(Y^*_s)]/[e\,((W/P)^*_{s'}\ \theta)]^2}{1-[c_w - c_\pi]\, j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi [1 - t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_{s'}\ \theta)]} \gtreqless\ 0 \qquad (3.86)$$

Where, $j_\theta = \frac{d[j(\theta,P,t_s)]}{d\theta} < 0$ and $de/d\theta > 0$

And, denominator of (3.86),

$$1 - [c_w - c_\pi] j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi [1 - t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_s, \theta)] > 0$$

In the numerator of (3.86),

i) $-[c_w - c_\pi] j_\theta\, [F^{-1}(Y^*_s)] < 0$

Here, post - tax wage income,

$$(W/P)^*_s\ [[F^{-1}(Y^*_s)]/\ [(e\,(W/P)^*_s, \theta)\ ]] = j(\theta,P,t_s) F^{-1}(Y^*_s)$$

With the increase in, θ , $j(\theta,P,t_s)F^{-1}(Y^*_s)$ falls as wage cost per efficiency unit, $j(\theta,P,t_s)$ falls that is , $j_\theta < 0$.The reason being similar to the pre – tax situation as explained in section 3.2.1.1.1 , where wage cost per efficiency unit, $g(\theta)$ falls with rise in θ , that is, $g_\theta < 0$.

Hence post - tax wage income and the net consumption demand out of it falls, that is,$-[c_w - c_\pi]\, j_\theta\, [F^{-1}(Y^*_s)] < 0$.

ii) $c_\pi\, de/d\theta\ t_s [F^{-1}(Y^*_s)]/[e((W/P)^*_s,\ \theta)]^2 > 0$

As effort, $e\ ((W/P)^*_s,\ \theta)$ incraeses with the rise in θ, that is, $de/d\theta > 0$, employment falls at the given level of output as set by the prevailing effective demand. Hence the

expenditure on specific tax falls; profit income increases and so commodity demand out of it increases, implying,

$$c_\pi \, de/d\theta \;\; t_s[F^{-1}(Y^*_s)]/[e((W/P)^*_s, \; \theta)]^2 \; > 0$$

Thus the change in commodity demand with shift in effort function is ambiguous.

The numerator of (3.86),

$$-[c_w - c_\pi] \, j_\theta \; [F^{-1}(Y^*_s)] \; + c_\pi \, de/d\theta \;\; t_s[F^{-1}(Y^*_s)] \; /[e((W/P)^*_s, \theta)]^2 \;\; \gtreqless \;\; 0$$

$$\frac{dY^*_s}{d\theta} \gtreqless \mathbf{0} \text{ depending on } \boldsymbol{t_s} \gtreqless \frac{[c_w - \; c_\pi] \;\; |j_\theta| \;\; [\, e((W/P)^*_s, \;\; \theta)]^2}{c_\pi \;\; |de/d\theta|}$$

Proposition 12

- *Similar to ad valorem tax, impact on aggregate commodity demand or optimum level of output with the policies that produces exogenous upward shift of effort of the workers, is ambiguous in presence of specific tax.*
- *Such impact depends on*
  a) *the magnitude of specific tax,*
  b) *magnitude of fall in wage cost per efficiency unit and increase in effort with respect to increase in θ(shift parameter)*
  c) *and marginal propensities to consume for wage and profit earners.*

3.6.2 2.5 Government Expenditure, Wage and Profit income Multiplier in presence of Specific Tax

From equation (3.78), the government expenditure multiplier and wage and profit income tax multipliers can be derived in presence of specific tax,

Expansion in government expenditure

$$dY^*_s/d\hat{g} = \frac{1}{[1-[c_w-c_\pi]\, j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi[1-t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_s,\theta)]]} > 0 \quad (3.87)$$

Wage and profit income tax multiplier

$$dY^*_s/d\tau_w = \frac{-c_w}{[1-[c_w-c_\pi]\, j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi[1-t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_s,\theta)]]} < 0 \quad (3.88)$$

$$dY^*_s/d\,\tau_\pi = \frac{-c_\pi}{[1-[c_w-c_\pi]\, j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi[1-t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_s,\theta)]]} < 0 \quad (3.89)$$

Here, $[1-[c_w-c_\pi]j(\theta,P,t_s)\, [F'^{-1}(Y^*_s)] - c_\pi[1-t_s\, [F'^{-1}(Y^*_s)]/[e((W/P)^*_s,\theta)]] > 0$,

Here government expenditure and income tax multipliers (in (3.87)**,** (3.88) and (3.89)) are sensitive to shift parameter of effort function, θ, value of specific tax imposed, t_s and the *mpcs* of wage and profit earners that is c_w and c_π respectively. Such multipliers in presence of specific tax are missing in *SNWMM (Benassy (1986).*

Proposition 13

- *In the RWDC with specific tax, demand management policies like increase in government expenditure and fall in income taxes has positive impact on output and employment*
- *Magnitude of these multipliers depends on the shift parameter of effort function,θ, value of specific tax imposed, t_s and the marginal propensities to consume for wage and profit earners, c_w and c_π respectively.*

3.7 Conclusion

In this chapter, a non – Walrasian fixed - price model is being formulated where optimum real wage is determined on the basis of efficiency wage consideration unlike *SNWMM* of *Benassy (1986)* (where both nominal wage and price are exogenously fixed).By assuming exogenously fixed commodity price, this model also revisits *SEWM* (*Solow (1979)*)

where price is considered to be flexible. Impact of pay roll taxes is widely examined in standard efficiency wage framework (*Yellen (1984), Shapiro and Stiglitz (1984), Johnson and Layard (1986), Pisauro (1990) etc.*), but study related to impact of such taxes is missing in standard non – Walrasian structure. Hence this paper also deals with the role of pay roll taxes like ad valorem and specific tax in the present non – Walrasian structure with efficiency wage.

Unlike *SNWMM* (*Benassy (1986)*, in the present fixed - price non – Walrasian framework real wage is determined on the basis of efficiency wage relationship and is set above the Walrasian level and there is persistent involuntary unemployment. Thus excess demand or equilibrium in the labour market is absent in the present framework. However at the exogenously fixed price, commodity market may or may not be equilibrium. Here two regimes are found to be relevant that is, i) equilibrium or excess demand in the commodity market with excess supply in labour market signifying the regime without commodity demand constraint (*RWODC*) and ii) excess supply of commodity and labour signifying regime with commodity demand constraint (*RWDC*). In both the cases the firm sets optimum real wage at the point where effort elasticity with respect to real wage is equal to unity (that is Solow Condition holds). Though in *RWODC* employment solely depends on effort function, in *RWDC* situation, optimum employment is determined both on the basis of effort function and the prevailing level of effective demand in the economy. It is clear that, level of unemployment in *RWDC* is higher than both that of the *KU* regime of *SNWMM* (*Benassy (1986)*) where only demand effect is prevalent and *SEWM* (*Solow (1979)*) where only efficiency effect works.

In the present chapter two broad sections are being formulated. The initial section deals with the basic non – Walrasian fixed - price model with efficiency wage which includes the determination of optimum solutions and the relevant policy implications in the regimes with and without demand constraints (that is in *RWODC* and *RWDC*). Second section explains the role of labour taxations (namely ad valorem and specific taxes) in the present non – Walrasian framework and examines the impact of different other policy incidences as in the pre - tax situation in each regime of the post tax situations.

In the basic non – Walrasian fixed - price model with efficiency wage in the pre tax situation shows the major upshots;

In *the regime without demand constraint (RWODC)*, ***first of all***, classical measure of lowering real wage via exogenous shift in nominal price (as in CU regime of S*NWMM*) becomes ineffective since complete indexation of wage exists due to the presence of fixed efficiency real wage, ***secondly***, policies resulting in the upward shift of effort of the workers has positive impact on output though impact on employment is ambiguous. Such policy implication is missing in *SNWMM.*

In the *regime with demand constraint (RWDC)*, ***first of all***, policies that result in exogenous increase in effort of the workers , lowers wage income and has negative impact on effective demand, output and employment in contrast to *RWODC*; however, such shift is absent in *SNWMM* where efficiency wage relationship is not been considered, ***secondly*** increase in government expenditure and fall in income taxes has positive impact on effective demand for output and employment but in contrast to the KU regime of *SNWMM* (*Benassy (1986)*), the magnitude of the government expenditure and income tax multipliers are sensitive to the properties of the effort function and parameter, θ.

The findings of the second section (where the non – Walrasian framework with efficiency wage in presence of pay roll taxes namely ad valorem and specific tax are being considered) are the following.

The results with the incidence of ad valorem tax;

In *the regime without demand constraint (RWODC)* are, ***first of all***, with the imposition of ad valorem tax optimum post tax real wage remains unchanged and employment falls (similar to *SEWM* of *Yellen (1984)*).***Secondly***, classical measure of lowering real wage via exogenous shift in nominal price is still ineffective, as the optimum real wage remains unchanged with the imposition of ad valorem tax and complete indexation of wage persists similar to the pre - tax situation. ***Finally***, with the imposition of ad valorem tax wage earners get adversely affected as wage income falls but the impact on in profit income is ambiguous.

The results in the *regime with demand constraint (RWDC)* are, ***first of all***, imposition of ad valorem tax has negative effect on effective demand, output and employment but real wage remains unchanged; significantly none of the studies in *SEWM* or *SNWMM* have examined the impact of ad valorem tax on commodity demand; though in *SEWM* (as in *RWODC*), ad valorem tax has similar effect on output and employment but it is solely due to efficiency effect and not demand effect whereas in the present case, such change is due to demand effect. ***Secondly***, with the imposition of ad valorem tax wage income remains unchanged but profit income falls. ***Thirdly***, unlike the pre - tax situation, impact of exogenous shift in effort function is ambiguous in presence of ad valorem tax, however the shift in the effort function has positive/negative or no impact on aggregate demand or output depending on the magnitude of the imposed tax rate as well as on the marginal propensities to consume for wage and profit earner. ***Finally***, demand management policies like increase in government expenditure and fall in income taxes has positive impact on effective demand output and employment, but the magnitude of these multipliers depend on the value of the ad valorem tax and also on the properties of effort unlike KU regime of *SNWMM* (*Benassy (1986)*).

Results with the incidence of specific tax;

The results in *the regime without demand constraint (RWODC)* are, ***first of all***, with the imposition of specific tax optimum post tax real wage increases and employment falls (similar to *SEWM* of *Yellen (1984)*).***Secondly***, since post - tax real wage is sensitive to commodity price, complete indexation of wage is absent; classical measure of lowering real wage via rise in commodity price becomes effective. ***Thirdly*** impact of the policies that result in upward shift in effort function is similar to that in the pre tax situation

The findings in the *regime with demand constraint (RWDC)* are, ***first of all***, aggregate demand for output increases with the rise in specific tax if effort elasticity with respect to specific tax is greater or equal to unity; in this particular case, increase in specific tax may have an employment generating role which is a strong contrast to the existing studies in *SEWM* (like *Ye1llen (1984)*) or in *RWODC* of the present model where imposition of specific tax always lowers employment. ***Secondly***, if effort elasticity with respect to specific tax is less than unity, impact of rise in specific tax on aggregate demand for

output is ambiguous and depends on the magnitudes of (a) the specific tax imposed, (b) effort elasticity with respect to specific tax, (c) effort elasticity with respect to real wage, and (d) marginal propensities to consume for both wage and profit earners. ***Thirdly***, similar to ad valorem tax, change in demand or output with shift in effort function is ambiguous in presence of specific tax which depends on magnitudes of (a) specific tax, (b) fall in wage cost per efficiency unit and increase in effort with respect increase in θ (shift parameter), and (c) marginal propensities to consume for wage and profit earners. ***Finally***, with specific tax, increase in government expenditure and fall in income taxes has positive impact on effective demand for output and employment; the magnitude of these multipliers depend on (a) parameter, θ, (b) value of specific tax imposed, t_s and (c) the marginal propensities to consume for wage and profit earners, c_w and c_π respectively.

CHAPTER - 4

NON - WALRASIAN IS - LM MODEL WITH ASYMMETRIC PRICE FLEXIBILITY AND EFFICIENCY WAGE

4.1 Introduction

In the standard non - Walrasian IS –LM model of *Benassy (1986)* both nominal wage and price are assumed to be asymmetrically flexible implying that prices are flexible upward but rigid downward. It is widely accepted that prices display some downward rigidity but in the case of excess demand they will increase until excess demand has disappeared. Thus excess demand that is consumer rationing will not appear on the goods market and one can observe three relevant regimes, i) excess supply in commodity and labour market, ii) excess supply in labour market with goods market cleared, iii) both the markets clear. But efficiency wage consideration is absent in the IS – LM model of *Benassy (1986).*

On the other hand, in standard efficiency wage models (*SEWM*) like *Solow (1979) and Yellen (1984)* commodity price is assumed to be completely flexible and the possibility of disequilibrium in the commodity market is absent. Moreover since efficiency real wage is set above the Walrasian level, there is a persistent involuntary unemployment in the labour market (as seen in Chapter 3).

The objective of the present chapter is to formulate a non – Walrasian IS – LM model with the assumption of asymmetric price flexibility like *Benassy (1986)* where optimum real wage is determined on the basis of efficiency wage consideration as in the case of *Solow (1979)*. It can be observed that, in the present framework there will be a persistent involuntary unemployment in presence of efficiency real wage in contrast to *Benassy (1986)* where we can have the possibility of the regimes with equilibrium in the labour and commodity market. Further, with the assumption of asymmetric price flexibility, commodity market is not always cleared unlike *SEWM* but there is a scope for excess supply in the commodity market where the firm may face commodity demand

constraint. Thus in the present model only two regimes are pertinent, i) excess supply in both the markets (*RWDC*) and ii) excess supply in labour market with goods market cleared (*RWODC*) . In the present framework, *RWODC* represents *SEWM* where goods market always clears but excess supply persists in the labour market due to efficiency wage.

In the above context, the present model analyzes

i) the impact of monetary and fiscal policies in both *RWDC* and *RWODC* ; results are then contrasted with that of both *SNWMM* (*Benassy (1986)*) and *SEWM* (*Solow (1979)* and *Yellen(1984)*).

ii) the impact of the policies that result in exogenous shift in effort function; the obtained outcome is then compared with similar policy shift in the framework of the fix price setting as studied in Chapter 3. However policies that shift effort of the workers has no role in the IS – LM framework of *Benassy (1986*) where efficiency wage consideration is absent.

iii) the situation where the IS – LM framework with efficiency wage in *RWODC* is extended by assuming partial wage rigidity when the firm faces certain fixed costs (such as hiring and training cost, traffic fees, housing outlays etc.) for employing a worker in line with *Lin and Lai (1998)*; impact of different policy implications are also been studied.

It can be observed that there are a number of extended studies in efficiency wage framework (*Gottfries and Westermark (1998), Stiglitz (1986), Summers (1988), Ball and Romer (1990), Lin and Lai (1998), Carter (2005)* etc) which examines the real effect of money or impact of monetary policy under the assumption of different nominal and real rigidities. However since real wage in the present study is determined on the basis of the effort function similar to the basic efficiency wage models like *Solow (1979)* and *Yellen (1984)*), the aim here is, to explore how the structure and the policy implications in *Solow (1979)* and *Yellen (1984)* gets altered if the commodity price is assumed to be asymmetrically flexible under the non - Walrasian framework.

Structure of the present chapter is as follows; section 4.2 explains the model where behavior of each agents are being discussed along with commodity and bond market equilibrium .Section 4.3 presents the IS – LM equations. Regime classification and the impact of different policy implementations in each regime of the present IS – LM model are explained in section 4.4. Section 4.5 gives the graphical representation of different regimes and policy impacts of the present model in comparison to *SNWMM* (*Benassy (1986)*). Conclusion of the present chapter is presented in section 4.6.

4.2 The Model

The model assumes an aggregate monetary economy with three representative agents; the firm and the household and the government. Due to the similar reason as explained in section (3.2) of Chapter 3; the household consists of two representative classes having different marginal propensities to consume, i) the wage earners who sell labour and ii) the profit earners who earn profit. There exist three markets, for goods, labour and bond where output is exchanged against money at price, P, labour against real wage (W/P) and bonds against money at price $(1/r)$ respectively. Bond market is always in equilibrium where price of bond (thus the interest rate (r)) is assumed to be fully flexible. The commodity price is assumed to be rigid downward with minimum value $\bar{P}$ and flexible upward, thus there may be equilibrium or excess supply in the commodity market. However, since profit maximizing firm sets the optimum real wage taking into account efficiency consideration, situation of excess demand or equilibrium in the labour market is absent. The firm distributes a part of its income to the profit earners and the undistributed part is retained for investment purposes. Taxes in any form are omitted in this particular structure in line with *Benassy (1986)* non – Walrasian IS – LM framework[1].

The determination of effective demand and supply functions are different from Chapter 3 due to the introduction of bonds, investment and undistributed profit. The determination

[1] The present IS – LM model can be extended by including taxation of different forms.

of consumption, investment and net bond demand functions involves intertemporal choices which are based on the K – equilibrium of *Benassy (1986)*[2].

Following subsections describe each of the agents and their behaviour in detail.

4.2.1 The Firm

Properties of the effort function and the profit maximizing behaviour of the firm which determines optimum real wage and employment (both in unconstrained and constrained case) are same as explained in section 3.2.1 of Chapter 3.

4.2.1.1 Determination of Optimum Real Wage and Employment

4.2.1.1.1 Unconstrained Firm

The firm determines optimum real wage on the basis of efficiency wage relationship at the point where Solow condition satisfies as in (3.6) that is

$$\mu_W = \frac{\mathrm{e}'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1$$

$(W/P)^*$ is the optimum efficiency real wage determined only on the basis of effort function, which is sensitive to parameter, θ .

Here, $(W/P)^* = \omega(\theta),\ \omega_\theta < 0$

The firm can enjoy notional profit, Π^M/P

$$\Pi/P = \Pi^M/P = F(e((W/P)^*, \theta)\, L^M) - (W/P)^*\, L^M$$

[2] Detail analysis of this derivation is given in page 48- 53 in *Benassy (1986)*.

The profit maximising level of output, Y^M

$$Y^M = F(F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]) = S(\theta), \ S_\theta > 0$$

Optimum actual employment,

$$L^M = [F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]]/[e((W/P)^*, \theta)] = \alpha(\theta), \ \alpha_\theta \gtreqless 0$$

4.2.1.1.2 Constrained Firm

The behaviour of the firm,when constraint in the commodity market is same as in section 3.2 .1 .2 of Chapter 3.

Optimum real wage, $(W/P)^*$ is still determined on the basis of effort function satisfying the Solow Condition (same as equation (3.6)).Thus optimum real wage remains unchanged even when the firm is constrained. Thus

$$\mu_W = \frac{e'((W/P),\theta)(W/P)}{e((W/P),\theta)} = 1$$

The employment level in efficiency unit is equal to the demand for labour necessary to produce Y^d as in *RWDC* of Chapter 3. Once optimum real wage $(W/P)^*$ is known, optimum actual employment in the constrained case can be solved as,

$$\bar{L} = [F^{-1}(Y^d)]/[e((W/P)^*, \theta)]$$

Therefore, if the firm faces constraint in the commodity market, the firm will earn constrained profit,

$$\Pi/P = \bar{\Pi}/P = Y^d - (W/P)^*[[F^{-1}(Y^d)]/[e((W/P)^*, \theta)]]$$

4.2.1.2 Investment and Bond Demand Function of the Firm

The firm distributes a part of its profit to the profit earners in the household and the rest that is undistributed profit is spent on investment and bond purchase. If Π be the profit earned by the firm, the profit earners in the household receives $[\Pi - u\Pi]$, where u is the fraction of profit that is kept undistributed. $\bar{m}_f$ is the initial and m_f is the final quantity

of money holding. The firm purchases net flow of bond, B_f where it is assumed that initial bond holding to be zero and makes and investment i.

The budget constraint of the firm management is,

$$Pi + B_f/r + m_f = \bar{m}_f + u\Pi \tag{4.1}$$

In line with *Benassy (1986)* it is assumed that the firm management has indirect utility function,$U_w(C_w, B_w, m_w, \sigma_w)$ [3] and solves the following problem to determine the investment and bond demand functions.

$$\text{Maximise } U_f(i_f, B_f, m_f, \sigma_f) \text{ s. t.} \tag{4.2}$$

$$Pi + B_f/r + m_f = \bar{m}_f + u\Pi$$

Since, i is the addition to stock of capital; $(K - K_0) = i$ where K and K_0 be the current and initial capital stock.

Where, $\sigma_f = \{(u\Pi), P, r\}$ are the set of current price and quantity signals to the firm, and it is assumed that expectations are based on these current signals and past signals which are a datum in the current period (following *Benassy (1986)*) .Thus expected signals, $\sigma_f{}^e = \psi_\pi(\sigma_f)$

The investment and bond demand function of the firm be

$$\check{\imath} = i(\Pi/P, (\bar{m}_f/P), r) \tag{4.3}$$

$$\check{B}_f = B((\Pi/P), (\bar{m}_f/P), r) \tag{4.4}$$

Firm may or may not be constrained in the goods market, thus in the unconstraint case,

$\Pi/P = \Pi^M/P$ and in the constrained case, $\Pi/P = \bar{\Pi}/P$

[3] Derivation of such indirect utility function is given in page 50- 51of *Benassy (1986)*.

The linear invest demand function be

$$\check{\imath} = i_u u\,[\Pi/P] - i_r r + \gamma\,[\bar{m}_f/P] \tag{4.5}$$

Here, $i_u > 0, i_r < 0, \gamma > 0$

4.2.2 The Household

The household consists of two representative classes having different marginal propensities to consume, i) the wage earners who sell labour and ii) the profit earners who earn profit. The wage earner and the profit earner in the household determines consumption and bond demand which in aggregate represents household demand for consumption good and bond.

4.2.2.1 Consumption and Bond Demand of the Wage Earner

The representative wage earner in the household sells L of labour, at real wage (W/P), which is assumed not to exceed the constant level L_0. Specifically, the scope of determining optimum supply of labour on the basis of labour leisure choice is ignored. The representative wage earner earns real wage income $[(W/P)\,L]$. She creates consumption, C_w, purchases net flow of bonds, B_w, has an initial money holding, $\bar{m}_w$ and final money holding , m_w. It is assumed that initial bond holding to be zero.

The budget constraint of the wage earner is

$$PC_w + B_w/r + m_w = \bar{m}_w + [WL] \tag{4.6}$$

It is assumed that the wage earner has indirect utility function, $U_w(C_w, B_w, m_w, \sigma_w)$

Where, σ_w is the set of current price and quantity signals, $\sigma_w = \{[[W/P]\,L],\ P,\ r\}$. Set of expected signals, ${\sigma_w}^e = \psi_w(\sigma_w)$.

The effective demands of consumption and bond of the wage earner is determined from the following program

$$\text{Maximise} \quad U_w(C_w, B_w, m_w, \sigma_w) \text{ s. t.} \tag{4.7}$$

$$PC_w + B_w/r + m_w = \bar{m}_w + B_{0w}/r + [WL]$$

Here effective consumption and bond demand depends on price and quantity signals

$$\breve{C}_w = C([[W/P]L], [\bar{m}_w/P], r) \tag{4.8}$$

$$\breve{B}_w = B([[W/P]L]), [\bar{m}_w/P], r) \tag{4.9}$$

The wage earner is not constrained in the bond market, which always clears and also on output market where commodity price is flexible upward.

We assume that, the wage earner is constraint in the labour market when it fails to sell the profit maximizing level of employment, L^M at the optimum efficiency real wage, $(W/P)^*$. If it sells $\bar{L}$, which is less than L^M at $(W/P)^*$, the realized income $[(W/P)^* \bar{L}]$ is less than the profit maximizing level of income $[(W/P)^* L^M]$.

$[[W/P]L] = [(W/P)^* L^M]$, when the wage earner is not constraint, and

$[[W/P]L] = [(W/P)^* \bar{L}]$,when the constraint is binding.

4.2.2.2 Consumption and Bond Demand of the Profit Earner

Profit earners in the household earn a part of the profit where the rest is kept for self - financing by the firm. If Π be the profit of the firm, the profit earners in the household earn $[\Pi - u\Pi]$, where u is the fraction of profit that is not distributed. Profit earners in the household spend a part of their earnings for consumption purposes, C_π, purchases net flow of bonds, B_π, has an initial money holding, $\bar{m}_\pi$ and a final holding m_π.

The budget constraint of the profit earner in the household is

$$PC_\pi + B_\pi/r + m_\pi = \bar{m}_\pi + [\Pi - u\Pi] \tag{4.10}$$

Here indirect utility function for the profit earner is assumed to be, $U_\pi(C_\pi, B_\pi, m_\pi, \sigma_\pi)$. Here current signals, $\sigma_\pi = \{\Pi, P, r\}$ and expected signals $\sigma_\pi{}^e = \psi_\pi(\sigma_\pi)$.

The consumption and bond demand function is determined by the profit earner

$$\text{Maximise } U_\pi(C_\pi, B_\pi, m_\pi, \sigma_\pi) \text{ s. t.} \tag{4.11}$$

$$PC_\pi + B_\pi/r + m_\pi = \bar{m}_\pi + [\Pi - u\Pi]$$

Here effective consumption and bond demand depends on current price and quantity signal,

$$\check{C}_\pi = C(\Pi/P, (\bar{m}_\pi/P), r) \tag{4.12}$$

$$\check{B}_\pi = B(\Pi/P, (\bar{m}_\pi/P), r) \tag{4.13}$$

If the firm is not constraint in the commodity market

$$\Pi/P = \Pi^M/P = F(e((W/P)^*, \theta) L^M) - (W/P)^* L^M$$

If the firm is constraint in the commodity market

$$\bar{\Pi}/P = Y^d - (W/P)^* [F^{-1}(Y^d)/[e((W/P)^*, \theta)]]$$

4.2.2. 3 Aggregate Consumption Function

The aggregate consumption demand of the household can be determined by adding the consumption demand of the wage earner and the profit earner (in (4.8) and (4.12))

Aggregate consumption demand, $\check{C}$ of the household,

$$\check{C} = \check{C}_w + \check{C}_\pi = C([(W/P) L], [\bar{m}_w/P], r) + C(\Pi/P, [\bar{m}_\pi/P], r)$$

The above consumption demand can be expressed in the following form considering the income distribution,

$$\check{C} = c_w [(W/P) L] + c_\pi[[\Pi/P] - u[\Pi/P]] + \beta[\bar{m}_h/P] - c_r r \tag{4.14}$$

Where, $c_w > 0,\ c_\pi > 0,\ \beta > 0$, c_r implies change in consumption per unit change in rate of interest, $c_r < 0.\ c_w > c_\pi$ as assumed earlier in Chapter 3 and $\bar{m}_h = \bar{m}_w + \bar{m}_\pi$

4.2.3 The Government

Government purchases a quantity of goods, $\hat{g}$, sells a net quantity of new bonds B, where B_0 is the initial bond holding, and creates a net quantity of money ($m - \bar{m}$), where m is the total quantity of money in the economy at the outset of the period. The government's budget constraint is

$$m - \bar{m} = P\hat{g} - B/r \tag{4.15}$$

Where, $\bar{m} = \bar{m}_f + \bar{m}_h \qquad m = m_f + m_w + m_\pi$

4.2.4 Commodity Market Equilibrium

Aggregate demand, Y^d of the economy includes consumption demand coming from household comprising of wage and profit earner on the other hand investment demand from the firm and demand for government expenditure.

$$Y^d = c_w\,[(W/P)L] + c_\pi[[\Pi/P] - u\,[\Pi/P]] + i_u u\,[\Pi/P] - c_r r - i_r r + \varepsilon\,[\bar{m}/P] + \hat{g} \tag{4.16}$$

Considering initial money holdings, $\bar{m}$ to be given in a period and hence are omitted in the function.

In the unconstrained case, aggregate demand,

$$Y^c = c_w\,[(W/P)^* L^M] + c_\pi[[\Pi^M/P] - u\,[\Pi^M/P]] + i_u u\,[\Pi^M/P] - c_r r - i_r r + \varepsilon\,[\bar{m}/P] + \hat{g} \tag{4.17}$$

The profit maximising level of output

$$Y^M = F(F'^{-1}\,((W/P)^*/[(e((W/P)^*, \theta)]\,) = S(\theta)$$

When the firm is unconstrained in the commodity market, excess demand for commodity does not exist due to upward flexibility of price. Profit maximizing level of output is always equal to the commodity demand, that is goods market is cleared.

Thus, $Y^M = Y^c = Y$

Commodity market equilibrium in the unconstrained case

$$Y = \left[[c_w - c_\pi] - u\right][i_u - c_\pi][(W/P)^* L] - [c_r + i_r]r + [c_\pi[1-u] - ui_u]Y + \varepsilon[\bar{m}/P] + \hat{g} \quad (4.18)$$

$$= Z(Y, \theta, P, r) + \hat{g}$$

Here, $c_w > c_\pi$ and $i_u > c_\pi$ since investment propensity of the firm out of undistributed profit income is assumed to be larger than the consumption propensity of the profit earner within the household. This holds following the *animal spirit* concept by *Keynes (1936)* where entrepreneurs have high passion for investment under all circumstances.

In the constrained case, the firm fails to produce the profit maximising level of output Y^M (as in *RWODC*) but produces the amount, Y^k just necessary to satisfy the level of effective demand, E.

Here, effective demand.

$$E = [c_w - c_\pi] - u[i_u - c_\pi][(W/P)^* \bar{L}] - [c_r + i_r]r + [c_\pi[1-u] - ui_u]Y + \varepsilon[\bar{m}/P] + \hat{g} \quad (4.19)$$

And, $Y^k = E = Y$

Commodity market equilibrium in the constrained case

$$Y = [c_w - c_\pi] - u[i_u - c_\pi][(W/P)^* L] - [c_r + i_r]r + [c_\pi[1-u] - ui_u]Y + \varepsilon[\bar{m}/P] + \hat{g}] \quad (4.20)$$

$$= Z(Y, \theta, P, r) + \hat{g} \quad (4.21)$$

Where, $Z(Y, \theta, P, r)$ is the total effective demand coming from the private sector and it is assumed that, $0 < Z_y < 1$, $Z_r < 0$, $Z_P < 0$.

4.2.5 Bond and Money Market Equilibrium

Total bond demand in the economy is sum of demand generating from wage and profit earners in the household and from the firm in (4.9), (4.13) and (4.4) respectively.

Total bond demand of the economy by adding the bond

$$\check{B} = \check{B}_w + \check{B}_\pi + \check{B}_f$$

$$= B_w([(W/P)\,L], [\bar{m}_w/P], r) + B_\pi([\Pi/P], u, [\bar{m}_\pi/P], r) + B_f([\Pi/P], u, [\bar{m}_f/P], r)$$

$$\check{B} = B(\theta, Y, r, P) \tag{4.22}$$

Considering initial money holdings, $\bar{m}$ to be given in a period, it is omitted in the function.

From the budget constraint of the government in (4.15), bond market equilibrium implies,

$$B(\theta, Y, r, P) = B/r = r\,[P\hat{g} - m + \bar{m}] \tag{4.23}$$

4.3 IS – LM equations

The two core equations in the system comprise of commodity and bond market equilibrium

$$Y = Z(Y, \theta, P, r) + \hat{g}$$

$$B(\theta, Y, r, P) = B/r = r\,[P\hat{g} - m + \bar{m}]$$

4.3.1 Derivation of Money Market Equilibrium

By adding the budget constraints of wage and profit earner in the household and of the firm, and considering the commodity market equilibrium, we get,

$$m = \bar{m} + PY - PZ(Y, \theta, P, r) - \frac{1}{r}B(\theta, Y, r, P)] = M(Y, \theta, P, r)$$

The above equation can be considered as money demand function.

Reciprocally bond demand function can be written as,

$$B\ (\theta, Y, r, P) = r\ [\overline{m} - \ M(Y, \theta, P, r) + \ PY - PZ(Y, \theta, P, r)]$$

Putting the above expression in the government's budget constraint (in 4.15), we can derive the money market equilibrium

$$M(Y, \theta, P, r) = m \tag{4.24}$$

We here assume that propensities to transaction demand for money of each agent (wage earner and profit earner in the household and the firm) are equal; thus money demand is no longer a function of parameter θ relating to efficiency of the worker. Thus money demand function can be expressed in a specific form by omitting parameter θ .

$$M\ (Y, r, P) = \ M_y Y - \ M_r r + M_P\ P \ = \ \ m \tag{4.25}$$

M_y imply propensity to transaction demand for money, which is same for wage and profit earner in the household and also for the firm. M_r is the amount of change in speculative money demand due to unit change in rate of interest. Here, $M_y > 0$, $M_r < 0$ and $M_P > 0$

IS – LM system in the present structure implies,

$$Y = Z(Y, \theta, P, r) + \hat{g}$$

$$m \ = M\ (Y, r, P)$$

4.4 Regime Classification

In the IS –LM model with asymmetric flexibility of *Benassy (1986)*, the scope of excess demand for commodity is absent as commodity price is flexible upward but rigid downward. Thus three regimes are relevant in *Benassy (1986)*, i) excess supply in commodity and labour market, ii) excess supply in labour market with goods market cleared, iii) both the markets clear.

Thus by assuming asymmetric price flexibility similar to *Benassy (1986)*, in this present structure excess demand in commodity market does not exists. Thus Region B in the regime classification of the model with fixed price of Chapter 3 (in section 3.3) is irrelevant in this model. However due to the presence of efficiency wage there is persistent involuntary unemployment, thus the third regime in *Benassy (1986)*, where both output and labour market clears, is absent in the present structure. Here we have,

i) Excess supply in output and labour market (*RWDC*) (Region A in Figure 3.4 of Chapter 3)

ii) Excess supply for labour and output market cleared. (*RWODC*) (curve CD in Figure 3.4 of Chapter 3)

4.4.1 Regime with Excess Supply of Output and Labour (*RWDC*)

If the commodity price is blocked at their minimum level, $\bar{P}$, there is excess supply in the commodity market and the firm faces demand constraint in the commodity market.

Here, $P = \bar{P}$, and the level of sales is thus given by the aggregate demand for goods.

The IS equation implies,

$$Y = [[c_w - c_\pi] - u[i_u - c_\pi]][(W/P)^* L] - [c_r + i_r]r + [c_\pi[1-u] - ui_u]Y + \varepsilon[\bar{m}/P] + \hat{g} \qquad (4.26)$$

Here, wage income, $[(W/P)^* L] = g(\theta)[F^{-1}(Y)]$

As, $L = [F^{-1}(Y)]/[e((W/P)^*, \theta)]$

Wage cost per efficiency unit, $(W/P)^*/[e((W/P)^*, \theta)] = g(\theta)$, $g_\theta < 0$ (as explained earlier in Chapter 3).

The IS equation in (4.26) can be rewritten as,

$$Y = \frac{[[c_w - c_\pi] - u[i_u - c_\pi]]g(\theta)[F^{-1}(Y)] - [c_r + i_r]r + + \varepsilon[\bar{m}/P] + \hat{g}}{1 - [c_\pi[1-u] - ui_u]} \qquad (4.27)$$

$$= Z(Y, \theta, P, r) + \hat{g}$$

Here, $c_w > c_\pi$ (in line with *Kaldor (1955)*) and $i_u > c_\pi$, assuming investment propensity of the firm out of undistributed profit income to be larger than the consumption propensity of the profit earner within the household.

Again, interest rate clears the bonds market or money market that is, LM curve implies,

$$M_y Y - M_r r + M_P P = M(Y, r, P) = m$$

Where, $M_y > 0$, $M_r < 0$ and $M_P > 0$

Optimum output Y^* and interest rate r^* are determined by combining IS (as in (4.27)) and LM equation,

$$Y^* = \frac{M_r[c_w - c_\pi - u\,[i_u - c_\pi]]\; g(\theta)\left[F^{-1}(Y^*)\right] + m\,[i_r + c_r] - M_P P\,[i_r + c_r] + M_r\,[\hat{g} + \varepsilon\,[\bar{m}/P]]}{[1 - c_\pi[1-u] - u i_u]M_r + [i_r + c_r]M_y} \qquad (4.28)$$

$$= K(P, m, \theta, \hat{g})$$

Initial money holdings, $\bar{m}$ is omitted in the above function as it is assumed to be given in a period.

Here supply of output is demand determined and hence supply curve is vertical in $P - Y$ plane similar to *Benassy (1986)* as shown in Figure 4.1 of section 4.5.1 where graphical representation of complete supply curves in IS – LM framework of *Benassy (1986)* as well as present model is described.

Equilibrium output, Y^* in the commodity market is determined where aggregate demand curve, $K(P, m, \theta, \hat{g}) = \hat{D}(P)$ intersects the vertical supply curve. This is shown in Figure (4.2) of section 4.5.2.

Here, equilibrium values of employment, price, real wage and wage income are as follows,

$$L^* = [F^{-1}(Y^*)]/[e\,((W/P)^*, \theta)]$$

$$P = \bar{P} = P^*$$

$$(W/P)^* = \omega(\theta),\ \omega_\theta < 0$$

$$(W/P)^* L^* = [(W/P)^*/[e((W/P)^*, \theta)]][F^{-1}(Y^*)] = g(\theta)[F^{-1}(Y^*)]$$

4.4.1.1 Impact of Increase in Money Supply

From equation (4.28) one can derive the impact of increase in money supply (m) on general equilibrium output, Y^*.

$$\frac{dY^*}{dm} = \frac{[i_r + c_r]}{[1 - c_\pi - u[i_u - c_\pi] - [c_w - c_\pi - u[i_u - c_\pi]]g(\theta)]F'^{-1}(Y^*)]\, M_r + [i_r + c_r]\, M_y} > 0 \qquad (4.29)$$

In *SNWMM* of *Benassy (1986)*, money multiplier in the same regime

$$\left[\frac{dY^*}{dm}\right]_{KU} = \frac{Z_r}{[1 - Z_y]M_r + Z_r M_y}$$

Here value of, $Z_y = c_y + i_y$ and $Z_r = -[i_r + c_r]$

In the present framework, marginal propensities to consume for wage and profit earner in the household are considered to be different and at the same time a specific fraction u of profit is assumed to remain undistributed where investment propensity out of undistributed profit income of the firm is assumed to be greater than the consumption propensity of the profit earner in the household. Here, change in total effective demand of private sector,

$$Z_y = c_\pi + u[i_u - c_\pi] + [c_w - c_\pi - u[i_u - c_\pi]]g(\theta)F'^{-1}(Y^*) \qquad (4.30)$$

Consumption demand of the profit earners in the household and investment demand of the firm increases if output increases leading to the rise in profit income; such rise can be represented as c_π and $u[i_u - c_\pi]$ respectively in (4.30).

With the rise in output optimum real wage, $(W/P)^*$ remains unchanged but employment increases (as real wage is determined entirely on the effort function and is not sensitive to change in demand or output as explained in section 3.2 .1 . 2 of Chapter 3); wage income increases, that is, $g(\theta)F'^{-1}(Y^*) > 0$. As a consequence net demand from the household

increases, that is, $[c_w - c_\pi]\, g(\theta)F'^{-1}(Y^*) > 0$ as $c_w > c_\pi$. But, there is a net fall in demand due to fall in undistributed profit income of the firm via rise in wage income, hence $-u[i_u - c_\pi]g(\theta)F'^{-1}(Y) < 0$ where $i_u > c_\pi$ as assumed in the model.

The net change in demand due to rise in wage income, $[c_w - c_\pi - u[i_u - c_\pi]]g(\theta)F'^{-1}(Y^*)$ is ambiguous and depends on the value of u, which is the fraction of profit income kept undistributed by the firm. Thus

$[c_w - c_\pi - u[i_u - c_\pi]]\, g(\theta)F'^{-1}(Y^*) \gtreqless 0$, according as

$$u \lesseqgtr [c_w - c_\pi]/[i_u - c_\pi] \tag{4.31}$$

In (4.30), $c_\pi > 0$ and $u[i_u - c_\pi] > 0$, but $[c_w - c_\pi - u[i_u - c_\pi]]g(\theta)F'^{-1}(Y^*) \gtreqless 0$

Assuming net change in investment and consumption demand with respect to output to be positive but less than unity, that is, $0 < Z_y < 1$, but the magnitude of Z_y in (4.30) differs depending on the different values of u as specified in (4.31). Accordingly, the slope of the IS curve[4] is negative but its degree gets affected by different values of u.

With the given demand schedule for bond, increase in money supply implies fall in supply of bond. This raises bond prices $(1/r)$, reducing r.The firm increases investment demand and consumption demand of the household goes up (as $i_r < 0$, $c_r < 0$). Effective demand and hence the level of output increases. This creates spill - over effect and hence net investment and consumption demand increases, that is $Z_y > 0$ but as explained above, the magnitude of Z_y in (4.30) depends on different values of u (as given in (4.31)).

Again rise in income increases transaction demand for money which consequently pulls rate of interest back up in the money market. Finally both output and money market settles to a new equilibrium point at lower r and higher Y. Lower r would further increase consumption and investment demand. Thus increase in money supply leads to an

[4] Slope of IS curve can be derived from (4.26) , which is, $dr/dY = -[1 - Z_y]/[i_r + c_r]$,
Where, $Z_y = c_\pi + u[i_u - c_\pi] + [[c_w - c_\pi] - u[i_u - c_\pi]]\, g(\theta)F'^{-1}(Y^*)$
The slope of the IS curve is negative, but the magnitude of the slope depends on the value of Z_y which again depends on $u \lesseqgtr [c_w - c_\pi]/[i_u - c_\pi]$ that is on $[[c_w - c_\pi] - u[i_u - c_\pi]] \gtreqless 0$.

expansionary impact on output through multiplier process. But the degree of such rise differs with different values of u which decides the magnitude of Z_y.

The magnitude of the impact of increase in money supply, m on output, Y^* as in (4.28) also differs depending on the value of u. Thus

a) $$\frac{dY^*}{dm} = \frac{[i_r + c_r]}{[1-c_\pi - u[i_u - c_\pi] - [c_w - c_\pi - u[i_u - c_\pi]]g(\theta)F'^{-1}(Y^*)]\,L_r + [i_r + c_r]\,L_y} > 0 \qquad (4.32)$$

When, $u < [c_w - c_\pi]/[i_u - c_\pi]$, implying, $[\,[c_w - c_\pi] - u[i_u - c_\pi]] > 0$

b) $$\frac{dY^*}{dm} = \frac{[i_r + c_r]}{[1-c_\pi - u[i_u - c_\pi] + [c_w - c_\pi - u[i_u - c_\pi]]g(\theta)F'^{-1}(Y^*)]\,L_r + [i_r + c_r]\,L_y} > 0 \qquad (4.33)$$

When, $u > [c_w - c_\pi]/[i_u - c_\pi]$, implying, $[[c_w - c_\pi] - u[i_u - c_\pi]] < 0$

c) $$\frac{dY^*}{dm} = \frac{[i_r + c_r]}{[1-c_\pi - u[i_u - c_\pi]]\,L_r + [i_r + c_r]\,L_y} > 0 \qquad (4.34)$$

When, $u = [c_w - c_\pi]/[i_u - c_\pi]$, implying $[[c_w - c_\pi] - u[i_u - c_\pi]] = 0$

It is clear from (4.32), (4.33) and (4.34), that magnitude of Z_y is higher in (a) but lower in (b) as compared to (c). Consequently, the magnitude of increase in output due to rise in money supply is larger in (a) but smaller in (b) as compared to (c).

However, in *SEWM* (*Solow (1979*), *Yellen (1984)*) nominal wage and price are assumed to be flexible; increase in money supply, raises commodity price, moreover as efficiency real wage is rigid which is determined on the basis of effort function; firm increases nominal wage in order to keep real wage unchanged due to any change in price level. Thus, employment and hence output remains unaltered implying money is neutral. In *RWDC* of the present non – Walrasian IS –LM model where the firm faces commodity demand constraint, money is not neutral because commodity price is fixed at a minimum level and rise in money supply increases production via rise in output demand creating real effect. This result can be contrasted with that of *SEWM* of *Solow (1979*) and *Yellen (1984).*

The above discussion also reveals that in the regime with excess supply in commodity and labour market, money has positive impact on output and employment similar to *SNWMM* of *Benassy (1986)* though the magnitude of the multiplier in the present case depends on the condition related to magnitudes of fraction of profit kept undistributed by the firm, investment propensity of the firm and marginal propensities to consume for wage and profit earners.

Proposition 1

- *In the present model, money is non- neutral in the regime with excess supply of labour and output (RWDC) at the fixed minimum price level.*
- *This result supports SNWMM (Benassy (1986)) but contrasts SEWM where money is neutral due to nominal wage and price flexibility.*
- *The magnitude of the impact of money supply on output, in the present case depends on a condition related to the values of (a) fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earner. This is a contrast to SNWMM (Benassy (1986)) where magnitude of the impact of money supply does not depend on any such condition involving above factors.*

4.4.1 .2 Impact of Exogenous Shift in Effort Function

The present section deals with the impact of exogenous shift in effort function on optimum output and employment in *RWDC* in the non – Walrasian IS – LM framework with efficiency wage. Similar to the case in non – Walrasian fixed price model in section 3.5.1 of Chapter 3, in the present set up exogenous increase in effort function with the increase in parameter, θ (due to the policy implementations which increase the factors like, access to and quality of health care, the quality and affordability of education and

training, investment on infrastructure, quality of job environment etc.) lowers wage income of the wage earners.

This happens as θ increases, wage cost per efficiency unit, $(W/P)^*/[e((W/P)^*, \theta)]$ that is $g(\theta)$ falls where real wage $(W/P)^*$ is lowered to $(W/P)^*_1$ but effort, $[e((W/P)^*, \theta)]$ increases to $[e((W/P)^*_1, \theta_1)]$. Higher level of effort however lowers actual employment at the given level of employment in efficiency unit, $[e((W/P)^*_1, \theta_1)L]^d$ as determined on the basis of prevailing effective demand or output. Both optimum real wage and employment falls and hence wage income falls.

Such fall in wage income may affect the existing level of effective demand resulting in a shift in IS curve. Thus the impact of rise in θ on Y^* is derived from equation (4.28),

$$\frac{dY^*}{d\theta} = \frac{M_r[c_w - c_\pi - u[i_u - c_\pi]\, g_\theta F^{'-1}(Y^*)]}{[1 - c_\pi - u[i_u - c_\pi] - [c_w - c_\pi - u[i_u - c_\pi]]\, g(\theta)F^{'-1}(Y^*)]M_r + [i_r + c_r]M_y]} \quad (4.35)$$

In the above equation, $g_\theta < 0$ as $g(\theta)$ falls with the rise in θ. Thus, $g_\theta F^{-1}(Y^*) < 0$ implying wage income falls.

Sign of impact of rise in θ on Y^* in (4.35) is ambiguous and depends on the following condition.

$$\frac{dY^*}{d\theta} \gtreqless 0 \text{ if } u \gtreqless [c_w - c_\pi]/[i_u - c_\pi] \quad (4.36)$$

Thus aggregate demand or equilibrium output may rise /fall or remain unchanged with the rise in θ and accordingly there may be an upward/ downward or no shift in IS curve based on the condition in (4.35) specifying the values of u , c_w, c_π and i_u.

As explained earlier, magnitude of Z_y that is ,

$c_\pi + u[i_u - c_\pi] + [c_w - c_\pi - u[i_u - c_\pi]]\, g(\theta)F^{'-1}(Y^*)$ is ambiguous and depends on $u \gtreqless [c_w - c_\pi]/[i_u - c_\pi]$;

Maginitude of the change in Y^* with respect to rise in θ in (4.35) will also depend on the similar condition as above.

This result contradicts with that of the impact of exogenous shift in effort function or rise in θ in the simple fixed - price non - Walrasian model with efficiency wage in absence investment demand in the pre - tax situation as presented in section 3.5.1 of Chapter 3 where impact of similar policies have negative impact on output and employment in *RWDC*. In the simple fixed - price non - Walrasian model with efficiency wage, rise in θ lowers wage income; this affects net consumption demand out of wage income resulting in a fall in effective demand and hence output. But in contrast to this, in the present IS-LM model with efficiency wage, though wage income falls with the rise in θ , net change in demand due to fall in wage income becomes ambiguous and the sign condition of such change depends on the condition involving the values of u , c_w, c_π and i_u. Hence change in aggregate demand or output due to rise in θ also becomes ambiguous and depends on the above factors.

If there is a rise/fall in output or income, a spill – over effect is generated where net consumption and investment demand increases as, $Z_y > 0$ that is $c_\pi + u[i_u - c_\pi] + [c_w - c_\pi - u[i_u - c_\pi]]\, g(\theta)F'^{-1}(Y^*) > 0$ in the denominator of (4.35) leading to further rise/fall in output. However, the magnitude of such change again depends on the value of u (following the condition in (4.31)) as explained in previous section (4.4.1.1).

Again the rise/fall in Y^* would increase/lower the transaction demand for money creating excess demand in the money market and hence rate of interest rises/falls. Further spill - over effect would result in a fall/rise in investment demand which partially crowds out the initial change in output. Eventually a new equilibrium output and rate of interest is attained through multiplier process via spiral effect from one market to the other. But magnitude of change in output due to rise in θ depends on the value of the factors like u, c_w, c_π and i_u.

Proposition 2

- *In the present IS – LM model with efficiency wage, policies resulting in a positive shift in effort function may have positive /negative or no impact on output and employment.*
- *Both the sign condition and the magnitude of such impact depend on a condition specifying the values of (a) the fraction of profit income kept undistributed by the firm, (b) marginal propensities to consume for wage and profit earners and also on (c) investment propensity of the firm.*
- *This result contrasts with that of the simple fixed - price non - Walrasian model with efficiency wage in absence of investment demand in pre labour taxation situation as presented in section 3.5.1 of Chapter 3 where impact of similar policies have negative impact on output and employment in RWDC .*
- *Impact of exogenous shift in effort function on equilibrium output is missing in IS – LM framework of SNWMM (Benassy (1986)) where wage is asymmetrically flexible but is not determined on the basis of efficiency consideration.*

4.4.1 .3 Impact of increase in Government Expenditure

Following equation (4.28), expansion in government expenditure $\hat{g}$ can be derived,

$$\frac{dY^*}{d\hat{g}} = \frac{M_r}{[1-c_\pi-u[i_u-c_\pi]-[c_w-c_\pi-u[i_u-c_\pi]]\, g(\theta)F^{'-1}(Y^*)]M_r+[i_r+c_r]M_y} > 0 \qquad (4.37)$$

In *SNWMM*, government expenditure multiplier in the similar regime

$$\left[\frac{dY^*}{dg}\right]_{KU} = \frac{M_r}{[1-Z_y]M_r+Z_rM_y}$$

In the present IS – LM framework as government expenditure $\hat{g}$ increases, IS curve shifts upward leading to rise in output and fall in rate of interest. As explained earlier there will be a series of spiral effect from commodity to money market and eventually a new

equilibrium would be reached. But unlike *Benassy (1986)* since the magnitude of Z_y depends on the value of u, marginal propensities to consume for wage and profit earners and investment propensity of the firm (same as specified in equation (4.30)), the government expenditure multiplier too is sensitive to the values of *u*.

4.4.1 .4 Impact of Commodity Price Shift

Impact of change in commodity price can be derived from equation (4.28)

$$\frac{dY^*}{dP^*} = \frac{-[M_P[i_r+c_r] + M_r\,[\epsilon\,[\bar{m}/P^{*^2}]]}{[1-c_\pi-u[i_u-c_\pi] - [c_w- c_\pi-u[i_u-c_\pi]]\; g(\theta)F^{'-1}\,(Y^*)]M_r+ [i_r+c_r]M_y} < 0 \qquad (4.38)$$

The above relation implies that fall in commodity price would increase output. Similar to other policy shifts the magnitude of the rise in output depends on the value of *u*.

Proposition 3

- *The demand generating policies like rise in government expenditure and fall in price has positive impact on output and employment.*
- *The magnitudes of these policy multipliers depend on the similar condition as mentioned proposition 1 and 2 involving the values of the factors like (a) fraction of profit income kept undistributed by the firm, (b) marginal propensities to consume for wage and profit earners and also on (c) investment propensity.*

Graphical representation of equilibrium in commodity market in *RWDC* and the impact of demand generating policies like rise in money supply, expansion in government expenditure and fall in commodity price are shown in section 4.5.2.

4.4. 2 Regime with Excess Supply for Labour and Output Market Cleared (*RWODC*)

In the present model commodity price, P is assumed to be asymmetrically flexible and is flexible when it is above the minimum level, $\bar{P}$ .Thus in this regime $P > \bar{P}$ and equilibrium price, P^* is determined by the equality of supply and demand.

Thus the firm in *RWODC* determines optimum real wage and employment without facing any commodity demand constraint similar to *SEWM*.

Real wage, $(W/P)^*$ is solely determined on the basis of effort function (at the point where, μ_W = 1) and accordingly profit maximizing actual employment, L^M is determined. Thus here,

$$(W/P)^* = \omega(\theta), \omega_\theta < 0$$

$$L^M = [F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]/[e((W/P)^*, \theta)] = \alpha(\theta), \alpha_\theta \gtreqless 0$$

Profit income,

$$\Pi/P = \Pi^M/P = F(e((W/P)^*, \theta) L^M) - (W/P)^* L^M$$

Profit maximizing level of output,

$$Y^M = F(F'^{-1}([(W/P)^*]/[e((W/P)^*, \theta)] = S(\theta), S_\theta > 0$$

This regime thus represents *SEWM* with asymmetric price flexibility (that is price flexible upward) rather than complete flexibility where commodity market is in equilibrium. But involuntary unemployment exists in labour market only due to high real wage which is determined entirely by the properties of effort function. Hence any exogenous shift in effort function leading to change in parameter θ would only affect output supply ($S_\theta > 0$).

In *SNWMM* (*Benassy (1986)*) where the firm does not consider efficiency wage consideration, nominal wage, W is blocked at the minimum level while price, P is

flexible as it is assumed to be above the minimum level. The supply function is of the neoclassical type,

$$Y = F(F'^{-1}(W/P)^{*}) = S(W,P), \qquad S_w < 0,\ S_P > 0$$

Here supply of output is sensitive to change in commodity price and nominal wage. Rise in P or fall in W would lower real wage leading to rise in employment and output.

In our present model, optimum efficiency real wage is determined entirely by the properties of effort function. With any change in price, the firm would adjust the nominal wage so as to keep real wage unchanged. Thus complete indexation of wage exists and real wage is rigid. Employment and hence output supply is insensitive to price. That is, $S_P = 0$.

Graphical representations of complete supply curves in IS – LM framework of *Benassy (1986)* as compared to the present study are described in Figure 4.1 of section 4.5.1. It can be seen that supply curves in $P - Y$ plane is positively sloped in *Benassy (1986)* where $S_P > 0$ but horizontal in the present model where $S_P = 0$ in *RWODC*.

In *RWODC* of the present model sales are equal to demand in the commodity market,

$$Y = [(c_w - c_\pi) - u(i_u - c_\pi)][(W/P)^{*} L] - [c_r + i_r]r + [c_\pi(1-u) - ui_u]Y + \varepsilon(\bar{m}/P) + \hat{g}$$
$$= Z(Y, \theta, P, r) + \hat{g}$$

Money or bond market equilibrium determining optimum rate of interest implies,

$$M(Y, r, P) = M_y Y - M_r r + M_P P = m$$

Combining commodity and money (or bond) market equilibrium one can determine aggregate demand, Y^*

$$Y^* = \frac{M_r[c_w - c_\pi - u[i_u - c_\pi]]\,[(W/P)^{*} L^*] + m\,[i_r + c_r] - M_P P[i_r + c_r] + M_r[\hat{g} + \epsilon\,[\bar{m}/P]]}{[1 - c_\pi[1-u] - ui_u]\,M_r + [i_r + c_r]M_y} \qquad (4.39)$$

$$= K(P, m, \theta, \hat{g})$$

In the present model, there is equilibrium in the commodity market where aggregate demand, $K(P, m, \theta, \hat{g}) = \widehat{D}(P)$ intersects supply, $\widehat{S}(\theta)$ and determines equilibrium supply of output, Y^* and price P^*(as shown in Figure 4.3 in section 4.5.3). Optimum values of real wage, $(W/P)^*$ and employment , L^* are determined only on the basis of effort function, that is parameter θ.

Expressions representing equilibrium supply of output, Y^*, optimum values of real wage, $(W/P)^*$, employment, L^* , wage income , $[(W/P)^* L^*]$ and are as following,

$Y^* = F(F'^{-1}([(W/P)^*]/[e((W/P)^*, \theta)] = S(\theta)$, $S_\theta > 0$ and $S_P = 0$.

$(W/P)^* = \omega(\theta),\ \omega_\theta < 0$

$L^* = [F'^{-1}((W/P)^*/[e((W/P)^*, \theta)]/[e((W/P)^*, \theta)] = \alpha(\theta)$, $\alpha_\theta \gtreqless 0$

$[(W/P)^* L^*] = \vartheta(\theta),\ \vartheta_\theta \gtreqless 0$

$P = P^*$

4.4.2.1 Impact of Fiscal and Monetary Policies

Impact of rise in money supply and government expenditure on equilibrium output and price can be derived as

$$\frac{dY^*}{d\hat{g}} = 0$$

$$\frac{dY^*}{dm} = 0$$

$$\frac{dP^*}{d\hat{g}} = \frac{M_r}{M_P[i_r + c_r] + M_r[\varepsilon\,[\bar{m}/P^{*2}]]} > 0$$

$$\frac{dP^*}{dm} = \frac{[i_r + c_r]}{M_P[i_r + c_r] + M_r[\varepsilon\,[\bar{m}/P^{*2}]]} > 0$$

Since output supply is insensitive to price ($S_P = 0$) due to rigid efficiency real wage, fiscal and monetary policies become neutral. Rise in demand due to expansion in $\hat{g}$ and

m would be completely crowded out by fall in private consumption demand due to rise in price.

In SNWMM (Benassy (1986)) (without efficiency wage consideration) demand generating policies are effective; but in the present model in presence of efficiency wage relationship, both monetary and fiscal policies become ineffective in this regime.

Even if price is flexible upward (asymmetrically flexible), money becomes neutral similar to the *SEWM* (*Solow (1979) and Yellen (1984)*) where price is assumed to be completely flexible and the firm faces no commodity demand constraint.

Proposition 4

- *In the present IS – LM model with efficiency wage, demand generating policies like rise in money supply and government expenditure are ineffective in the regime with goods market cleared and excess supply of labour (RWODC).However rise in commodity price crowds out increase in demand due to such policy implementation.*
- *This is a contrast to the IS – LM model of SNWMM (Benassy (1986) without efficiency wage consideration) where such policies are effective in the similar regime.*
- *In our model since price is flexible upward (asymmetrically flexible), both monetary and fiscal policies become ineffective similar to SEWM ((Solow (1979) and Yellen (1984)) where complete price flexibility exists but the firm faces no commodity demand constraint as in RWODC of the present model.*

4.4.2.2 Impact of Exogenous Shift in Effort Function

Any policy implementation that results in exogenous upward shift in effort function, that is increase in parameter, θ, would affect optimum real wage , output and employment.

Supply of output, $Y^* = S(\theta)$

Aggregate demand for output, $Y^* = K(P, m, \theta, \hat{g})$ (following (4.39))

And, $P = P^*$

As explained in section 3.2 .1 .1.1 of Chapter 3 (following equation (3.12))

$$\frac{dY^*}{d\theta} = S_\theta > 0 \tag{4.40}$$

Hence we can derive,

$$\frac{dP^*}{d\theta} = \frac{M_r[c_w - c_\pi - u[i_u - c_\pi]]\ \vartheta_\theta - S_\theta[[1 - c_\pi[1-u] - ui_u]M_r + [i_r + c_r]M_y]}{[M_P[i_r + c_r] + M_r[\epsilon\ [\bar{m}/P^{*2}]]} \gtreqless 0 \tag{4.41}$$

As explained in section 3.2 .1 .1.1 of Chapter 3, optimum real wage falls and the change in optimum actual employment is ambiguous with the increase in θ in *RWODC*. Thus change in wage income also becomes ambiguous, that is $\vartheta_\theta \gtreqless 0$ and so as the change in consumption demand out of wage income, $[c_w - c_\pi - u[i_u - c_\pi]]\vartheta_\theta$.

If wage income rises/falls or remains unchanged with the rise in θ, $\vartheta_\theta \gtreqless 0$, consequently household demand rises/falls or remains unchanged according as $[c_w - c_\pi]\vartheta_\theta \gtreqless 0$ where $c_w > c_\pi$. But in presence of undistributed profit income, investment demand falls/increases or remains unchanged according as, $-u[i_u - c_\pi]\vartheta_\theta \lesseqgtr 0$, where, $i_u > c_\pi$.

Here shift in net demand that is, $[c_w - c_\pi - u[i_u - c_\pi]]\vartheta_\theta$, due to rise/fall or unchanged wage income with the rise in θ, becomes ambiguous.

Thus impact of increase in θ on commodity price which depends on the shift in net commodity demand, $[c_w - c_\pi - u[i_u - c_\pi]]\vartheta_\theta$ (as can be seen from equation (4.41) and can be explained in terms of three following cases,

I. $[c_w - c_\pi - u[i_u - c_\pi]]\vartheta_\theta > 0$ when

i) $\vartheta_\theta > 0$ and $u < [c_w - c_\pi]/[i_u - c_\pi]$ that is $[c_w - c_\pi - u[i_u - c_\pi]] > 0$ or

ii) $\vartheta_\theta < 0$ and $u > [c_w - c_\pi]/[i_u - c_\pi]$,that is $[c_w - c_\pi - u[i_u - c_\pi]] < 0$

Here net demand from wage income increases with the rise θ and aggregate demand curve shifts upward. Following (4.40), as supply curve shifts upward with the rise in θ , ($S_\theta > 0$) and further in the above case demand curve shifts upward, the impact on commodity price is ambiguous in (4.41), that is, $\frac{dP^*}{d\theta} \gtreqless 0$.

II. $[\, c_w - c_\pi - u[i_u - c_\pi]]\, \vartheta_\theta < 0$ when

i) $\vartheta_\theta < 0$ and $u < [c_w - c_\pi] / [i_u - c_\pi]$ that is $[c_w - c_\pi - u[i_u - c_\pi]] > 0$ or

iii) $\vartheta_\theta > 0$ and $u > [c_w - c_\pi] / [i_u - c_\pi]$,that is $[c_w - c_\pi - u[i_u - c_\pi]] < 0$

In this above case, net demand from wage income falls with the rise θ implying $[\, c_w - c_\pi - u[i_u - c_\pi]]\, \vartheta_\theta < 0$ resulting in a downward shift in aggregate demand curve. In (4.41) since $S_\theta > 0$, commodity price falls, that is, $\frac{dP^*}{d\theta} < 0$.

III. $[\, c_w - c_\pi - u[i_u - c_\pi]]\, \vartheta_\theta = 0$ when

i) $\vartheta_\theta = 0$ and $u < [c_w - c_\pi] / [i_u - c_\pi]$ that is $[c_w - c_\pi - u[i_u - c_\pi]] \gtreqless 0$ or

ii) $u = [c_w - c_\pi] / [i_u - c_\pi]$, that is $[c_w - c_\pi - u[i_u - c_\pi]] = 0$ and $\vartheta_\theta \gtreqless 0$

Here net demand from wage income remains unchanged and hence there is no shift in aggregate demand curve with the rise in θ. Since, $S_\theta > 0$, supply curve shifts upward and in (4.41) , $\frac{dP^*}{d\theta} < 0$ implying that commodity price falls.

Proposition 5

- *Though in the regime of excess supply of labour with goods market cleared (RWODC), both monetary and fiscal policies are ineffective, but policies that shift effort of the workers upward have positive impact on supply of output ,however impact on employment is ambiguous same as in the simple fixed – price non - Walrasian model formulated in Chapter 3.*

- *Here the impact of such policies on price of the commodity is ambiguous.*

- *Rise in parameter, θ, has positive impact on output but its impact on aggregate demand is ambiguous which depends on the factors related to direction of change in wage income, the fraction of profit income kept undistributed by the firm, investment propensity of the firm and marginal propensities to consume for wage and profit earners.*

- *If aggregate demand dose not shift at all or shifts downward, commodity price falls; but if aggregate demand shifts upward, price may rise /fall or remain unchanged depending on the relative magnitudes of shift in supply and demand schedule.*

- *Impact of exogenous shift in effort function on equilibrium output is missing in IS – LM framework of SNWMM (Benassy (1986)) where wage is not determined on the basis of efficiency consideration.*

Impact of different demand generating policy implementations like rise in money supply, expansion in government expenditure in *RWODC* is graphically explained in Figure 4.3 of section 4.5.3. Impact of exogenous shift in effort function on output and price of the same regime is also represented graphically in Figure 4.4 in section 4.5.4.

4.4. 3 *RWODC* in Case of Partial Rigidity of Wage

Actual average cost of labour may involve some fixed costs such as hiring and training cost, some taxes (labour taxation like specific tax), traffic fees , housing outlays etc. which are not flexible and hence nominal wage is partially rigid (*Lin and Lai (1998)).* These are fixed costs to the firm for employing a worker. Any change in commodity price would affect real value of the fixed cost and hence real wage becomes sensitive to price. Thus wage is partially rigid and complete indexation of wage is absent. Since in this IS – LM model we do not consider the incidence of any tax, it is assumed that the presence of partial rigidity of wage is due to any of the above factors other than specific tax as mentioned above. It can be observed that demand management policies are effective in *RWODC* when there is partial rigidity of wage and complete indexation is absent.

The optimization process of the firm in presence of such fixed type costs, φ is similar to that in presence of specific tax in *RWODC* as explained in section (3.6.2.1) of Chapter 3.Thus real wage increases and employment falls with the introduction of φ. However, in presence of the fixed cost, real wage falls and employment increases with the increase in price.

Optimum real wage, $(W/P)^*_{\varphi} = \omega(\theta, P, \varphi)$, $\quad \omega_\theta < 0\ , \omega_P < 0$ and $\omega_\varphi > 0$

Optimum actual employment in this case

$$L_{\varphi}{}^{M} = \frac{F'^{-1}(\,[(W/P)^*_{\varphi} + \varphi] \,/\, [e((W/P)^*_{\varphi}, \theta)]\,)}{e((W/P)^*_{\varphi}, \theta)} = \alpha(\theta, P, \varphi) \tag{4.42}$$

Where, $\alpha_\theta \gtreqless 0\ , \alpha_P > 0 \quad \alpha_\varphi < 0$

Wage income, $[(W/P)^*_{\varphi} L^{M}{}_{\varphi}] = \vartheta(\theta, P, \varphi)\ , \vartheta_\theta \gtreqless 0,\ \vartheta_P \gtreqless 0$ and $\vartheta_\varphi \gtreqless 0$

Accordingly, optimum level output produced is specified as,

$$Y_{\varphi}{}^{M} = F(F^{'-1}(\,[(W/P)^*_{\varphi} + \varphi] \,/\, [e((W/P)^*_{\varphi}, \theta)]\,) = S(\theta, P, \varphi) \tag{4.43}$$

$S_P > 0\ , S_\theta > 0, S_\varphi < 0$

Optimum profit,

$$\Pi^{M}_{\varphi}/P = Y^{M}{}_{\varphi} - [(W/P)^*_{\varphi} + \varphi] L^{M}{}_{\varphi} \tag{4.44}$$

Aggregate demand in presence of fixed cost,

$$Y^{c}_{\varphi} = c_w\,[[(W/P)^*_{\varphi} L_{\varphi}{}^{M}] + c_\pi[[\Pi^{M}_{\varphi}/P] - u\,[\Pi^{M}_{\varphi}/P]] + i_u u\,[\Pi^{M}_{\varphi}/P] - c_r r - i_r r + \epsilon\,[\bar{m}/P] + \hat{g} \tag{4.45}$$

In this regime price is determined by the condition of equality of supply and demand in the commodity market. Sales equals demand in the goods market,

$$Y^{c}_{\varphi} = Y^{M}{}_{\varphi} = Y$$

The IS equation implies,

$$Y = c_w\,[[(W/P)^*_{\varphi}\,L_{\varphi}{}^{M}] + c_\pi[[\Pi^M_\varphi/P] - u\,[\Pi^M_\varphi/P]] + i_u u\,[\Pi^M_\varphi/P] - c_r r - i_r r + \epsilon\,[\overline{m}/P] + \hat{g} \quad (4.46)$$

The money or bond market equilibrium determining optimum rate of interest, implies,

$$M(Y, r, P) = M_y Y - M_r r + M_P P = m \quad (4.47)$$

From IS and LM curve in (4.46) and (4.47) aggregate demand function can be derived

$$\boldsymbol{Y^*} = \frac{\boldsymbol{M_r[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta(\theta,P,\varphi) - \varphi\,\alpha\,(\theta,P,\varphi)\,[c_\pi[1-u] - ui_u] + \varepsilon\,[\overline{m}/P] + \hat{g}] - M_P\,P\,[i_r + c_r] + m[i_r + c_r]}}{\boldsymbol{[1 - c_\pi[1-u] - ui_u]M_r + [i_r + c_r]M_y}} \quad (4.48)$$

$$= K_\varphi(P, m, \theta, \hat{g}, \varphi)$$

Supply of output, $Y^* = S(\theta, P, \varphi)$; at equilibrium, $P = P^*$

4.4. 3.1 Impact of Increase in Money Supply

From we can derive the impact of increase in money supply on output and commodity price.

$$\frac{dY^*}{dm} = \frac{S_P K_{\varphi m}}{S_P - K_{\varphi P}} > 0 \quad (4.49)$$

$$\frac{dP^*}{dm} = \frac{K_{\varphi m}}{S_P - K_{\varphi P}} > 0 \quad (4.50)$$

Where, $K_{\varphi m} = \frac{[i_r + c_r]}{[1 - c_\pi[1-u] - ui_u]M_r + [i_r + c_r]M_y} > 0$, $S_P > 0$

$$K_{\varphi P} = \frac{M_r[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P - \varphi\,\alpha_P[c_\pi[1-u] + ui_u] - \varepsilon\,[\overline{m}/P^{*2}] - M_P[i_r + c_r]}{[1 - c_\pi[1-u] - ui_u]\,M_r + [i_r + c_r]\,M_y} < 0 \quad (4.51)$$

$K_{\varphi P}$ represents the impact of a change in demand due to change in price, which is assumed to be negative. However, here this condition is not always satisfied. To get the sign condition of $K_{\varphi P}$, let us consider the individual term of the expression in (4.51).

First of all, we have already seen that in presence of fixed cost both real wage and employment are sensitive to price where wage income may rise, fall or remain unchanged with the rise in price, that is, $\vartheta_P \gtreqless 0$.

Secondly, depending on the value of u, that is whether $u \gtreqless [c_w - c_\pi]/[i_u - c_\pi]$; demand from wage income may rise, fall or remain unchanged, according as $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P \gtreqless 0$

Thirdly, since φ imply fixed cost of employing a worker, expenditure on fixed cost increases as employment increases with the rise in price, $\alpha_P > 0$. Thus profit income falls affecting both consumption demand of the profit earners in the household and investment demand of the firm, that is, $\varphi\alpha_P[c_\pi[1-u] - ui_u] < 0$.

Fourthly, as $M_P > 0$, transaction demand for money increases (in liquid form), with rise in commodity price; at the given level of money supply , speculative demand for money would fall to maintain money market equilibrium leading to rise in rate of interest. This would lower investment and consumption demand, thus, $M_P[i_r + c_r] < 0$.

Finally, with the rise in price, value of money holding or assets falls and the demand from it falls, $\varepsilon\,[\bar{m}/P^{*2}] < 0$

Since all the terms in the numerator is negative other than $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P$, that is the change in net demand from wage income is crucial determining factor of the sign condition of $K_{\varphi P}$.

In the numerator of the expression in (4.51), if the net demand from wage income falls or remains unchanged with the rise in price, that is $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P \leq 0$ and since demand from all other sources falls , aggregate demand falls with rise in price, ; $K_{\varphi P} < 0$.

But if the net demand from wage income increases, $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P > 0$, in order to get the condition that change in aggregate demand be negative , $K_{\varphi P} < 0$, we need to assume,

$$\varphi\,\alpha_P[c_\pi[1-u] + ui_u] + \varepsilon\,[\bar{m}/P^{*2}] + M_P[i_r + c_r] > M_r\,[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P$$

Since the magnitude of $K_{\varphi P}$ depends on change in aggregate demand from wage income, that is $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P\,] \gtreqless 0$, magnitude of the multiplier, $\frac{dY^*}{dm}$ in (4.49) and the impact of rise in money supply on price, $\frac{dP^*}{dm}$ in (4.50) depends on the sign of $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P$, that is on the values of u, c_w, c_π, i_u and the sign condition of change in wage income with respect to price, that is, $\vartheta_P \gtreqless 0$.

4.4. 3.2 Impact of Increase in Government Expenditure

The impact of increase in government expenditure can be derived as,

$$\frac{dY^*}{d\,\hat{g}} = \frac{S_P K_{\varphi g}}{S_P - K_{\varphi P}} > 0 \tag{4.52}$$

$$\frac{dP^*}{d\,\hat{g}} = \frac{K_{\varphi g}}{S_P - K_{\varphi P}} > 0 \tag{4.53}$$

Where, $K_{\varphi g} = \frac{M_r}{[1 - c_\pi[1-u] - ui_u]M_r + [i_r + c_r]M_y} > 0$, $S_P > 0$

$$K_{\varphi P} = \frac{M_r[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P - \varphi\alpha_P[c_\pi[1-u] + ui_u] - \varepsilon\,[\bar{m}/P^{*2}] - M_P[i_r + c_r]}{[1 - c_\pi[1-u] - ui_u]M_r + [i_r + c_r]M_y} < 0$$

Here also the sign condition of $K_{\varphi P}$ is not obvious as in the earlier case where we talked about the impact of change in money supply. It is assumed that $K_{\varphi P} < 0$. For this we need to assume,

$$\varphi\,\alpha_P[c_\pi[1-u] + ui_u] + \varepsilon\,[\bar{m}/P^{*2}] + M_P[i_r + c_r] > M_r\,[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P$$

Similar to the case of change in money supply, the magnitude of $K_{\varphi P}$ and hence $\frac{dY^*}{d\,\hat{g}}$ and $\frac{dP^*}{d\,\hat{g}}$ in (4.52) and (4.53) respectively depends on the sign of $[[c_w - c_\pi] - u[i_u - c_\pi]]\,\vartheta_P$, that is on the value of u, the fraction of undistributed profit income and the sign condition of change in wage income due to change in price , that is $\vartheta_P \gtreqless 0$.

Proposition 6

- *Impact of monetary and fiscal policies are effective in RWODC in the IS – LM framework in presence partial wage rigidity unlike the similar policy impact in RWODC with full wage rigidity.*
- *The magnitude of the policy multipliers depend on the sensitivity of aggregate demand with respect to price which in turn depends on the condition related to values of (a) the fraction of undistributed profit income, (b) marginal propensities to consume for wage and profit earners,(c) investment propensity of the firm and also on (d) the direction of change in wage income with price.*
- *Such type of partial wage rigidity is not considered in SNWMM of Benassy (1986).*

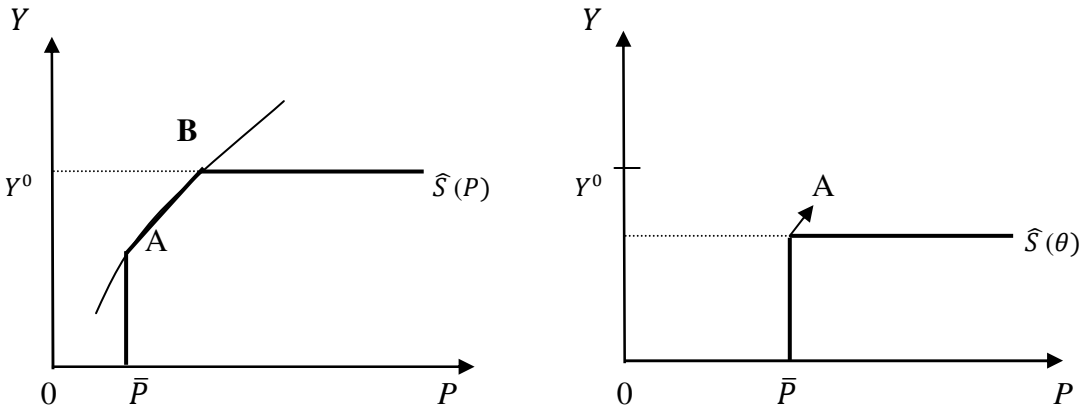
The commodity market equilibrium and the impact of various demand generating policies in the above case of IS – LM model with efficiency wage and partial wage rigidity is represented graphically in Figure 4.5 of section 4.5.5.

4.5 Graphical Representation

In this section presents the graphical representation of regime classification and efficacy of different policy implications in each regime of the present model which are then compared with that of *Benassy (1986)*. The next sub section considers a graphical representation of complete supply curve and draws the comparison of the present models with that of *Benassy (1986).*

4.5.1 Supply Curve

In the panel (a) of Figure (4.1) the complete shape of supply curve in IS - LM framework of *Benassy (1986)* is represented where output, Y and commodity price, P is represented in vertical and horizontal axis respectively. Here supply curve is denoted by $\widehat{S}(P)$.



Panel (a)
Supply curve with asymmetric price flexibility in IS – LM model of *Benassy (1986)* without efficiency wage.

Panel (b)
Supply curve with asymmetric price flexibility in the present IS – LM model with efficiency wage.

Figure 4.1 Supply curves in *Benassy (1986)* and the present IS – LM framework

There are three parts in the supply curve. The vertical part, $\bar{P}$A represents the equation where, $P = \bar{P}$, upward sloping, AB when supply of output, $Y = F\left(F'^{-1}(\bar{W}/P)\right) = S(P, W)$, (here price is flexible above $\bar{P}$ but nominal wage, W is fixed at the minimum) and horizontal above B when output reaches the Walrasian level that is $Y = Y^0$.

In panel (b) of Figure (4.1), $\widehat{S}(\theta)$ represents the complete shape of supply curve in $P - Y$ space in the present IS – LM model with efficiency wage.

In the present model, supply of output, Y depends only on parameter θ, the shift parameter corresponding to the effort function, that is $Y = \widehat{S}(\theta)$

As seen in panel (b) of Figure (4.1), supply curve has two parts. Supply curve has vertical part, $\bar{P}$A where P is fixed at its minimum level, $\bar{P}$. This is similar to the shape of the supply curve at the fixed minimum level of price in *Benassy (1986)* as shown in panel (a) of Figure (4.1).When P is flexible above $\bar{P}$ and since complete indexation of wage exists due to the presence of efficiency wage in the present model, supply of output is insensitive to price change ($S_P = 0$). Supply curve is horizontal above $\bar{P}$ unlike *Benassy (1986)* where it is positively sloped, AB ($S_P > 0$). Thus positively sloped part AB of supply curve in *Benassy (1986)* as represented in panel (a) of Figure 4.1 is not

feasible in the present model. Moreover due to the presence of efficiency wage, involuntary unemployment is persistent and hence Walrasian level of output, Y^0 is not attainable and hence level of output always lies below Y^0.

4.5.2 Equilibrium in *RWDC* and Impact of Demand Generating Policies

If the price is assumed to be fixed at the minimum level, $\bar{P}$ there is excess supply in both commodity and labour market that is the firm faces constraint in the commodity market and the situation is denoted as regime with demand constraint (*RWDC*).

Panel (a) and (b) in Figure 4.2 represent commodity market equilibrium in *RWDC* in IS – LM framework of *Benassy (1986)* and the present case respectively.

In the present model, aggregate demand and supply curve are denoted as,

$Y = K(P, m, \theta, \hat{g}) = \widehat{D}(P)$ and $Y = \widehat{S}(\theta)$ respectively.

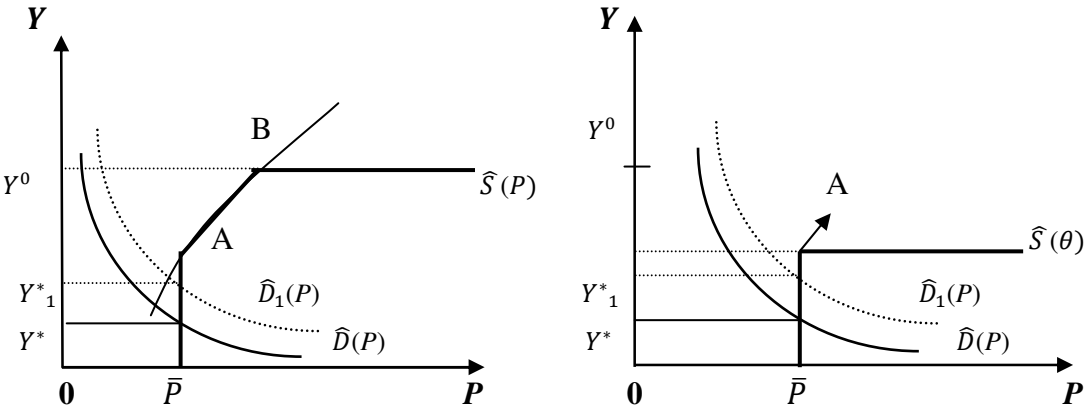


Figure 4.2 Equilibrium in *RWDC* and shift in demand curve

In *RWDC* of the present model, since P is at its minimum $\bar{P}$; the supply curve has a vertical part, $\bar{P}$A as shown in panel (b). Equilibrium output, Y^* is determined where demand curve $\widehat{D}(P)$ intersects at the vertical part of the supply curve, $\widehat{S}(\theta)$.With demand generating policies, like rise in money supply and government expenditure and fall in price , demand curve $\widehat{D}(P)$ shifts upward to $\widehat{D}_1(P)$, hence optimum output increases from

Y^* to Y^*_1 in panel (b). Moreover in the present IS – LM model with efficiency wage, increase in θ may also shift aggregate demand curve upward in *RWDC* depending on the condition involving fraction of profit income kept undistributed by the firm, marginal propensities to consume for wage and profit earners and also on investment propensity.

In the similar regime in IS – LM framework of *Benassy (1986)*, aggregate demand and supply function are denoted as $Y = K(P, m, \hat{g}) = \widehat{D}(P)$ and $Y = S(P, W) = \hat{S}(P)$ respectively.

Both aggregate demand and supply function is independent of θ as efficiency wage consideration is absent in *Benassy (1986)*. As represented in panel (a) of Figure 4.2, at the fixed minimum price $\bar{P}$ supply curve has vertical part, $\bar{P}$A and equilibrium output is determined at Y^* where demand curve, $\widehat{D}(P)$ intersects at the vertical part of the supply curve, $\widehat{S}(P)$ similar to the present model. Impact of demand generating policies would shift demand curve from $\widehat{D}(P)$ to $\widehat{D}_1(P)$ and output level increases from Y^* to Y^*_1 in panel (a). Since demand curve is insensitive to θ, scope of the policies that shift effort of the workers or increase θ is missing in *Benassy (1986)*.

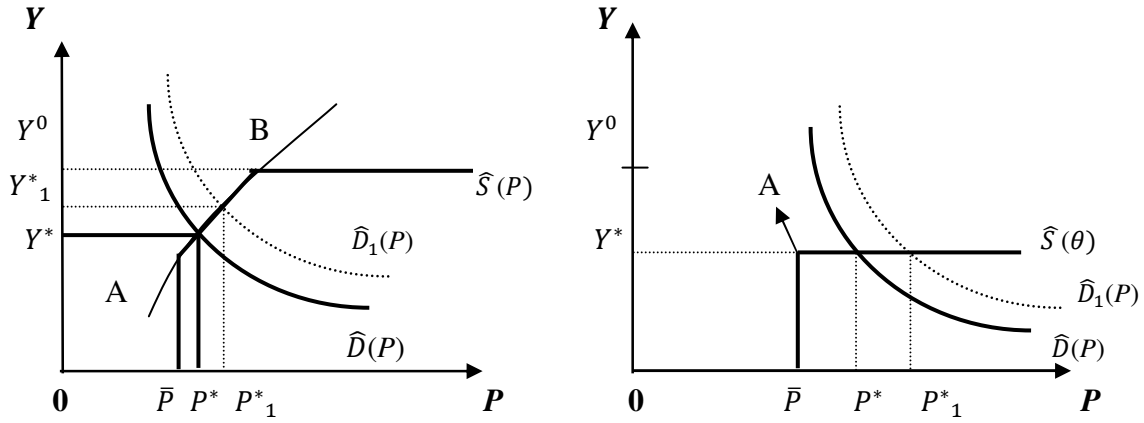
4.5.3 Equilibrium in *RWODC* and Impact of Demand Generating Policies

In Figure 4.3 panel (a) and (b) provide diagrammatic representation of commodity market equilibrium in *RWODC* in IS - LM framework of *Benassy (1986)* and the present model respectively.

If commodity price is above the minimum level, $\bar{P}$, it is flexible (due to the assumption of asymmetric price flexibility) and commodity market is always cleared. In the present model there is persistence involuntary due to the presence of efficiency wage. We define the situation where there is excess supply in the labour market and equilibrium in the commodity market, as the regime without demand constraint (*RWODC*).

In Figure (4.3) aggregate demand and supply curve are denoted as $\widehat{D}(P)$ and $\widehat{S}(\theta)$ respectively.

Here, $Y = K(P, m, \theta, \hat{g}) = \widehat{D}(P)$ and supply curve is, $Y = \widehat{S}(\theta)$.



Panel (a) **Panel (b)**

Figure 4.3 Equilibrium in *RWODC* and shift in demand curve

In *RWODC* of the present model supply curve has a horizontal part (where output is insensitive to price in presence of efficiency wage), hence equilibrium P^* is determined at the point where demand schedule, $\widehat{D}(P)$ intersects at the horizontal part of supply curve, $\widehat{S}(\theta)$ .Equilibrium output, Y^* is determined on the basis of the effort function only This is shown in panel (b) of Figure 4.3.

With fiscal and monetary policies like rise in m or $\hat{g}$ demand curve $\widehat{D}(P)$ shifts to $\widehat{D}_1(P)$; as a result equilibrium output remains unchanged but commodity price increases from P^* to P^*_1 as shown in panel (b) of Figure (4.3) .Thus demand generating policies are effective in the present regime.

The above result can be contrasted to *Benassy (1986)* given in Panel (a) in Figure (4.3) where supply curve is positively sloped as supply of output is sensitive to price in absence of efficiency wage consideration.

In the similar regime of *Benassy (1986),* equilibrium price P^* and output Y^* is determined by the intersection of demand curve denoted by $Y = K(P, m, \hat{g}) = \widehat{D}(P)$ and supply curve, $Y = S(P, W)$.

In *Benassy (1986)*, with monetary and fiscal policies demand curve shifts upward from $\widehat{D}(P)$ to $\widehat{D}_1(P)$ in panel (a) of Figure (4.3).This raises equilibrium output level from Y^* to Y^*_1 and equilibrium price from P^* to P^*_1. Hence demand generating policies are effective in the similar regime of IS – LM framework of *Benassy (1986)* where efficiency wage consideration is absent.

4.5.4 Impact of Exogenous Shift in Effort Function in *RWODC*

In the present model, aggregate demand schedule, $Y = K(P, m, \theta, \hat{g}) = \widehat{D}(P)$ and supply schedule, $Y = \widehat{S}(\theta)$. As discussed earlier in the theoretical section of the present study, both demand and supply schedules are sensitive to parameter θ related to effort of the workers. Policies that lead to rise in θ implying upward shift in effort function shifts supply curve upward (as explained in section 3.2 .1 .1.1 of Chapter 3) but aggregate demand schedule may shift upward/downward or remain unchanged depending on the condition related to relative magnitudes of fraction of profit income kept undistributed by the firm, marginal propensities to consume for wage and profit earners and also on investment propensity (as explained in section 4.4.1 .2 of the present chapter).

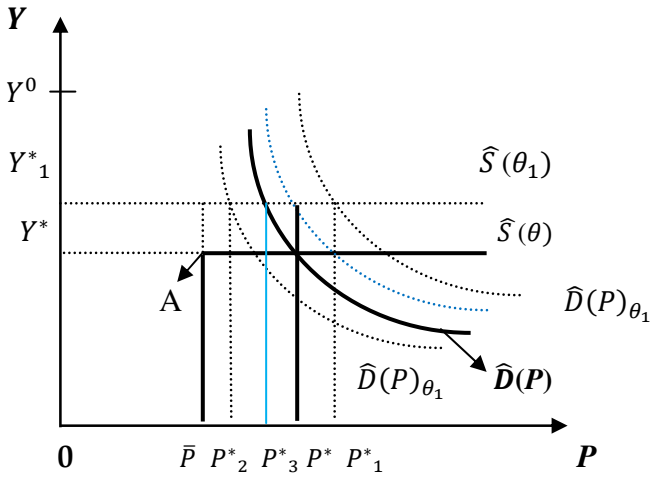


Figure 4.4 Impact of shift in effort function *RWODC*

In Figure 4.4 we represent the commodity market equilibrium in *RWODC* of the present IS – LM model and the impact of upward shift in effort function. Y^* and P^* represent initial level of equilibrium output and commodity price respectively that are determined by the intersection of aggregate demand curve, $\widehat{D}(P)$ and supply curve, $\widehat{S}(\theta)$ in Figure 4.4.

Upward shift in effort function due to any exogenous policy implementation implies rise in parameter θ to θ_1.This shifts supply curve, $\widehat{S}(\theta)$ upward to $\widehat{S}(\theta_1)$ leading to a rise in supply of output from Y^* to Y^*_1; again as mentioned above, aggregate demand curve, $\widehat{D}(P)$ may rise or fall to $\widehat{D}(P)_{\theta_1}$and also may remain unchanged at $\widehat{D}(P)$ as shown in Figure 4.4.

As mentioned above supply of output increases with rise θ but change in commodity price is ambiguous and depends on the direction of shift in aggregate demand curve. Equilibrium commodity price would increase or remain unchanged when aggregate demand curve shifts upward but falls when demand curve shifts downward or does not alter. In Figure (4.4), commodity price increases to P^*_1 when aggregate demand curve shifts upward to $\widehat{D}(P)_{\theta_1}$ and falls to P^*_2 when aggregate demand curve shifts downward to $\widehat{D}(P)_{\theta_1}$.

Commodity price remains unchanged at P^* even when aggregate demand curve shifts upward (blue coloured demand curve in Figure (4.4)). Again price may fall to P^*_3 when aggregate demand curve remains unaltered at $\widehat{D}(P)$ but supply curve shifts upward to $\widehat{S}(\theta_1)$ with the rise in θ.

Since in the IS – LM framework of *Benassy (1986)* efficiency wage relationship is not been considered, upward shift in effort function is insignificant.

4.5.5 Impact of Demand Generating Policies in Case of Partial Wage Rigidity in *RWODC*

The IS – LM framework with efficiency wage is extended assuming partially wage rigidity where the firm faces certain fixed cost, φ for employing a worker. The impact of

demand generating policies is then tested in *RWODC*. As argued in the theoretical section (4.4.3), the supply of output is sensitive to commodity price. Rise in price lowers the real value of fixed cost, which in turn affects the real wage. Thus supply curve is positively sloped above the minimum price level, $\bar{P}$ (where commodity price is flexible) in *RWODC* similar to IS – LM framework of *Benassy (1986).*

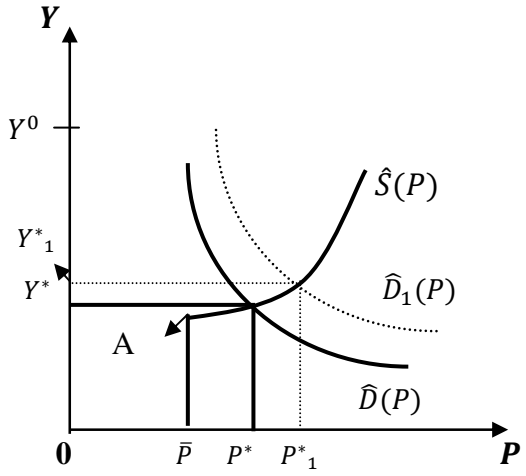


Figure 4.5 Impact of shift in effort function in case of partial wage rigidity in *RWODC*

Here supply curve is denoted as, $Y = S(\theta, P, \varphi) = \hat{S}(P)$ and

Aggregate demand curve as, $Y = K_{\varphi}(P, m, \theta, \hat{g}, \varphi) = \hat{D}(P)$

In Figure (4.5), $\hat{S}(P)$ supply curve, which is positive sloped above the minimum price level, $\bar{P}$ and $\hat{D}(P)$ represent the demand curve. Equilibrium Y^* and P^* are determined by the intersection of $\hat{S}(P)$ and $\hat{D}(P)$.

Both monetary and fiscal policies become effective as upward shift in demand curve from $\hat{D}(P)$ to $\hat{D}_1(P)$ increases both the level of output and price to Y^*_1 and P^*_1 respectively similar to *Benassy (1986).*

Since the present model fails to attain the Walrasian level of output as there is persistent level of involuntary unemployment owing to efficiency wage; the third regime in *Benassy (1986)* where both commodity and labour markets clear is not relevant in the present model. Hence equilibrium output Y^* is always below the Walrasian level Y^0 where the supply curve is horizontal in *Benassy (1986).*

4.6 Conclusion

In this chapter an IS – LM model (with Non -Walrasian feature (*Benassy (1986*)) is formulated by assuming asymmetric price flexibility and considering efficiency wage relationship. In the present IS – LM framework two regimes are relevant, i) excess supply in commodity and labour market (*RWDC*), ii) excess supply in labour market with goods market cleared (*RWDOC).*

For such type of model i) impact of monetary and fiscal policies are considered and contrasted in each regime with that of both *SNWMM* (*Benassy (1986)*) and *SEWM* (*Solow (1979)* and *Yellen (1984)*), ii) the impact of exogenous upward shift in effort function are also examined in each regime which is not considered in *SNWMM* (*Benassy (1986)*) as real wage is not determined on the basis of efficiency wage relationship.

When price is fixed at its minimum level excess supply in the commodity market may persists and again since real wage is determined on the basis of effort function there is persistent involuntary unemployment in the labout market. This situation thus represents excess supply in commodity and labour market or the regime with demand constraint (*RWDC*).In this regime the firm faces commodity demand constraint; optimum real wage is still determined on the basis of efficiency wage relationship but optimum employment depends both on the aggregate demand prevailing in the economy and the effort level corresponding to the optimum real wage. The equilibrium output and rate of interest are determined where both commodity and money market are in equilibrium.

The following are some important results in regard to the impact of monetary and fiscal policies and also the policies that shift effort of the workers in RWDC.

First of all, in the present IS – LM model, demand generating policies like rise in money supply and government expenditure and fall in commodity price has positive impact on output and employment. Thus money is found to be non neutral in the regime with excess supply of labour and output (*RWDC*) at the fixed minimum price level. This result supports S*NWMM* (*Benassy (1986*) but contrasts *SEWM* (*Solow (1979)* and

Yellen (1984)) where money is neutral due to complete wage and price flexibility and scope of excess supply in commodity market is absent.

However the magnitudes of all the policy multipliers in the present model differ from that of S*NWMM* (*Benassy (1986*).Magnitudes of these multipliers in the present case depend on a condition relating to the values of (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. Similar multipliers in S*NWMM* (*Benassy (1986*)) do not depend on any such condition involving the above factors. This arises because in the present model marginal propensities to consume for wage and profit earners in the household are assumed to be different whereas these are assumed to be equal in *Benassy (1986*).

Secondly, in the present IS – LM model with efficiency wage, policies resulting in positive shift in effort function may have positive /negative or no impact on output and employment. The sign condition of this impact on output depends on the similar condition as mentioned above involving the values of the factors like (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. This result contrasts our simple fixed price non - Walrasian model with efficiency wage in absence of investment demand of the firm in Chapter 3 where impact of the policies that shift effort of the workers upward has negative impact on output and employment in the pre labour taxation situation of *RWDC*. In the simple fixed - price model with efficiency wage, exogenous shift in effort of the workers lowers wage income; this affects net consumption demand out of wage income resulting in a fall in effective demand and hence output. But in contrast to this, in the present IS - LM model with efficiency wage, though wage income falls with the upward shift in effort of the workers, net change in demand due to fall in wage income becomes ambiguous and the sign condition of such change depends on the condition involving the values of (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. Hence change in aggregate demand or output due to rise in θ also becomes ambiguous and depends on the above factors.

However policies that shift effort of the workers has no role in the IS – LM framework of *Benassy (1986*) where efficiency wage consideration is absent.

Again in the present model, commodity price is assumed to be flexible above the minimum level and equilibrium in the commodity market prevails. But due to the presence of efficiency real wage, excess supply in the labour market persists. Thus regime without demand constraint (*RWODC*) represents the situation where there is excess supply in the labour market and commodity market clears. In this regime optimum price is determined by the intersection of supply and demand. The equilibrium output and rate of interest are determined where both commodity and money market are in equilibrium.

The following are the results related to the impact of monetary and fiscal policies and also the policies that result in exogenous shift of the effort of the workers in RWODC.

First of all, in the present IS – LM model with efficiency wage, both monetary and fiscal policies are ineffective in this regime. This is due to the fact that, since real wage is fixed on the basis of efficiency of workers, change in commodity price has no impact on real wage. Thus employment and hence output is insensitive to price change. Eventually supply curve has a horizontal part in $P - Y$ space. Any upward shift in aggregate demand schedule due to demand generating policies like rise in money supply and government expenditure keep level of output unchanged. However rise in commodity price crowds out increase in demand due to such policy implementations. This is a contrast to the impact of similar policy shift in the same regime of the IS – LM model of *SNWMM* (*Benassy (1986*)). In absence of efficiency wage relationship in *Benassy (1986*) supply of output is sensitive to price in this regime implying positively sloped supply curve and hence upward shift in demand schedule due to either monetary or fiscal policy has positive impact on output and commodity price. As price is flexible upward (asymmetrically flexible), demand generating policies are ineffective similar to *SEWM* (*Solow (1979) and Yellen (1984)*) where price is assumed to be completely flexible but the firm faces no commodity demand constraint as in *RWODC* of the present model. ***Secondly***, though in the regime of excess supply of labour with goods market cleared, monetary and fiscal policies are ineffective, policies that shift effort of the workers

upward have positive impact on supply of output. However, impact of such shift on aggregate demand is ambiguous and hence change in price of the commodity is also ambiguous. ***Thirdly***, if aggregate demand dose not shift at all or shifts leftward with upward shift in effort of the workers, commodity price falls; but if aggregate demand shifts rightward the change in price depends on the relative magnitude of shift in both supply and demand schedule. ***Finally***, impact of upward shift of effort of the worker on employment is ambiguous.

Moreover the present structure of IS – LM model with efficiency wage in *RWODC* has been extended assuming partial rigidity of wage rather than complete rigidity. It can be observed that the firm may face certain fixed costs (such as hiring and training cost, some taxes (labour taxation like specific tax), traffic fees, housing outlays etc.) for employing a worker. The real value of such costs fall with rise in price and thus real wage too becomes sensitive to price. Supply curve in this particular case is positively sloped. Hence monetary and fiscal policies have positive impact on output and price when real wage is partially rigid. ***The results of this extension are summarised as follows;***

First of all, demand generating policies like rise in government expenditure and money supply are effective in the IS – LM framework with efficiency wage in presence of partial wage rigidity. ***Secondly***, the magnitude of the policy multipliers depend on the sensitivity of aggregate demand with respect to price which in turn depends on the condition related to values of (a) the fraction of undistributed profit income, (b) marginal propensities to consume for wage and profit earners,(c) investment propensity of the firm and also on (d) the direction of change in wage income with price. ***Finally***, such type of partial wage rigidity is not considered in *SNWMM* of *Benassy (1986)*.

CHAPTER - 5

NON – WALRASIAN TWO COUNTRY OPEN ECONOMY MODEL WITH EFFICIENY WAGE

5.1 Introduction

In *Benassy (1986)* a simple non – Walrasian two country open economy macro model has been formulated in which one homogenous good is exchanged, the price of which clears the world market and wage is exogenously given in each country. In this context the effects of various policies on the country pursuing them and their repercussion on the other country has been studied under flexible and fixed exchange rate regimes. The perusal of the literature suggests that there are some extensions of the efficiency wage model in a open economy framework like *Wilson (1990)*, *Lai (1990,1992,1993)* etc, but it has been observed that there is a dearth in the studies on two country open economy model in non – Walrasian framework with efficiency wage.

In the present chapter a non- Walrasian two country open economy macro model (following *Benassy (1986*)) is reformulated by introducing efficiency wage consideration in the system. This is done by assuming that real wage is set endogenously on the basis of efficiency wage relationship only in country 1 (home country), while in country 2 nominal wage is exogenously given in line with *Benassy (1986)*to keep the analysis simple. However, commodity price is flexible[1] and price in each country is determined on the basis of exchange rate as assumed by *Benassy (1986*).Impacts of various policies in the country where such policies are undertaken and their consequence on the other country has been examined under flexible and fixed exchange rate regimes

Various policies undertaken by country 1 (that assumes efficiency wage consideration) have certain impact on its own economy as well as on country 2. Whereas, in *Benassy (1986)* impact of same policies pursuing by either of the country produce

[1]Unlike Chapter 4 minimum price cannot be assumed in the present model since the good is homogenous and exchange rates can change.

identical results both under flexible and fixed exchange rate, in our model with efficiency wage consideration in country 1, similar policies undertaken by country 1 and 2 produces different results. In the present open economy structure, results of different policy impositions in both the countries are examined under fixed and flexible exchange rate system and then contrasted with that of *Benassy (1986)* non - Walrasian open economy model where efficiency wage consideration is absent.

In the present open economy model with efficiency wage, impact of policies that results in exogenous shift in effort of the worker in country 1 has significant effect on its own economy as well as on country 2 in both flexible and fixed exchange rate regimes.Impact of such shift in effort of the worker is analyzed in the present study, it is noted that such policies are irrelevant in country 2 where wage is exogenously fixed and efficiency wage consideration is absent similar to two country open economy model of *Benassy (1986).*

In the next section, the basic model is constructed. Section 5.3 describes open economy equilibrium and different policy implications undertaken both in country 1 and 2 under flexible and fixed exchange rate. Finally section 5.4 draws some conclusion of the model.

5.2 The Model

In the present model two economies are considered in the two countries labeled as 1 and 2 where a unique homogenous output is produced and price of which clears the market in both the countries.

In each country there is a national market for labour. In country 1 real wage is determined on the basis of efficiency consideration and in country 2 nominal wage is exogenously fixed on the basis of *Benassy (1986)*.The internationally traded good is sold at price P_1 in country 1 and at price P_2 in country 2. There are no capital movements within the two countries.

Let ε be the level of exchange rate that is the value of country 2's money in terms of country 1's money .The values of $P_1$and P_2 are related by,

$$P_1 = \varepsilon P_2 \tag{5.1}$$

Since, it is a single good and single market with an exchange rate market where currencies of the two countries are exchanged at the rate, ε. This market always clear, either through flexibility of ε, in case of flexible exchange rates , or through central bank's interventions in case of fixed exchange rate.

The agents of the two countries are firm, household and the government. Since in country 1 real wage and hence employment is determined on the basis of efficiency wage consideration; in order to trace out the impact of efficiency wage on wage income and hence on aggregate demand, two classes in the household: wage and profit earners having different marginal propensities to consume has to be assumed. In the present two country open economy model, it is assumed that household in both the countries consist of similar two classes as supported by the literature like *Kaldor (1955)* (same as in previous two chapters). Moreover marginal propensities to consume for wage and profit earner are different for any particular country although respective values of marginal propensities to consume also vary among the countries.

The behaviour of each agent is explained in following sections.

5.2.1 The Firm

In the present two country open economy structure we assume that firms in country 1 take into account of the efficiency of the workers while determining optimum real wage, while in country 2 nominal wage is exogenously given. Thus the behaviour of the representative firm in country 1 and 2 differs unlike *Benassy (1986)* where wages are given exogenously in both the countries.

In country 1, the representative firm fixes the level of wage rate by considering efficiency wage relationship

$$Y_1 = F_1(eL_1) \qquad F'(eL_1) > 0\,, \qquad F''(eL_1) < 0 \tag{5.2}$$

Where, Y_1 is the output produced; L_1 and e denote the amount of labour hired by the firm and worker's effort respectively in country 1.

As explained in Chapter 3 in section 3.2 .1 , effort , e depends on real wage (W/P) and parameter θ which effect efficiency of the worker (other than real wage) signifying access to and quality of health care ,the quality and affordability of education and training , investment on infrastructure , quality of job environment etc..

Effort function takes the form,

$$e = e(W_1/P_1, \theta) \tag{5.3}$$

Where $e' = de/d(W_1/P_1) > 0$ and $e'' = d^2e/d(W_1/P_1)^2 < 0$

Since, commodity market always clears; the firm is unconstrained in the commodity market. And the optimum solution of the unconstrained firm's problem is similar to that in section 3.2.1 of Chapter 3[2].

It has already been discussed in Chapter 3 that the scope of full employment is absent when the firm determines real wage considering efficiency wage hypothesis. Thus we here assume that unemployment is persistent in country 1 due to the presence of efficiency wage. Here change in nominal price and wage has no impact on output supply, since optimum real wage in country 1, (W_1/P_1) is rigid which is determined only on the basis of effort function and is sensitive only to shift parameter θ.

Thus system of equations in unemployment situation of country 1

Optimum real wage,

$$(W_1/P_1) = \omega_1(\theta),\ \omega_{1\theta} < 0 \tag{5.4}$$

Again optimum employment,

$$L_1 = \left[F'^{-1}(W_1/P_1)/[e\big((W_1/P_1), \theta\big)]\right]/[e((W_1/P_1), \theta)] = \alpha_1(\theta),\quad \alpha_{1\theta} \gtreqless 0 \tag{5.5}$$

[2]Here the firm does not have any investment plans unlike Chapter 4.

And the supply of output,

$$Y_1 = F_1(F_1'^{-1}((W_1/P_1)/(e(W_1/P_1),\theta)) = S_1(\theta) \quad (5.6)$$

Where, $S_{1\theta} > 0$, $S_{1P_1} = 0$, $S_{1W_1} = 0$

In ***country 2***, since wage is exogenously given there may be either unemployment or full employment in the labour market. If there is a situation of unemployment, the firm carries out its neoclassical employment and sales plan if on the other hand full employment prevails; employment, production and sales are fixed at the maximum level.

The representative firm in country 1 faces simple production function in line with *Benassy (1986)*,

$$Y_2 = F_2(L_2) \qquad F'(L_2) > 0, \qquad F''(L_2) < 0 \quad (5.7)$$

Where, Y_2 and L_2 be the output produced and labour hired by the firm in country 2.

5.2.2 The Household

The consumption demand of the representative household in country 1 and 2 are generated both by ***wage and profit earners*** having positive marginal propensities to consume, c_{w1} and $c_{\pi 1}$ in country 1 and c_{w2} and $c_{\pi 2}$ in country 2 respectively. Let C_1 and C_2 be the aggregate consumption demand of the household in country 1 and 2. C_1andC_2 are determined by maximising utility subject to respective budget constraints of wage and profit earners in the household (as explained in the unconstrained case in section 3.2 .2 of Chapter 3) in country 1 and 2.

$$C_1 = [c_{w1} - c_{\pi 1}][(W_1/P_1)\,L_1] - c_{w1}\tau_{w1} + c_{\pi 1}Y_1 - c_{\pi 1}\tau_{\pi 1} + \beta_1\,[\overline{m}/P_1] \quad (5.15)$$

$$C_2 = [c_{w2} - c_{\pi 2}][(W_2/P_2)\,L_2] - c_{w2}\tau_{w2} + c_{\pi 2}Y_2 - c_{\pi 2}\tau_{\pi 2} + +\beta_2\,[\overline{m}/P_2] \quad (5.16)$$

5.2.3 Government

Governments in each country levy taxes,τ_{w1},τ_{w2} on wage earners and $\tau_{\pi1}$, $\tau_{\pi2}$ on profit earners in real terms; their demands for output are g_1 and g_2 respectively.

The aggregate demand ${Y^d}_1$and ${Y^d}_2$in country 1 and 2 respectively are,

$${Y^d}_1 = [c_{w1} - c_{\pi1}][(W_1/P_1)\,L_1] - c_{w1}\tau_{w1} + c_{\pi1}Y_1 - c_{\pi1}\tau_{\pi1} + \beta_1\,[\overline{m}/P_1] + g_1 \quad (5.17)$$

$${Y^d}_2 = [c_{w2} - c_{\pi2}][(W_2/P_2)\,L_2] - c_{w2}\tau_{w2} + c_{\pi2}Y_2 - c_{\pi2}\tau_{\pi2} + +\beta_2\,[\overline{m}/P_2] + g_1 \quad (5.18)$$

5.3 Open Economy Equilibrium

The regime with equilibrium in labour market is absent in country 1 due to the presence of efficiency wage, thus there is only one regime with excess supply of labour. But country 2 has two regimes depending on whether labour market is in excess supply (unemployment) or excess demand (full employment).

As stated earlier, the relation of equivalence for price, that is, "law of one price" as stated in *Benassy (1986)* can be expressed as,

$$P_1 = \varepsilon P_2 \quad (5.19)$$

The definition of balance of payment surplus for country 1 is expressed in terms of the homogenous good and is denoted as,

$$B = Y_1 - C_1 - g_1 \quad (5.20)$$

Surplus of country 1 is however the deficit of country 2.

The equations that determine the non – Walrasian equilibrium in the present open economy structure are as follows.

Total sales of output on the world market, $Y_1 + Y_2$ is equal to the total demand coming from households and governments, that is,

$$Y_1 + Y_2 = [c_{w1} - c_{\pi 1}][(W_1/P_1)\, L_1] - c_{w1}\tau_{w1} + c_{\pi 1}Y_1 - c_{\pi 1}\tau_{\pi 1} + \beta_1 [\bar{m}/P_1] + g_1$$
$$+ [c_{w2} - c_{\pi 2}][(W_2/P_2)\, L_2] - c_{w2}\tau_{w2} + c_{\pi 2}Y_2 - c_{\pi 2}\tau_{\pi 2} + \beta_2 [\bar{m}/P_2] + g_2 \quad (5.21)$$

The supply side equations in each country are different in present model where real wage is determined on the basis of efficiency wage relationship in country 1 while wage is exogenously given in country 2. However supply side equations are identical in open economy model of *Benassy (1986)* where wage is exogenously given in both countries.

The profit maximizing level of output and employment when unemployment situation prevails in country 2,

$$Y_2 = F_2[\, {F_2}'^{-1}(W_2/P_2)] \quad (5.22)$$

$$L_2 = {F_2}'^{-1}(W_2/P_2) \quad (5.23)$$

If full employment persists in country 2,

$$L_2 = L_{02} \quad (5.24)$$

$$Y_2 = Y_{02} = F_2(L_{02}) \quad (5.25)$$

Where, L_{02} level of maximum employment that is labour supply in country 2.

If we set, $S_2\,(P_2, W_2) = F_2[\, {F_2}'^{-1}(W_2/P_2)]$, $S_{2P_2} > 0, S_{2W_2} < 0$

The determination of Y_2 and L_2 can be summarized as,

$$Y_2 = \min\,[S_2\,(P_2, W_2), Y_{02}] \quad (5.26)$$

$$L_2 = {F_2}^{-1}(Y_2) \quad (5.27)$$

Since unemployment always prevails in country 1 due to the presence of efficiency wage, scope of full employment is absent. Thus equations representing supply of output and employment in country 1,

$$Y_1 = S_1\,(\theta) \quad (5.28)$$

$$L_1 = {F_1}^{-1}(\,Y_1)/[e\,((W_1/P_1), \theta)] \quad (5.29)$$

Complete system of the model and the effect of different policy implementations undertaken by each country are considered under flexible and fixed exchange rates.

5.3.1 Flexible Exchange Rates

In the case of flexible exchange rates in absence of capital movements, the balance of payment is identical to the trade balance, that is, $B = 0$.

This transforms the demand - side equation for the output market into two independent equations

$$Y_1 = [c_{w1} - c_{\pi 1}][(W_1/P_1)L_1] - c_{w1}\tau_{w1} + c_{\pi 1}Y_1 - c_{\pi 1}\tau_{\pi 1} + \beta_1 [\bar{m}/P_1] + g_1 \quad (5.30)$$

$$Y_2 = [c_{w2} - c_{\pi 2}][(W_2/P_2)L_2] - c_{w2}\tau_{w2} + c_{\pi 2}Y_2 - c_{\pi 2}\tau_{\pi 2} + \beta_2 [\bar{m}/P_2] + g_2 \quad (5.31)$$

In the system of flexible exchange rate countries are insulated from each other. But unlike *SNWMM* (*Benassy (1986)*), the system of equations in the two countries is not identical since the firms in country 1 are considering efficiency wage relationship while the firms in country 2 are not.

Complete systems of equations concerning each country are,

Country 1:

$$Y_1 = [c_{w1} - c_{\pi 1}]g(\theta){F_1}^{-1}(Y_1) - c_{w1}\tau_{w1} + c_{\pi 1}Y_1 - c_{\pi 1}\tau_{\pi 1} + \beta_1 [\bar{m}/P_1] + g_1 \quad (5.32)$$

$$Y_1 = S_1(\theta)S_{1\theta} > 0,\ S_{1P_1} = 0,\ S_{1W_1} = 0 \quad (5.33)$$

$$L_1 = {F_1}^{-1}(Y_1)/[e((W_1/P_1), \theta)],\quad \alpha_{1\theta} \gtreqless 0$$

Wage income, $[(W_1/P_1)\, L_1] = g(\theta){F_1}^{-1}(Y_1)$

Where, wage cost per efficiency unit, $(W_1/P_1)/[(e(W_1/P_1), \theta)] = g(\theta)$

$\varepsilon = P_1/P_2$

Country 2:

$$Y_2 = (c_{w2} - c_{\pi 2})(W_2/P_2) F_2^{-1}(Y_2) - c_{w2}\tau_{w2} + c_{\pi 2}Y_2 - c_{\pi 2}\tau_{\pi 2} + \beta_2(\overline{m}/P_2) + g_2 \quad (5.34)$$

$$Y_2 = \min [S_2(P_2, W_2), Y_{02}] \ , \ S_{2P_2} > 0, S_{2W_2} < 0 \quad (5.35)$$

$$L_2 = F_2^{-1}(Y_2) \ , \alpha_{2P_2} > 0, \alpha_{2W_2} < 0$$

Wage income, $[(W_2/P_2) L_2] = (W_2/P_2) F_2^{-1}(Y_2)$

$$\epsilon = P_1/P_2$$

The basic difference between the two countries lies in the fact that in country 1 real wage is rigid on the basis of efficiency wage relationship where as in country 2 it is not. Hence in country 1 output supply is insensitive to change in nominal price and wage but depends only on parameter θ that causes exogenous shift in the effort of the workers (as explained in section 3.5.1 of Chapter 3). Moreover in country 2, rise in nominal price and wage has positive and negative impact on output supply respectively.

In the present model, increase in price leads to depreciation of the currency.Considering the unemployment situation, all relevant multipliers are determined and compared with the similar multipliers in the case of fixed exchange rate.Since the system of equations in country 1 is different from country 2 in the present model; nature of the policy multipliers will not be identical in both the countries. In contrast to this, in *SNWMM* (*Benassy (1986)*), the nature of the impact of different policies on demand, production and employment are identical in both the countries.

However results of different policies under flexible exchange rate without capital movements are similar to the closed economy.

5.3.1.1 Impact of Keynesian Policies in Country 2

Since the firm in country 2 do not consider efficiency wage relationship, demand management policies in country 2 are effective which matches with the non – Walrasian two country open economy model of *Benassy (1986)*. But magnitude of the multiplier

differs due to the assumption of different marginal propensities to consume for wage and profit earners. This can be seen as the expansion in government expenditure (g_2) or fall in income taxes of wage and profit earners (τ_{w2} , $\tau_{\pi 2}$) in country 2 is derived from (5.34) and (5.35).

$$\frac{dY_2{}^*}{dg_2} = \frac{S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} > 0$$

$$\frac{dY_2{}^*}{d\tau_{w2}} = \frac{-c_{w2}\ S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} < 0$$

$$\frac{dY_2{}^*}{d\tau_{\pi 2}} = \frac{-c_{\pi 2}\, S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} < 0$$

$$\frac{dP_2{}^*}{dg_2} = \frac{S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} > 0$$

$$\frac{dP_2{}^*}{d\tau_{w2}} = \frac{-c_{w2}\, S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} < 0$$

$$\frac{dP_2{}^*}{d\tau_{\pi 2}} = \frac{-c_{\pi 2}\, S_{2P_2}}{[1 - c_{y2}]\, S_{2P_2} + c_{p2}} < 0$$

Here, $c_{y2} = c_{\pi 2} + [c_{w2} - c_{\pi 2}][W_2/P_2]\,[F_2{}^{'-1}(Y_2{}^*)]$

$$c_{p2} = -[\beta_2\,[\bar{m}_2/P_2{}^2] - [c_{w2} - c_{\pi 2}]\,[\omega_{p2} F_2{}^{-1}(Y_2{}^*)]]$$

Where, $\omega_{p2} = d\,[W_2/P_2]/d\,P_2 < 0$

Here demand management policies are effective and as price increases, there is a depreciation of the currency.

It is obvious that in the above expressions for expansion in government expenditure (g_2) or fall in income taxes (τ_{w2} ,$\tau_{\pi 2}$), if we put $c_{w2} = c_{\pi 2} = c_{y2}$; the expressions for the multipliers matches with that of *Benassy (1986)* where the expressions for the multipliers are same for the two countries. The multiplier in the two country open economy model of *Benassy (1986)*) are as follows,

$$\frac{dY_2{}^*}{dg_2} = \frac{S_{2P_2}}{[1 - c_{y2}] S_{2P_2} + c_{p2}} > 0$$

$$\frac{dY_2{}^*}{d\tau_{y2}} = \frac{-c_{y2}S_{2P_2}}{[1-c_{y2}]S_{2P_2} + c_{p2}} < 0$$

$$\frac{dP_2{}^*}{dg_2} = \frac{1}{[1-c_{y2}]S_{2P_2} + c_{p2}} > 0$$

However, we will see shortly while discussing the policy changes in country 1 that the effect of the policy changes for country 2 will not be identical with that of country 1 for our proposed model.

Proposition 1

- *Under flexible exchange rate, Keynesian Policies are effective in country 2 where efficiency wage relationship is not being considered.*
- *Increase in price leads to depreciation of currency.*
- *The sign condition of the effect of these policies are same as that of Benassy (1986) .However, the magnitude of the impact in the present model are different from Benassy (1986) because of the assumption of different marginal propensities for wage and profit earners in the household*

5.3.1.2 Impact of Income Policies in Country 2

Since in country 2 wage is exogenously fixed, income policies (fall in nominal wage, $dW_2 < 0$) affect optimum level of output and commodity price. This can be derived from (5.34) and (5.35),

$$\frac{dY_2{}^*}{dW_2} = \frac{[[c_{w2} - c_{\pi 2}]F_2{}^{-1}(Y_2{}^*)]/P - c_{P_2}\ S_{2w_2}}{[1-c_{y2}]\ S_{2P_2} + c_{P2}} \gtreqless 0$$

$$\frac{dP_2{}^*}{dW_2} = \frac{[[c_{w2} - c_{\pi 2}]F_2{}^{-1}(Y_2{}^*)]/P + [1-c_{y2}]\ S_{2w_2}}{[1-c_{y2}]\ S_{2P_2} + c_{P_2}} > 0$$

Impact of similar income policies under flexible exchange rate in *Benassy (1986)* where, marginal propensities to consumefor wage and profit earners are considered to be equal can be traced through,

$$\frac{dY_2{}^*}{dW_2} = \frac{-\,c_{P_2}\,S_{2w_2}}{[1-c_{y2}]\,S_{2P_2}\,+\,c_{P2}} < 0$$

$$\frac{dP_2{}^*}{dW_2} = \frac{[1-c_{y2}]\,S_{2w_2}}{[1-c_{y2}]\,S_{2P_2}\,+\,c_{P_2}} > 0$$

In *Benassy (1986)* these effects are identical when country 1 undertakes income policies, as in both the countries wage is exogenously fixed unlike the present model.

In our present model, the impact of income policies on output in country 2 is ambiguous. This is because with different marginal propensities for wage and profit earners in the household, fall in wage, lowers wage income and also commodity demand out of it. On the other hand, fall in wage in country 2 increases its supply of output. Thus downward shift in demand and upward shift in supply schedule (which is positively sloped where supply of output is sensitive to price) due to fall in wage leads to fall in commodity price in country 2 but change in optimum output is ambiguous which depends on the magnitude of relative shift in demand and supply schedule.

This is a contrast to the impact of similar policy on output in *SNWMM* (*Benassy (1986)*) where marginal propensities to consume of the profit and wage earner is same for any particular country; as a result income policy undertaken by any particular country affect its supply of output (supply schedule being positively sloped where supply of output is sensitive to price) via fall in wage, but demand schedule remains unaltered. Thus, income policy has a positive impact on output and negative impact on price.

However commodity price in country 2 of the present model falls leading to appreciation of currency similar to *SNWMM* (*Benassy (1986)*).

Proposition 2

- *Impact of income policy (fall in nominal wage) in country 2 on output would be ambiguous in contrast to SNWMM (Benassy (1986)) where marginal propensities to consume of the profit and wage earner is same for any particular country.*

- *Such policy implementation lowers commodity price and leads to appreciation similar to Benassy (1986).*

- *Magnitude of fall in commodity price due to income policies in the present model differs from that of Benassy (1986)since marginal propensities to consume for wage and profit earners in the household are being considered to be different.*

5.3.1.3 Impact of Keynesian Policies in Country 1

Impact of Keynesian policies like rise in government expenditure, fall in wage and profit income taxes in country 1 is derived from (5.32) and (5.33).

$$\frac{dY_1^*}{dg_1} = 0$$

$$\frac{dY_1^*}{d\tau_{w1}} = 0$$

$$\frac{dY_1^*}{d\tau_{\pi 1}} = 0$$

$$\frac{dP_1^*}{dg_1} = \frac{1}{\beta_1[\bar{m}_1/P_1^2]} > 0$$

$$\frac{dP_1^*}{d\tau_{w1}} = \frac{-c_{w1}}{\beta_1[\bar{m}_1/P_1^2]} < 0$$

$$\frac{dP_1^*}{d\tau_{\pi 1}} = \frac{-c_{\pi 1}}{\beta_1[\bar{m}_1/P_1^2]} < 0$$

Where, $c_{P_1} = -\beta_1[\bar{m}_1/P_1^2]$

In country 1 demand management policies like rise in government expenditure and fall in wage and profit income taxes become ineffective. Since in country 1, the firm considers efficiency wage relationship, optimum real wage is determined only on the basis of effort function and is insensitive to price (as complete indexation of wage exists). Thus employment and hence supply of output remain unchanged with price change. Here, $S_{1P_1} = 0$.

Increase in government expenditure or fall in income taxes would increase price, and create depreciation, but since supply of output is insensitive to price, output and employment remains unaltered.

However, rise in demand due to demand management policies would be crowded out by the fall in private consumption.

Proposition 3

- *Increase in government expenditure or fall in income taxes that is Keynesian Policies in country 1 would increase price and create depreciation but unlike country 2 these policies has no impact on output and employment.*

- *This result is a contrast to SNWMM (Benassy (1986))* where such *Keynesian Policies are effective in both the countries and hence affects output and employment as neither of the country considers efficiency wage relationship.*

5.3.1.4 Impact of Exogenous Shift in effort function in Country 1

Since in country 1, real wage is determined on the basis of efficiency consideration, income polices (aiming at lowering nominal wage) are inconsistent unlike country 2 where nominal wage is exogenously fixed and such policies are effective.

In country 1 output supply is sensitive to the parameter θ, representing, access to and quality of health care ,the quality and affordability of education and training , investment on infrastructure , quality of job environment etc. Any exogenous change in these factors would shift effort of the workers. Thus any policy implementation that changes θ in country 1 would affect optimum real wage, output and price.

The impact of increase in θ on output and price in country 1 can be derived from (5.32) and (5.33); such impact is not operative in country 2 where efficiency wage is not considered.

$$\frac{dY_1{}^*}{d\theta} = S_{1\theta} > 0$$

$$\frac{dP_1{}^*}{d\theta} = \frac{-[1- c_{Y_1}]\, S_{1\theta} - [c_{w1}- c_{\pi 1}]\, g_\theta\, F_1{}^{-1}(Y_1)]}{c_{P_1}} < 0$$

Where, $c_{Y_1} = c_{\pi 1} + [c_{w1} - c_{\pi 1}]\, g(\theta) F_1{}'^{-1}(Y_1)$,

As discussed in section (3.2 .1 .1.1) of Chapter 3, supply of output increases with increase in θ, $S_{1\theta} > 0$, again at the given level of output wage income falls , that is $g(\theta)F_1{}^{-1}(Y_1)$ falls. This leads to a downward shift in demand curve where, $[c_{w1} - c_{\pi 1}] g_\theta\, F_1{}^{-1}(Y_1) < 0$.

In presence of efficiency wage in country 1, supply of output is insensitive to price and supply curve is horizontal in $P - Y$ space. Upward shift in supply curve and downward shift in demand curve with rise in θ increases output and lowers commodity price.

Impact of increase in θ in country 1 would thus resemble the effect of income policies in *SNWMM (Benassy (1986)*) where efficiency wage consideration is absent in both the countries and there is the assumption of equal marginal propensities to consume for wage and profit earners. Moreover due to the assumption of equal marginal propensities to consume of the wage and profit earner in *SNWMM* (*Benassy (1986)*) demand is insensitive to change in wage but supply curve (supply schedule being positively sloped where supply of output is sensitive to price) shifts upward with the fall in wage leading to rise in level of output.

However, the result of the upward shift in effort function differs from the impact of income policy undertaken by country 2 of the present model. This happens because in absence of country 2, supply of output is sensitive to price (supply curve is positively sloped), with the imposition of income policy, supply schedule shifts upward but demand schedule shifts downward (as marginal propensities to consume of the wage and profit earners are different).Thus impact of such a policy on output is ambiguous which depends on the magnitude of relative shift in demand and supply schedule.

Proposition 4

- *Policies that provide positive shift in effort function are effective in country 1 under flexible exchange rate.*
- *Such policies leads to a upward shift in supply of output but commodity demand shifts downward due to the fall in wage income which results in lower commodity price in country 1.*
- *Fall in commodity price leads to appreciation of currency.*
- *This result resembles the effect of income policies (resulting in fall in nominal wage) in SNWMM (Benassy (1986)), where wage is fixed exogenously in both the countries and marginal propensities to consume of the wage and profit earners are assumed to be the same.*
- *The effect of shift in effort of the workers on output in country 1 differs from that of the effect of income policies in country 2 in the present model where the firms do not consider efficiency wage relationship but marginal propensities to consume of the wage and profit earners are different.*

5.3.2 Fixed Exchange Rates

Similar to the flexible exchange rate situation, the firm in country 1 considers efficiency wage relationship while in country 2 both nominal wage and price are exogenously given wage is not related to the efficiency consideration. Hence the impact of these policies would have different impact on the economy in each country.

Under fixed exchange rate system, ϵ is equal to 1.Thus

$$P_1 = P_2 = P$$

Following open economy structure of *Benassy (1986)*, we consider the situations where unemployment persists in both countries. That is

$$Y_1 = F_1(F_1'^{-1}((W_1/P)/(e(W_1/P),\theta)) = S_1(\theta)$$

$$Y_2 = F_2\left[F_2'^{-1}(W_2/P)\right] = S_2(P, W_2)$$

The system of equations in the present structure implies,

$$Y_1 + Y_2 = [c_{w1} - c_{\pi1}][(W_1/P)\,L_1] - c_{w1}\tau_{w1} + c_{\pi1}Y_1 - c_{\pi1}\tau_{\pi1} + \beta_1[\bar{m}_1/P] + g_1 +$$

$$[c_{w1} - c_{\pi1}][(W_2/P)\,L_2] - c_{w2}\tau_{w2} + c_{\pi2}Y_2 - c_{\pi2}\tau_{\pi2} + \beta_2[\bar{m}_2/P] + g_2 \quad (5.36)$$

Balance of payment surplus

$$B = Y_1 - [c_{w1} - c_{\pi1}][(W_1/P)L_1] + c_{w1}\tau_{w1} - c_{\pi1}Y_1 + c_{\pi1}\tau_{\pi1} - \beta_1[\bar{m}_1/P] - g_1 \quad (5.37)$$

5.3.2.1 Impact of Keynesian Policies in Country 2

Impact of Keynesian policies on output, homogenous commodity price and balance of payment in country 2 are derived from (5.36) and (5.37)

$$\frac{dY_2}{dg_2} = \frac{S_{2P}}{D_1 + D_2} > 0$$

$$\frac{dY_1}{dg_2} = 0$$

$$\frac{dP}{dg_2} = \frac{1}{D_1 + D_2} > 0$$

$$\frac{dB}{dg_2} = \frac{D_1}{D_1 + D_2} > 0$$

Where, $D_1 = c_{1P}$ and $D_2 = \left[1 - c_{Y_2}\right]S_{2P} + c_{2P}$

Impact of Keynesian policies in *SNWMM* of *Benassy (1986)* under fixed exchange rate is,

$$\frac{dY_2}{dg_2} = \frac{S_{2P}}{D_1 + D_2} > 0$$

$$\frac{dY_1}{dg_2} = \frac{S_{1P}}{D_1 + D_2} > 0$$

$$\frac{dP}{dg_2} = \frac{1}{D_1 + D_2} > 0$$

$$\frac{dB}{dg_2} = \frac{D_1}{D_1 + D_2} > 0$$

Where, $D_1 = \left[1 - c_{Y_1}\right]S_{1P} + c_{1P}$

$$D_2 = \left[1 - c_{Y_2}\right]S_{2P} + c_{2P}$$

Impact of Keynesian policies in country 2 has positive impact on its own output but fails to affect the output level in country 1 where real wage is fixed on the basis of efficiency wage and supply of output is insensitive to price as explained in case of flexible exchange rate in section 5.3.1.Price of homogenous good increases under fixed exchange rate and balance of payment improves. This is a contrast to *SNWMM* of *Benassy (1986)* where Keynesian policies undertaken in either of the country affects the output level of both the countries.Such policy implementation in country 2 raises price of homogenous good and improves balance of payment measured in terms of country 1.

Proposition 5

- *Keynesian policies are effective in raising own country's output in fixed exchange rate for country 2 where efficiency wage is not being considered, but does not affect the output of country 1 where real wage is set on the basis of efficiency wage consideration. This is a contrast to SNWMM of Benassy (1986) where Keynesian policies undertaken in either of the country affects the output level of both the countries.*
- *Under fixed exchange rate, price of homogenous good increases.*
- *Balance of payment measured in terms of country 1improves with the Keynesian policies in country 2.*

5.3.2.2 Impact of Income Policies in Country 2

Impact of income policies (fall in nominal wage, $dW_2 < 0$) in country 2 under fixed exchange rate can be derived from (5.36) and (5.37).

$$\frac{dP}{dW_2} = \frac{[[c_{w2} - c_{\pi 2}]F_2^{-1}(Y_2)]/P + [1 - c_{Y_2}]S_{2w_2}}{D_1 + D_2} > 0$$

$$\frac{dY_2}{dW_2} = \frac{[[c_{w2} - c_{\pi 2}]F_2^{-1}(Y_2)]/P - [[1 - c_{Y_2}]S_{2P} + c_{2P} + c_{1P}]S_{2w_2}}{D_1 + D_2} \gtreqless 0$$

$$\frac{dY_1}{dW_2} = 0$$

$$\frac{dB}{dW_2} = \frac{D_1[[c_{w2} - c_{\pi 2}]F_2^{-1}(Y_2)]/P + [1 - c_{Y_2}]S_{2w_2}}{D_1 + D_2} > 0$$

Here income policies undertaken by country 2 lower homogenous commodity price in both the countries which are same but impact on its own output level is ambiguous. This depends on the relative magnitude of the shift in demand and supply schedule due to similar reason as explained earlier in case of flexible exchange rate in section (5.3.1.2). However level of output in country 1 remains unchanged since real wage is fixed on the

basis of efficiency wage creating complete indexation of wage and hence change in price due to fall in nominal wage in country 2 does not affect supply of output in country 1.Balance of payment in country 1 is also adversely affected since supply of output remains unchanged and commodity demand increases due to fall in commodity price.

Impact of income policies in the present model differs from that of *SNWMM*, *Benassy (1986)* where income policy undertaken in a particular country increases its own output (under the assumption of equal marginal propensity to consume of the wage and profit earner) but has negative effect on output and balance of payment of the foreign country.

Proposition 6

- *Impact of income policies (fall in nominal wage) on output level in country 2 is ambiguous and depends on the relative magnitude of the shift in demand and supply schedule.*

- *Output level in country 1 remains unaltered with such policy implementation.*

- *With the imposition of income policies in country 2, commodity price which is same in both the countries falls under fixed exchange rate.*

- *Balance of payment measured in terms of country 1 is adversely affected with income policies in country 2.*

5.3.2.3 Impact of Keynesian Policies in Country 1

Under fixed exchange rate, impact of Keynesian policies (like rise in government expenditure or fall in income taxes) undertaken by country 1 are determined from (5.36) and (5.37).

$$\frac{dY_1}{dg_1} = 0$$

$$\frac{dP}{dg_1} = \frac{1}{D_1 + D_2} > 0$$

$$\frac{dY_2}{dg_1} = \frac{S_{2P}}{D_1 + D_2} > 0$$

$$\frac{dB}{dg_1} = \frac{-[\left[1 - c_{\pi 2} - [c_{w2} - c_{\pi 2}][W_2/P]\left[{F_2}'^{-1}\left(Y_2{}^*\right)\right]\right] S_{2P} + [c_{w2} - c_{\pi 2}]\,\omega_p\, {F_2}^{-1}\left(Y_2{}^*\right)] + \beta_2[\bar{m}_2/P^2]]}{D_1 + D_2} < 0$$

In contrast to *SNWMM* (*Benassy (1986)*) impact of Keynesian policies in country 1 fails to affect its own output but has positive impact on output level of country 2 via rise in commodity price of the homogenous good which is same for both the countries under fixed exchange rate. But similar to *Benassy (1986)* Keynesian policies has negative impact on balance of payment; though the magnitude of such effect differs.

Proposition 7

- *Keynesian policies undertaken by country 1 are not effective in raising own countries output in fixed exchange rate for country 1 where efficiency wage is being considered, similar to the case of flexible exchange rate.*
- *Such policies increase price of the homogenous good produced and transacted in both the countries under fixed exchange rate.*
- *Since in the fixed exchange rate system commodity price is same in both the countries, output of country 2 increases.*
- *This worsens the balance of payment situation measured in terms of country 1 which fails to increase its own output while output in country 2 (where efficiency wage relationship is absent) increases via price rise.*

5.3.2.4 Impact of Exogenous Shift in Effort Function in Country 1

Under fixed exchange rate, impact of policies that increase θ (that shifts the effort of the workers up) would affect output in country 1 and also that of country 2 via change in price of the homogenous good.

Since optimum real wage in country 1 is determined on the basis of efficiency consideration, which depends only on the shift parameter of the effort function, θ. Effect of policies that result in rise in θ is derived from (5.36) and (5.37).

$$\frac{dY_1}{d\theta} = S_{1\theta} > 0$$

$$\frac{dP}{d\theta} = \frac{-[1-c_{\pi 1}-[c_{w1}-c_{\pi 1}]\,g(\theta){F_1}'^{-1}(Y_1)]\,S_{1\theta}+[c_{w1}-c_{\pi 1}]\,g_\theta {F_1}^{-1}(Y_1)]]}{D_1+D_2} < 0$$

$$\frac{dY_2}{d\theta} = \frac{-[[1-c_{\pi 1}-[c_{w1}-c_{\pi 1}]\,g(\theta){F_1}'^{-1}(Y_1)]\,S_{1\theta}+[c_{w1}-c_{\pi 1}]\,g_\theta {F_1}^{-1}(Y_1)]\,S_{2P}]}{D_1+D_2} < 0$$

$$\frac{dB}{d\theta} = \frac{[[1-c_{\pi 1}-[c_{w1}-c_{\pi 1}]\,g(\theta)\,{F_1}'^{-1}(Y_1)]\,S_{1\theta}+g_\theta {F_1}^{-1}(Y_1)]\,D_2}{D_1+D_2} > 0$$

From the above results it is clear that increase in θ would shift the effort of the workers up in country 1 which lowers the efficient real wage putting positive impact on the supply of output in country 1.Rise in θ also has negative impact on commodity demand via fall in wage income. But since supply schedule is horizontal in $P-Y$ space, supply of output is insensitive to price ($S_{1P}=0$)), upward shift in supply and downward shift in demand schedule leads to a rise in optimum level of output in country 1.This has negative effect on commodity price of homogenous good under fixed exchange rate which in turn lowers the level of output in country 2 and improves balance of payment in country 1.

It is interesting to note that impact of rise in θ on output and price resembles to that of the effect of income policies (that lowers nominal wage) in *SNWMM* (*Benassy (1986)*).This happens as in *Benassy (1986)* even though efficiency wage is not been considered, due to the assumption of equality of marginal propensities to consume of wage and profit

earners, commodity demand schedule remains unaltered but supply schedule shifts upward with fall in wage, resulting in a rise in output.

Impact on output in the present case however differs from income policies undertaken in country 2 of the present model .This is because in country 2, in absence of efficiency wage consideration, supply schedule is positively sloped ($S_{2P} > 0$), and the impact on output becomes ambiguous when income policies produce downward shift in demand (as marginal propensities to consume of wage and profit earners differ) and upward shift in supply schedule.

Proposition 8

- *Impact of policies that result in upward shift in effort function in country 1 has positive impact on its own output.*
- *Price of the homogenous good under fixed exchange rate falls.*
- *This has negative impact on output in country 2 under fixed exchange rate.*
- *Balance of payment measured in terms of country 1 improves.*
- *These results resemble the effect of the income policies (that lowers nominal wage) in Benassy (1986) but the effect differs from income policies undertaken in country 2 of the present model.*

5.4 Conclusion

In this chapter of the thesis, a simple non - Walrasian two country open economy macro model with efficiency wage is formulated following *Benassy (1986*).However in contrast to *Benassy (1986)* where wage is exogenously fixed in both the countries, here real wage is set by efficiency wage consideration in country 1 (home country) whereas in country 2 wage is exogenously given. The efficacy of different policy implications are then

examined under the cases of i) flexible and ii) fixed exchange rate in both the countries as compared to *Benassy (1986)*.Most interestingly the impact of policies leading to shift in the effort of the workers in country 1 are also being studied under fixed and flexible exchange rate. Such policy implementations will not be taken into account in country 2 of the present model where efficiency consideration is missing, similar to *Benassy (1986*).The impact of different policies are described below.

In case of flexible exchange rate in country 2, first of all, Keynesian Policies has positive impact on outputwhere efficiency wage relationship is not being considered. This increases commodity price which leads to depreciation of currency similar to *Benassy (1986)*.The magnitude of the impact of these policies and price change in the present model are different from *Benassy (1986)*as marginal propensities for wage and profit earners in the household are assumed to be different in contrast to *Benassy (1986)*. ***Secondly***, the impact of income policies under flexible exchange rate (leading to fall in nominal wage) in country 2 on output in the present model is ambiguous. This is a contrast with *Benassy (1986)* where similar policies have positive impact on output. This result occurs because of the assumption of common marginal propensities to consume of the wage and profit earner in *Benassy (1986)*.***Finally***, such policy implementation lowers commodity price and leads to appreciation similar to *Benassy (1986).*

In case of flexible exchange rate in country 1, first of all, increase in government expenditure or fall in income taxes that is Keynesian Policies increases price and create depreciation but unlike country 2 these policies has no impact on output and employment. This result is a contrast to *SNWMM* (*Benassy (1986)*) where such Keynesian Policies are effective in both the countries as neither of the country considers efficiency wage. ***Secondly***, since the firm in country 1 sets real wage taking into account efficiency of workers, policies that shift effort of the workers upward affect output and price level. Such policies lead to upward shift in supply of output but commodity demand shifts downward as wage income falls due to such shift. This lowers commodity price, leading to appreciation of currency under flexible exchange rate in country 1. ***Finally***, the result related to upward shift in effort of the workers in country 1 of the present model resembles to the impact of income policy (resulting in fall in nominal wage) in *SNWMM*

(*Benassy (1986)*) in *SNWMM* where wage is fixed exogenously and marginal propensities to consume of the wage and profit earners are same. However, the result of the upward shift in effort function differs from the impact of income policy undertaken by country 2 of the present model where the firms do not consider efficiency wage but marginal propensities of wage and profit earners are assumed to be equal.

In case of fixed exchange rate in country 2,where wage is fixed exogenously, ***first of all***, Keynesian policies are effective in raising own country's output under fixed exchange rate, but does not affect the output of country 1where real wage is set on the basis of efficiency wage consideration. This is a contrast to *SNWMM* of *Benassy (1986)* where Keynesian policies undertaken in either of the country affects the output level of both the countries. ***Secondly***, such policy implementation in country 2 raises price of homogenous good and improves balance of payment measured in terms of country 1. ***Finally***, impact of income policies (fall in nominal wage) on output level in country 2 is ambiguous and depends on the relative magnitude of the shift in demand and supply schedule. Output level in country 1 remains unaltered with such policy implementation. With the imposition of income policies in country 2, price of the homogenous good falls under fixed exchange rate and balance of payment measured in terms of country 1 is adversely affected.

In case of fixed exchange rate in country 1, first of all,Keynesian policies are not effective in raising its own countries output in fixed exchange rate. This result is also same as in the case of flexible exchange rate. ***Secondly***, these policies increase price of the homogenous good produced and transacted in both the countries under fixed exchange rate. In the fixed exchange rate system, since there is a unique price of the good in both the countries, output of country 2 increases. This worsens the balance of payment situation which is measured in terms of country 1 as these policies fail to increase its own output while output in country 2 (where efficiency wage relationship is absent) increases via price rise. Similar to the present case, in *SNWMM, (Benassy 1986)* balance of payment worsens with the Keynesian policies in country 1 under fixed exchange rate, where output of country 2 increases along with its own output as none of the two countries considered efficiency wage relationship. ***Thirdly***, impact of policies that result

in upward shift in effort function in country 1; (a) has positive impact on its own output but commodity price under fixed exchange rate falls, (b) has negative impact on output level of country 2 under fixed exchange rate ,(c) improves the balance of payment measured in terms of country 1. ***Finally***, the impact of shift in effort function in country 1 resembles to the effect of income policies (that lowers nominal wage) in *SNWMM* (*Benassy (1986)*) but differs from income policies undertaken in country 2 of the present model.

CHAPTER – 6

SUMMARY AND CONCLUSIONS

Summary and Results

In the present thesis, an attempt has been made to study efficiency wage analysis in a non – Walrasian framework. It has been observed that in the static standard efficiency wage models (*SEWM*) the scope of any disequilibrium in the commodity market is being avoided assuming complete price flexibility.

Moreover, it has also been seen that under the assumption of fixed wage and commodity price in the standard static non - Walrasian (*SNWMM*) or so called disequilibrium framework (*Patinkin (1956, 1965), Clower (1965), Barro – Grossman (1971), Malinvaud (1977), Benassy (1982, 1986) etc.*) different unemployment regimes evolve depending on various demand and supply situations in commodity and labour market such as, i) Keynesian Unemployment (KU), having excess supply in both commodity as well as labour market, ii) Classical Unemployment (CU), with excess supply of labour and excess demand for goods, iii) Repressed Inflation (RI) having excess demand for both goods and labour. Though based on non – Walrasian framework, *Picard (1995)* has considered a simple overlapping generation model with efficiency wage and tested the impact of fiscal policy, it has been observed that none of the standard static non – Walrasian macro models or *SNWMM* as mentioned above take into account of the fact that there may be some endogenous relationship between efficiency of the workers and their wages; rather they take wages as exogenously given or linked to price.

The present study thus integrates the two literatures; *SEWM* and the *SNWMM* by formulating a static non - Walrasian model where commodity price is assumed to be either exogenously fixed or asymmetrically flexible in line with *SNWMM* of *Benassy (1986)* but real wage is determined on the basis of efficiency wage relationship as in *SEWM* of *Solow (1979)*. This generalizes both the standard efficiency wage literature where commodity price is no longer completely flexible and also static non -

Walrasian macro framework where real wage is determined on the basis of efficiency wage consideration rather than exogenously fixed. The impact of different policy implementations are then examined and compared to that of *SEWM* and *SNWMM*.

Chapter 1 being the introduction, Chapter 2 discusses the survey of the existing literature. Then in subsequent chapters the following three dimensions of the problem have been carried out in the proposed generalized structure.

The ***first problem*** of the study is divided into two broad parts.

The first part stems from the following observation. It has been observed that in *SEWM* of *Solow (1979), Yellen (1984) etc.* commodity price is assumed to be perfectly flexible. Hence they do not allow the possibility that there may be lack of commodity demand at the exogenously fixed prices and the producer in fact may take the constraint into account while setting the optimum real wage and employment. At the same time the existing literature on static non – Walrasian macro model does not take into account that the firm can set real wage considering efficiency wage relationship. Thus a simple generalized model has been formulated where commodity price is assumed to be fixed in line with non - Walrasian model of *Benassy (1986)* and real wage is determined on the basis of efficiency wage consideration following *SEWM* (*Solow (1979)*). Further, in the present framework we assume that, other than real wage, effort of the workers also gets affected by a shift parameter. Shift in such a parameter may be due to change in any one or more than one of the exogenous factors like access to and quality of health care, the quality and affordability of education and training , investment on infrastructure , quality of job environment etc..

Since the aim of the present thesis is to generalize the non – Walrasian model where firm sets real wage by taking into account efficiency wage relationship, it is likely that, effect of such operation by the firm will in the first instance have an impact on wage, employment and hence on wage income and thereby it will affect aggregate demand in the economy. Thus in order to trace out the impact of efficiency wage on wage income and hence on aggregate demand, we introduced two classes in the household: wage and profit earner having different marginal propensities to consume as supported by the

literature like *Kaldor(1955)* ,which is a contrast to *Benassy (1986)* where marginal propensities to consume for wage and profit earner are considered to be equal.

Such generalised model contradicts *SEWM* (*Solow (1979)*) where commodity price is flexible rather than fixed and also *SNWMM (Benassy (1986)* where wage is exogenously fixed and not determined on the basis of efficiency wage consideration. This model then tries to i) examine different classical and Keynesian policy implications which are compared with that of *Benassy (1986)* and ii) examine the impact of the policies that result in exogenous shift in effort function; relevantly such policy implication is missing in *SNWMM.*

The second part has been motivated by the following facts .We find that a number of studies based on standard efficiency wage framework (*Yellen (1984), Johnson and Layard (1986), Shapiro and Stiglitz (1984) and Pisauro (1991) etc.*) examine the impact of incidence of pay roll taxes such as labour taxations (ad valorem tax (wage tax) and (specific tax (employment tax)). However, while studying the effect of these policies; the authors did not take into account of the possibility that the firm may face commodity demand constraint at the exogenously given price. Thus, there is enough scope to revisit the impact of these taxation policies in the generalized model as proposed above. Relevantly, it may be mentioned that the effect of such labour taxations have not been observed in the models with standard non - Walrasian framework.

Based on this observation, a fixed - price non –Walrasian model with efficiency wage are extended introducing pay roll taxes such as ad valorem and specific tax. These models would help to i) investigate the role of ad valorem and specific tax that is pay roll taxes in non – Walrasian framework, ii) observe how the impact of such taxations on optimum solutions in the present set up differ from that of *SEWM* (specifically of *Yellen (1984)* having same properties of the effort function as that of the present model), iii) identify the impact of classical and Keynesian policy measures in presence of ad valorem and specific tax and iv) explain how the impact of the policies that result in exogenous shift in effort function as studied in the first part of the problem as mentioned above, gets affected with the introduction of these taxes. ***The whole study is presented in Chapter 3.***

The second problem evolves from study related to the existing non – Walrasian IS – LM framework of *Benassy (1986)* where both nominal wage and price are assumed to be asymmetrically flexible implying that prices are flexible upward but rigid downward. Assumption of asymmetric price flexibility has been considered to be more realistic, as it is widely accepted that prices display some downward rigidity but in the case of excess demand they will increase until excess demand has disappeared. Here excess demand that is consumer rationing will not appear on the goods market. Hence one can observe three relevant regimes in IS – LM model of *Benassy (1986)*, i) excess supply in commodity and labour market, ii) excess supply in labour market with goods market cleared, iii) both the markets clear. However, it is clear that efficiency wage consideration is absent in the IS – LM model of *Benassy (1986).* Hence, one can reconsider this non – Walrasian IS – LM model where the firm sets the real wage taking into account efficiency wage relationship.

An IS – LM model is thus formulated by allowing the non -Walrasian model of *Benassy (1986*) involving asymmetric price flexibility to incorporate efficiency wage relationship. However, due to the similar reason as explained in Chapter 3; in the present IS – LM framework with efficiency wage, the household consists of two representative classes, wage and profit earners having different marginal propensities to consume. The firm distributes a part of its income to the profit earners and the undistributed part is retained for investment purposes. Taxes in any form are omitted in this particular structure in line with *Benassy (1986)* non – Walrasian IS – LM framework.

Such IS- LM framework intends to i) consider the impact of monetary and fiscal policies; results are then contrasted with that of both *SNWMM* (*Benassy (1986)*) and *SEWM* (*Solow (1979)* and *Yellen (1984)*).ii) explore the impact of the policies that result in exogenous shift in effort function; the obtained outcome is then compared with similar policy shift in the framework of the fix price setting as studied in Chapter 3. However, policies that shift effort of the workers has no role in the IS – LM framework of *Benassy (1986*) where efficiency wage consideration is absent and iii) construct an extended model by assuming partial wage rigidity when the firm faces certain fixed costs (such as hiring and training cost, traffic fees, housing outlays etc.) in line with *Lin and Lai (1998)*

for employing a worker; here the impact of different policy implications are also been studied. ***The second problem is considered in Chapter 4.***

The third problem deals with the simple non – Walrasian two country open economy macro model of *Benassy (1986).* In such a model one homogenous good is exchanged, the price of which clears the world market and wage is exogenously given in each country. In this context the effects of various policies on the country pursuing them and their repercussion on the other country has been studied under flexible and fixed exchange rate regimes. However, while framing such model *Benassy (1986)* did not introduce efficiency wage relationship. Again there are some extensions of the efficiency wage model in a open economy framework like *Wilson (1990)*, *Lai (1990, 1992,1993)* etc*,* but it has been observed that there is a dearth in the studies on two country open economy model in non – Walrasian framework with efficiency wage.

Hence a possible extension of the non – Walrasian two country open economy model of *Benassy (1986*) is performed by assuming that the real wage is set by the firm endogenously on the basis of efficiency wage relationship. To keep the analysis simple it is assumed that, only the firms in country 1 determine real wage on the basis of efficiency wage relationship whereas in country 2 wage is exogenously fixed. Price of the homogenous commodity in each country is determined on the basis of exchange rate. Since in country 1 real wage and hence employment is determined on the basis of efficiency wage consideration; in tune with the previous chapters in order to trace out the impact of efficiency wage on wage income and hence on aggregate demand, two classes in the household: wage and profit earners having different marginal propensities to consume is assumed. In the present two country open economy model, it is assumed that household in both the countries consist of similar two classes as supported by the literature like *Kaldor (1955)* (same as in previous two chapters). Moreover marginal propensities to consume for wage and profit earner are different for any particular country although respective values of marginal propensities to consume also vary among the countries.

In this open economy structure, i) the efficacy of different Keynesian and income policy implications in both the countries are examined under flexible and fixed exchange rate,

ii) moreover in country 1 where efficiency wage consideration is present, whether policies undertaken by this country leading to exogenous shift in effort of the workers has strong impact on the global economy is being thoroughly investigated. It is clear that impact of such policy implementation cannot considered in country 2 where efficiency wage relationship is absent. ***Chapter 5 carries out the whole study.***

There are some concluding remarks on the basis of the whole study. These are presented elaborately as following:

In Chapter 3 and ***in the first part*** which deals with the construction of the proposed generalized fixed - price non – Walrasian model with efficiency wage as discussed above, it has been observed that the firm may or may not face constraint in the commodity market while determining optimum real wage and employment. However, in both the cases the firm sets optimum real wage at the point where effort elasticity with respect to real wage is equal to unity (that is *Solow Condition* holds). Real wage as determined on the basis of efficiency wage relationship is set above the Walrasian level. Thus excess demand or equilibrium in the labour market is absent and excess supply in the labour market is persistent in the present framework .Though in the unconstrained case employment solely depends on effort function ,in the constrained situation ,optimum employment is determined both on the basis of effort function and the prevailing level of effective demand in the economy. Hence in our present framework only two regimes are found to be relevant that is, i) equilibrium or excess demand in the commodity market with excess supply in labour market (*RWODC*) and ii) excess supply of commodity and labour (*RWDC*).The third regime of *Benassy (1986)* that is Repressed Inflation (RI) having excess demand for both goods and labour is not consistent in the present non – Walrasian set up with efficiency wage.

The following conclusions are derived from the basic fixed – price non –Walrasian model with efficiency wage in RWODC and RWDC;

In *RWODC, first of all*, the firm is unconstraint in the commodity market and can freely determine optimum solution of real wage using profit maximisation problem similar to *SEWM* of *Solow (1979)*. Optimum real wage, employment and supply of output depend

only on the shift parameter θ relating to effort function. ***Secondly***, classical measure of lowering real wage via exogenous shift in nominal price is ineffective since output is insensitive to price change because of prevalence of complete indexation of wage due to fixed efficiency wage .This result contrasts the CU regime of S*NWMM* of *Benassy (1986)* where the similar policy impact has positive impact on output and employment. ***Thirdly***, policies resulting in the exogenous upward shift of effort function (resulting in increase in parameter θ) lowers optimum real wage and hence the minimum wage cost per efficiency unit (MC) corresponding to new effort function falls. To maintain optimality condition, marginal productivity of employment in efficiency unit (MP_{eL}) has to be lowered leading to rise in employment in efficiency unit (eL). As effort of the workers (e) has already increased with upward shift in effort function, actual employment (L) increases/falls or remains unchanged according as, magnitude of rise in $eL \gtreqless$ magnitude of rise in e. Thus effect of upward shift in effort function on employment is ambiguous; however, such policy implication is missing in *SNWMM*.

In RWDC, first of all, the firm is constraint in the commodity market, optimum real wage still depends on shift parameter θ relating to effort function similar to *RWODC* but optimum employment is sensitive both to the prevailing effective demand and parameter θ. Resulting unemployment is higher in *RWDC* which arises both due to demand and efficiency effect as compared to *RWODC* where only efficiency effect works. Again it is clear that, level of unemployment in *RWDC* is higher than both that of the *KU* regime of *SNWMM* (*Benassy (1986)*) where only demand effect is prevalent and *SEWM* (*Solow (1979)*) where only efficiency effect works. ***Secondly***, based on the short side rule, supplies of output is determined by the prevailing effective demand and hence demand management policies like increase in government expenditure and fall in income taxes has positive impact on output and employment but the magnitude of these policy multipliers are sensitive to the properties of the effort function. This result can be contrasted with the result of the KU regime of *SNWMM* (*Benassy (1986)*), where magnitudes of the policy multipliers related to increase in government expenditure and fall in income taxes are not sensitive to the properties of effort function. ***Finally***, policies leading to exogenous increase in effort of the workers, lowers optimum real wage but at the same time effort of the workers increases. However, in *RWDC*, since at the given

price, supply of output is determined on the basis of commodity demand and hence employment in efficiency unit (eL) is fixed. Thus at the given (eL), as e rises , actual employment, L falls. Both fall in real wage and employment due to rise in θ , leads to fall in wage income. Since it is assumed that marginal propensity to consume for the wage earner is larger than that of the profit earner in the household, aggregate demand and hence output falls with the fall in wage income; this result differs from that of the similar policy implementation in *RWODC* where output level increases and impact on employment is ambiguous as explained earlier.

The findings of the fixed – price non –Walrasian model in presence of ad valorem and specific tax as studied in the second part of chapter 3 are discussed below.

In RWDOC, imposition of ad valorem tax, first of all, keeps optimum real wage unchanged which still depends only on parameter θ; this happens due to the fact that, even in the post tax situation real wage is determined at the point where effort elasticity with respect to real wage is equal to unity (*Solow condition* still holds) similar to the pre tax situation in the same regime. Again with the imposition of ad valorem tax, marginal cost curve shifts upward, and in order to maintain the optimality condition marginal productivity of employment in efficiency unit (MP_{eL}) increases. Thus employment in efficiency unit (eL) falls, and as optimum real wage remains unchanged, the corresponding effort level e too does not alter. Again since (eL) falls but e remains unchanged, actual employment level L falls. Relevantly, it may be mentioned that in *Yellen (1984)* also imposition of the ad valorem tax keeps optimum real wage unchanged but employment falls. But in *Yellen (1984)* commodity demand constraint will never appear due to the assumption of complete price flexibility, whereas in our present case the existing level of fixed commodity price is such that there is no such commodity demand constrain. ***Secondly***, with the imposition of ad valorem tax, wage earners get adversely affected as wage income falls but impact on profit income is ambiguous. ***Thirdly***, impact of the policies that shift effort function upward in *RWODC* in presence of ad valorem tax is similar to that of the pre -tax situation. ***Finally***, classical measure of lowering real wage via exogenous shift in nominal price is still ineffective similar to the pre -tax situation; this is because even after the imposition of ad valorem tax optimum

post tax real wage depends only on parameter θ and is insensitive to price change where complete indexation of wage persists even in the post - tax situation.

Similarly in RWDC due to imposition of such ad valorem tax, ***first of all***, real wage is still determined at the point where elasticity of the effort function is equal to unity similar to the pre - tax situation. As a result real wage and hence effort of the workers, e remains unaltered. Since in this regime with commodity demand constraint, output produced is equal to the prevailing effective demand, (following short side of the market rule of *Benassy (1986)*), employment in efficiency unit (eL) as determined by the commodity demand prevailing in the economy is given and actual employment, L will also remain unchanged. Thus at the given level of effective demand, increase in ad valorem tax keeps optimum real wage and employment unchanged and hence wage income also remains unaltered. Here profit earner bears entire burden of the tax and hence the consumption demand out of profit income falls leading to fall in net effective commodity demand and hence output and employment. There is a dearth in the studies in *SEWM* (*Yellen (1984)*) or *SNWMM* (*Benassy (1986)*) dealing with the impact of labour taxation like ad valorem tax on commodity demand and leading to the conclusion that changes in commodity demand (due to imposition of such tax) can in turn affect optimum employment solution. ***Secondly***, imposition of ad valorem tax in *SEWM* or *RWODC* has similar effect on real wage, output and employment; but as explained earlier such results in *SEWM* or *RWODC* is solely due to efficiency effect and not demand effect whereas in *RWDC* of the present model the result occurs both due to demand and efficiency effect. ***Thirdly***, policies that produce upward shift in effort function lower real wage and employment leading to fall in wage income in *RWDC* as explained in pre -tax situation. Consumption demand created out of wage income falls. Again, tax expenditure of the firm too falls with the fall in wage income which in turn increases profit income and hence the commodity demand arising out of it. Thus impact of upward shift in effort function on effective demand is ambiguous and depends on the relative magnitudes of the ad valorem tax imposed and the marginal propensities to consume for wage and profit earners. ***Finally***, demand management policies like increase in government expenditure and fall in income taxes has positive impact on effective demand for output and employment; further wage

income increases with the rise in employment as efficiency real wage is fixed and profit income increases with rise in output. But again in presence of ad valorem tax, rise in wage income lowers profit income via rise in tax expenditure. Here responsiveness of net savings of the household with respect to income is positive but its magnitude depends on value of the ad valorem tax and parameter θ related to effort function. The magnitude of government expenditure and income tax multipliers too depends on these factors. This is a contrast to *SNWMM (Benassy (1986))* where magnitude of such policy multipliers depends only on marginal propensity to consume.

Imposition of the specific tax in the fixed – price non –Walrasian generalised model with efficiency wage implies that in RWODC, first of all, optimum real wage is determined at the point where effort elasticity with respect to real wage is less than unity that is Solow condition no longer holds. Since specific tax is a kind of fixed cost of employing a worker, the firm wants to increase efficiency of the works in order to neutralize the fixed cost. To do so, the firm has to increase real wage. Thus the firm no longer operates at the minimum level of *MC*; but is set at a higher level. In order to maintain optimality condition, MP_{eL} has to increase and hence optimum employment in efficiency unit (eL) falls. Moreover, imposition of specific tax increases real wage which in turn increases effort level, e of the worker. The resulting effect will be, a fall in actual employment, L. Thus optimum post tax real wage increases and employment falls similar to *SEWM* of *Yellen (1984)*. ***Secondly***, impact of imposition of specific tax on wage income is ambiguous as post tax real wage increases and employment falls; since movement of wage income is ambiguous, impact on profit income is also ambiguous. ***Thirdly,*** impact of the policies leading to upward shift in effort of the workers, is similar to that of the pre - tax situation. ***Finally***, since optimum real wage depends on the real value of specific tax, any rise in exogenously given price will affect real wage. Here post tax real wage is sensitive to price and complete indexation of wage is absent in presence of specific tax. Thus classical measure of lowering real wage via rise in commodity price becomes effective.

With the imposition of the specific tax in RWDC, first of all, optimum real wage is set at the point where effort elasticity with respect to real wage is less than unity. Due to the

similar reason as discussed in case of *RWODC*, optimum real wage increases leading to rise in effort of the workers, e. In *RWDC* employment in efficiency unit (eL) is fixed on the basis of prevailing effective demand and since e increases, actual employment, L will fall. ***Secondly***, as (eL) is fixed at the given effective demand, rise in effort is equivalent to fall in employment. Moreover since at the optimum, effort elasticity with respect to real wage is less than unity, rise in effort is less than the rise in real wage. Thus rise in real wage is larger than fall in employment and hence post tax wage income increases. Further at the given output level (determined on the basis of prevailing effective demand), as post tax wage income increases with the imposition of specific tax, profit income falls. But imposition of specific tax on the one hand directly increases cost at the given employment level and on the other hand with the fall in post - tax employment, tax expenditure falls which would lower the cost and put positive impact on profit income. Change in post - tax profit income is thus ambiguous. It follows that with the rise in specific tax, wage income increases and consumption demand created from it also increases but again change in effective demand from profit income is ambiguous as the movement of profit income is ambiguous. Change in profit income however depends on the magnitude of elasticity of effort with respect to specific tax which is the combined effect of elasticity of real wage with respect to specific tax and effort elasticity with respect to real wage. Due to the imposition of specific tax, employment falls at the same level of output. Whether the extent of fall in employment will be higher than or equal to the extent of rise in specific tax depends on the elasticity of effort with respect to specific tax. If such elasticity exceeds unity, the extent of fall in employment will be larger than the increase in specific tax. Accordingly fall in tax expenditure due to fall in employment is larger or equal to the rise in cost with specific tax. Hence profit income would increase or remain unchanged accordingly and so as the commodity demand arising out of it. Net effective commodity demand (arising out of both wage and profit income) would then increase. In this particular case, increase in specific tax may have an employment generating role which is a strong contrast to the existing studies of *SEWM* (like *Ye1llen (1984)*) or in *RWODC* of the present model where rise in specific tax always lowers employment. However if elasticity of effort with respect to specific tax is larger than unity, profit income falls and accordingly commodity demand generating out of it falls.

However, as already discussed, commodity demand arising from wage income increases with the imposition of specific tax. Thus net change in aggregate demand or output will be ambiguous with the rise in specific tax and depends on a condition specifying the magnitude of the specific tax, effort elasticity with respect to specific tax, effort elasticity with respect to real wage and also on marginal propensities to consume for both wage and profit earners. ***Fourthly***, policies that shift effort function upward lowers wage cost per efficiency unit, reason being similar to the pre – tax situation, wage income falls and hence net consumption demand out of it falls. Again, as effort, e increases, actual employment, L falls at the given level of (eL) as set by the prevailing effective demand. Hence expenditure on specific tax falls; profit income and commodity demand out of it increases, implying that the change in net commodity demand with shift in effort function is ambiguous. Here net change in commodity demand with shift in effort function depends on a condition relating to the magnitude of specific tax, fall in wage cost per efficiency unit and increase in effort with respect increase in shift parameter θ, and also marginal propensities to consume for wage and profit earners. ***Finally***, demand management policies like increase in government expenditure and fall in income taxes has positive impact on effective commodity demand output and employment; further wage income increases with the rise in employment as efficiency real wage is fixed. Profit income on the one hand increases with rise in output but again falls as in presence of specific tax where rise in employment increases tax expenditure. Responsiveness of net savings of the household with respect to income being positive its magnitude depends on the shift parameter of effort function, θ, value of specific tax imposed, and the marginal propensities to consume for wage and profit earners. Accordingly the magnitudes of the above policy multipliers too depend on the above factors.

In Chapter 4, a IS – LM model is being constructed where commodity price shows asymmetric movement (that is, price is flexible upward but rigid downward) and real wage is determined on the basis of efficiency wage relationship. In presence of rigid efficiency real wage, there is persistent involuntary unemployment in the labour market. In the present structure, only two regimes are found to be consistent, i) excess supply in commodity and labour market (*RWDC*), where commodity price is fixed at the minimum level and ii) excess supply in labour market with goods market cleared (*RWDOC)* where

commodity price is assumed to be above the minimum level and is flexible in nature. The third regime of the IS – LM model in *Benassy (1986)* where both output and labour market clears, is absent in the present model as efficiency real wage is set above the Walrasian level and full employment in labour market is ruled out.

Conclusions regarding the impact of different policy implications in RWDC and RWODC in the IS – LM model with efficiency wage are expressed below;

In RWDC, ***first of all***, real wage is still determined on the basis of effort function alone which depends only on parameter θ .At the fixed minimum price, supply of output is equal to prevailing effective demand on the basis of short side rule similar to *RWDC of* fixed – price model in Chapter 3. Hence optimum employment is determined both on the basis of parameter θ and prevailing demand. ***Secondly***, as at the given demand schedule for bond, increase in money supply implies fall in supply of bond which raises bond prices, reducing rate of interest. The firm increases investment and at the same time consumption demand of the household goes up. Effective demand and hence the level of output and employment increases. This creates spill - over effect leading to rise in wage income where real wage is fixed on the basis of efficiency consideration. As a consequence net demand from the household increases (where marginal propensity consume of the wage earner is assumed to be larger than profit earner), but at the same time there is a net fall in demand due to fall in undistributed profit income of the firm via rise in wage income. Assuming net change in investment and consumption demand with respect to output to be positive but less than unity, the magnitude of such change depends on the condition related to the values of (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. Accordingly,, increase in money supply leads to an expansionary impact on output through multiplier process, but the magnitude of rise in output depends on these above factors. Thus money is non - neutral which supports S*NWMM* (*Benassy (1986)* in the regime with excess supply in commodity and labour market but contrasts *SEWM* where money is neutral due to complete flexibility of nominal wage and price. This result however contrasts *Benassy (1986)* in a sense that in *Benassy (1986)* the magnitude of the impact of money supply does not

depend on any such condition involving the above factors. This mainly arises because in the present model marginal propensities to consume for wage and profit earners in the household are assumed to be different whereas these are assumed to be equal in *Benassy (1986*). ***Thirdly***, other demand generating policies like rise in government expenditure and fall in price also has positive impact on output and employment supporting the result in S*NWMM* (*Benassy (1986*).But due to similar reason as explained above magnitudes of these policy multipliers in the present case also depend on the same condition relating to the values of the factors like (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. ***Finally***, in the present IS – LM model with efficiency wage, policies resulting in positive shift in effort function may have positive /negative or no impact on output and employment. The sign condition of this impact on output depends on the similar condition as mentioned above involving the values of the factors like (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. This result contrasts our simple fixed price non - Walrasian model with efficiency wage in absence of investment demand of the firm in Chapter 3 where impact of the policies that shift effort of the workers upward has negative impact on output and employment in the pre labour taxation situation of *RWDC*. In the simple fixed - price model with efficiency wage, exogenous shift in effort of the workers lowers wage income; this affects net consumption demand out of wage income resulting in a fall in effective demand and hence output. But in contrast to this, in the present IS - LM model with efficiency wage, though wage income falls with the upward shift in effort of the workers, net change in commodity demand due to fall in wage income becomes ambiguous and the sign condition of such change depends on the condition involving the values of (a) the fraction of profit income kept undistributed by the firm, (b) investment propensity of the firm and (c) marginal propensities to consume for wage and profit earners. Hence change in aggregate demand or output due to rise in θ also becomes ambiguous and depends on the above factors. However policies that shift effort of the workers has no role in the IS – LM framework of *Benassy (1986*) where efficiency wage consideration is absent.

In RWODC, first of all, we find that both monetary and fiscal policies are ineffective since supply of output is insensitive to price due to complete indexation of wage in presence of efficiency wage; supply curve has horizontal part in $P - Y$ space and any shift in demand with either rise in money supply or government expenditure keeps level of output unchanged. This result contrasts the IS – LM model of *SNWMM* (*Benassy (1986*)) where monetary and fiscal policies are effective as supply curve is positively sloped in the similar regime without efficiency wage consideration and upward shift in demand due to monetary or fiscal policy would increase level of output and price. However ineffectiveness of monetary and fiscal policies in this regime supports *SEWM* (*Solow (1979) and Yellen (1984)*) where price is assumed to be completely flexible and firm faces no commodity demand constraint similar to *RWODC* of the present model, and at the same time complete indexation of wage persists. ***Secondly***, it has been observed that policies that shift effort function upward have positive impact on output supply but its impact on aggregate demand is ambiguous. As already explained in Chapter 3, optimum real wage falls and the change in optimum actual employment is ambiguous with such shift of effort of the workers in *RWODC*. Thus change in wage income also becomes ambiguous, and so as the net shift in consumption and investment demand out of wage income. Thus shift in aggregate demand depends on the factors related to direction of change in wage income, the fraction of profit income kept undistributed by the firm, investment propensity of the firm and marginal propensities to consume for wage and profit earners. If aggregate demand remains unaltered or shifts leftward with upward shift in effort of the workers, commodity price falls; but if aggregate demand shifts rightward, the change in price depends on the relative magnitude of shift in both supply and demand schedule. Impact of exogenous shift in effort function on equilibrium output is missing in IS – LM framework of *SNWMM* (*Benassy (1986)*) where wage is not determined on the basis of efficiency consideration.

The IS – LM model with efficiency wage in *RWODC* has also been extended assuming partial wage rigidity which emerges when the firm faces certain fixed costs (such as hiring and training cost, some taxes (labour taxation like specific tax), traffic fees, housing outlays etc.) for employing a worker following *Lin and Lai (1998)*. Since in this IS – LM model we do not consider the incidence of any tax, it is assumed that the

presence of partial rigidity of wage is due to any of the above factors other than specific tax. With rise in price the real value of such fixed costs falls which in turn affects real wage and thus complete indexation of wage is now absent. ***The results of this extension are summarised as follows;***

First of all, here demand generating policies like rise in government expenditure and money supply are effective in the IS – LM framework with efficiency wage in presence of partial wage rigidity unlike the similar policy impact in *RWODC* with full wage rigidity. As aggregate demand curve shifts upward with such policy imposition, commodity price increases in *RWODC*. Optimum real wage thus falls since complete indexation of wage is absent in case of partial wage rigidity; employment and supply of output thus increases. ***Secondly***, the magnitudes of the policy multipliers depend on the sensitivity of aggregate demand with respect to price. It has been observed that change in net demand from wage income is crucial determining factor of the sign condition of the change in aggregate demand with respect to price. However, in presence of fixed cost, real wage falls and employment increases with the rise in price, hence wage income may rise, fall or remain unchanged. Accordingly, change in undistributed profit income of the firm too becomes ambiguous. Here net change in net demand from wage income is found to depend on the condition related to (a) value of the fraction of undistributed profit income, (b) marginal propensities to consume for wage and profit earners, (c) investment propensity of the firm and also on (d) the direction of change in wage income with price. ***Finally***, such type of partial wage rigidity is not considered in *SNWMM* of *Benassy (1986)*.

In Chapter 5, a simple non - Walrasian two country open economy macro model with efficiency wage is formulated following *SNWMM* of *Benassy (1986*). In contrast to *Benassy (1986)* where wage is exogenously fixed in both the countries, here real wage is set by efficiency wage consideration in country 1 (home country) whereas in country 2 wage is exogenously given. Impacts of various policies in the own country where they are undertaken, and the consequences on the other country has been examined. Since the system of equations in country 1 is different from country 2 in the present model; nature of the policy multipliers will not be identical in both the countries. In contrast to this, in

SNWMM (*Benassy (1986)*) the nature of the impact of different policies on effective demand is similar in both the countries.

The results related to the efficacy of different policy implications under the cases of i) flexible and ii) fixed exchange rate in both the countries are the following,

In case of flexible exchange rate in country 2, first of all, Keynesian Policies has positive impact on output where efficiency wage relationship is not being considered. Shift in aggregate demand due to these policy implementations in country 2 lead to increase in commodity price and hence supply of output increases, where nominal wage is exogenously set. This causes depreciation of currency similar to *Benassy (1986)*.The magnitude of the impact of these policies and price change in the present model are different from *Benassy (1986)* as marginal propensities for wage and profit earners in the household are assumed to be different in contrast to *Benassy (1986)*. ***Secondly***, the impact of income policies under flexible exchange rate (leading to fall in nominal wage) in country 2 on output in the present model is ambiguous. This is because due to the assumption of different marginal propensities to consume for wage and profit earners in the household, fall in wage, lowers wage income and also commodity demand out of it. On the other hand, fall in wage in country 2 increases its supply of output. Thus downward shift in demand and upward shift in supply due to fall in wage leads to a fall in commodity price in country 2 but change in optimum output is ambiguous which depends on the magnitude of relative shift in demand and supply schedule. This is a contrast to the impact of similar policy on output in *SNWMM* (*Benassy (1986)*) where marginal propensities to consume of the profit and wage earner is same for any particular country; as a result income policy undertaken by any particular country affect its supply of output via fall in wage, but demand schedule remain unaltered. Thus, income policy has a positive impact on output and negative impact on price. ***Finally***, such policy implementation lowers commodity price and leads to appreciation similar to *Benassy (1986)*.

In case of flexible exchange rate in country 1, first of all, increase in government expenditure or fall in income taxes that is Keynesian Policies increases price and create depreciation but unlike country 2 these policies has no impact on output and

employment. This is because in country 1, the firm considers efficiency wage relationship and optimum real wage is determined on the basis of effort function which is insensitive to price (as complete indexation of wage exists). Thus employment and hence supply of output remain unchanged with price change. However, rise in demand due to demand management policies would be crowded out by the fall in private consumption with rise in price. This result is a contrast to *SNWMM* (*Benassy (1986)*) where such Keynesian Policies are effective in both the countries as neither of the country considers efficiency wage. ***Secondly***, since the firm in country 1 sets real wage taking into account efficiency of workers, policies that shift effort function upward affect output and price level. Such policies lead to upward shift in supply of output but commodity demand shifts downward as wage income falls due to such shift and marginal propensities to consume for wage earner is assumed to be larger than that of profit earners. This lowers commodity price, leading to appreciation of currency under flexible exchange rate in country 1. ***Finally***, the result related to upward shift in effort function in country 1 of the present model resembles to the impact of income policy (resulting in fall in nominal wage) in *SNWMM* (*Benassy (1986)*). In *SNWMM (Benassy (1986)*) where wage is fixed exogenously and since marginal propensities to consume of the wage and profit earners are assumed to be equal, demand is insensitive to change in wage but supply curve shifts upward with the fall in wage leading to rise in level of output. However, the result of the upward shift in effort function differs from the impact of income policy undertaken by country 2 of the present model. This happens because in country 2 supply of output is sensitive to price, with the imposition of income policy, supply schedule shifts upward but demand schedule shifts downward (as marginal propensities to consume of the wage and profit earners are different).Thus impact of such a policy on output is ambiguous which depends on the magnitude of relative shift in demand and supply schedule.

In case of fixed exchange rate in country 2*,* where wage is fixed exogenously, ***first of all***, Keynesian policies are effective in raising own country's output under fixed exchange rate, but does not affect the output of country 1where real wage is set on the basis of efficiency wage consideration. This is a contrast to *SNWMM* of *Benassy (1986)* where Keynesian policies undertaken in either of the country affects the output level of both the countries. ***Secondly***, such policy implementation in country 2 raises price of

homogenous good and improves balance of payment measured in terms of country 1. ***Thirdly***, impact of income policies (fall in nominal wage) on output level in country 2 is ambiguous and depends on the relative magnitude of the shift in demand and supply schedule due to similar reason as explained earlier in case of flexible exchange rate. Output level in country 1 remains unaltered with such policy implementation since supply of output is insensitive to price change in presence of efficiency wage. ***Finally***, with the imposition of income policies in country 2, balance of payment measured in terms of country 1 is adversely affected under fixed exchange rate.

In case of fixed exchange rate in country 1, first of all, in contrast to *SNWMM* (*Benassy (1986)*) impact of Keynesian policies in country 1 fails to affect its own output but has positive impact on output level of country 2 via rise in unique commodity price of the homogenous good which is same for both the countries under fixed exchange rate.. ***Secondly***, such policy implementations worsen the balance of payment situation which is measured in terms of country 1. Similar to the present case, in *SNWMM, (Benassy 1986)* balance of payment worsens with the Keynesian policies in country 1 under fixed exchange rate, where output of country 2 increases along with its own output as none of the two countries considered efficiency wage relationship. ***Thirdly***, impact of policies that result in upward shift in effort function in country 1; (a) shifts supply of its own output where real wage is determined on the basis effort function, again demand schedule shifts downward since wage income falls and marginal propensities to consume for wage earner is assumed to be larger than that of profit earners. This results in rise in output and fall in homogenous commodity price under fixed exchange rate falls, (b) has negative impact on output level of country 2,(c) improves the balance of payment measured in terms of country 1. ***Finally***, the impact of shift in effort function in country 1 resembles to the effect of income policies (that lowers nominal wage) in *SNWMM* (*Benassy (1986)*) but differs from income policies undertaken in country 2 of the present model due to similar reason as explained in case of flexible exchange rate.

Concluding Remarks

The present study integrates the two literatures, the standard efficiency wage model (*SEWM*) and standard non – Walrasian macro model (*SNWMM*) by first of all formulating a static non- Walrasian model where commodity price is assumed to be either exogenously fixed or asymmetrically flexible in line with *Benassy (1986)* but real wage is determined on the basis of efficiency wage relationship as in *Solow (1979*). In such a model the effect of different demand management policies, labour taxation policies like ad valorem and specific tax and the policies that lead to exogenous shift in effort function are examined. Secondly, the thesis generalised IS- LM model of *Benassy (1986)* by incorporating the possibility of wage setting firm taking into account the efficiency wage relationship. In such a model monetary and fiscal policies and also the policies resulting in exogenous shift in effort function has been carried out. Thirdly, the simple non – Walrasian two country model of *Benassy (1986)* has been extended by introducing the existing the efficiency wage relationship in country 1.With such an extended open economy structure the efficacy of different Keynesian and income policy implications in both the countries under fixed and flexible exchange rate are explored and the study related to effect of exogenous shift in effort function in country 1 has been carried out.

To keep the analysis simple, we have assumed only the specification of effort function of *Solow (1979*) and *Yellen (1984).*Also in the present open economy framework we have not derived traditional Marshall – Lerner condition to examine the effect of devaluation. Further we have assumed static structure. However the findings obtained in the generalized model as discussed above suggest that the results are clearly distinct from the static standard efficiency wage model (*Solow (1979*) and *Yellen (1984)*) and also from non – Walrasian macro model (*Benassy (1986)*) even within this restrictive simple set up.

The extensions of the model as mentioned above like i) incorporation of the other type of effort function different from *Solow (1979*) and *Yellen (1984)* as available in the literature for example *Johnson and Layard (1986), Shapiro and Stiglitz (1984), Summers (1988)*, *Pisauro (1990 etc.* derivation of traditional Marshall – Lerner condition in non –Walrasian open economy structure with efficiency wage and iii) generalisation of the static model in a dynamic framework can be carried out and are the agenda of our future research.

APPENDIX

Appendix -1

A Note on Pay Roll tax or Social Security Tax

Considering different variations in efficiency wage structures, involuntary unemployment being an obvious outcome due to persistent imbalance in the labour market, studies regarding different policy instruments have been evolved. Moreover in most countries, pay roll wage and employment tax are used to finance Social Security, Medicare and Unemployment Insurance expenditure. Both pay roll ad valorem or wage tax and specific or employment tax are imposed to the firms on the basis of the wage bill of their employees and their employment level respectively. However specific tax acts as a fixed cost of employing a worker. This increases labour cost and the firm lowers wage to pass on the share of the tax to the employee. The extent of sharing however depends on the elasticities of labour demand and supply schedule that is on the nature of the labour market. The process also affects the optimum employment level of the firm.

Since efficiency wage creates imperfection in the labour market; there are a wide range of studies that tested the impact of such pay roll tax on wage and employment. The results however differ based on distinct assumptions regarding the properties of effort function in each model. Some efficiency wage literature has also studied the impact of tax policy on employment in a two sector general equilibrium framework.

Appendix – 2

According to equation (3.57) of section 3.6.1.2.2 the effective demand in presence of ad valorem tax,

$$E_a = [c_w - \ c_\pi]g(\theta)F(Y) + \ c_\pi Y - \ c_\pi t_a g(\theta)F(Y) - \ c_w\tau_w - \ c_\pi\tau_\pi + \beta\,[\overline{m}/P] + \hat{g} \quad \text{(A2.1)}$$

With the increase in Y, $(W/P)^*$ remains unchanged at the given effort function even at the post ad valorem tax equilibrium. Effort, $e((W/P)^*, \theta)$ too remains unchanged but employment increases with the increase in Y, where, $\bar{L} = [F^{-1}(Y)/[e((W/P)^*, \theta)]$.

As real wage remains unchanged and employment increases, wage income, $g(\theta)F^{-1}(Y)$ increases. And hence net demand from wage income increases, that is $[c_w - c_\pi]g(\theta)F'^{-1}(Y) > 0$.

On the other hand as wage income increases, expenditure on ad valorem tax of the firm increases, reducing the profit income and hence the commodity demand out of it, that is $c_\pi t_a g(\theta)F'^{-1}(Y) < 0$

Moreover as Y increases, profit income and the corresponding demand, $c_\pi Y$ increases. Net demand from profit income increases , $c_\pi[1 - t_a g(\theta)F'^{-1}(Y)] > 0$

Thus, first order change in E_a with respect to Y is derived from (A2.1)

$$\boldsymbol{dE_a/dY = [c_w - c_\pi]g(\theta)F'^{-1}(Y) + c_\pi[1 - t_a\, g(\theta)F'^{-1}(Y)] > 0} \qquad \text{(A2.2)}$$

Since diminishing marginal productivity exists, $F''^{-1}(Y) < 0$, rate of rise in wage income and the rate of rise in demand from wage income falls, that is $[c_w - c_\pi]g(\theta)F''^{-1}(Y) < 0$.

As the rate of rise in wage income falls, rate of increase in expenditure on ad valorem tax to the firm falls reducing the rate of fall in profit income , thus the associated demand out of profit income increases, that is, $c_\pi t_a g(\theta)F''^{-1}(Y) > 0$

Second order change implies,

$$d^2E_a/dY^2 = [[c_w - c_\pi] - c_\pi t_a]\, g(\theta)F''^{-1}(Y)$$

And, $\boldsymbol{d^2E_a/dY^2 \gtreqless 0}$ depending on $\boldsymbol{t_a \gtreqless [c_w - c_\pi]/c_\pi}$ (A2.3)

***Based on* (A2.2) and (A2.3), aggregate demand curve has different shapes depending on the relative magnitude of ad valorem tax and marginal propensities to consume for wage and profit earners.**

Appendix – 3

According to equation (3.77) of section 3.6.2.2.2, the effective demand in presence of specific tax,

$$E_s = [c_w - c_\pi]\, j(\theta, P, t_s) F^{-1}(Y) + c_\pi Y - c_\pi [F^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s - c_w \tau_w - c_\pi \tau_\pi + \beta[\bar{m}/P] + \hat{g} \quad \text{(A3.1)}$$

With the increase in Y, post tax real wage, $(W/P)^*_s$ remains unchanged at the given effort function. Effort, $e((W/P)^*_s, \theta)$ too remains unchanged but employment increases with the increase in Y, where, $\bar{L} = [F^{-1}(Y) / [e((W/P)^*_s, \theta)]$.

As real wage remains unchanged and employment increases, wage income, $[(W/P)^*_s / [e((W/P)^*_s, \theta)]]\ F^{-1}(Y)]$ increases. And hence net demand from wage income increases, that is $[c_w - c_\pi]\, F'^{-1}(Y)\ [(W/P)^*_s / [e((W/P)^*_s, \theta)]]\ > 0$.

As employment increases, expenditure on specific tax or employment tax of the firm increases, reducing the profit income. Thus demand from profit income falls, that is, $c_\pi [F^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s < 0$.

Moreover as Y increases, profit income and the corresponding demand, $c_\pi Y$ increases. Net demand from profit income increases , $c_\pi [1 - [F^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s] > 0$

Thus, first order change in E_s with respect to Y is derived from (A3.1)

$$dE_s/dY = (c_w - c_\pi)[(W/P)^*_s F'^{-1}(Y)] / [e((W/P)^*_s, \theta)]] + c_\pi [1 - [F^{-1}(Y) / [e((W/P)^*_s, \theta)]\, t_s] > 0 \quad \text{(A3.2)}$$

Since diminishing marginal productivity exists, $F''^{-1}(Y) < 0$, rate of rise in wage income and the rate of rise in demand from wage income falls, that is $[c_w - c_\pi] [F''^{-1}(Y)\ (W/P)^*_s] / [e((W/P)^*_s, \theta)]] < 0$.

Again due to diminishing marginal productivity, $F''^{-1}(Y) < 0$, rate of increase in employment falls ,that is, $[F''^{-1}(Y) / [e((W/P)^*_s, \theta)] < 0$. Hence the rate of increase in expenditure on specific tax or employment tax of the firm falls. This reduces the rate

of fall in profit income .Thus the corresponding commodity demand increases, that is, $c_\pi\,[F''^{-1}\,(Y)\,/[e((W/P)^*_s,\,\theta)\,]\,t_s > 0$.

Second order change,

$$\boldsymbol{d^2E_s/dY^2 = -[c_w - c_\pi]\,[(W/P)^*_s F''^{-1}\,(Y)\,]/[e((W/P)^*_s,\,\theta)\,]] + c_\pi\,[F''^{-1}\,(Y)\,/[e((W/P)^*_s,\,\theta)\,]\,t_s}$$

Thus, $d^2E_s/d\,Y^2 \gtreqless 0$ depending on $t_s \gtreqless \frac{[c_w - c_\pi](W/P)^*_s}{c_\pi}$ (A3.3)

Following (A3.2) and (A3.3) aggregate demand curve has different shapes depending on the relative magnitude of specific tax and marginal propensities to consume for wage and profit earners.

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