Liberalisation, Wages and Sector Growth – General Equilibrium Analysis for India

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Dedicated to the loving memory of Mr. Bimal K. Chakraborty (late) and Mrs. Pratima Chakraborty (late)

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Abstract

This doctoral thesis enlightens different channels through which liberalised trade policies can have differential impact on the organisation of production in different sectors that subsequently seep into the relatively larger share of the workforce, employed in the agricultural or non-agricultural informal sectors with wage earnings below or just above the poverty line. In the four core chapters, this thesis brings together salient features of a developing dual economy like India, such as the dualism observed in domestic factor markets and co-existence of internationally non-traded goods, within the realm of general equilibrium framework that captures structural features of trade and production patterns for a typical developing country (DC hereafter) like India.

Chapter 3 explains why a DC like India may experience a jobless growth in the organised sectors during liberalised regime within the framework of a three-sector mobile capital version of Harris-Todaro (HT hereafter) type general equilibrium model describing rural-urban migration with agricultural dualism and a non-traded intermediate input. Main findings support the fact that as a consequence of different trade reform policies, organised sectors have experienced increased competition from foreign markets which has forced them to relax labour laws, with the freedom to switch towards relatively capital-intensive techniques of production, resulting in retrenchment of relatively less productive workers and ending up with jobless pattern of growth in these organised urban sectors during the liberalised regime. These results are particularly interesting for their contradiction to the predictions of the standard HT model.

Chapter 4 explores a controversial policy debate in DCs including India, concerning acquisition of agricultural land to set up Special Economic Zones (SEZs) in order to promote industrialisation. This essay critically analyses the implications of this policy, using a three-sector HT type general equilibrium model with the SEZ sector characterised with increasing returns to scale (IRS) sector, having an imperfectly competitive market. It is found that following an inflow of foreign capital due to the government policy of easing the entry

criteria for FDI, the industry expands through spillover effects and in turn, the agricultural sector may expand for a sufficiently higher degree of scale economies in the SEZ sector through the general equilibrium implication on resource reallocation. The magnitude of urban unemployment may fall, albeit the workers in general will be worse-off due to reduction in the wage income. National income of the economy may increase and export by the SEZ sector may rise simultaneously, given a negligible income-elasticity of demand for the SEZ-good. These results are particularly interesting for their stark contradiction with the standard general equilibrium models of production and trade developed yet in this context and their policy implications.

Motivated by a set of stylised facts based on provincial data for India, Chapter 5, by utilising a four-sector general equilibrium framework with segmented labour and capital markets (domestic), proposes that factor-specific technological progress only in the capital-intensive segment of the urban formal sectors may affect the urban informal workers adversely, while a technological progress (trade-induced) in the vertically integrated skill-intensive formal sector benefits them. The quantitative analysis demonstrates that when both of the formal sectors undergo capital-using technological progress, urban informal wage may improve, provided the vertically integrated formal sector could save more on the capital cost of production compared to the relatively capital-intensive formal sector and capital flows to the informal sectors. This helps understand trends in urban poverty given the strong association between urban informal wage and the degree of urban poverty.

Finally, Chapter 6, using a full-employment general equilibrium model with internationally non-traded goods and international fragmentation in skill-intensive production, illuminates how liberalised input trade, by enhancing demand for skills in the skill-intensive service sectors, could affect the unskilled wages prevailing in the informal sectors and employment conditions in those sectors, through the existence of finished non-tradable and the corresponding domestic demand-supply forces. The underlying developing economy is characterised by dual unskilled labour market with unionised formal and non-unionised informal sectors. Quantitative analyses have also

been performed to simulate how the changes in elasticities of factor substitution in production of different sectors account for the movement in informal wage and therefore the movement in skilled–unskilled wage gap. Extending the basic model with involuntary unemployment of the skilled workforce, it is again found that the relative wage inequality in a developing country like India with rigid organised sector labour market has not been governed only by the increase in the skilled wages.

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Chapter 1 – Introduction

The term ‘globalisation’ most commonly defines a process of integration with the rest of the world. Such integration is routed through increasing volume of foreign trade and investment. Since 1980s, trade liberalisation has become an important agenda of many countries’ development strategies. Supporters of liberalisation argue that opening up domestic markets to foreign competition and foreign direct investment can contribute to more competition and efficiency gains of domestic industries, resulting in a more efficient allocation of resources and greater overall output. Opponents warn that domestic producers may be unable to achieve efficiency gains, since they fail to successfully adapt foreign technologies to indigenous methods of production that has been subcontracted to the local small-scale (informal) industries or because of the distortions in domestic factor markets that often prevent expansion of efficient industries as well as investments in new technology. Which of these two views is closer to the truth has important implications for trade policy. Therefore, the major task of an economist is to evaluate the welfare implications of such policies both from aggregate and distributive perspectives.

In 1991, after decades of pursuing an import-substitution industrialization strategy, India introduced a radical reform of her external sector. As reported in Kumar and Mishra (2008), the average tariff imposed on manufacturing products dropped from 117 per cent in 1990–91 to 39 per cent in 1999–2000. The reduction in tariffs was much more severe in India than in the trade liberalisation experiences in Latin American countries such as Mexico, Colombia and Brazil (Kumar and Mishra 2008). In addition to tariffs, India has also reduced non-tariff barriers (NTBs) from 1991. The average ‘import-coverage ratio’ (the share of imports subject to non-tariff barriers) reduced from 82 per cent in 1990–91 to 17 per cent in 1999–2000 (Kumar and Mishra 2008).

It has been argued that an outward-oriented policy that aims to reduce barriers to free trade will help to address the problems of developing countries (DCs), particularly on the employment front (Chaudhuri and Mukhopadhyay 2010).

However, trade reform measures have made India increasingly reliant on external economic factors like other DCs, which have become increasingly volatile (Kaplinsky 2001). As a result, the non-OECD developing countries have become increasingly reluctant to implement tariff reform as a possible strategy (Yanikkaya 2003). In case of India, although trade reform measures led to a lowering of the relative price of equipment investment (via the cuts in tariffs and NTBs of capital and intermediate goods) that had an unambiguous positive effect on economic growth, positive effect on total factor productivity growth in the service sectors and significant positive impact on the efficiency in the Indian organised manufacturing sectors (Sen 2008). However, mistakes in sequencing and implementing economic reforms have led to retrenchment of huge number of workers from the organised sectors resulting in 'jobless growth' in the organised sectors, increased poverty in the urban areas and widening of wage gap between skilled and unskilled workers during the liberalised regime in India (Sen 2008).

It is well-known that in a developing economy the 'informal sector' hosts a substantial proportion of the workforce in unregistered activities, primarily characterised by the ease of entry and unregulated markets. As suggested by many authors (Agenor 1996; Schneider and Enste 2000 and the references therein) more than 70% of the workforce is engaged in the informal sector of a DC: "From a 'black hole' to an 'entrepreneurial' factory: the informal sector is here to stay!" (World Development Report 2013: Jobs). In South Asian countries such as India, a significant proportion (about 85% in non-agricultural activities of India) of the working population are engaged in the informal sector. In 1995, the informal sector accounted for almost 92.5 per cent of India's workforce (Jhabvala and Subrahmanya 2000). In other words, less than 10% of the workforce is employed in the organised or formal sectors. The share of the informal sector in total output can also be quite high. For example, Nagaraj (2004b) reports a figure of 40% for India.

According to the International Labour Organisation (ILO) World Employment Report (ILO 1998 p. 168), the informal sector is classified into three categories:

a) The *micro-enterprise sub-sector* is the most important part, typically connected to the formal sector through various types of sub-contracting arrangements.

b) The *household-based sub-sector*, where major activities are carried out by family members (mostly by the unpaid female labour force). Most households belong to the lower tail of the income-distribution and are unable to come out of the poverty-trap.

c) The *independent service sector,* comprises of domestic helpers, street-vendors, cleaners, street-barbers etc., as well as those referred to as casual labour. The skills required for these occupations are of the most basic nature in the informal skill hierarchy.

In this thesis, we define 'informal' sector as the unregulated sector where minimum wage laws are not maintained. These sectors comprise unskilled workers in rural areas, engaged in agro-based low-cost production (internationally tradable or non-tradable) and/or in the non-agricultural own-account enterprises of the urban areas as well as in many subcontract firms producing various parts and semi-processed components (primarily internationally non-tradable) for the parent urban formal sector firms. This definition allows us to focus on the economic conditions of the majority of the workforce in DCs like India.

While organised workforce can negotiate and use bargaining strength to affect the unionised wage, the informal labour market usually responds to competitive conditions (Agenor 1996; Agenor and Montiel 1996). Labour market rigidities usually lead to the hiring of informal workers who are hired at a wage rate lower than the one prevailing in the formal sector (Marjit 2003; Marjit et al. 2007). In this scenario, economists and policymakers throughout the entire developing world engage in debate to answer the questions like: Does liberal trade policy hurt these non-unionised workers? Does militant labour unionism help these workers? Emotions can run high and political instincts may overpower scientific arguments. Naturally, this calls for an exploration of simple economics that can shed light on such issues.

Since DCs are generally deficient in effective employment insurance schemes, the displaced workers from the sector experiencing decline in relative price can hardly afford to remain unemployed. Absorption of labour retrenched from the more regulated sectors by this 'informal' or unorganised sector is, therefore, likely to be a major reason behind the concurrent increase in income (wage) inequality and informalisation, as well as the relatively jobless patterns of growth observed in many DCs in the recent years, including India (Razmi 2009).

It is, therefore, necessary to explicitly take into account the structural features of labour markets in DCs like India to analyse the implications of a more open trade regime. The interaction between the formal and the informal labour markets provides an interesting twist to the standard neoclassical general equilibrium models and lead to interesting relationship between commodity and factor prices. In fact, the informal segment can accommodate voluntary and involuntary employment at the same time and trade reform tends to affect their incentives in different ways.

Standard trade theory models have not been adopted to capture the characteristics of factor markets in DCs like India. For example, various issues of the National Sample Survey of India (1989–90 to 2010-11) suggest rising real wage in the informal sector in the post-reform period. Therefore, expansion of employment in the informal sector does not necessarily reflect growing impoverishment in the informal sector. In addition, the nature of capital mobility between formal and informal segments also appears to be crucial; since dualism in domestic capital (credit) market often arrest free capital movement from formal to informal sectors that subsequently alters the demand for low-skilled labour, the associate factor of production, in the informal sector.

Along with these features, existence of the internationally non-traded goods, another salient feature of a DC like India, with the domestic market clearing condition, significantly changes many standard results of the trade theory models. This point will be illustrated in Chapter 2, with a review of different relevant literature in this context.

To bring all these issues under consideration together, interactions between goods and factor markets and inter-sectoral production linkages are of central importance. The Ricardian set-up or models with firm-heterogeneity based on productivity differences pioneered by Melitz (2003) cannot capture simultaneously the linkages between formal and informal production activities and the role of factor-substitutability in production. Moreover, the focus of this thesis is not to explore selection effect of the firms into the world market. Therefore, these approaches would not have been appropriate to model the interaction between the product and factor markets of these two broad sectors for a developing economy within a general equilibrium framework.

Therefore, this thesis purports to explore thread of channels through which a range of aspects of liberalisation (trade policy, inward foreign investment, imported foreign technology, Special Economic Zones and so on), in conjunction with rapid urbanisation, could affect income (wages) of the relatively marginalised workers with respect to the specific economic and policy conditions designed to represent a developing country such as India. These conditions alternatively allow for differences in the international tradability of different types of goods and services; for differences in the formality of production and unionisation of labour across sectors of the economy; and for differences in the scope for factor (labour and capital) mobility. The novel aspect of this thesis would, therefore, be to bring in all these salient features of a developing dual economy (like India) altogether into tractable analytical long-run (steady-state) general equilibrium models of production in open economy.

The structure of the thesis is as follows:

Chapter 2 constitutes the Literature Review characterising the class of static general equilibrium models with non-traded goods and identifying the ‘gaps’ to which the thesis contributes.

Chapter 3 addresses why a developing country may experience ‘jobless growth’ in the organised sectors following liberalisation within the framework of a three-sector mobile capital Harris-Todaro type general equilibrium model

describing rural-urban migration with agricultural dualism and a non-traded intermediate input.

Chapter 4 contributes to the Indian policy debate by addressing the question whether the acquisition of agricultural land to establish Special Economic Zones (SEZ) can support structural transformation and dual sector growth in the context of India? In particular, this essay again uses a three-sector Harris-Todaro type general equilibrium (GE) model with the SEZ sector characterised by an increasing returns to scale (IRS) sector, having an imperfectly competitive market.

Chapter 5, motivated by a set of stylised facts based on provincial data for India, investigates the incidence of urban poverty by modelling the impact of technological progress in the formal sectors on the urban informal wage in a four-sector full-employment general equilibrium framework with labour and capital market distortions.

Chapter 6 develops a multi-sector full-employment general equilibrium model with internationally non-traded goods and international fragmentation in skill-intensive production, to understand the mechanism how trade-induced productivity improvement in the skill-intensive sector is channelized to the informal sector wages and employment through the existence of finished non-tradable and the corresponding domestic demand-supply forces. The numerical analysis simulates how the changes in elasticities of factor substitution in production of different sectors account for the movement in informal wage and therefore the movement in skilled–unskilled wage gap. The extended model with involuntary unemployment of skilled labour (incorporated using the 'fair wage hypothesis') effectively demonstrates the robustness of the results obtained under the full-employment model.

Finally, Chapter 7 concludes the thesis with a summary and critical evaluation of the contribution, recognises the limitations and suggests some further extensions.

Chapter 2 – Real Wage and Finished Non-tradable in General Equilibrium: A Symposium

It is well-known that once a country leaves complete autarky behind, only some markets become global; other markets continue to be purely national, or perhaps even regional. This is due to many different reasons such as, high natural barriers to trade (e.g., transportation costs, different preferences of the residents in different countries) or different policy factors like prohibitive tariffs and non-tariff barriers. Production of such non-traded goods is another important feature. It is well known that existence of non-tradable significantly alters many of the standard results. In this context, we step out of the restricted one-factor setting and consider production structures with two or more factors of production, with existence of a non-tradable (either finished product or intermediate input) alongside the exportable(s) and importable(s).

The purpose of this chapter is to review the class of static general equilibrium models of production that examine how far the implication of trade reform measures in the formal sectors on the real informal wages hinges upon the presence of non-traded goods in a small, open developing economy like India. The different models discussed in this chapter do not only provide a consolidated review of the existing notable research in this particular field, but also stand as the basic models that will be extended in the rest of the thesis chapters in different contexts.

2.1 Real Wage and Non-traded Goods in Full-employment General Equilibrium Models[1]

We start with Jones (1974) that modifies the Heckscher-Ohlin-Samuelson (HOS) model to include a non-traded good. Although earlier papers (Pearce 1961; McDougall 1965; Komiya 1967; and McDougall 1970) provided generic

[1] Sections 2.1, 2.2 and 2.4 are based upon the simple exposition of Jones (2012a).

treatment of trade models with non-traded goods, Jones (1974) was the first contribution where existence of non-traded goods was considered in a 3×2 (three-sector, two-factor) HOS framework, to elucidate how the market for non-traded goods is linked to the market for traded goods for a small open economy.

2.1.1 Non-traded Goods in Full-employment Heckscher-Ohlin Model (Jones 1974)

This is essentially an HOS-type general equilibrium model with three sectors: export, import and non-traded sector. The economy consumes only two of the commodities, the non-traded good and the imported commodity. Therefore there is no domestic demand for the exportable. In the production side of the economy, only two goods are produced: the non-traded good and the exportable, i.e., this economy does not produce the importable.[2] All goods are produced under competitive conditions using labour and capital. Also technology does not allow joint production – each commodity is produced in a separate process using inputs of capital and labour. There is a tariff on the importable imposed at the ad-valorem rate t.[3] Both factors (labour and capital) are perfectly mobile, so we first write down the equation system that characterises the production equilibrium for the economy. The production equilibrium is characterised by two zero-profit conditions (prices brought down to the level of unit costs in competitive equilibrium) and factor market equilibrium conditions (stating that all factors of production are fully utilised).

[2] That means, at the steady-state equilibrium level, the horizontal domestic supply curve (because of CRS) of importable lies above the world price of imports – hence there is no domestic production of importable.

[3] Although there is no domestic production of importable, import duties (such as tariff) may have been imposed in this general equilibrium framework, in order to support the production of non-tradable.

The export good is chosen as the numeraire and the small open economy faces a globally determined terms of trade.[4] Let us denote

W =Wage rate (competitive) of labour (L);

r = Rental return to capital (K);

P_M^* = the world price of importable (given by the small, open economy assumption);

P_N = Domestic price of non-traded good;

E = Output produced in the export sector;

N = Output produced in the non-traded sector;

a_{ji} =Per-unit requirement of the j^{th} factor in order to produce one unit of the i^{th} good; ($j = L, K; i = E, N$; so for example, $a_{LE} = L_E/E$; where L_E = labour employed in the export sector);

$\bar{L}$ = Endowment of labour in the economy;

$\bar{K}$ = Capital-endowment of the economy;

t = Advalorem rate of tariff on importable (M).

The two zero-profit conditions for the competitive producers are given by:

$$Wa_{LE} + ra_{KE} = 1 \tag{2.1}$$

$$Wa_{LN} + ra_{KN} = P_N \tag{2.2}$$

The full-employment condition of labour is given by:

$$a_{LE}E + a_{LN}N = \bar{L} \tag{2.3}$$

Full-utilisation condition of capital is given by:

$$a_{KE}E + a_{KN}N = \bar{K} \tag{2.4}$$

[4] At the initial equilibrium, in absence of tariff, we have terms-of-trade as globally determined as $(1/P_M^*)$. However, with the imposition of tariff at the *advalorem* rate t, the domestic terms-of-trade becomes $\left(\frac{1}{P_M^*(1+t)}\right)$. Therefore, any tariff-induced change in this domestic terms-of-trade would be termed as (domestic) 'terms-of-trade effect' in this essay.

Price of the non-tradeable has been determined by the domestic demand-supply equality condition given by the following equation:

$$D_N(P_N/P_M^*(1+t), Y) = N \qquad (2.5)$$

Where $D_N, P_M^*(1+t)$ and Y are respectively the demand for the non-traded good, tariff-inclusive domestic price of imports and national income of the economy.

Assuming away the presence of foreign capital in economy's initial capital endowment, since in the post-trade steady-state equilibrium situation always trade is balanced, we have

$$E = P_M^* M = P_M^* D_M$$

Since there is no domestic production of the importable M, $D_M = M$ (entire domestic demand is met by imports).

Given that aggregate value of spending is equal to the aggregate value of production describes the budget constraint (note that we also have $D_N = N$ by Equation (2.5)),

$$P_M^* D_M + P_N D_N = Y = E + P_N N \qquad (2.6)$$

Hence, domestic price of the non-traded good must be consistent with the levels of factor prices determined by the prices of the two internationally traded goods.

Therefore, the general equilibrium model is closed with 6 independent equations with 6 unknowns. The endogenous variables are W, r, P_N, E, N and Y. The parameters of the model are $P_M^*, t, \bar{L}$ and $\bar{K}$.

Equations (2.1) and (2.2) together look like the price system of the HOS model and display HO properties. So these two Equations together constitute a 'Heckscher-Ohlin subsystem (HOSS)' or a 'HO nugget'.

Stability Conditions

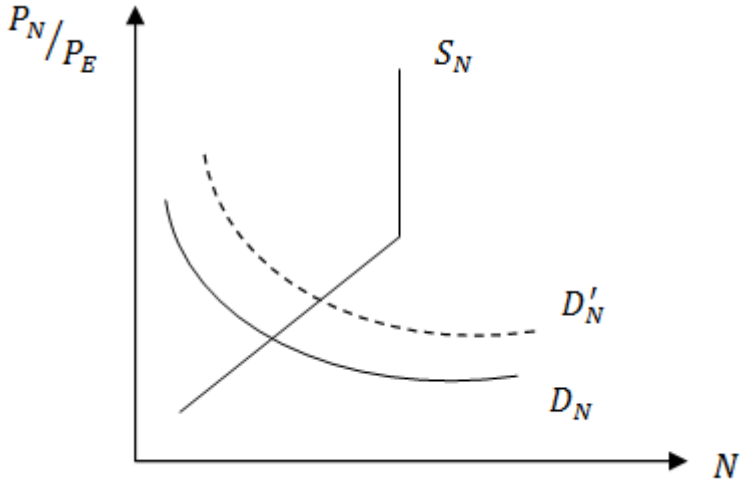
Such long-run general equilibrium models, concentrating on the production side of the economy, typically assume away the existence of any adjustment costs in the dynamic adjustment mechanism of the system. This trivially implies equilibria in the competitive product markets are Marshallian stable and in the factor markets are Walrasian stable.[5]

Comparative Static Exercise

We have $dt < 0$, ceteris paribus. Therefore, only price of the imported good (P_M) falls owing to a tariff cut. The country's demand for the non-traded commodity is affected in two different ways. Assuming all commodities are substitutes (i.e. ruling out complementarity in demand) and given real income, the quantity demanded of non-tradeable falls since that of importable increases. This is the pure substitution effect. However, the fall in P_M increases the national income of the economy. Supposing α_M (with $0 < \alpha_M < 1$) is the share of income for labourers or capital-owners spent on the importable (good X_M), the real income increases by $(-\alpha_M dt)$. This is a pure (domestic) terms-of-trade effect. Any subsequent induced change in the price of non-tradeables does not affect real incomes for the nation, although it will have different effects on the real incomes of the two factors. Now assuming the demand for non-tradeable is relatively inelastic, income effects dominate substitution effects, so P_N increases by the upward shift in the D_N schedule (since P_E unchanged).

[5] For an explicit statement on this, one can check Jones (2012b).

Figure 2.1: The Market for Non-traded Good



Using Equation (A2.1) – (A2.2) in Appendix 2.1, totally differentiating Equation (2.1) we have (^ indicates proportional change; for example, $\hat{X} = dX/X$)

$$\theta_{LE}\widehat{W} + \theta_{KE}\hat{r} = 0 \qquad (2.7)$$

Where θ_{ji} is the cost-share of the j^{th} factor in the i^{th} sector ($j = L, K; i = E, N$), with $\sum_j \theta_{ji} = 1$.

Similarly, total differentiation of Equation (2.2) yields

$$\theta_{LN}\widehat{W} + \theta_{KN}\hat{r} = \widehat{P_N} \qquad (2.8)$$

Solving Equations (2.7) and (2.8) by Cramer's rule, we obtain

$$\widehat{W} = -(\theta_{KE}/|\theta|)\widehat{P_N} \qquad (2.9)$$

Where the determinant $|\theta| = (\theta_{LE}\theta_{KN} - \theta_{KE}\theta_{LN}) = (\theta_{KN} - \theta_{KE})$ is positive (negative) if the non-tradeable sector is more (less) capital-intensive than the export sector.[6] Since the price of exportable is normalised to unity, an increase

[6] To be more precise, $|\theta|$ is positive (negative) if sector N uses more (less) capital-intensive techniques in the production process than sector E in ***value terms***, i.e., if $\left(\frac{ra_{KN}}{a_{LN}}\right) \gtrless \left(\frac{ra_{KE}}{a_{LE}}\right)$. That means relative cost-share of capital (labour) in the production of sector N is higher (lower) than the relative cost-share of capital (labour) in sector E's production or vice-versa. This trivially implies sector N uses more (less) capital-intensive techniques in the production process than sector E in ***physical terms***, i.e., $(a_{KN}/a_{LN}) \gtrless (a_{KE}/a_{LE})$ and vice-versa. In other words, relative proportion of capital (labour) used in sector N's per-unit of production is higher (lower) than relative proportion of capital (labour) used in per-unit production of sector E.

in P_N leads to increase (fall) in nominal wage rate if in the nugget, non-traded sector (sector N) is more (less) capital-intensive than the export sector (sector E). Let us denote spending share on the non-traded good as α_N (where $0 < \alpha_N < 1$) and w as the real wage rate. Then the change in real wages is given by:

$$\widehat{w} = \alpha_M(-dt) - [\alpha_N + (\theta_{KE}/|\theta|)]\widehat{P_N} = -\alpha_M dt + \widehat{W} - \alpha_N\widehat{P_N} \qquad (2.10)$$

Note that now the change in nominal wage rate must be adjusted by the overall cost of living, which now also includes the change in the price of the non-traded good. The terms-of-trade improvement (due to the tariff-reduction on importable) helps but the rise in the price of the non-traded good hurts by changing the consumer price index faced by the workers.

Let us assume that this non-tradeable is less capital-intensive than the importable. Let us also stick to the assumption that income effects in domestic demand for the non-traded goods outweigh the substitution effects, so that price of the non-tradeable will rise. Then following the decrease in price of the importable due to the tariff reduction, nominal wage will increase. Although price of the non-traded good also rises, the nominal wage rate will increase, in relative terms, by more than the price of any produced good, thus ensuring that real wage will rise under the above assumptions. But if the demand for non-traded good is relatively elastic, so that the substitution effect mentioned above dominates the income effect of terms-of-trade (domestic) improvement owing to fall in P_M, P_N will fall and nominal wages will fall (as seen from Equation (2.10)). In that case although the fall in nominal wages should dominate the change in the price of any produced commodity, the (domestic) terms-of-trade improvement makes the change in real wage in Equation (2.11) ambiguous.

Now suppose sector N is more capital-intensive and the demand for non-traded good is relatively elastic, so that the substitution effect mentioned above dominates income effect of terms-of-trade improvement owing to fall in P_M. In this scenario, since P_N falls and $|\theta| > 0$, Equation (2.10) reveals that nominal wage increases and one can easily follow from Equation (2.11) that this will transmit to an unambiguous increase in real wage.

So in this set-up with non-traded goods, containing a nugget, the implication on real earnings of the labourers following a tariff reform on the importable depends on two most important assumptions:

(a) Assumption about the relative factor-intensity ranking in the nugget;
(b) Assumption about the demand behaviour of the domestic residents for the non-traded good.

2.1.2 Non-traded Goods in Heckscher-Ohlin model with Segmented Labour Market

Let us reconsider Jones (1971) set-up with segmented labour market, assuming that the exportable is produced in a high-wage organised sector and the non-traded good is produced in the unorganised sector with flexible wages. In sector E, which is now the higher wage organised sector, wage is pegged at a higher level by prior negotiations with labour unions. In particular, we assume that the wage in sector E is institutionally given and fixed (or rigid) at a higher rate W^* above the competitive rate (W).[7] Those unable to get a job in this sector E would be absorbed in the residual non-traded good producing sector at competitive wages. This non-traded good producing sector essentially characterises informal sector of a developing country (DC) like India. Therefore, in spite of the existence of wage-differential (i.e., $W^* > W$), labour is fully employed and there is no open unemployment in this model. This type of full-employment characterisation of labour market in general equilibrium model is consistent with the existing theoretical analyses of dual labour markets in the context of DCs such as: Carruth and Oswald (1981), Agenor and Montiel (1996), Marjit, Broll and Sengupta (2000), Marjit and Beladi (2002), Marjit and Acharyya (2003), Marjit (2003), Marjit, Kar and Acharyya (2007), Beladi et al. (2012). In case of India, a typical example of a DC, the National Sample Survey Organization of the Government of India (various reports) reports a low unemployment rate among the lower-skilled poor people working

[7] We are not modelling this wage-fixation explicitly here. A formal derivation of unionised wage through collective bargaining is shown in the Appendix, based on a simplified version of Chaudhuri (2003).

in informal sectors. This is quite understandable because the people in the lower deciles of the income group in such countries cannot survive without a job. Therefore, this structure is appropriate for a DC with sizable informal sector, such as India.

The zero-profit condition for sector E changes to:

$$W^* a_{LE} + r a_{KE} = 1 \qquad (2.1.1)$$

Totally differentiating Equation (2.1.1), applying Envelope condition and solving simultaneously with Equation (2.8) by Cramer's rule, we get

$$\widehat{W} = \widehat{P_N}/\theta_{LN} \qquad (2.11)$$

$$\hat{r} = 0 \qquad (2.12)$$

Since r is held fixed by W^*, there will always be a one-to-one relationship between changes in the price of non-tradeable and the competitive wage rate, unlike Equation (2.9) in the earlier set-up.

Therefore the change in real wages will now be given by:

$$\widehat{w} = \alpha_M(-dt) - [\alpha_N - (1/\theta_{LN})]\widehat{P_N} = -\alpha_M dt + \widehat{W} - \alpha_N \widehat{P_N} \qquad (2.13)$$

If the price of non-tradeable rises, it hurts the consumers by changing the overall consumer price level. At the same time, since the nominal wage unambiguously increases more than proportionately to the increase in the price of non-traded good (evident from Equation (2.11) as $\theta_{LN} < 1$), it follows from Equation (2.13) that the real wage will always increase in this set-up if the domestic demand for non-tradeable is relatively inelastic. Therefore in this set-up with segmented labour market, the implication on real earnings of the labourers following a tariff reform on the importable depends only on the demand behaviour of the domestic residents for the non-traded good, but not on any assumption about relative factor-intensity ranking between the export sector and the non-traded sector.

2.1.3 Real Wage and Non-traded Goods in Specific Factors Model

Let us now assume that in Jones (1974) set-up with non-tradeable, labour is mobile perfectly among the production sectors whereas capital is sector-specific. This way we embed the non-traded good into the Jones (1971) specific-factor set-up, instead of the Heckscher-Ohlin set-up discussed in previous sub-section.

The general equilibrium set-up will be re-specified. We continue to assume competitive markets and constant returns to scale (CRS) technology with diminishing marginal productivities of factors. The two zero-profit conditions will be:

$$Wa_{LE} + r_E a_{KE} = 1 \tag{2.14}$$

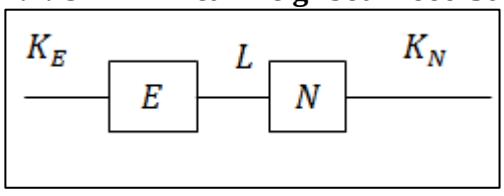
$$Wa_{LN} + r_N a_{KN} = P_N \tag{2.15}$$

The full-employment condition for labour will be same as in Equation (2.3), however, the full-utilisation condition of capital in Equation (2.4) will change to:

$$a_{KE}E = K_E \tag{2.16}$$

$$a_{KN}N = K_N \tag{2.17}$$

Figure 2.2: 3 × 2 Linear Neighbourhood Structure



Given K_E and K_N, Equations (2.16) and (2.17) solve E and N respectively in terms of factor prices. Substituting them in Equation (2.3) and solving simultaneously with Equations (2.14) – (2.15), we can determine W, r_E, r_N, E and N in terms of the price of non-tradeable, P_N. Finally solving simultaneously Equations (2.5) and (2.6) we obtain P_N. Then substituting the

solution for P_N, we solve for all other endogenous variables in terms of parameters and exogenous variables of the model.

We have, as before, $\widehat{P_M} < 0$ since $dt < 0$, ceteris paribus. In this case, the money wage rate changes by a relative amount that is a positive weighted average of relative changes in the prices of all commodities produced domestically. Since price of the exportable is fixed by small open economy assumption, the relative change in money wage rate is a positive fraction times the relative change in the price of non-traded good. But if the distributive share of the inter-sectorally mobile factor, labour, is higher in the non-traded sector compared to the export sector, this fraction will also be larger.[8] Let us denote this relative labour-intensity in the non-traded sector as $\overline{\theta_N}$. Suppose s_N is the share of non-tradeable in total gross production of the economy. Then $\overline{\theta_N} = (\lambda_{LN}/s_N)$, where λ_{LN} is the proportion of the economy's labour force used to produce non-tradeable, $(0 < \lambda_{LN} < 1)$. Let us also denote $\sigma_N = \gamma_{LN}/(\gamma_{LN}\lambda_{LN} + \gamma_{LE}\lambda_{LE})$; where γ_{Li}s denote the elasticities of demand for labour (i.e., elasticities of the marginal product of labour) in sector $i, (i = N, E)$ and $\gamma_L = (\gamma_{LN}\lambda_{LN} + \gamma_{LE}\lambda_{LE})$ is the weighted average of the elasticities (with weights being the labour shares of respective sectors), constituting the overall aggregate elasticity of demand for labour (see Caves et al. 2007, page S20 – S21).

Thus, we have

$$\widehat{W} = s_N[\overline{\theta_N}\sigma_N]\widehat{P_N} \qquad (2.18)$$

The intuition behind this product formulation is simple: The response of the wage rate to a change in price of the non-tradeable is larger the more important the good in total output (i.e., higher s_N), the higher the relative labour-intensity of the good ($\overline{\theta_N}$) and the relatively more elastic the demand for labour used in the non-traded good (so that marginal product falls more slowly and hence wage increases more as price rises). The term in the bracket $\{\overline{\theta_N}\sigma_N\}$, is known as '*intensity-elasticity nugget*' (Jones and Ruffin 2008). Note that rankings of

[8] This is a special type of factor intensity classification in terms of the relative distributive shares of the mobile factor, used for analytical purpose in specific factor models. For details, see Jones and Neary (1984).

factor substitutability, along with factor intensities, do matter in specific-factor model unlike the Heckscher-Ohlin model.

Assuming that labour has the same taste patterns as all the members of the economy and let the share of non-tradeable in production and consumption be the same (i.e., $s_N = \alpha_N$), the change in overall consumer price index (p) is given by:

$$\hat{p} = s_N \widehat{P_N} + \alpha_M dt \tag{2.19}$$

As before, α_M denotes the share of spending on the importable. So the change in real wages will now be given by:

$$\widehat{w} = \alpha_M(-dt) + \alpha_N[\overline{\theta_N}\sigma_N - 1]\widehat{P_N} \tag{2.20}$$

Comparing Equation (2.20) to Equation (2.13) one can realise that the relative factor-intensity rankings play different roles in Heckscher-Ohlin and in specific-factor models. When the intensity-elasticity nugget is close to 1, the production techniques are on average same in sectors E and N. In that case, the real wage must go up in specific-factor model as the changes in money wage following the change in the price of non-traded good will exactly match the change in the consumer price index.

2.1.4 Trade Liberalisation and Informal Wage in Segmented Labour Markets with Non-traded Goods (Marjit and Maiti 2005; Marjit et al. 2007; 2008)

We now consider the general equilibrium models that have implemented the tools discussed in the above sub-sections. In particular, we are going to review the implications of tariff reform in the import-competing sector on informal wage in a general equilibrium structure with segmented labour market and with existence of large agricultural and informal sectors.

Case (a): Perfect mobility of capital

There will be four sectors in this set-up: sector A is the agricultural sector within the rural economy that produces using labour (L, with competitive rate of wage W) and land-capital[9] (T, with return R). Sector F is the formal sector within the urban economy, producing internationally tradable manufacturing good using labour and capital (K, with return r). Labour in sector F earns an institutionally given wage W^* fixed over and above the competitive wage rate (W). Sector M is producing internationally traded import-competing non-agricultural good with labour (at a competitive rate W) and capital. We assume 't' is the ad-valorem rate of tariff imposed on the imports of commodity M. Sector N is producing a non-traded informal good using only labour. We assume all the sectors are in *close vicinity* and hence those who cannot get employed in the formal sector at W^*, can get a job in either of the sectors A, M or N at the market-determined wage rate W. So we have full-employment of labour with wage-differential ($W^* > W$) like the set-up discussed in sub-section 2.1.1. All the product markets are competitive and production functions exhibit CRS with diminishing marginal productivity of factors.

The competitive zero-profit conditions for the four sectors are given by:

$$Wa_{LA} + Ra_{TA} = P_A^* \tag{2.21}$$

$$W^* a_{LF} + ra_{KF} = P_F^* \tag{2.22}$$

$$Wa_{LM} + ra_{KM} = P_M^*(1+t) = P_M \tag{2.23}$$

$$Wa_{LN} = P_N \tag{2.24}$$

The full-employment conditions entail:

$$a_{TA}A = T \tag{2.25}$$

$$a_{KF}F + a_{KM}M = K \tag{2.26}$$

$$a_{LA}A + a_{LF}F + a_{LM}M + a_{LN}N = L \tag{2.27}$$

[9] The input 'land–capital' is broadly conceived to include durable capital equipment of all kinds (see Bardhan 1973).

The domestic market clearing condition for the non-traded good can be written as:

$$D_N(P_N, P_M, Y) = N \tag{2.28}$$

Where $D_N(.)$ denotes the domestic demand for the non-traded good and Y denotes the aggregate factor income of this small, open economy. We assume N is a normal good with negative and positive own-price and income elasticities of demand, while the cross-price elasticity is positive as well. We are also assuming for algebraic simplicity that a_{LN} is fixed.

We have four price variables: W, R, r and P_N solved from the four zero-profit conditions; given the ad-valorem tariff rate (t) and internationally given commodity prices for A, F and M. So we can determine aggregate income Y. Since factor prices are determined, we can get the unit factor-coefficients, a_{ji}s. Then we solve Equations (2.25) – (2.28) simultaneously to determine A, F, M and N. Thus the endogenous variables are solved in terms of parameters of the model.

Let us trace out the general equilibrium implications of a tariff cut in sector M on real wage (we have $dt < 0$, ceteris paribus):

Solving Equation (A2.3) by Cramer's rule we find:

$$\widehat{W} = (dt/\theta_{LM}) < 0 \tag{2.29}$$

Since $\theta_{LM} \in (0,1)$, $\left|\widehat{W}\right| > |dt|$.

$$\hat{R} = -(\theta_{LA} dt/\theta_{TA}\theta_{LM}) > 0 \tag{2.30}$$

And,

$$\hat{r} = 0 \tag{2.31}$$

Since r is already determined from the zero-profit conditions for sector F (given W^* and the world price of F, P_F^*), it is clear from the competitive conditions in sector M and in sector A that a reduction in tariff in sector M reduces the wage rate (W) and increases the rental return to land-capital (R).

Now the decrease in W will lead to the fall in P_N, given the one-to-one relationship between money wage and P_N in Equation (2.24):

$$\widehat{P_N} = \theta_{LN}\widehat{W} < 0 \tag{2.32}$$

Since the cost-share of labour,θ_{LN}, is always less than unity, P_N always decreases less than proportionately to the reduction in money wage. Therefore, money wage rate always falls, in relative terms, by more than the price of any produced commodity in this small, open economy. Hence, real wage always goes down in this set-up.

Case (b): Sector-specific capital in *F* and *M*

This case when capital cannot move between sectors F and M has been discussed in Marjit et al. (2007). Sector M is the tariff-protected import-competing sector as before. Therefore, Equations (2.22), (2.23) and (2.26) change in the following way:

$$W^* a_{LF} + r_F a_{KF} = P_F^* \tag{2.33}$$

$$W a_{LM} + r_M a_{KM} = (1+t)P_M^* \tag{2.34}$$

$$a_{KF} F = K_F \tag{2.35}$$

$$a_{KM} M = K_M \tag{2.36}$$

So the full-utilisation condition in Equation (2.26) changes to Equations (2.35)-(2.36) which now describe sector-specificity of capital, with no relationship between r_F and r_M, the rental returns to K_F and K_M respectively.

From Equation (2.33) since r_F is pegged by W^* and P_F^*, we obtain a_{KF}. So from Equation (2.35), we find F, given K_F. Thus Equations (2.21), (2.34), (2.25), (2.27) and (2.36) constitute a typical specific factors model of Jones (1971) with variables W, R, r_M, A and M. Using Equations (2.25) and (2.36), one can determine A and M as functions of (R/W) and (r_M/W) respectively, given K_M and $\bar{T}$. Then using Equations (2.21), (2.34) and (2.25) we obtain

W, R and $r_M$in terms of P_N. Substituting the values of W, R and r_M (obtained as functions of of P_N) into the expressions for A and M obtained from Equations (2.25) and (2.36), we find W, R, r_M, A and M as functions of P_N. Then substituting the values for W, R, r_M, A and M (derived in terms of P_N) into the full-employment condition for labour,[10] we finally solve for P_N. Now substituting back the solution for P_N into the expressions for W, R, r_M, A and M, we obtain solutions for all endogenous variables in terms of internationally given commodity prices and other parameters of the model.

If $P_M = (1 + t)P_M^*$ falls owing to a reduction in ad valorem tariff rate (t), then following the magnification effect as in Jones (1971) we obtain

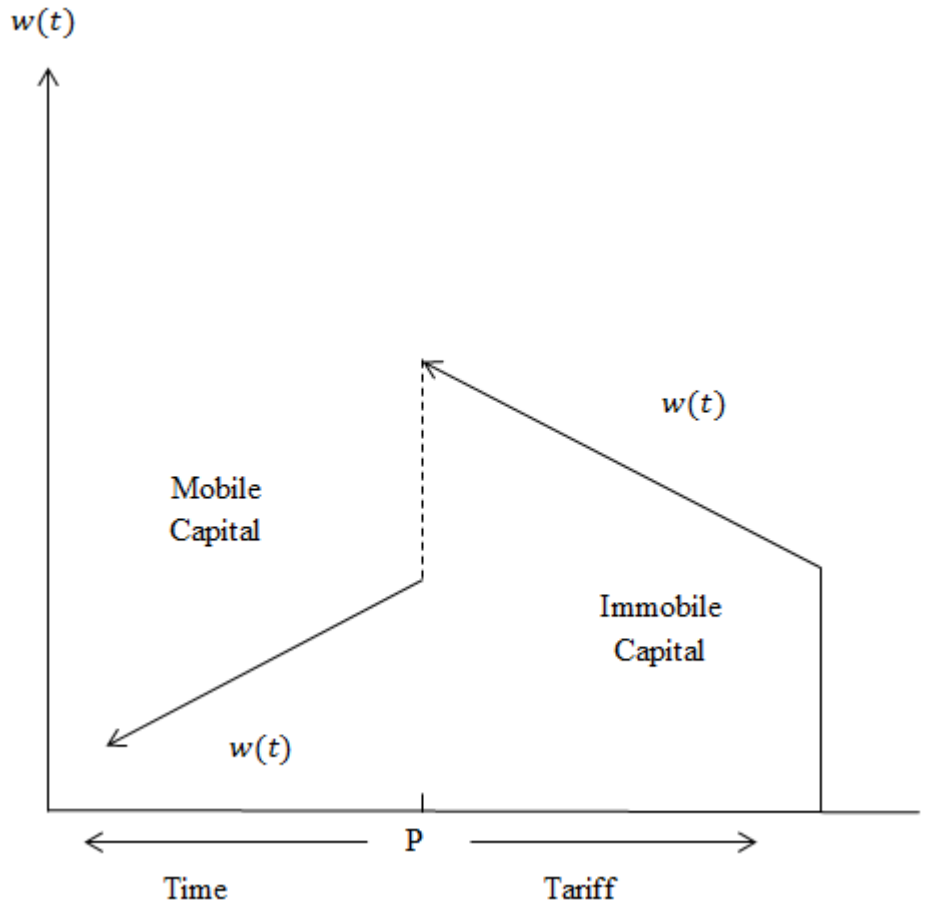
$$\widehat{r_M} < \widehat{P_M}(= dt) < \hat{R} < \widehat{P_A}(= 0) < \widehat{W} \qquad (2.37)$$

As P_M falls following a tariff cut in sector M, this sector will contract, releasing labour. As capital is sector-specific, it cannot be relocated. As a result, (K_M/L_M) increases owing to which r_M falls but W rises. Note that since r_M falls by more than the reduction in P_M, the competitive equilibrium in sector M is still maintained. Since W rises, to satisfy the zero-profit condition for sector A, R falls. As explained before, the increase in money wage raises P_N less than proportionately[11] and therefore increase in money wage will exceed, in relative terms, prices of all produced commodities as before, ensuring that real wage increases.

Let us summarise the movement in informal real wage (w) without and with capital mobility following reduction in the ad valorem rate of tariff (t) imposed on sector M in Figure 2.3: as t goes down over time, starting with immobile capital, real informal wage increases as explained above. But as capital becomes mobile (at point P), a further reduction in tariff rate leads to reduction in w. At point P, we have the discontinuity since capital starts to relocate from Sector M.

[10] Note that F has already been solved using Equation (38) in terms of P_F^*, W^* and K_F.
[11] Note that a_{LN} is fixed.

Figure 2.3: Movement of Real Informal Wage with Sector-specific Capital and with Perfect Capital Mobility

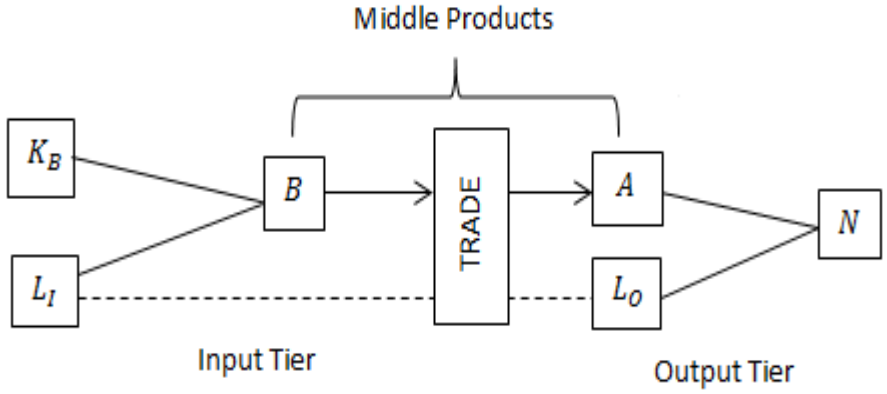


2.1.5 Non-traded goods in Sanyal and Jones (1982) 'Middle Products' Setting

The seminal contribution of Sanyal and Jones (1982) is to take into consideration the fact that there is a range of productive activities wherein productive resources and raw materials are transformed into final commodities ready for consumption, so that the role of international trade is to convert products available in early stages of production into a different set of products more useful as inputs to produce the final goods required by the consumers. That is, international trade takes place in the 'middle' of the production process. The 'Input Tier' combines local resources to produce a set of 'middle products', which then get traded for other middle products, which, in turn, will

be used as inputs in the 'Output Tier' of the economy, the tier producing final consumer goods.

Figure 2.4: Trade in Middle Products



To address the issue of the impact of a tariff reform on the real wage rate, let us simplify the middle products set-up as in Jones (2012a): There is only one production activity in the Input Tier to produce a middle product B using labour and one specific input K_B. This middle product, B, will be exchanged in the world market for another middle product A, which will be combined with labour in the Output Tier to produce a single non-tradeable N. This is depicted in Figure 2.4.

Suppose there is a tariff levied on the imports of the middle product A at the ad valorem rate t. So the domestic price of A is $P_A = P_A^*(1+t)$, where P_A^* is the world price of A. The key comparative static exercise we are interested in is a reduction in the ad valorem rate of tariff levied on A.

The zero-profit condition for the non-tradeable

$$Wa_{LN} + P_A a_{AN} = P_N \tag{2.38}$$

Where a_{jN}s are per-unit requirement of the j^{th} input $(j = L, A)$ in order to produce 1 unit of the non-tradeable. Totally differentiating the zero-profit condition in Equation (2.38) gives

$$\theta_{LN}\widehat{W} + \theta_{AN}\widehat{P_A} = \widehat{P_N} \tag{2.39}$$

Where θ_{jN}s denote cost-share of j^{th} inputs in sector N.

Full-employment condition of the mobile factor (labour) in the Input Tier (I) and Output Tier (O) implies given the fixed aggregate labour force, any increase in the use of labour to produce traded middle product X_B must decrease the amount of labour used in the Output Tier. In relative terms,

$$\lambda_{LI}\widehat{L_I} + \lambda_{LO}\widehat{L_O} = 0 \tag{2.40}$$

Where λ_{LI} and λ_{LO} respectively denote employment shares of labour in Input and Output Tiers.

Given the amount of specific input K_B in the Input Tier, the demand for labour in the Input Tier is related to the wage rate (assuming the price of B remains unchanged) by a downward-sloping marginal product schedule, given by:

$$\widehat{L_I} = -\varrho\widehat{W} \tag{2.41}$$

Where ϱ is the elasticity of demand for labour in Input Tier.

In this simplified model, Output Tier produces only one non-traded good. In the production process, the producers use labour (of amount $a_{LN}X_N$) and the imported middle product, A.

Assuming there is some degree of substitutability between labour and the middle product (A) used in production of the non-traded good, let us denote σ_N as the elasticity of substitution between labour and A. Then following envelope condition for cost-minimisation by the competitive producers

$$\theta_{LN}\widehat{a_{LN}} + \theta_{AN}\widehat{a_{AN}} = 0 \tag{2.42}$$

And by definition,

$$(\widehat{a_{AN}} - \widehat{a_{LN}})/\left(\widehat{W} - \widehat{P_A}\right) = \sigma_N \tag{2.43}$$

Solving Equations (2.42) and (2.43) we obtain

$$\widehat{a_{LN}} = -\theta_{AN}\sigma_N\left(\widehat{W} - \widehat{P_A}\right) \tag{2.44}$$

The demand for labour in the Output Tier depends on (i) the total production of the non-tradeable, N and (ii) the intensity with which labour is used per unit

output, a_{LN}, and it is given by the product of the two. Hence, for any perturbation in the intensive or extensive margin, we have:

$$\widehat{L_O} = \widehat{a_{LN}} + \widehat{N} \tag{2.45}$$

So substituting from Equations (2.41), (2.44)–(2.45) into Equation (2.40), we obtain the solution for change in money wage rate:

$$\widehat{W} = \{\lambda_{LO}\theta_{AN}\sigma_N/(\lambda_{LO}\theta_{AN}\sigma_N + \lambda_{LI}\varrho)\}\widehat{P_A} + \{\lambda_{LO}/(\lambda_{LO}\theta_{AN}\sigma_N + \lambda_{LI}\varrho)\}\widehat{N} \tag{2.46}$$

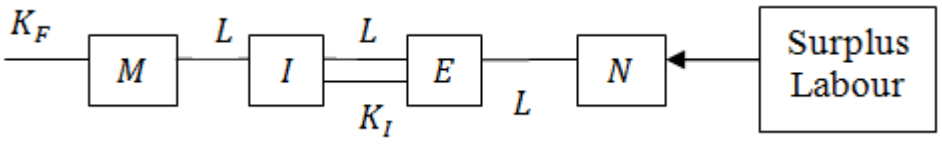
Note that the coefficient of $\widehat{P_A}$ is a positive fraction. So when $\widehat{P_A} < 0$ following a tariff cut on the imports of middle product A, ignoring any income-effect (i.e., $\widehat{N} = 0$), money wages fall, but less than proportionately to the fall in P_A due to the change in tariff. So from Equation (2.39) it follows that the price of non-tradeable, P_N, will also be depressed as a result and since $\widehat{P_N}$ is the weighted average of $\widehat{P_A}$ and $\widehat{W}$, money wage rate does not fall as much as P_N. Therefore without income effects, the real wage rate must rise despite a reduction in money wage.

The initial reduction in P_A induces the producers in the Output Tier to substitute labour by the imported middle product A, so that some labour is shifted to the Input Tier, depressing the nominal wage rate. However, as explained above, this decrease in money wage rate is less than the subsequent reduction in the price of non-traded good. Real incomes at Home will improve following the fall in domestic price of the middle product A, leading to greater consumption of non-tradable, produced in the Output Tier. Therefore, transfer of some labourers into the Input Tier may not compensate the movement of labour into the Output Tier following the income effect, induced by the increased production of non-traded good in the Output Tier. Hence, money wage rate can potentially increase. In any case since the nominal wage rate always falls by less than proportionately to the reduction in P_N, real wage rate always goes up in this set-up following a tariff reduction on the imports of the middle product A.

2.1.6 Real Wage and Non-traded Goods with Backward Production Linkage and Restricted Capital Mobility (Marjit 2003)

Marjit (2003) explores the relationship between trade liberalisation and informal wage in a set-up where capital does not flow between (or, in other words, capital allocation is fixed between) the formal and the informal sectors. An extension of the three-sector version presented in Marjit (2003) could be to consider that the informal sector performs two types of activities: one is to provide intermediate inputs to the formal import-competing sector and the other is to produce finished non-traded good. Formal workers enjoy unionised higher wages (W^*) while the informal workers receive market-determined lower wages (W). Sector M here produces within the formal segment using unionised labour, (formal) capital and a non-traded intermediate input I. The informal segment produces I and E with labour (receiving flexible wages) and capital. E is the exportable sector where M is the protected import-competing sector of the economy. As mentioned before, capital is segment-specific, it cannot move between formal and informal sectors. Therefore, I and E are produced by the informal variety of capital (K_I) whereas M is produced using formal (competitive) variety of capital (K_F). There is another sector N in this small, open economy that absorbs surplus labour and produces a non-traded finished final good using only those surplus labourers.

Figure 2.5: The Model



The surplus labour working in this sector receives a subsistence wage $\underline{W}$. We have $W^* > W > \underline{W}$. Yet there is no open unemployment in this set-up as workers cannot survive without jobs and the labour market (unskilled) always clears.

Using the same notation as before, the competitive zero-profit conditions in the product markets are given by

$$\underline{W} a_{LN} = P_N \tag{2.47}$$

$$W a_{LE} + r_1 a_{KE} = P_E^* \tag{2.48}$$

$$W a_{LI} + r_1 a_{KI} = P_I \tag{2.49}$$

$$W^* a_{LM} + r_2 a_{KM} + P_I a_{IM} = P_M^* (1 + t) \tag{2.50}$$

Where r_1 is the interest rate to informal variety of capital and r_2 is the interest rate to the formal variety of capital.

The factor market clearing conditions can be represented as

$$a_{LN} N + a_{LE} E + a_{LI} I + a_{LM} M = L \tag{2.51}$$

$$a_{KE} E + a_{KI} I = K_I \tag{2.52}$$

$$a_{KM} M = K_F \tag{2.53}$$

Demand-supply equality condition for the internationally non-traded intermediate input

$$I^D = a_{IM} M = I^S = I \tag{2.54}$$

We assume that

- a_{IM} is fixed;
- K_F and L are substitutes.

Assuming both sectors E and N exist in the rural area and only urban population can avail N, if only α-proportion of total urban income is spent on N, the domestic demand-supply balance in the market of finished non-traded good implies

$$\alpha P_M^* (1 + t) M = (1 - \alpha) P_N N \tag{2.55}$$

The system comprises nine equations (Equation (2.47) – (2.55)) with nine unknowns, namely $(W, r_1, r_2, P_I, P_N, E, I, M, N)$. Given the parameters in this model $(P_E^*, P_M^*, t, L, K_I, K_F)$, all these unknowns are uniquely solved. The solution takes the following route. Given P_I, r_2 is determined from Equation (2.50) and M is obtained from Equation (2.53) (since a_{ji}s are already

determined given factor prices by the assumption of CRS). This, therefore, yields employment of labour in the formal sector, $a_{LM}M$ and production in non-traded consumption good-producing sector, N (since given $\underline{W}$, P_N is cost-determined) from Equation (2.55). Since a_{LN} is fixed by construction (given $\underline{W}$), this also determines employment in the non-traded finished good sector. Therefore, now Equations (2.52) – (2.53) jointly determine E and I as functions of P_I. W and r_1 are determined as functions of P_I from Equations (2.48) – (2.49). Thus we have, $I = I^S$ (the supply of I) and once M is known, I^D (demand for I) is also known. Therefore, in order to determine P_I, we can define an excess demand function

$$I^D(P_I) - I^S(P_I) = E(P_I) \tag{2.56}$$

Equation (2.56) holds if and only if there exists a $P_I = P_I^e > 0$ such that $E(P_I)|_{P_I = P_I^e} = 0$. It is straightforward to show[12] that $E'(.) < 0$ and therefore, the market for I is locally stable. This ensures existence of a positive and unique P_I^e and thereby guarantees 'complementarity' in productions of sectors I and M.

As before, the comparative static exercise under consideration is to look at the impact of lower tariff, hence lower domestic price of M, $P_M = P_M^*(1+t)$, on W, the informal wage. As a consequence, sector M contracts releasing labour to sectors E and I. On the other hand, given that P_N is cost-determined, it is only demand for N that affects its production. Since $P_M M$ falls unambiguously, demand for N falls and consequently, sector N contracts as well, further releasing labour to sectors E and I. Therefore, there is a net influx of labour in the 'Heckscher-Ohlin nugget' formed by sectors E and I, leading to a Rybczynski effect. If sector I is relatively intensive in the use of K_I in per-unit of production compared to labour, sector I contracts while sector E expands. Therefore, both demand for and supply of M falls. Hence, impact on P_I^e is ambiguous. However, if the share of sector M in total employment is negligible, which is a legitimate assumption in the Indian context given the capital intensive nature of importable production, the beneficiary impact on

[12] and will be shown in Chapter 3

sector M in terms of reduced labour cost of production is negligible as well and the demand effect (decline in demand for I) dominates and an excess supply of I is generated owing to which, P_I^e declines. Therefore, the subsequent Stolper-Samuelson effect yields an increase in W that accompanies a reduction in the production of M. Therefore, the more productive (i.e. non-surplus) informal workers get employed in sector E at higher competitive money wage and subsequently at higher real wage than before. But the relatively less productive workers (inclusive of retrenched workers from sectors M and I) will have to work at lower wage (and also some of them accept the subsistence wage $\underline{W}$) and will lose in real terms.

2.2 Real Wage and Non-traded Goods with Agricultural Dualism and Urban Unemployment

2.2.1 Review: Rural-urban Migration and Non-traded Goods in a Harris-Todaro Economy with Urban Unemployment (Hazari and Sgro 1991)

A dual economy, in a broad sense, is divided into an urban (industrial) sector and a rural (agricultural) sector. The labour market, on the other hand, is segmented into two groups: the workers of the industrial zone earning higher wages than their rural counterparts. Existence of this wage-differential forms the basis of rural-urban migration. Rural workers are lured to migrate by economic incentives as well as by other incentives of urban life. But some of the migrants unfortunately, not being able to get jobs in organised sector, wait for their chance to get employment and thus swell up the number of open urban unemployment, though they could be fully employed in the rural sector at prevailing competitive wage rate. Harris and Todaro (1970) formalised this labour allocation mechanism, which is generally observed between rural and urban areas in a low-income developing country. Several attempts have been made to revisit and extend the basic Harris-Todaro model in different

directions (such as Bhagwati and Srinivasan 1974; Fields 1975; Corden and Findlay 1975; Calvo 1978; Bhatia 1979; Khan 1980, 1982; Batra and Naqvi 1987; Beladi and Naqvi 1988; Chaudhuri 1989; Grinols 1991 Chandra and Khan 1993; Gupta 1993, 1994, 1995; Chao and Yu 1996; Yabuuchi 1993, 1998; Basu 2000). One important issue is implication of economic liberalisation on open unemployment given that the magnitude of open unemployment in developing countries like India has been increased substantially. However, a significant omission in the HT model has been the absence of proper treatment of finished non-traded goods. Also agricultural dualism is a common characteristic of the agro-dominated developing countries (DCs), like India. The distinction between the descriptions of 'advanced' and 'backward' in agriculture can be made on the basis of inputs used, economies of scale, efficiency and elasticity of substitution. Many of the farmers in the agricultural sector of a developing economy continue to use old and unscientific methods of cultivation although in other parts of the economy advent of the 'Green Revolution' technology has brought about revolutionary changes with respect to production technologies and the use of modern inputs use and thereby increasing factor productivity. Therefore, adoption of the Green Revolution technology has increased the extent of agricultural dualism in a developing economy.

In a typical agro-based DC, such as India, there are many final agricultural products. Staples are consumed domestically (i.e., internationally non-traded) and produced mainly by small and marginal farmers using traditional techniques of production. Commercial crops and some of the food-grains are produced by large cultivators using modern techniques; these commodities are exported and their prices are determined internationally. Hazari and Sgro (1991) have been the first to introduce non-traded non-agricultural product and non-traded agricultural product to properly depict a small, open developing dual economy with rural and urban migration and agricultural dualism in the rural areas within a Harris-Todaro setting.

The rural sector produces two goods: a primary exportable agricultural product (E) and another non-tradeable consumption good (N_R), which can be treated as an agricultural product produced by the backward agricultural sector, with the

help of land-capital and labour, to be consumed only by rural consumers. Similarly, urban sector produces an importable manufacturing good (M) and a non-traded finished manufacturing product (N_U) using capital and labour, to be consumed only by urban people. The importable M is protected by an import tariff, t, at an ad valorem rate. Land-capital is perfectly mobile between the two rural sectors with a rental return R, while capital is perfectly mobile between the two urban sectors with the rental return r. On the other hand, labourers are unionised in the urban area and receive W^* which has been determined by prior negotiation and pretty higher than the competitive market-determined wage prevails in rural area, W. Therefore, labour is imperfectly mobile between the two regions. This inter-regional wage-gap forms the basis of this rural-urban migration. All markets are perfectly competitive except the labour market in the urban sector, with neoclassical production functions. Finally, commodity E is taken as numeraire and so its price is normalised to unity.

Urban Area

The competitive zero-profit conditions in the urban area for the two sectors imply

$$W^* a_{LM} + r a_{KM} = P_M^* (1 + t) \tag{2.57}$$

$$W^* a_{LN_U} + r a_{KN_U} = P_{N_U} \tag{2.58}$$

All the notations have usual meanings as before. P_{N_U} is the price of the non-traded good produced in the urban area. Full utilisation of capital is given by

$$a_{KN_U} N_U + a_{KM} M = K \tag{2.59}$$

K is the stock of capital available in the urban area only. Let L_{unemp} denote the urban unemployment of labour force. The labour endowment equation states (L_U is total urban workforce)

$$a_{LN_U} N_U + a_{LM} M + L_{unemp} = L_U \tag{2.60}$$

Market clearance for the urban traded and non-traded good implies

$$D_M = M + M^* \tag{2.61}$$

$$D_{N_U} = N_U \tag{2.62}$$

Where D_M and D_{N_U} denote demand for urban manufacturing importable and the urban non-traded good respectively and M^* denote imports of M.

Notice that the urban region variables are solved as a function of $P_M\ (= P_M^*(1+t)), W$ and K. Note that W^* determines employment level of labour in the two urban sectors, hence, the system behaves like the standard Heckscher-Ohlin-Samuelson model where all variables are determined through P_M, K and employment level of workers in the urban area.

Rural Area

Similarly, the zero-profit conditions in the competitive product markets of the rural area entail

$$Wa_{LE} + Ra_{TE} = 1 \tag{2.63}$$

$$Wa_{LN_R} + Ra_{TN_R} = \quad P_{N_R} \tag{2.64}$$

Factor market clearing conditions

$$a_{LE}E + a_{LN_R}N_R = L_R \tag{2.65}$$

$$a_{TE}E + a_{TN_R}N_R = T \tag{2.66}$$

We also assume that E is partly domestically consumed and partly exported. Therefore, the market clearing condition in the domestic market implies

$$D_E = E - X_E \tag{2.67}$$

$$D_{N_R} = N_R \tag{2.68}$$

Where X_E denotes export of E and other notations have usual meanings as before.

Rural-Urban Migration Mechanism

The Harris-Todaro migration equilibrium condition can be captured as

$$\left(\frac{W^*\left(a_{LN_U}N_U+a_{LM}M\right)}{a_{LN_U}N_U+a_{LM}M+L_{unemp}}\right)=W \tag{2.69}$$

The above equation tells that the expected urban wage should be equal to competitive rural wage rate in the migration equilibrium. Using this, Equation (2.69) can be written as

$$\frac{W^*\left(a_{LN_U}N_U+a_{LM}M\right)}{L_U}=W \tag{2.70}$$

This equation tells that the average wage of all workers in a Harris-Todaro economy must be equal to the rural wage. This is termed as the 'envelope property' in a Harris-Todaro model.

Note that this HT equilibrium is 'Pareto-suboptimal' because

a) The wages are not equalised across sectors so that rural-urban wage differential persists.
b) There exists unemployment in migration equilibrium (this is essential to yield average wage over the labour force to be equal to rural wage).

We assume that sector E uses more labour-intensive techniques in the production process than the backward agricultural sector producing non-tradable in physical and value terms.[13]

Stability Conditions

In all such long-run general equilibrium models we typically assume away the existence of any adjustment costs in the dynamic adjustment mechanism of the system. This trivially implies equilibria in the competitive product markets are Marshallian stable and in the factor markets are Walrasian stable. Now let us proceed to the global stability condition of migration equilibrium.

As mentioned above, the key assumptions of Harris-Todaro set-up is that rural workers will continue to migrate to the urban sector so long as expected urban

[13] Which seems legitimate: if we think rice as produced in the backward agricultural sector (sector N_R) and cotton (or jute) in the advanced agricultural sector (sector 2) for delivery to the textile industry (sector E); then the production of rice requires less labour per unit of land vis-à-vis the processing of raw cotton/jute for delivery to the textile industry.

wage remains higher than the rural sector wage and therefore, the 'long run equilibrium' is achieved when the urban worker population reaches a level such that the expected urban wage equals the competitive rural wage.

However as per Harris and Todaro (1978) the expected wage-differential can be a constant value $\lambda \neq 0$. When this differential reaches λ, the net migration ceases. Therefore, in order to evaluate the stability of the migration equilibrium, we can derive a mechanism of adjustment that is based on the following function of sign preservation:

$$\widehat{M_U} = f\left(\left(\frac{W^*\left(a_{LN_U}N_U + a_{LM}M\right)}{a_{LN_U}N_U + a_{LM}M + L_{unemp}}\right) - W\right); f'(.) > 0, f(0) = 0 \qquad (2.71)$$

Based on this adjustment mechanism, Harris and Todaro (1978) showed that the migration equilibrium is globally asymptotically stable. This means that the economy would tend to migration equilibrium with unemployment in the urban sector generated by the presence of a relatively high minimum wage for all possible initial conditions.

Comparative Static Exercise

Following an import-liberalisation policy (reduction in t), domestic price of commodity M falls. From Equation (2.57) it is evident that r should fall for the purpose of satisfying the zero-profit condition for sector M. The urban region is a variation on the HOS two-sector trade model. Hence, the behavioural properties of urban sub-system are similar. With fixed wage in the urban area, a reduction in r reduces P_{N_U}. This leads to relatively lower production of finished non-tradable under the assumption that the non-tradable is relatively more capital-intensive. However cheaper availability of capital induces urban producers to use less labour in both sectors and thereby decreases the number of available jobs in the urban area for every prospective rural migrant. This induces greater supply of labour in the rural area and thereby lowering the competitive rural wage rate. From the zero-profit condition of export sector, it is evident that rental on land-capital rises. Therefore, producers in both the rural sectors adopt relatively more labour-intensive techniques of production.

This induces the relatively land-capital intensive non-tradable producing sector (N_R) to expand at the expense of agricultural exportable producing sector (E). This implies that the domestic price of non-traded agricultural product (P_{N_R}) rises as well. Therefore, real rural wage falls in terms of both exportable and the non-traded agricultural product as a consequence of tariff reform, intensifying their wretchedness in the rural area. ■

2.2.2 Model with Agricultural Dualism (Chaudhuri 2007)

To take into account these features, Chaudhuri (2007)[14] considered the following general equilibrium set-up:

$$Wa_{LE} + Ra_{TE} = 1 \tag{2.72}$$

$$Wa_{LN} + Ra_{TN} = P_N \tag{2.73}$$

$$W^* a_{LM} + ra_{KM} = P_M^*(1+t) = P_M \tag{2.74}$$

Assuming product markets are competitive, Equations (2.72) – (2.74) represent zero-profit conditions for the advanced agricultural sector producing exportable (E), backward agricultural sector producing non-tradeable (N) and the manufacturing sector producing importable (M) respectively. Sectors E and N are within the rural economy and sector M is within the urban economy. We assume workers receive a contractual wage, W^*, in the urban manufacturing sector which is strictly higher than received by their rural counterparts.

All the other notations denote usual meanings used in the earlier sections. Therefore the full-utilisation conditions for land-capital (T, with rental return R) and capital (K, with return r) respectively imply

$$a_{TE}E + a_{TN}N = T \tag{2.75}$$

$$a_{KM}M = K \tag{2.76}$$

[14] However, Chaudhuri (2007) used this general equilibrium structure to analyse implications of FDI on welfare and urban unemployment.

There is unemployment of labour in the urban sector. The labour endowment equation of the economy is given by the following

$$a_{LE}E + a_{LN}N + a_{LM}M + L_{unemp} = L \tag{2.77}$$

Where L_{unemp} is the level of urban unemployment.

Since the probability of finding a job in the urban manufacturing sector is $\left[a_{LM}M/\left(a_{LM}M + L_{unemp}\right)\right]$ in this set-up, the expected wage for a prospective rural migrant in the manufacturing sector is $\left[W^{*}a_{LM}M/\left(a_{LM}M + L_{unemp}\right)\right]$. Therefore, the migration equilibrium condition is expressed as

$$\left(W^{*}a_{LM}M/\left(a_{LM}M + L_{unemp}\right)\right) = W \tag{2.78}$$

Substituting for L_{unemp} from Equation (2.78) back into Equation (2.77) entails

$$a_{LE}E + a_{LN}N + \left(W^{*}/W\right)\, a_{LM}M = L \tag{2.79}$$

Therefore, aggregate wage-income of the workers in this economy is WL.[15]

The domestic demand-supply for the non-traded agricultural product is given by

$$D_N(P_N, P_M, Y) = N \tag{2.80}$$

Where Y is the national income of the economy at world prices and is given by:

$$Y = WL + RT + rK - tP_M^{*}M \tag{2.81}$$

Where RT is the rental income from land–capital. rK is the capital income. Finally, $tP_M^{*}M$ is the cost of tariff protection at world prices.

The working of the system is as follows. The production structure does not possess the decomposition property but sectors E and N have price sub-systems described in Equations (2.72) and (2.73) constituting a 'HO-nugget'. r is determined from Equation (2.74) and is exogenously given. The equilibrium values of W and R are obtained from Equations (2.72) and (2.73) as functions of P_N. M is found from (2.76) as W^{*} and r are known. Inserting the values of W, R and M into Equation (2.81) we solve for Y. Then using the values for

[15] 'Envelope Property' of HT economy.

W, R, r and M into Equation (2.79) and solving this equation with Equation (2.79) simultaneously, we determine E and N as functions of P_N. Then substituting values for Y and N into Equation (2.80) and solving we get P_N. Now using the solution for P_N, we determine W, R, E and N. Finally, L_{unemp} is obtained from Equation (2.77).

The key comparative static response we want to trace out is of $dt < 0$, ceteris paribus. Totally differentiating Equations (2.72) – (2.74), applying envelope conditions and solving by Cramer's rule, we obtain

$$\widehat{W} = -\left(\widehat{P_N}\theta_{TE}/|\theta|\right) \tag{2.81}$$

$$\hat{R} = \left(\widehat{P_N}\theta_{LE}/|\theta|\right) \tag{2.82}$$

$$\hat{r} = (dt/\theta_{KM}) < 0 \tag{2.83}$$

Where $|\theta| = (\theta_{LE}\theta_{TN} - \theta_{TE}\theta_{LN}) = (\theta_{TN} - \theta_{TE})$. As assumed by Chaudhuri (2007), sector N is more labour-intensive compared to sector E. So we have $|\theta| < 0$.

Totally differentiating Equation (2.76) we obtain:

$$\widehat{M} = -\widehat{a_{KM}} = \sigma_M\theta_{LM}(dt/\theta_{KM}) < 0 \tag{2.84}$$

A tariff reduction on the imports of commodity M reduces the domestic price of M faced by the competitive producers. So sector M contracts. Also since rental to capital (r) falls, (W^*/r) rises and hence sector M releases labour to the two rural sectors (containing a HO-nugget). As labour flows to the nugget, sector N (sector E) expands (contracts) following a Rybczynski effect as sector N is more labour-intensive relative to sector E. As the supply of the non-traded commodity produced by sector N rises given its demand, its price (P_N) falls to satisfy the demand-supply equality condition described in Equation (2.80). However, contraction of sector M reduces the cost of tariff protection. So ceteris paribus, this will raise the national income at world prices as efficiency in production increases, leading to the increase in demand for good N given its supply, exerting an upward pressure on P_N. However if P_N rises as a net effect, it will lead to a Stolper-Samuelson effect in the nugget, resulting in an increase

in the money wage rate (this is evident from Equation (2.81) since $|\theta| < 0$). But from Equation (2.81) it is also clear that since $\theta_{TE} > (\theta_{TE} - \theta_{TN}) > 0$, $\Rightarrow \left|\widehat{W}\right| > \left|\widehat{P_N}\right|$, so real wage rate increases if P_N goes up as a 'net effect'. But in such case, the level of urban unemployment will fall unequivocally. This is because the migration equilibrium in Equation (2.78) gets affected in two ways:

(a) As the urban manufacturing sector contracts owing to tariff reduction, number of jobs available falls; so probability of getting a job in the urban sector for every prospective rural migrant falls. This will lead to a reverse migration back to the rural sectors.
(b) The increase in the money wage rate will also prevent the rural workers from joining the urban unemployment pool.

One can infer that the working population, on average, gets better-off following a tariff cut on the importable M if P_N goes up as a net effect in this set-up. ■

Summary Evaluations and Planned Contributions

The gaps in the existing literature discussed so far, in lights of the existing state of knowledge could be discussed in terms of the following table (Table 2.1).

Table 2.1

<table>
<tr><th colspan="2" rowspan="2">Sector Definitions</th><th colspan="4">Factor Market Characteristics</th><th rowspan="2">Vertical Production Linkage with Formal Sector</th><th rowspan="2">Use of Imported Intermediate Input (Middle Products) in Formal Sectors</th></tr>
<tr><th>Substitutability between Land & Labour</th><th>Capital Market</th><th>Unskilled Labour Market</th><th>Skill Differences</th></tr>
<tr><td rowspan="3">Informal Sector</td><td>Agricultural (in Rural Area) – Models with Urban Unemployment</td><td>Not Considered in Existing Literature Such as Hazari & Sgro (1991), Chaudhuri (2007)</td><td>Perfect (Hazari & Sgro 1991; Chaudhuri 2007), although imperfection could have been addressed</td><td rowspan="3">Perfect</td><td rowspan="3">All the informal sector workers are equally unskilled and perfectly mobile within the informal sectors (b/n different sub-sectors)</td><td>No (Hazari & Sgro 1991; Chaudhuri 2007)</td><td rowspan="3">N/A</td></tr>
<tr><td rowspan="2">Non-agricultural (in Urban or Semi-urban Area) – Models with Full Employment of Unskilled Labour</td><td rowspan="2">N/A</td><td rowspan="2">Often imperfection in informal credit market is addressed by restricted capital-mobility between informal & formal sectors (Marjit 2003; Marjit et al. 2007).</td><td>Yes (Marjit 2003)</td></tr>
<tr><td>No (Jones 1974; Marjit et al. 2007; Marjit & Maiti 2005)</td></tr>
<tr><td colspan="2" rowspan="2">Formal (Non-agricultural) Sector</td><td rowspan="2">N/A</td><td rowspan="2">Perfect</td><td rowspan="2">Unionised (Marjit & Maiti 2005; Marjit et al. 2007; 2008)</td><td>Yes (Marjit & Acharyya 2003)</td><td rowspan="2">N/A</td><td rowspan="2">Not considered in the literature discussed (except Jones 2012a) and in most of the existing literature</td></tr>
<tr><td>No (Marjit 2003; Marjit & Maiti 2005; Marjit et al. 2007, 2008)</td></tr>
</table>

Planned Contribution of the Thesis

Chapter 3 extends the variant of HT model with agricultural dualism and open unemployment discussed in section 2.5 (Chaudhuri 2007) to bring the role of vertical linkage in agricultural production, when the backward agricultural sector produces a non-traded agricultural input for the urban formal sector.

In Chapter 4, we again take recourse to a three-sector HT-type model of rural-urban migration to deal with the issue of land acquisition for setting up industrial zones and how such policy can support structural transformation and dual sector growth in the context of India.

However, the jobless pattern of growth in the urban formal sector consequential upon the liberal trade reforms and deregulation in this segment of the economy (to be demonstrated in Chapters 3 and 4) is entirely a by-product of the absorption of this retrenched workforce (relatively 'unskilled') by the informal or unregulated sector of the economy. This is because these workers cannot survive without a job and they find some means in the informal sector to survive. This leads to the clearing of the ('unskilled') labour market and therefore necessitates the typical 'full-employment condition' for them in the general equilibrium framework. Chapter 5 depicts such an urban economy in a wage-differential full-employment setting, adding capital (credit) market dualism and vertical production linkage with non-traded goods, in order to explore implications of trade-induced productivity growth on informal wage-employment conditions.

Chapter 6 places the Sanyal and Jones (1982) 'middle product' setting within a multi-sector general equilibrium framework, which essentially presents a variant of the structure illustrated in section 2.1.5, but incorporates vertical production linkage and a skill-intensive sector as well. Numerical analysis has also been performed to simulate how the changes in elasticities of factor substitution in production in different sectors account for the movement in informal wage and therefore the movement in skilled–unskilled wage gap.

Appendix 2.1

Totally differentiating zero-profit condition in Equation (2.1) we have (note that internationally given price of E has been normalised to unity)

$$\left(\frac{Wa_{LE}}{1}\right)\left(\frac{dW}{W}\right)+\left(\frac{Wa_{LE}}{1}\right)\left(\frac{da_{LE}}{a_{LE}}\right)+\left(\frac{ra_{KE}}{1}\right)\left(\frac{dr}{r}\right)+\left(\frac{ra_{KE}}{1}\right)\left(\frac{da_{KE}}{a_{KE}}\right)=0 \quad \text{(A2.1)}$$

Producers in each sector choose techniques of production in order to minimise unit costs. This leads to the condition that the weighted average of changes in unit factor coefficients (with the weights being the cost-share of each factor; e.g., $[Wa_{LE}/(P_E=1)]$ is the cost-share of labour in the export sector) along the unit isoquant in each sector must vanish near the cost-minimisation point. This states that an iso-cost line is tangent to the unit isoquant. In mathematical terms, cost minimisation conditions for sector 1 may be written as:

$$\left(\frac{Wa_{LE}}{1}\right)\left(\frac{da_{LE}}{a_{LE}}\right)+\left(\frac{ra_{KE}}{1}\right)\left(\frac{da_{KE}}{a_{KE}}\right)=0 \quad \text{(A2.2)}$$

This is known as the 'envelope condition' (see Caves et al. 2007 for details).

Appendix 2.2

Totally differentiating the competitive zero-profit conditions in Equations (2.22) – (2.24), applying 'envelope conditions' and then arranging them in matrix form, we obtain:

$$\begin{pmatrix}\theta_{LA} & \theta_{TA} & 0\\ 0 & 0 & \theta_{KF}\\ \theta_{LM} & 0 & \theta_{KM}\end{pmatrix}\begin{pmatrix}\widehat{W}\\ \hat{R}\\ \hat{r}\end{pmatrix}=\begin{pmatrix}0\\ 0\\ dt\end{pmatrix} \quad \text{(A2.3)}$$

Where θ_{ji} is the cost-share of the j^{th} factor in the i^{th} sector ($j=L,T,K; i=A,F,M$), with $\sum_j \theta_{ji}=1$.

Appendix 2.3: Derivation of The Unionised Wage Function (based on Chaudhuri 2003, Chaudhuri and Mukhopadhyay 2010)

Consider that urban sector comprises only the organised formal manufacturing sector (sector M).[16] Production in sector M needs two factors of production: capital (K) and labour (L).[17] We have perfect capital market but unionised labour market that the industry is facing. Assuming that each firm of sector has a separate labour union, the unionised wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative union in the industry. Labour is our variable factor of production here.

The representative firm's profit function is given by

$$\pi = P_M Q(L, K) - W^* L$$

$P_M (= P_M^*(1 + t))$ is taken as exogenous by the organised sector producers. The representative labour union maximises the aggregate wage-income of its members net of their opportunity wage-earnings

$$\Omega = (W^* - W)$$

Here the competitive wage is the opportunity wage to the workers in the industry. This is because any worker unable to receive job in the formal (organised) sector has only the best option is to go back to the unorganised sector in order for not to be remained unemployed.

We consider a co-operative game between the firm and the labour union leading to the determination of the unionised wage and the employment level, given by $W^*$and L, respectively. If the two players can't reach an agreement, the game won't be played. In that case organised sector production would be

[16] So we assume away the presence of urban non-tradable producing sector - N_R in Hazari and Sgro (1991) set-up, N in Chaudhuri (2007) model.

[17] Bringing non-traded intermediate input in the calculation will not change the qualitative results; however will only complicate the calculation.

zero as the workers have to accept jobs in the unorganised sector. So given the above two objective functions, the disagreement payoff is just [0, 0].

The Nash bargaining solution is derived from the following maximization problem:

$$\underset{W^*, L}{Max}\ J = [P_M Q(L, K) - W^* L]^{(1-U)} \times [(W^* - W)L]^U$$

Where U is the bargaining power of the labour union.

The first-order conditions are:

$$(1 - U)[(W^* - W)L] = U[P_M Q(.) - W^* L] \quad \text{(A2.4)}$$

And

$$(1 - U)(P_M Q_L -)L = -U[P_M Q - W^* L] \quad \text{(A2.5)}$$

Using (A2.4) and (A2.5) we obtain

$$P_M Q_L = W \quad \text{(A2.6)}$$

Differentiating (A2.6) yields

$$\left(\frac{\partial L}{\partial W}\right) = \frac{1}{P_M Q_{LL}} < 0;\ \left(\frac{\partial L}{\partial P_M}\right) = -\frac{Q_L}{P_M Q_{LL}} > 0 \quad \text{(A2.7)}$$

Simplifying Equation (A2.4)

$$W^* = U\frac{P_M Q(.)}{L} + (1 - U)W \quad \text{(A2.8)}$$

Equation (A2.8) is the unionised wage function which can be written in the general form as

$$W^* = f(P_M, W, U) \quad \text{(A2.9)}$$

Differentiation of Equation (A2.8) and use of Equation (A2.7) yields

$$\left.\begin{aligned} \frac{\partial W^*}{\partial U} &= \left(\frac{1}{L}\right)(P_M Q(.) - WL) > 0 \\ \frac{\partial W^*}{\partial W} &= \left\{(1-U) + \frac{U(WL - P_M Q(.))}{L^2 P_M Q_{LL}}\right\} > 0 \end{aligned}\right\} \quad \text{(A2.10)}$$

Thus we have proved that the unionised wage is a positive function of both the competitive wage and the bargaining power of the labour union. ■

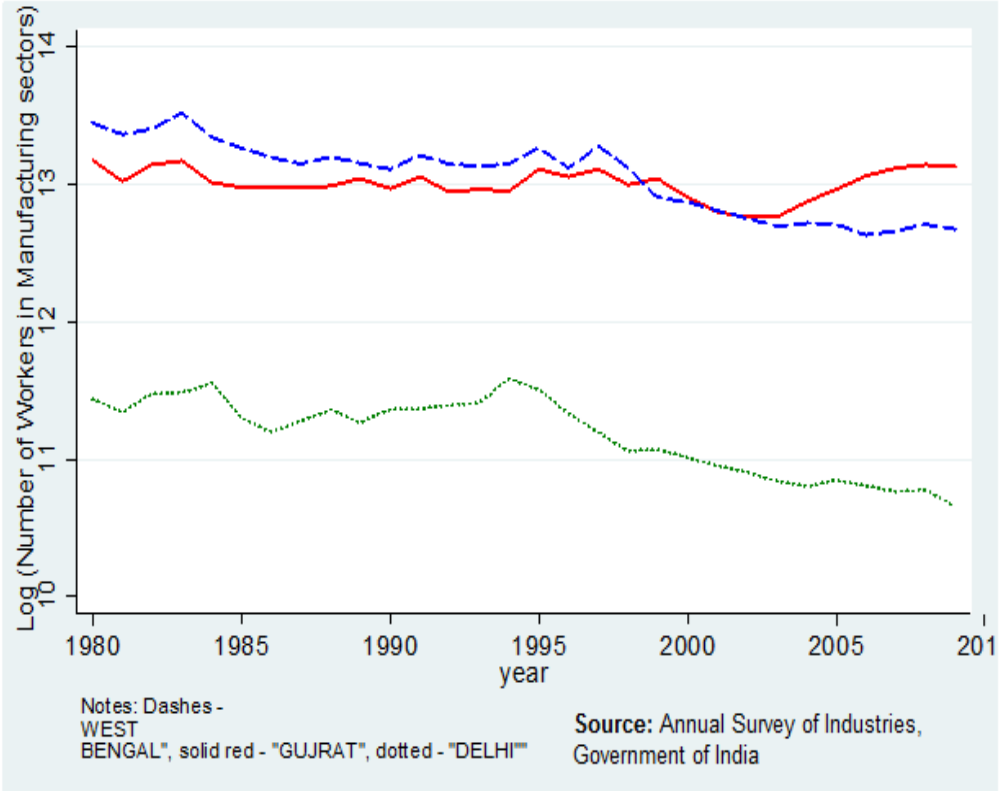
Chapter 3 – Liberalisation and 'Jobless Growth' with Agricultural Dualism

3.1 Introduction

Available empirical evidence such as Bhaduri (2007) and Bhalotra (1998), is suggestive of the fact that India observed stagnation in organised sector employment in the late 1980s. Surprisingly, even after extensive economic reforms in 1991, India continues to face substantial adjustment costs in implementing economic liberalisation programs (Jha 2003). As demonstrated in Golder (2000), Nagaraj (2004a) and so on; after reform, India immediately witnessed a boom for four years, 1992-1996, followed by a retrenchment, but soon India experienced loss in employment of 15% of the workforce employed in 11 major industry groups in organised manufacturing in 17 major states from 1996 to 2001. According to the most recent National Sample Survey (NSS) round conducted from July 2009 to June 2010, organised sector employment declined dramatically between 2004-2005 and 2009-2010, especially when compared to the earlier five-year period. This is quite unanticipated given that this was a period of very rapid GDP expansion and points to the growing possibility of 'jobless growth' in the organised manufacturing sectors in the reform period. As a result of increased competition, the labour laws have been weakened with greater substitution from labour to capital that generates the opportunity of the organised sectors' employers to pay the workers at a rate closer to the market-determined one, which, in turn, would make easier for these employers to fire the relatively less productive workers without much protest, since the wage-differences to the outside options has declined. According to the relevant NSS rounds, the labour force growth rate in the organised sectors was 2.43 per cent per annum (p.a.) between 1983-84 and 1993-94, and then it came down to 1.31 per cent p.a. between 1993-94 and 1999-2000.

Using the state-level data on India's registered manufacturing industries from 1980-2009 we have found that the employment pattern in the urban manufacturing industries even at the state-level does not exhibit any significant upward trends; in most cases they are rather decreasing or stagnant. The following graph illustrates the case for West Bengal, Gujrat and Delhi as an example.[18]

Figure 3.1: Trend in Organised Sector Employment (West Bengal, Gujrat and Delhi), 1989 – 2009



Therefore, one can infer that trade liberalisation during the 1990s did not result in any significant increase in productive job opportunities for the organised sector labour force. This records typically similar outcome as Dani Rodrik's concept of 'Premature Deindustrialisation' from the employment front in the organised sectors,[19] where registered manufacturing experiences more rapid productivity growth than the rest of the economy. Since withdrawal of the non-tariff barriers coupled with significant reduction in import tariffs, the domestic

[18] Other states and union territories show similar trends in employment pattern in organised sectors. So for the sake of brevity we have chosen the three most important states.
[19] See Rodrik (2015) in this context.

organised sector firms which have been protected as yet have not been able to cope with foreign competitors and have been forced to pull their shutters down leading to widespread open unemployment. The unorganised sector expanded but has not been able to absorb all retrenched workers from the organised sector. The consequence has been a steep increase in the level of open unemployment. On the other hand this will not hamper the growth of the economy as the organised sector benefits from the higher productivity of the remaining workforce and can emerge as competitive in the international market. This has generated scepticism regarding the allocation of the benefits of growth owing to reform. The growth India is experiencing in this liberalised regime, is indeed 'jobless' (Indiresan 2002; Sen 2005). This may tempt us to analyse the impact of economic reform on welfare and open unemployment in a developing economy in terms of a general equilibrium framework.

3.2 Research Gap and the Context of Research

The simple two-sector mobile capital version of HT (Harris and Todaro 1970) model (a' la Corden and Findlay 1975) may not appropriately describe the complex nature of a low income developing economy, since the presence of agricultural dualism and non-traded goods remain the two important features of such an economy. The non-traded goods may be either intermediate inputs or final commodities. Hazari and Sgro (1991) and Chaudhuri (2007) incorporated agricultural dualism in presence of finished non-tradable to analyse why the developing countries are luring for foreign capital. However, the backward agricultural sector of an agro-dominated DC like India does consist of many subcontract firms producing commercial agricultural crops for the urban agro-based industrial sectors (Mukherjee 2012). Some examples in the Indian context may include the cases where the agriculture sector provides sugarcane to sugar mills to convert it into sugar; the development of textile industry and its allied fields that is totally attributed to cotton producing subcontract agricultural firms. Such commodities are restricted to cross international borders by the domestic government for two main reasons: firstly to control

domestic prices, and secondly to ensure the sufficient supply of such important inputs to the agro-based industries (Mukherjee 2012). In fact, India has imposed a restriction on cotton exports on 2012 to ensure the sufficient supply of fibre to the textile industries, despite higher demand from the U.S. and other Western trading partners and the reason was attributed to the fact that India was not using imported fibres in her textile industries (The Wall Street Journal 2012). Such evidence points towards modelling agricultural dualism in the context of DCs like India with the existence of non-traded intermediate input, rather than the finished non-tradable to examine the consequences of reform policies. Mukherjee (2012) incorporated these features within a three sector mobile capital version of HT model to analyse the impacts of foreign capital inflow on welfare and the level of urban unemployment. However, economic reforms involve not only a liberalised investment policy but also removal of protectionist policy and structural reforms like deregulating the labour market, making it more competitive by curbing the bargaining strength of the labour unions in determining the unionised wage in their liberalisation policy packages. But relaxing the labour laws is a politically sensitive issue. This is because, it is apprehended by the labour unions that if government intervenes by imposing a partial or complete ban on reformulating employment security laws to curb the power of trade unions, the union's power to mark up wages over the supply of labour falls. Consequently, the unionised wage falls, inducing workers to migrate back to the rural (or informal) sectors, depressing the general wage of the poorer group of the working population engaged in these sectors. Therefore, along with the implications of a trade reform policy on welfare and urban unemployment of the economy, it is equally important to know how far is the conventional wisdom that reforms in organised sector labour market depress the competitive rural wage is valid.

All of the above-mentioned facts bring the necessity of examining the consequences of these two policies on competitive rural wages and urban unemployment problem in terms of similar set-up to Mukherjee (2012) with agricultural dualism and a non-traded intermediate input, where capital has partial mobility between formal and informal agricultural sectors (since one of the two informal agricultural sectors, namely the backward agricultural sector,

uses capital apart from labour and land to produce intermediate input for sector 3). This, however, has not been considered in existing related models (with agricultural intermediate input-producing local informal sector) such as Marjit (2003) or Chaudhuri and Banerjee (2007); since all of these models considered the short-run situation with immobility of capital between formal and informal sectors to address similar research question. Here lies the contribution of this modelling set-up in the context of analysing implications of trade reform measures on rural informal wage and urban unemployment.

3.3 The Model

Consider a small open economy, broadly divided into an urban manufacturing sector and a rural sector, which is sub-divided into 'advanced' agricultural sector (sector 1) and 'backward' agricultural sector (sector 2). Sector 1 uses labour and land as inputs, and is assumed to be the export sector of the economy. Sector 2 produces a commercial agricultural crop as an intermediate input for the urban manufacturing sector using land, labour and capital. The urban manufacturing sector (sector 3) may be an agro-based industry that uses labour, capital and the intermediate input. Sector 3 is the import-competing sector of the economy and is protected by an import tariff, imposed at an *advalorem* rate.[20] The per-unit requirement of the intermediate input is assumed to be technologically fixed in urban sector.[21] Workers in urban sector earn an institutionally given wage, W^*,[22] while the wage rate in the other two sectors, W, is market determined. Since the two agricultural sectors are in close vicinity (within the rural area), labour is perfectly mobile between backward

[20] We assume ad-valorem equivalence of any quantitative or other restrictions on imports, such as quotas.

[21] It rules out the possibility of substitution between the non-traded input and other factors of production in urban sector.

[22]This is a simplifying assumption. Assuming each urban sector firm has a separate labour union, the unionised wage function can be derived as a solution to a Nash bargaining game between the representative firm and the representative union. This function has been derived in Appendix 2.3, Chapter 2.

and advanced agricultural sectors; but there exists imperfection (owing to unionisation) in the urban manufacturing labour market. Production functions exhibit constant returns to scale with diminishing marginal productivity to each factor. The two wages are related by the Harris-Todaro condition of migration equilibrium with $W < W^*$. Agricultural commodity is chosen as numeraire, so its price is set equal to unity.

The following notation is used:

W= competitive rural wage rate for labour (L);

W^*= institutionally given wage rate in urban sector;

R= rate of return to land (denoted by N in this chapter);

r= rental rate return to capital (K);

a_{ji}= amount of the j^{th} input used to produce 1 unit of the i^{th} good;

$X_i =$ output of sector i;

$L_U =$ urban unemployment level;

$P_2 =$ domestic price of non-traded (internationally) intermediate input;

$P_3 =$ international price of good 3;

$t =$ ad valorem rate of tariff;

$\theta_{ji} =$ cost share of j^{th} input in the production of good i (for example, $\theta_{L2} = Wa_{L2}/P_2$);

$\lambda_{ji} =$ share of sector i in the total employment of factor j (for example, $\lambda_{N1} = a_{N1}X_1/N$);

$\wedge$ = proportional change.

The three zero-profit conditions are given by

$$Wa_{L1} + Ra_{N1} = 1 \tag{3.1}$$

$$Wa_{L2} + Ra_{N2} + ra_{K2} = P_2 \tag{3.2}$$

$$W^* a_{L3} + r a_{K3} + P_2 a_{23} = (1+t)P_3 \quad (3.3)$$

Factor Market Equilibrium conditions are given by

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 + L_U = L \quad (3.4)$$

By Harris-Todaro Migration Equilibrium condition,

$$\left(W^* a_{L3} X_3 \Big/ (a_{L3}X_3 + L_U) \right) = W \quad (3.5)$$

Inserting $(a_{L3}X_3 + L_U) = \left(W^* a_{L3} X_3 \Big/ W \right)$ in Equation (3.4) we obtain

$$\left(\frac{W^*}{W}\right) a_{L3}X_3 + a_{L2}X_2 + a_{L1}X_1 = L \quad (3.6)$$

$$a_{K2}X_2 + a_{K3}X_3 = \bar{K} \quad (3.7)$$

$$a_{N1}X_1 + a_{N2}X_2 = N \quad (3.8)$$

The left-hand sides of Equation (3.7) and (3.8) respectively represents the level of demand for capital and land. We assume away presence of any foreign capital (K_F) in economy's ateady-state level capital endowment. Endowment of (domestic) capital is parametrically given. So these two equations are the full-utilisation conditions for these two factors of production. The full-utilisation conditions for these two factors are ensured by the perfect flexibility in the prices of these factors.

The demand for the non-traded input must equal its supply. Therefore,

$$X_2^D = X_2 = a_{23}X_3 \quad (3.9)$$

$a_{23}X_3$ denotes the level of demand for the intermediate input. Perfect flexibility of the domestic price of the internationally non-traded input ensures this equality in equilibrium.

The economy's social welfare is measured by a strictly quasi-concave social welfare function[23]

$$U = U(D_1, D_3) \tag{3.10}$$

Where

D_1 =Domestic consumption of agricultural commodity 1 by the society

D_3 =Domestic consumption of the final manufacturing product by the society

(We implicitly assume that the non-tradable produced by advanced agricultural sector are not used for consumption purpose).

Balanced trade implies[24]

$$D_1 + P_3 D_3 = X_1 + P_3 X_3$$

In terms of domestic prices,

$$D_1 + P_3(1+t)D_3 = X_1 + P_3(1+t)X_3 + tP_3(D_3 - X_3) = WL + RN + r\overline{K} + tP_3(D_3 - X_3) = Y \tag{3.11}$$

Y stands for national income at domestic prices. It is not a decomposable system since the factor prices cannot be solved from the three zero-profit conditions alone.

The working of our general equilibrium model is as follows:

We have eight endogenous variables in the system: $W, R, r, P_2, X_1, X_2, X_3$ and L_U. $L, N, \overline{K}$ and P_3 are the exogenous variables to the model; while the policy parameters are t, W^*. It is not a decomposable system. Regarding the determination of endogeneous variables, given W^*, P_3, t; W, R and r are determined from our price-system given by Equations (3.1)−(3.3) as functions of P_2. Once factor prices are determined, factor coefficients are also

[23] Assuming homogeneity in preferences of the individuals – a typical assumption in this literature. See Chaudhuri and Mukhopadhyay (2010) for details.

[24] In this class of static general equilibrium models, we are typically concerned about post-trade situations in a small, open economy under steady-state equilibrium. Hence, all the endogenous variables and policy-parameters are always adjusted to maintain steady-state equilibrium such that the trade is balanced.

determined as functions of P_2. Then from Equations (3.6) – (3.8) X_1, X_2 and X_3 are determined as functions of P_2. Finally P_2 is obtained from Equation (3.9).

Following Mukherjee (2012), I also assume that sector 1 is relatively more land-capital intensive than sector 2 in physical and value terms.[25]

3.3.1 Global and Local Stability of Equilibrium

As demonstrated in Chapter 2, the equilibrium of the system is locally stable and the HT migration equilibrium is globally stable. Also the market for non-traded input is also locally stable as shown in Appendix 3.2.

3.3.2 Comparative Statics – Reduction in Protection in Import-competing Sector

Taking total differentiation of Equations (3.1) – (3.3), applying envelope conditions for the competitive producers[26] and then solving these three first-order conditions of profit-maximisation using the Cramer's rule we obtain (note that $\left(Wa_{ji}/P_i\right) = \theta_{ji}$)

$$\widehat{W} = -\frac{\theta_{N1}}{|\theta|}\left[(\theta_{K3} + \theta_{23}\theta_{K2})\widehat{P_2} - \theta_{K2}T\hat{t}\right] \tag{3.12}$$

$$\hat{R} = \frac{\theta_{L1}}{|\theta|}\left[(\theta_{K3} + \theta_{23}\theta_{K2})\widehat{P_2} - \theta_{K2}T\hat{t}\right] \tag{3.13}$$

$$\hat{r} = \frac{(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{N2})}{|\theta|}\left(T\hat{t} - \theta_{23}\widehat{P_2}\right) \tag{3.14}$$

Where

$$|\theta| = \theta_{K3}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

and,

[25] See footnote 12 of Chapter 2 in this context.
[26] This has been explained in details in Appendix 2.1 of Chapter 2.

$$T = \left(\frac{t}{1+t}\right) > 0;$$

Similarly, totally differentiating Equations (3.6) – (3.8) (noting that now we have j^{th} input's physical share in the production of good $i, \lambda_{ji} = X_i a_{ji}/J$, where J is the total endowment of input j in the economy), substituting (3.12) – (3.14) and solving by Cramer's rule we get

$$\widehat{X_2} = \frac{1}{|\lambda|}\Big[\left(\lambda_{N1}\lambda_{K3}C_1 + \lambda_{L1}\lambda_{K3}C_2 + \tilde{\lambda}_{L3}\lambda_{N1}C_3\right)\hat{P}_2 - \left(\lambda_{L1}\lambda_{K3}C_4 + \lambda_{N1}\lambda_{K3}C_5 + \lambda_{N1}\widetilde{\lambda_{L3}}C_6\right)\hat{t}\Big] \quad (3.15)$$

$$\widehat{X_3} = \frac{1}{|\lambda|}\Big[\left(\lambda_{L1}\lambda_{N2}C_3 - \lambda_{L1}\lambda_{K2}C_2 - \lambda_{L2}\lambda_{N1}C_3 - \lambda_{N1}\lambda_{K2}C_1\right)\hat{P}_2 - (\lambda_{L1}\lambda_{N2}C_6 - \lambda_{L1}\lambda_{K2}C_4 - \lambda_{L2}\lambda_{N1}C_6 - \lambda_{K2}\lambda_{N1}C_5)\hat{t}\Big] \quad (3.16)$$

Note that we have all of the $C_1, C_2, C_3, C_4, C_5 < 0$.[27] Under the condition $\tilde{\lambda}_{L3}$ is negligible,[28] $C_6 < 0$. Since the output of sector 2 is relatively more labor-intensive compared to land vis-à-vis sector 1, we have $|\theta| = \theta_{K3}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$. Therefore, $\Delta = \left[C_3\left(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1} - \lambda_{N1}\widetilde{\lambda_{L3}}\right) - \lambda_{L1}C_2 - \lambda_{N1}C_1\right] > 0$. It can be shown that by the stability condition in the market for non-traded input $\left(\Delta/_{|\lambda|}\right) < 0$.[29] This implies $|\lambda| < 0$ as $\Delta > 0$.

Also, it is straigtforward to obtain

$$\widehat{P_2} = \frac{\hat{t}}{\Delta}\left[C_6\left(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1} - \tilde{\lambda}_{L3}\lambda_{N1}\right) - C_4\lambda_{L1} - C_5\lambda_{N1}\right] \quad (3.17)$$

So if (i) $\tilde{\lambda}_{L3} \cong 0$, (ii) $|\theta| = \theta_{K3}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$, then $\widehat{P_2} < 0$, $\widehat{X_2} > 0$ and $\widehat{X_3} < 0$.

[27] See Appendix 3.1 for these expressions.

[28] This is a realistic assumption since for most of the low-income developing countries share of employment in the organised sector is likely to become negligible over time, as bulk of the workforce are engaged in informal jobs, including agriculture. For example, in India, more than 90% people are engaged in agriculture and other informal activities. The focus of this essay is such LDCs. This assumption has also been used in Marjit (2003). The assumption is about share of employment in the organised sector. To assume share of employment in the organised sector is negligible compared to the other sectors of the economy does not rule out the existence of unemployment in sector 3, nor reduce the importance of sector 3. Empirically it only indicates that productivity has improved in sector 3.

[29] This has been demonstrated in Appendix 3.2.

Differentiating (3.10) – (3.11) we get

$$\frac{dU}{U_1} = dD_1 + (1+t)P_3 dD_3 = J\left[(1-L_1)W\widehat{W} + tP_3\left(tP_3 S\hat{t} - X_3\widehat{X_3}\right)\right]$$

Where $U_1 = \frac{\partial U}{\partial D_1}, J = \frac{1+t}{\{1+(1-c)t\}}, S = \left(\frac{\partial D_3}{\partial P_3^*}\right) + \left(\frac{\partial D_3}{\partial Y}\right)D_3$ is the Slutsky's pure substitution term, and $c = (1+t)P_3\left(\frac{\partial D_3}{\partial Y}\right)$ is the marginal propensity to consume good 3.

$$\frac{dU}{U_1\hat{t}} = J\left[\left\{(1-L_1)W\frac{\widehat{W}}{\hat{t}} - tP_3X_3\left(\frac{\widehat{X_3}}{\hat{t}}\right)\right\} + (tP_3)^2 S\right] \qquad (3.18)$$

represents the impact of tariff-reduction on welfare.

Substituting $\widehat{P_2}$ from Equation (3.17) into (3.12), we obtain

$$\widehat{W} = -\left(\frac{\theta_{N1}\hat{t}}{|\theta|}\right)\left[\left\{\begin{matrix} C_6\left(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1} - \tilde{\lambda}_{L3}\lambda_{N1}\right) \\ -C_4\lambda_{L1} - C_5\lambda_{N1} \end{matrix}\right\}\left(\frac{\theta_{K3}+\theta_{23}\theta_{K2}}{\Delta}\right) + \theta_{K2}T\right] \qquad (3.19)$$

So $\widehat{W} < 0$ when $\hat{t} < 0$, iff $|\theta| < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$.

Now, From HT migration equilibrium we have,

$$L_U = \left[\left\{\left(\frac{W^*}{W}\right) - 1\right\}a_{L3}X_3\right]$$

Totally differentiating the migration equilibrium condition we obtain

$$\widehat{L_U} = \frac{\lambda_{L3}}{\lambda_{LU}}\left[\underbrace{\left(\frac{W^*}{W} - 1\right)\left(\widehat{a_{L3}} + \widehat{X_3}\right)}_{<0,\text{centripetal force}} + \left\{\underbrace{-\left(\frac{W^*}{W}\right)\widehat{W}}_{>0,\text{centrifugal force}}\right\}\right] \qquad (3.20)$$

These lead to the following proposition:

Proposition 3.1. *Tariff reduction may lead to stagnant employment situation in the urban manufacturing sector if* $\left|\widehat{X_3}\right| \cong \left|\widehat{W}\right|$ *provided* $\tilde{\lambda}_{L3} \cong 0$ *and sector 1 is relatively land-capital intensive than sector 2 in physical and value terms.*

Proof. It is straightforward to argue from Equations (A2.1), (3.16) – (3.17) and (3.19) when $\tilde{\lambda}_{L3}$ is negligible,$|\theta| < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$; we have $C_6 < 0 => \widehat{X_3} < 0$; $\widehat{P_2} < 0$; $\widehat{W} < 0$ when $\hat{t} < 0$. Thus Equation (3.20) indicates the possibility of zero net job creation in the urban sector during liberalised regime. The intuition is as follows:

A reduction in import tariff depresses the domestic price of the finished agro-based manufacturing good produced by urban manufacturing sector, leading to the contraction of sector 3. The capital-intensive urban sector now demands less capital which in turn lowers the return to capital, r. This contraction of sector 3 reduces both demand for and supply of the non-traded input produced by advanced agro-processing sector; but as long as the urban manufacturing sector accounts for significantly low share of total employment, the demand-effect dominates and P_2 falls. Now in the 'Heckscher-Ohlin nugget' formed by the two agricultural sectors (using two mobile factor: labour and land), the fall in P_2 induces a Stolper-Samuelson effect, inducing W to fall but R (return to land) to go up under the assumption $|\theta| < 0$.

Note that there will be four different impacts on social welfare: total wage income decreases as W falls; rental income from land-capital rises; return to mobile capital falls; and as X_3 falls, the cost of tariff protection of the import-competing sector, tP_3X_3, falls. So there is a possibility to achieve an increase in the economy-wide social welfare: if the initial tariff rate is large enough so that the net effect of reduction in distortion costs of tariff becomes dominant.

Now let us explain Equation (3.20) which shows the effect on urban unemployment: (i) sector 3 contracts. (ii) since (W^*/r) rises labour-output ratio in sector 3, a_{L3}, falls. Therefore, the number of jobs available in the urban sector, $a_{L3}X_3$, falls. This decreases the expected urban wage for every prospective rural migrant leading to a reverse migration from urban to rural sector. This is the 'centripetal force' reducing the extent of urban unemployment. However, as competitive rural wage falls, that will induce the rural workers to leave the rural sectors and to join the urban unemployment pool. This is the 'centrifugal force' worsening the problem. If the relative strengths of these two opposite forces are more or less equal to each other,

there may be no net job creation in the urban sector. Also if the magnitude of the centrifugal force is larger, the economy might experience significant job losses in the urban sector even adopting this policy of tariff reform.

However as pointed out before, the economy-wide social welfare may improve. This indicates the possibility of the economy to experience 'jobless growth'[30] in this liberalised regime. ■

The organised manufacturing sector accounts for a small share of total employment in most of the low-income developing countries and this extension adds insight into why for a DC like India trade liberalisation might be welfare improving but there may be significant job losses or stagnation in urban employment.

3.3.3 Reduction in Bargaining Strength of the Labour Union in Organised Sector

We relax the assumption of an institutionally given wage in the urban sector and take into account the fact that the urban sector faces an unionised labour market. So W^* is now endogenously determined as

$$W^* = W^*(W, U)^{31}$$

Where U is the bargaining power of the labour unions. And we have, $W^* = W$ for $U = 0$, $W^* > W$ for $U > 0$; $\left(\partial W^*/\partial W\right), \left(\partial W^*/\partial U\right) > 0$.

Therefore, Equation (3.3) can be re-written as

$$W^*(W, U)a_{L3} + ra_{K3} + P_2 a_{23} = (1 + t)P_3 \qquad (3.3a)$$

[30] However, because this is a static (steady-state equilibrium) model, 'growth' means sectoral expansion from initial equilibrium point to the final/resultant long-run steady-state equilibrium point, without considering the instantaneous dynamic adjustment between these two equilibrium points.

[31] See Appendix 2.3 of Chapter 2 for a simple version of the determination of W^* through collective bargaining, based on Chaudhuri (2003), Chaudhuri and Mukhopadhyay (2010).

A policy of labour-market reform takes the form of government intervention to reduce the bargaining strength of the labour-union (U), leading to a decrease in the unionised wage rate (W^*).[32]

Accordingly the comparative statics exercise yield:

$$\widehat{X_2} = \frac{1}{|\lambda|}(\lambda_{L1}\lambda_{K3}B_2 + \lambda_{N1}\lambda_{K3}B_1 + \lambda_{N1}\lambda_{L3}B_3)\widehat{W^*} \qquad (3.21)$$

$$\widehat{X_3} = \frac{1}{|\lambda|}(\lambda_{L1}\lambda_{N2}B_3 - \lambda_{L1}\lambda_{K2}B_2 - \lambda_{L2}\lambda_{N1}B_3 - \lambda_{K2}\lambda_{N1}B_1)\widehat{W^*} \qquad (3.22)$$

As explained previously, under the assumption that sector 2 is relatively labour-intensive than sector 1 in value-sense (i.e., $|\theta| < 0$), we have both B_1, B_2 being < 0. But the sign of B_3 is ambiguous. If $\lambda_{K2} \cong 0$ (i.e., proportion of capital used in sector 2 is negligible), $B_3 < 0$.[33] Therefore, from Equations (3.21) and (3.22), when $\widehat{W^*} < 0$, under the sufficient conditions $\lambda_{K2} \cong 0$ and $|\theta| < 0$, since we already have $|\lambda| < 0$ we obtain $\widehat{X_2},\ \widehat{X_3} > 0$.

Accordingly we have

$$\widehat{P_2} = -\left(\frac{\widehat{W^*}}{\Delta}\right)[B_3(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) - B_2\lambda_{L1} - B_1\lambda_{N1}] \qquad (3.23)$$

As stated earlier, $\Delta > 0$. So when $\widehat{W^*} < 0$, $\widehat{P_2} > 0$ if $\lambda_{K2} \cong 0$, $|\theta| < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$.

Finally, we have

$$\widehat{W} = \left(\frac{\theta_{N1}\widehat{W^*}}{|\theta|}\right)\begin{bmatrix}\{B_3(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) - B_2\lambda_{L1} - B_1\lambda_{N1}\} \\ \left(\frac{\theta_{K3}+\theta_{23}\theta_{K2}}{\Delta}\right) + \theta_{K2}\theta_{L3}\end{bmatrix} \qquad (3.24)$$

So when $\widehat{W^*} < 0$, we have $\widehat{W} > 0$ if $\lambda_{K2} \cong 0$, $|\theta| < 0$ and $(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$.

[32] Several empirical studies (such as Bhalotra 2002, Besley and Burgess 2004) have noted that in India, before the advent of economic reforms organised workers in the large firms were to reap wages higher than the supply price of labour due to strong labour regulations through collective bargaining (offer of negotiations, strikes etc.) and restricted mobility of the labour in the organised sectors through various labour laws (such as Industrial Disputes Act, 1947). This makes Indian policymakers to seriously think over to reformulate labour laws to curb union power so that unions' power to mark up wages over the supply of labour would decrease and as a consequence unionised wage would fall.

[33] Expressions for B_1, B_2, B_3 are presented in Equation (A3.2) of Appendix 3.1 in this chapter.

Therefore we are now in a position to state the following proposition:

Proposition 3.2. *Competitive wage rises following a policy of labour-market reform if* $\lambda_{K2} \cong 0$ *and sector 1 is relatively more land-capital intensive than sector 2 in physical and value terms.*

Proof. Government intervention to curb the bargaining power of labour-union, leading to a reduction in the unionised wage, makes it possible for the urban sector (sector 3) to save on labour input and raises the effective price of the commodity (net of labour cost) as faced by the manufacturing producers. This helps sector 3 to expand (note that ambiguous sign of B_3 will have no effect on expansion of sector 3 so long as proportion of workforce employed in sector 3 is negligible). This will increase the demand for capital given supply as the capital-intensive sector 3 will demand more capital for its expansion. That will make capital relatively costlier (rise in r). At the same time sector 3 will demand more of the non-traded input produced by sector 2. As output of sector 2 is used in a fixed proportion in sector 3, that will enable sector 2 to expand. But since r rises that will tend to push P_2 downwards to satisfy zero-profit condition for sector 3. However under the sufficient condition $\lambda_{K2} \cong 0$ (proportion of capital employed in sector 2 is negligible), P_2 rises. This will induce a Stolper-Samuelson effect in the HO-nugget formed by sectors 1 and 2, owing to which competitive rural wage rises as sector 1 is relatively land-capital intensive than sector 2 in physical and value terms ($|\theta| < 0, (\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1}) < 0$).

Note that this again points to the possibility of 'jobless growth' in the urban manufacturing sector:

a) **Joblessness:** So from the above discussion it is clear that if $\lambda_{K2} \cong 0$ and sector 1 is relatively more land-capital intensive than sector 2: (i) sector 3 will expand, (ii) competitive wage (W) and return to capital (r) will rise, while (iii) unionised wage (W^*) will fall. As (W^*/r) falls, producers in sector 3 will switch to more labour-intensive techniques of production than before. In other words, a_{L3} rises. So number of jobs available in the urban sector, $a_{L3}X_3$, rises. As a result, every

prospective rural migrant will be lured to migrate to the urban sector (sector 3) which accentuates the urban unemployment problem (centrifugal force). However since the unionised urban wage falls and competitive rural wage rises (under the sufficient conditions mentioned above), the rural-urban wage gap falls. This prevents the rural workers from joining the urban unemployment pool (centripetal force).

From HT migration equilibrium we have,

$$L_U = \left[\left\{\left(\frac{W^*}{W}\right) - 1\right\} a_{L3} X_3\right]$$

Totally differentiating both sides

$$\widehat{L_U} = \underbrace{\frac{W^*}{(W^* - W)}\left(\widehat{W^*} - \widehat{W}\right)}_{<0\ (\text{centripetal force})} + \left(\underbrace{\widehat{a_{L3}} + \widehat{X_3}}_{>0\ (\text{centrifugal force})}\right)$$

It is again possible that these two opposite forces more or less equal, resulting stagnation in urban employment. Also sufficiently stronger centrifugal force could lead to enormous number of job losses.

b) **Growth[34] Effect:** Therefore, as the resultant implications total wage-earnings rises, total rental income from land-capital falls while return to capital remains unchanged. However as sector 3 expands, the cost of tariff-protection on the supply side increases which works negatively on welfare. Of course social welfare may increase if the positive impact of rise in aggregate wage earnings outweighs the negative forces. But that benefit will not accrue to the job losers if in the economy there is no net job creation / significant loss in productive jobs. So the economy will again experience a 'jobless growth'.

[34] See footnote 28 in this context.

3.4 Concluding Remarks

This essay makes some theoretical predictions about the puzzling incidence of 'jobless growth' which has made India's liberalisation policy a very contentious issue. The key comparative static exercises considered in this essay are the consequences of liberalised trade policies (captured by a tariff cut in the protected import-competing sector) and liberalisation of labour laws (captured by a reduction in the bargaining strength of the labour unions). The contribution of this modelling structure, with respect to the earlier related works (namely, Marjit 2003; Chaudhuri and Banerjee 2007) has been to incorporate partial capital mobility between the rural agricultural (informal) and the urban manufacturing (formal) sectors,[35] albeit with existence of urban unemployment. This analysis also has also been able to show

a) Impact of trade liberalisation policy in presence of labour market imperfection on the competitive rural (informal) wage when there exists agricultural dualism in the rural economy; and
b) Labour market reforms, contrary to the conventional wisdom, may raise the competitive wage.

These results suggest that government needs to be very careful in the implementation of these different liberalisation policies to achieve welfare gains, while the latter result is extremely crucial as it suggests why labour market reform is an important liberalisation policy in the context of an agro-dominated developing economy. The different theoretical models here try to show that economic reforms may lead to output expansion without a growth in productive employment in the organised sector.

However none of these policies can rule out the prediction of 'jobless growth' as explained in proposition 3.1 and implied from proposition 3.2. So this theoretical analysis just restates the fact mentioned at the outset of this essay that trade reform measures have made India increasingly dependent on extremely volatile external economic events, as a result of which markets for the products of organised sector have been opened up for competition too

[35] In particular, capital is mobile between sector 2 and sector 3.

rapidly that contributed to weakening the labour laws and allowed the employers to replace capital for labour, leading to increased productivity of the remaining workers and lower share of employment in the organised sectors (which has been captured by the sufficient condition $\tilde{\lambda}_{L3} \cong 0$ in our model). Therefore, it has been the case that the 'growth-effect' does not 'trickle down' to the job losers, leading to 'jobless growth' in the organised sectors. That is precisely why increasing productive employment becomes a real challenge for a developing economy like India during this liberalised regime (World Development Report, 2013).

Appendices

Appendix 3.1

(i) The Tables Summarising Model Characteristics

Table A3.1: Model Characteristics

<table>
<tr><th>No of Sectors</th><th colspan="2">Sector Definitions</th><th colspan="2">Input Usage</th><th rowspan="2">Relative Factor-intensity Ranking</th></tr>
<tr><td rowspan="3"></td><th>Traded</th><th>Non-traded</th><th>Agricultural Sectors (Sectors 1 & 2)</th><th>Registered Agro-based Manufacturing Sector (Sector 3)</th></tr>
<tr><td>• Sector 1 →
‘Advanced’ agricultural sector within the rural area. Producing primary exportable.</td><td rowspan="2">• Sector 2 →
‘Backward’ agricultural sector, providing local agricultural intermediate inputs for sector 3.</td><td>• Labour Market→
Competitive labour market – labourers are perfectly mobile between sectors 1 & 2, since both of them are situated in close vicinity within the rural area.</td><td>• Labour Market→
Unionised (imperfect) labour market, with workers receiving contractual wage.</td><td rowspan="2">• Heckscher-Ohlin (HO) ‘nugget’ →
Formed by the sectors 1 & 2, using two common factors – land and labour.
• In this HO-nugget, we assume sector 1 is relatively more land-intensive than sector 2.</td></tr>
<tr><td>• Sector 3 →
Organised ‘agro-based’ industrial sector within the urban area. Producing import-competing goods (for e.g., sugar)</td><td>• Land Usage →
Sectors 1 & 2 use land in production of agricultural products.
• Capital Usage →
Sector 2 uses capital, on the top of using land in its production.</td><td>• Capital Usage →
Sector 3 uses capital, on the top of using labour and intermediate input (provided by Sector 2) in its production.</td></tr>
</table>

Table A3.2: The General Equilibrium System

VARIABLES			KEY EQUATIONS DESCRIBING THE MODEL		SIMPLIFYING ASSUMPTION
ENDOGENOUS	EXOGENOUS	POLICY-PARAMETERS	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	
$W, R, r, P_2, X_1, X_2, X_3, L_U$	$\bar{K}, L, N, P_3$	$t > 0, W^* > 0$	Equations (3.1) – (3.3).	Equations (3.6) – (3.8), (7).	a_{23} is constant.

(ii) Derivations of Some Algebraic Expressions

$$C_1 = \frac{1}{|\theta|}\left[\begin{array}{c}(\theta_{K3}+\theta_{23}\theta_{K2})\bar{\lambda}_{Li}\bar{S}^k_{Lj}+\theta_{N1}(\theta_{K3}+\theta_{23}\theta_{K2})(1-\lambda_{L3})- \\ \theta_{23}(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})(\lambda_{L2}S^2_{LK}+\tilde{\lambda}_{L3}S^3_{LK})\end{array}\right] < 0$$

$$|\lambda| = \left(\lambda_{L1}\lambda_{N2}\lambda_{K3}-\lambda_{L2}\lambda_{N1}\lambda_{K3}+\tilde{\lambda}_{L3}\lambda_{N1}\lambda_{K2}\right)$$

$$\tilde{\lambda}_{L3} = \left(\frac{W^*}{W}\right)\lambda_{L3}$$

$$\bar{\lambda}_{Li}\bar{S}^k_{Lj} = (\lambda_{L1}S^1_{LN}+\lambda_{L2}S^2_{LN}+\lambda_{L2}S^2_{LK}\theta_{N1}) > 0$$

$$\Delta = \left[C_3\left(\lambda_{L1}\lambda_{N2}-\lambda_{L2}\lambda_{N1}-\lambda_{N1}\widetilde{\lambda_{L3}}\right)-\lambda_{L1}C_2-\lambda_{N1}C_1\right]$$

$$C_2 = \left(\frac{1}{|\theta|}\right)\left[\left(\theta_{K3}+\theta_{23}\theta_{K2}\right)\bar{\lambda}_{Ni}\bar{S}^k_{Nj}-\theta_{23}(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})\lambda_{N2}S^2_{NK}\right] < 0$$

$$\bar{\lambda}_{Ni}\bar{S}^k_{Nj} = (\lambda_{N1}S^1_{NL}+\lambda_{N2}S^2_{NL}+\lambda_{N2}S^2_{NK}\theta_{L1}) > 0$$

$$C_3 = \left(\frac{1}{|\theta|}\right)\left[\left(\theta_{K3}+\theta_{23}\theta_{K2}\right)(1-S^2_{KK}\theta_{L1})\lambda_{K2}-\theta_{23}(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})\lambda_{K2}(S^2_{KL}+S^2_{KN})\right] < 0$$

$$C_4 = \frac{T}{|\theta|}\left[\bar{\lambda}_{Ni}\bar{S}^k_{Nj}\theta_{K2}-(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{N2})\lambda_{N2}S^2_{NK}\right] < 0$$

$$C_5 = \frac{T}{|\theta|}\left[\theta_{K2}\bar{\lambda}_{Li}\bar{S}^k_{Lj}-(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})(\lambda_{L2}S^2_{LK}+\tilde{\lambda}_{L3}S^3_{LK})\right] < 0$$

$$C_6 = \frac{T}{|\theta|}\left[\theta_{K2}\tilde{\lambda}_{L3}(\theta_{L1}S^2_{KK}-1)-(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{N2})\lambda_{K2}(S^2_{KL}+S^2_{KN})\right]$$

(A3.1)

Where S^i_{jk} is the degree of substitution between factors j and k in the i[th] sector ($j,k = L,N,K$ and $i = 1,2,3$). For example, $S^2_{KL} = (\partial a_{K2}/\partial W)(W/a_{K2})$. $S^i_{jk} > 0$ for $j \neq k$ and $S^i_{jj} < 0$. Note that since the production functions are linearly homogenous, the factor coefficients a_{ji}s would also be homogenous of degree zero in factor prices. Therefore, the sum of these elasticities for any factor of production in any sector with respect to factor prices must be equal to zero. As an example, for labour in the advanced agricultural sector we have $\left(S^1_{LL}+S^1_{LN}\right) = 0$.

Also,

$$B_1 = \left(\frac{1}{|\theta|}\right)[\theta_{K2}\theta_{L3}(\lambda_{L1}S_{LN}^1 + \lambda_{L2}S_{LN}^2 + \lambda_{L2}S_{LK}^2\theta_{N1}) - (\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})\{\theta_{L3}\lambda_{L2}S_{LK}^2 + \lambda_{L3}S_{LK}^3(\theta_{L3} + \theta_{K3})\}]$$

$$B_2 = \frac{\theta_{L3}}{|\theta|}[\theta_{K2}(\lambda_{N1}S_{NL}^1 + \lambda_{N2}S_{NL}^2 + \lambda_{N2}S_{NK}^2\theta_{L1}) - (\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})\lambda_{N2}S_{NK}^2]$$

$$B_3 = \frac{1}{|\theta|}\begin{bmatrix}\theta_{K2}\theta_{L3}\lambda_{K2}(\theta_{L1}S_{KK}^2 - 1) - (\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) \\ \{\lambda_{K2}\theta_{L3}(S_{KL}^2 + S_{KN}^2) + \lambda_{K3}S_{KL}^3(\theta_{L3} + \theta_{K3})\}\end{bmatrix}$$

(A3.2)

Appendix 3.2: Stability Condition in Non-traded Intermediate Input Market

P_2, the price of non-traded intermediate input must adjust to clear its domestic market. Therefore, the stability condition for equilibrium in this market needs

$$\{d(X_2^D - X_2)/d\,P_2\} < 0$$

That means around equilibrium, initially, $X_2^D = X_2$. Therefore,

$$\left\{\left(\hat{X}_2^D/\widehat{P_2}\right) - \left(\widehat{X_2}/\widehat{P_2}\right)\right\} < 0 \qquad \text{(A3.3)}$$

Now $X_2^D = a_{23}X_3$ is the demand for non-traded input. Total differentiation gives, $\hat{X}_2^D = \hat{X}_3$. Using Equations (3.15) and (3.16), we get respectively

$$\left(\frac{\hat{X}_2}{\hat{P}_2}\right) = \left(\frac{1}{|\lambda|}\right)\left(\lambda_{N1}\lambda_{K3}C_1 + \lambda_{L1}\lambda_{K3}C_2 + \lambda_{N1}\widetilde{\lambda_{L3}}C_3\right) \qquad \text{(A3.4)}$$

$$\left(\frac{\hat{X}_3}{\hat{P}_2}\right) = \left(\frac{1}{|\lambda|}\right)(\lambda_{L1}\lambda_{N2}C_3 - \lambda_{L1}\lambda_{K2}C_2 - \lambda_{L2}\lambda_{N1}C_3 - \lambda_{N1}\lambda_{K2}C_1) \qquad \text{(A3.5)}$$

Using Equations (A3.3) – (A3.5) we get the required stability condition

$$\frac{\Delta}{|\lambda|} < 0 \qquad \text{(A3.6)}$$

Where

$$\Delta = \left[C_3\left(\lambda_{L1}\lambda_{N2} - \lambda_{L2}\lambda_{N1} - \lambda_{N1}\widetilde{\lambda_{L3}}\right) - \lambda_{L1}C_2 - \lambda_{N1}C_1\right] \quad \blacksquare$$

Chapter 4 – Special Economic Zones and Agriculture: An Alternative Theorisation

4.1 Introduction

Special Economic Zones (SEZs) are specifically defined duty-free enclaves and that are considered to be foreign territory for the purposes of trade operations, and duties and tariffs. In order to avoid import substitution strategy, many developing countries (including India) have adopted more external-looking-export-oriented industrialisation (Mukherjee 2012). Formation of export processing zones (EPZs) has been the most prominent feature of this export-oriented development strategy. Since the 1960s such zones were formed mainly in Asia, this concept of SEZs is not new. Development of these zones caused economic growth due to increased exports. The economic activities vary in these zones and mostly undivided zones are specialized in their particular exports. These range from financial services, bonded warehouses, transportation or border trade. Some zones have more advanced projects regarding research and development. SEZ has become a broad term in the sense that it now represents an open area and is not bounded. For example, the single-factory zones like the export based factories in India or warehouses in Bangladesh can also be counted as SEZs. Some of the activities carried out in SEZs range from initial assembly to even tourist attractions. The figures of International Labour Organization (ILO) tell us that in total (after continuous proliferation) there are 3,500 SEZs (or equivalently, export processing zones, EPZs hereafter) in over 130 countries. The first two developing countries which latched on to the idea of SEZ were Puerto Rico (in 1962) and India (in 1965). The decade of 1970s saw a lot of countries take the initiative to establish EPZs including South Korea, Sri Lanka, and countries in Latin America, Caribbean, Africa and West Asia.

In addition to exemption from import and export duties, establishments in SEZs get sufficient incentives in terms of benefits in income tax, service tax

and other obligations to the central and state governments. Therefore, it is not at all surprising that a large number of enterprises have queued up either to develop an SEZ or to enter an already established SEZ in India. Although well-implemented and designed SEZ can benefit a host-country in different ways: increases in employment, FDI attraction, general economic growth, foreign exchange earnings, international exposure and transfer of new technologies and skills; the policy has come under substantial criticism. New SEZs have to be established on continuous bases to keep up the rate of employment which is not possible all the time. At the same time, it is very difficult to assess the extent of benefit the workers gain from SEZs, the reason is that there is no clarity in how the benefits are measured.

Across different provinces of India during the recent years, thousands of farmers protested against the government's compulsory land acquisition at some sites, claiming they had not been compensated adequately (Fernandes, 2007). The protesters insisted that the policy would not be able to create the number of jobs as suggested by the government. Concerns have also been expressed on the displacement of farmers by land acquisition, loss of fertile agricultural land, a huge revenue loss to the exchequer and adverse consequences of uneven growth. Such a dilemma has been observed in many predominantly agricultural countries, including India, that intend to industrialise using agricultural land. One can see for example: Bhaduri (2007), Sarma (2007), Reddy and Redyy (2007) and so on.

The relevant existing theoretical literature in this context have prescribed SEZ as a second best policy and provide the basis for much of the criticism against SEZs. There is need to extend theoretical foundations of SEZs for a better understanding of their contribution to the economic growth.

The major questions in this context are:

- To what extent are SEZs effective in promoting industrial development, without hurting agriculture, in the context of a liberalised investment policy?

And,

- How are the workers affected (in terms of real wage and employment conditions) due to this policy?

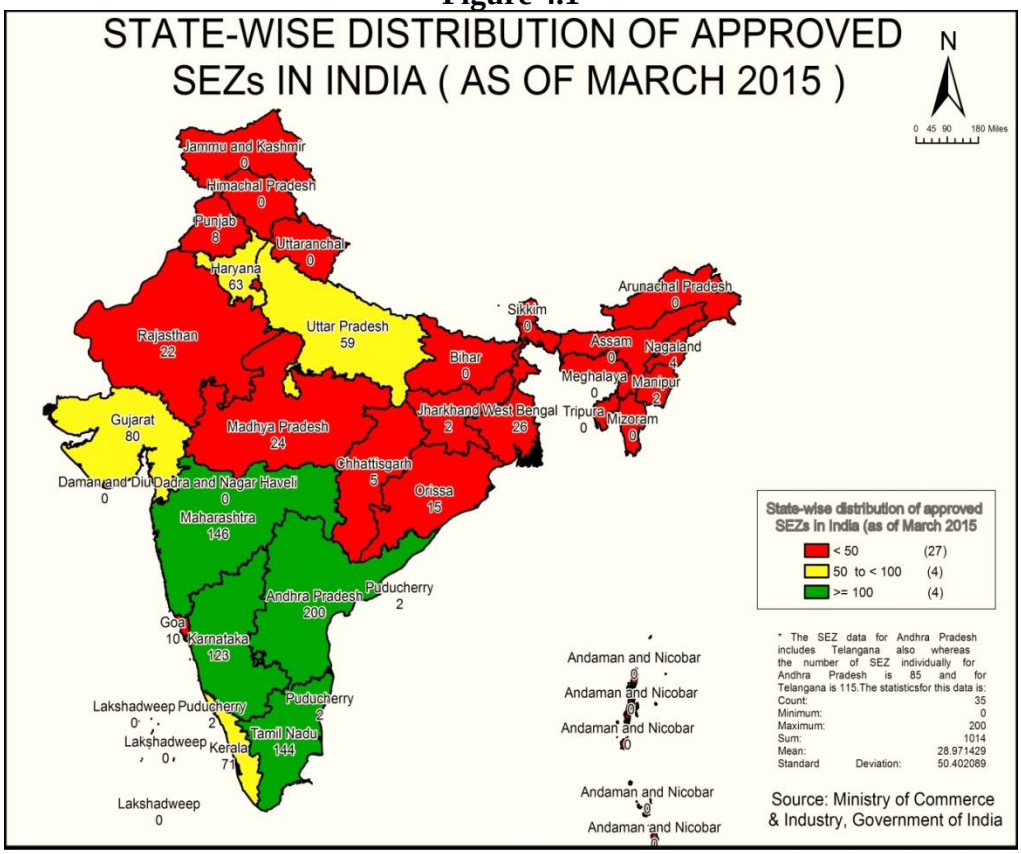
Starting with some stylised facts on Indian experience with EPZs/SEZs, this article discusses gaps in existing relevant theoretical general equilibrium model on EPZs/SEZs and then answered the above two questions with an encompassing theoretical general equilibrium model with imperfect competition in the SEZ-led industrial sector. The contribution of this essay has been to address the increasing returns in the SEZ-led industrial sector (owing to the within-industry spillover effect, which, in turn, is due to localisation of similar firms within the SEZ-industry[36]) within a three-sector HT-type static general equilibrium model. Finally, the last section concludes.

4.2 SEZs in India: Performances and Policy Issues

India had been the first country in Asia to set up an SEZ, in Kandla (Gujarat) in 1965. However, India has gained interests of the policymakers for EPZs since the declaration of the SEZ Policy on 2000, followed by the SEZ Act on 2005, which came into operation on 10 February 2006. As of 11 August 2008, 250 new SEZs were notified (Murayama and Yokota 2009).

[36] This point is further explored in section 4.3.

Figure 4.1



The zones formed before 2006 have been responsible for increased employment of more than six times from 12,468 persons in February 2006 to 79,015 persons in 31st March 2012 and increased investment of more than four times from 17,563.1 million INR in February 2006 to 76,376.1 million INR in 17th July 2012. Apparently, the rate of value addition in the zones in India is at par with these countries that were successful in establishing backward economic linkages. This is despite the fact that policy obligations on value addition were done away with in the SEZ scheme (2000). In fact, the value addition increased from 42% during the 1990s (Aggarwal 2004) to 48% over the period 2000-2005. The table below summarises the economic activity in those SEZs in terms of employment and investment as up to 2012.

Table 4.1: Employment and Investment in SEZs

	SEZs notified after February 2006	State/Pvt. SEZs before 2006	Central Government SEZs	Total
SEZ Notified as on 17.7.2012	389	12	7	408
Formal approval less notified:	200		-	200
No. of valid approvals	48	-	-	48
Operational units as on 31st March 2012	153	-	-	153
Employment as on 31st March 2012 (no. of persons)	5,52,048	79,015	2,13,853	8, 44,916 (264%)
Investment as on 17.07.2012 (Rs. million)	1,82,750.74	76,376.1	11,486.41	2, 01,874.76 (3081%)

Source: Fact Sheet on Special Economic Zones (Ministry of Commerce and Industry, Government of India) 2012.

Table 4.2: Export Performances by the SEZs in India

Years	Exports		Growth over previous year
	Value in Rs. million	Billion USD	
2005-2006	22,840	5.08	-
2006-2007	34,615	7.69	52%
2007-2008	66,638	14.81	93%
2008-2009	99,689	22.15	50%
2009-2010	2,20,711	49.05	121%
2010-2011	3,15,868	70.19	43%
2011-2012	3,64,478	81.00	15%
2012-2013	4,76,159	88.18	31%

Source: Ministry of Commerce and Industry, Government of India.

Table 4.2 reveals that there has been continuous improvement in the export performance of SEZs since the SEZ policy was announced on 2005. In fact, it was the implementation of the SEZ Act on 2006 that provided a major impetus to the export performance of the SEZs. However, during the recent years (since 2010), the growth in exports by SEZs registered in each financial year over the previous year has been quite modest compared to the earlier years (2006-10).

While the opponents argue that the act will lead to a large-scale land acquisition by developers and displacement of arable land, the reality is something else. The land requirement of all SEZs (including those under consideration) is 1,00,000 hectare, which is less than 0.1 per cent of total

cultivable land and not be more than 0.066% of the total land area in India. Although there is a huge debate on the extent of compensation and rehabilitation packages for the displaced families owing to land-acquisition, SEZ compensation packages in most of the cases have not been meagre. For instance, in Maharashtra, MIDC has come out with a rehabilitation package which includes assured employment for members of the displaced families and land at concessional rates for them in the developed area.

— Given the above facts, it is really important to have an appropriate theoretical structure that can be used to analyse and evaluate consequences of liberalising a small, open, developing dual economy like India through the SEZs, in a way that can provide testable hypotheses for empirical analysis and also serve as guidance for suitable policy prescriptions. This is precisely what this chapter aims for.

4.3 Context and Key Research Questions

There is extensive theoretical literature that examines the welfare aspect of forming export zones. This includes Hamada (1974), Hamilton and Svennson (1982, 1983), Miyagiwa (1986, 1993), Young and Miyagiwa (1987), Beladi and Marjit (1992) and Yabuuchi (2000) who have found formation of export zones to be welfare deteriorating in the presence of tariff-protected and capital-intensive import-competing sectors. However, Devereux and Chen (1995) have demonstrated that welfare effects of export zones can be of two types: volume of trade effect and a factor terms-of-trade effect. The second effect improves welfare while the first effect is ambiguous and depends critically on factor intensities of the protected sectors in the economy. The earlier works in the literature have ignored the second effect which, however, is highly significant and may make the formation of export zone welfare-improving.

A recent theoretical contribution in this context has been Chaudhuri and Yabuuchi (2010) that critically evaluates the consequences of SEZ-led industrialisation policy using agricultural land, using of a three-sector Harris–

Todaro (HT) type general equilibrium (GE) model with an SEZ located in the rural sector. They argue that in the absence of sufficiently large government spending on irrigation projects and other infrastructural development to improve the productivity of agricultural land, formation of the SEZ affects agriculture adversely.

One potential pitfall in the theoretical contributions on SEZ/EPZ discussed above is the assumption of perfect competition and constant returns to scale (CRS) production technology in the SEZ sector and thus ignoring the possibilities of having increasing returns brought about by positive externalities, which, in turn, are arising due to the clustering of more and more similar firms within one industry facilitated by SEZs. Hence, there are output gains owing to increased number of firms within the SEZ-industry. These economies are external to the firm but internal to the industry. This essay specifically incorporates this issue where the production technology in the SEZ sector is characterised by increasing returns to scale (IRS) generated from positive spillover at within-industry level. In a recent paper by Chakraborty (2008), welfare consequence of an exogenous capital inflow has been analysed in a two-sector general equilibrium model where one sector generates a positive spill-over and other sector is characterised by CRS. Thus, Chakraborty (2008) serves as our point of departure from Chaudhuri and Yabuuchi (2010), within the otherwise similar three-sector HT-type GE set-up. Such framework is quite relevant for a developing Asian country like India.

It is found that following an inflow of foreign capital due to the government policy of easing the entry criteria for FDI, for a sufficiently higher degree of scale economies in the IRS sector and in the absence of any subsidy policy, both agriculture and SEZ sectors can develop simultaneously. However, competitive wage rate falls in real terms so there are possibilities of reduction in urban unemployment.

4.4 The Model

We have a small open Harris-Todaro type economy producing three goods, just like Chaudhuri and Yabuuchi (2010). One sector is an agricultural sector and produces X_1 with constant returns to scale (CRS) technology using labour (L) and land-capital (T).[37] The second sector is an industry in the SEZ located in the rural area that manufactures an industrial good X_2. However, unlike Chaudhuri and Yabuuchi (2010), X_2 is produced by costlessly assembling an array of intermediate inputs. These intermediate inputs are produced by monopolistically competitive producers using a composite factor bundle, m, produced by land-capital, labour and capital (K) with CRS technology. This is the same structure as pioneered by Ethier (1982) and has been utilised in our framework in the same fashion as in Chakraborty (2008, 2009). The third sector is the urban sector that produces a manufacturing commodity, X_3 with the help of labour and capital with CRS. Workers in the urban sector earn an institutionally given wage, W^*, while the wage rate in the other two sectors (agricultural and SEZ), W, is market determined with $W^* > W$.[38]

The production technology to assemble X_2 is given by:

$$X_2 = \left[\sum_{i=1}^{n} x_i^{\rho}\right]^{1/\rho}, \text{where } 0 < \rho < 1 \qquad (4.1)$$

Where x_i is the i^{th} intermediate input. Intermediate inputs are imperfect substitutes. ρ measures the degree of differentiation of intermediate inputs. Given the number of intermediate inputs, the production function described in Equation (1) exhibits CRS but there is increasing returns to a higher degree of specialisation as measured by the number of intermediate varieties n. These economies are external to the firm but internal to the industry in the production of X_2. That is, X_2 producers take n as given. We further assume that intermediate inputs are non-traded. Thus economies of scale are purely

[37] The input 'land–capital' is broadly conceived to include durable capital equipment of all kinds. For details, see Bardhan (1973).

[38] In fact, one of the incentives for formation of SEZ in the rural areas is the readily available cheap labour.

localised within the national boundaries. As in Ethier (1982), we assume that all intermediate goods have identical cost functions.

The cost of producing the quantity x of a given variety of intermediate input is

$$C_x = (ax + b)P_m \tag{4.2}$$

Where a and b are marginal and fixed requirements of m respectively and P_m is the price of the factor bundle m. The presence of fixed cost implies internal economies of scale at the firm level in the production of intermediate inputs.

An individual producer of X_2 maximises profit subject to the production function in Equation (4.1), for parametrically given 'n'. This generates the input demand function for each intermediate input (Helpman and Krugman, 1985)

$$x_i = ((q_i)^{-\sigma} \sum_{i=1}^{n} q_i x_i / \sum_{i=1}^{n} q_i^{1-\sigma}) \tag{4.3}$$

Where q_i is the price of the i^{th} variety of intermediate input and $\sigma = 1/(1-\rho)$ is the elasticity of substitution between any pair of intermediate inputs. Assuming a large number of intermediate input producers, strategic behaviour is ruled out on the part of these intermediate input producers. Therefore, 'σ' can now be interpreted as the elasticity of demand faced by the intermediate inputs producers.

Consequently, the producer of the i^{th} intermediate input equates marginal revenue to marginal cost

$$q_i \left(1 - \frac{1}{\sigma}\right) = aP_m \tag{4.4}$$

Taking note of the fact that $\sigma = 1/(1-\rho)$, we have

$$q_i = aP_m/\rho \tag{4.5}$$

Therefore, price of the i^{th} variety of intermediate input is a constant mark-up over the marginal cost. With identical technology, since all firms charge the same price for intermediate inputs, we have $q_i = q$. Free entry drives down profits to zero (the Chamberlinian large group case). Thus, the operating surplus must be just enough to cover the fixed cost

$$(q/\sigma)x_i = bP_m \tag{4.6}$$

This also implies that output x_i is the same for all producers ($x_i = x$).

Dividing Equation (4.5) by (4.6) we obtain,

$$x = b\rho/a(1-\rho) \tag{4.7}$$

Under symmetry ($x_i = x$) Equation (4.1) collapses to

$$X_2 = n^{\alpha}x,\ \alpha > 1 \tag{4.8}$$

Note that Equation (4.7) implies output per firm (x) is constant. Thus, Equation (4.8) implies that any expansion of X_2 would be brought about by increase in n only. Therefore, as mentioned previously, there are increasing returns to scale at the industry level in X_2 production.

If n is the equilibrium effective number of produced varieties, then the total amount of factor bundle (m) produced and used in the production of x is given by

$$m = n(ax + b) \tag{4.9}$$

Since zero-profit condition prevails in all the final output markets and also at the level of m production, the price sub-system is given by the following set of equations:

$$Wa_{L1} + Ra_{T1} = P_1 \tag{4.10}$$

$$Wa_{Lm} + Ra_{Nm} + ra_{Km} = P_m \tag{4.11}$$

$$W^{*}a_{L3} + ra_{K3} = P_3 \tag{4.12}$$

And

$$P_2X_2 = nqx = P_m m \tag{4.13}$$

Where P_1, P_2 and P_3 are the world prices of the traded final goods, given by the small open economy assumption while R and r are the rental to land-capital and net return to capital respectively. a_{jk}s ($j = L, T, K; k = 1, m, 3$) denote unit factor-coefficients. Note that in Equation (4.13), the second part of the

equality follows from the zero-profit condition prevailing in the intermediate inputs production and using symmetry in intermediate inputs production (i.e., $q_i = q$ and $x_i = x$); while the first part of the equality follows from the zero-profit condition at the level of X_2 production.

Using Equation (4.8), Equation (4.13) becomes

$$P_2 = n^{1-\alpha} q \tag{4.14}$$

Full utilisation of available capital stock ($\bar{K}$) implies:

$$\bar{K} = K_D + K_F(r, \mu) = a_{Km} m + a_{K3} X_3 \tag{4.15}$$

We assume that domestic and foreign varieties of capital stocks are perfect substitutes. μ is the parameter denoting the magnitude of restrictions that inhibits free international movement of capital into the host country. A liberalised investment policy implies both simplification of FDI norms and betterment of quality of governance that ensure a larger inflow of foreign capital and is captured by a reduction in the value of μ.[39]

The rural and urban wage rates are related by HT condition of migration equilibrium where the *expected* urban wage equals the rural wage with $W^* > W$. In this situation, the rural workers either can stay in rural areas in order to get a job at a low wage rate or can migrate to urban area in search of high-paid jobs but at the risk of unemployment. Since the probability of finding a job in the urban manufacturing sector is $(a_{L3} X_3 / (a_{L3} X_3 + L_U))$, the labour allocation mechanism between the sectors should be expressed as[40]

$$\left(W^* a_{L3} X_3 \Big/ (a_{L3} X_3 + L_U) \right) = W \tag{4.16}$$

The labour endowment equation is given by

[39] Simplification of FDI norms includes bringing of more sectors under the automatic route for which no prior permissions from the FDI regulatory authorities are required, increasing of FDI caps in different sectors, simplification of procedural delays etc.

[40] See, for example, Harris and Todaro (1970), Corden and Findlay (1975), Basu (2000), Batra and Naqvi (1987) and Beladi and Naqvi (1988) for the HT model and the labour allocation mechanism. Also see Mukherjee (2012, 2014).

$$\bar{L} = a_{L1}X_1 + a_{Lm}m + a_{L3}X_3 + L_U \quad (4.17)$$

Where $\bar{L}$ is the total labour force in the economy and L_U is the level of urban unemployment.

Substituting from Equation (4.16) we obtain:

$$\bar{L} = a_{L1}X_1 + a_{Lm}m + (W^*/W)a_{L3}X_3 \quad (4.18)$$

Full utilisation condition of land-capital is given by:

$$\bar{T} = a_{T1}X_1 + a_{Tm}X_m \quad (4.19)$$

Where $\bar{T}$ is the endowment of land-capital in the economy.

We assume, in line with Chaudhuri and Yabuuchi (2010) that land-output ratio in sector m (a_{Tm}) is constant. This assumption rules out the possibility of substituting land-capital by other factors of production in sector m. However, labour and capital are substitutes and the production function displays constant returns to scale in these two inputs. This assumption, albeit made for algebraic simplicity, is not without any basis. There is generally a fixed requirement of land-capital to set up the industries within a SEZ. Additionally other durable assets, such as buildings and fixed facilities, are always used in a fixed proportion (unless depleted) and they cannot be substituted by other factors of production.

Furthermore, we assume that sector m, which is within the SEZ, is more land-capital intensive than the agricultural sector in both physical and value terms.[41] Although SEZ use less labour and land as compared with their usage in

[41] Since, the input 'land-capital' includes land and other durable capital equipment of all kinds. But apart from tractors and other agricultural equipment, there are many other durable assets (such as, buildings and machines) that are necessary for industrial set-up; rather than agricultural activities. In this context, we have made this assumption that has also been used in Chaudhuri and Yabuuchi (2010), and is quite realistic indeed. This is because, as per report of the Ministry of Commerce and Industry of India, as on the date 31st March 2012, amount of land acquired for different SEZs is 71,502 hectares that has displaced about 1,000,000 agricultural workers from land. If these people were engaged in agriculture the labour–land ratio in agriculture would have been 13.99. On the contrary, in 71,502 hectares of land in SEZs 8,44,916 persons have so far been employed. So the labour–land ratio in SEZ is 11.82. These figures, therefore, depict agriculture as more labour-intensive (or equivalently, less land-intensive) relative to SEZ.

agriculture, any of these two factors can be utilised more intensively with respect to the other in sector m than the agricultural sector.

4.4.1 Comparative Static Exercise

Easing of entry criteria for foreign capital in this model is captured by a decrease in the value of the parameter μ. '^' denotes proportional change (e.g., $\hat{x} = dx/x$). Given W^* and P_3 we determine r from (4.12). So we have $\hat{r} = 0$ when $\hat{\mu} < 0$.

Totally differentiating Equations (4.10)–(4.11) and applying cost-minimising 'envelope conditions' for competitive producers[42] we get

$$\widehat{W}\theta_{L1} + \hat{R}\theta_{T1} = 0 \tag{4.20}$$

$$\widehat{W}\theta_{Lm} + \hat{R}\theta_{Tm} = \widehat{P_m} \tag{4.21}$$

Where θ_{jk} denotes cost-share of the j^{th} input in the production of the k^{th} good. Totally differentiating Equation (4.14) we obtain

$$\hat{q} = (\alpha - 1)\hat{n} \tag{4.22}$$

Note that Equation (4.5) implies $\hat{q} = \widehat{P_m}$ and Equation (4.9) implies $\hat{m} = \hat{n}$. Then Equation (4.22) boils down to

$$\widehat{P_m} = (\alpha - 1)\hat{m} \tag{4.23}$$

Equation (4.23) implies an upward sloping derived demand curve (Figure 1 below) for factor bundle m. This introduces the problem of instability. We show in Appendix 4.1 that under a stable equilibrium α must be bounded above. The stability condition subdues the extent of the scale economy and ensures normal comparative statics response.

Therefore, Equation (4.21) boils down to

[42] See Chapter 2.

$$\widehat{W}\theta_{Lm} + \hat{R}\theta_{Tm} - (\alpha - 1)\widehat{m} = 0 \qquad (4.24)$$

FDI promotional measures lead to an increase in the supply of foreign capital, K_F, in the economy. To see how inter-sectoral composition of output changes following this policy, we differentiate Equations (4.15), (4.18), (4.19) totally and arrange them with Equations (4.20) and (4.24) in matrix form to obtain:

$$\begin{pmatrix} \theta_{L1} & \theta_{T1} & 0 & 0 & 0 \\ \theta_{Lm} & \theta_{Tm} & 0 & -(\alpha-1) & 0 \\ A & 0 & 0 & \lambda_{Km} & \lambda_{K3} \\ -C & D & \lambda_{L1} & \lambda_{Lm} & \widetilde{\lambda_{L3}} \\ E & -E & \lambda_{T1} & \lambda_{Tm} & 0 \end{pmatrix} \begin{pmatrix} \widehat{W} \\ \hat{R} \\ \widehat{X_1} \\ \widehat{m} \\ \widehat{X_3} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ B\hat{\mu} \\ 0 \\ 0 \end{pmatrix} \qquad (4.25)$$

Where

$A = \lambda_{Km}S_{KL}^{m} > 0, B = (\partial K_F/\partial\mu)(\mu/K_F)(K_F/\bar{K}) < 0, C = \left(\lambda_{L1}S_{LT}^{1} + \lambda_{Lm}S_{LK}^{m} + \widetilde{\lambda_{L3}}\right) > 0,\ \widetilde{\lambda_{L3}} = (W^*/W)\lambda_{L3}, D = \lambda_{L1}S_{LT}^{1} > 0, E = \lambda_{T1}S_{TL}^{1} > 0$. $S_{j_1j_2}^{k}$ is the degree of substitution between factors j_1 and j_2 in the k^{th} sector and $S_{j_1j_2}^{k} > 0$ for $j_1 \neq j_2$. For example, $S_{TL}^{1} = (W/a_{T1})(\partial a_{T1}/\partial W) > 0$ and so on. λ_{jk} is the share of factor j in the total employment of sector k.

The value of the determinant of the coefficient matrix of the system is:

$$\Omega = |\theta|_{LT}\left\{(\lambda_{L1}\lambda_{Tm} - \lambda_{T1}\lambda_{Lm})\lambda_{K3} + \lambda_{T1}\lambda_{Km}\widetilde{\lambda_{L3}}\right\} - (\alpha - 1)\Theta \qquad (4.26)$$

Or, equivalently,

$$\Omega = |\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3}) - (\alpha - 1)\Theta \qquad (4.26.1)$$

Where $\Theta = \left\{A\theta_{T1}\lambda_{T1}\widetilde{\lambda_{L3}} + \lambda_{T1}\lambda_{K3}(C\theta_{T1} + D\theta_{L1}) + E\lambda_{L1}\lambda_{K3}\right\} > 0$. Now as shown in Appendix 4.1, a stable equilibrium under Marshallian quantity adjustment rule in the market for m ensures that $\Omega > 0$ in a general case, and necessitates our assumed factor-intensity ranking between sectors 1 and m to be held true, that is $|\theta|_{LT} = (\theta_{L1}\theta_{Tm} - \theta_{Lm}\theta_{T1}) > 0$ or in other words, sector m is relatively more land-intensive than sector 1 and $|\lambda|_{LK} = \left(\lambda_{Km}\widetilde{\lambda_{L3}} - \lambda_{T1}\lambda_{Lm}\right) > 0$, meaning sector m is relatively more capital-intensive than sector 3.

4.4.1.1 Change in Output of SEZ Sector

We get from Equation (4.25):

$$\widehat{m}/\hat{\mu} = B\lambda_{T1}\widetilde{\lambda_{L3}}|\theta|_{LT}/\Omega \tag{4.27}$$

Since $|\theta|_{LT} > 0, \Omega > 0, B < 0$; it follows from Equation (4.27) that $\widehat{m}/\hat{\mu} < 0$ holds unambiguously. So $\widehat{m} > 0$ when $\hat{\mu} < 0$. As Equation (4.9) implies $\widehat{m} = \hat{n}$ and Equation (4.8) gives $\widehat{X_2} = \alpha\hat{n}$ (since x is constant), we have

$$\widehat{X_2} = \alpha\widehat{m} \tag{4.28}$$

Therefore, $\widehat{m}/\hat{\mu} < 0$ implies that the SEZ sector also expands when $\hat{\mu} < 0$.

4.4.1.2 Change in Competitive Wage Rate

$$\left(\widehat{W}/\hat{\mu}\right) = -(B/\Omega)\theta_{T1}\lambda_{T1}\widetilde{\lambda_{L3}}(\alpha - 1) \tag{4.29}$$

Since $|\theta|_{LT} > 0, \Omega > 0, B < 0, \alpha > 1$, Equation (4.29) implies $\widehat{W} < 0$ when $\hat{\mu} < 0$. In other words, competitive wage falls unambiguously as a consequence of foreign capital inflow brought about by easing the entry criteria of FDI.

Proposition 4.1. *Liberalised FDI policy increases the output of the SEZ sector under IRS but reduces competitive wage in the rural sector in a stable equilibrium.*

4.4.1.3 Change in Output of Agricultural Sector

Solving Equation (4.25) for $\widehat{X_1}$ with respect to $\hat{\mu}$ we obtain:

$$\left(\widehat{X_1}/\hat{\mu}\right) = -\left(B\widetilde{\lambda_{L3}}/\Omega\right)\{E(\alpha - 1) - \lambda_{Tm}|\theta|_{LT}\} \tag{4.30}$$

So $\left(\widehat{X_1}/\hat{\mu}\right) < 0$ if and only if $(\alpha - 1) < (\lambda_{Tm}|\theta|_{LT}/E)$ holds. However, stability condition in the market for m imposes another upper bound on $(\alpha - 1)$ as in Equations (A4.7) – (A4.8) in Appendix 4.1. Simple manipulation yields:

$$(\lambda_{Tm}|\theta|_{LT}/E) > \{|\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3})/\Theta\} \text{ if } 1 \geq S_{KL}^{m}\theta_{T1}\lambda_{Tm} > 0.$$

Therefore, FDI promotional measures may lead to an expansion of the agricultural sector if $1 \geq S_{KL}^{m}\theta_{T1}\lambda_{Tm} > 0$.

4.4.1.4 Change in Output of Sector 3

$$\left(\widehat{X_3}/\hat{\mu}\right) = (B/\Omega)[|\theta|_{LT}|\lambda|_{LT} - (\alpha - 1)(\lambda_{T1}(C\theta_{T1} + D\theta_{L1}) + E\lambda_{L1})] \quad (4.31)$$

Where $|\lambda|_{LT} = (\lambda_{L1}\lambda_{Tm} - \lambda_{T1}\lambda_{Lm}) > 0$ since sector m is more land-intensive. From Equation (4.31), it is easy to check that sector 3 will contract if and only if $(\alpha - 1) > \{|\theta|_{LT}|\lambda|_{LT}/(\lambda_{T1}(C\theta_{T1} + D\theta_{L1}) + E\lambda_{L1})\}$ holds. It is easy to show that if $1 \geq S_{KL}^{m}\theta_{T1}\lambda_{Tm}$ and $1 \leq \lambda_{T1}(S_{LT}^{1} + S_{TL}^{1})$ we have:

$$\{|\theta|_{LT}|\lambda|_{LT}/(\lambda_{T1}(C\theta_{T1} + D\theta_{L1}) + E\lambda_{L1})\} < (\alpha - 1) < \left\{|\theta|_{LT}\begin{pmatrix}\lambda_{T1}|\lambda|_{LK} + \\ \lambda_{L1}\lambda_{Tm}\lambda_{K3}\end{pmatrix}/\Theta\right\} < (\lambda_{Tm}|\theta|/E) \quad (4.32)$$

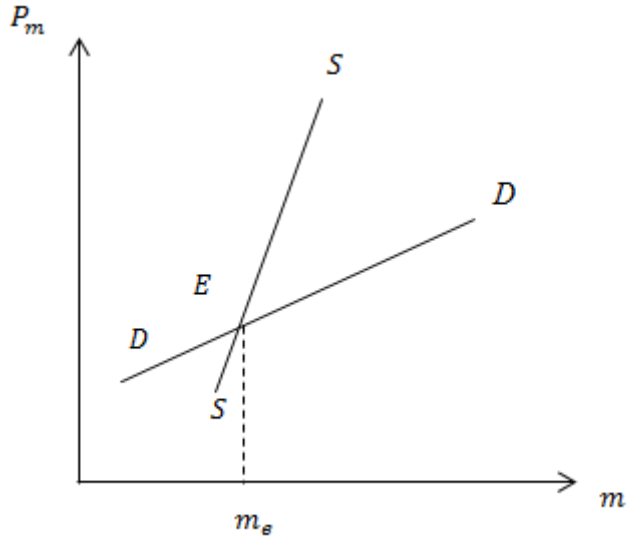
For this range of $(\alpha - 1)$, inflow of foreign capital, taking place through the easing of FDI restrictions, leads to expansion of the output in agriculture sector but contraction of the output in urban manufacturing sector.

Proposition 4.2. *Easing of FDI restrictions increases the output of the agricultural sector (sector 1) but contracts the urban sector (sector 3) for a sufficiently high degree of scale economies in the SEZ sector, such that for a stable equilibrium we have* $S_{KL}^{m}\theta_{T1}\lambda_{Tm} \leq 1 \leq \lambda_{T1}(S_{LT}^{1} + S_{TL}^{1})$.

Remarks on Propositions 4.1 and 4.2

First, an inflow of foreign capital, ceteris paribus, leads to an expansion of the capital-intensive sector m and a contraction of sector 3 following a Rybczynski effect. This contraction of sector 3 the expected urban wage falls, leading to a reverse migration of workers from the urban back to the rural sector.

Figure 4.2 – Equilibrium in the Domestic Market for 'm'



The DD schedule in Figure 4.2 depicts the relationship $\widehat{P_m^d} = (\alpha - 1)\hat{m}$. Now we can also derive the supply curve SS for factor bundle m (corresponding to Equation (A4.5) in Appendix 4.1) by tracing out the implication of an exogenous increase in P_m on the supply of m. Ceteris paribus, an increase in P_m implies higher R and lower W via the usual Stolper-Samuelson effect in the HOSS (since sector 1 is relatively more labour-intensive).

Therefore, in sector 1, labour-output ratio (a_{L1}) rises while land-output ratio (a_{T1}) falls. In sector m, land-output ratio (a_{Tm}) is constant. From Equation (4.19) it is clear that given the available land-endowment of the economy, for given output-composition, land becomes relatively surplus in the HOSS, resulting in an increase in the supply of m. This gives a positively sloped supply curve SS in Figure 4.2 with equilibrium at E. The way we have drawn the DD and SS curves in Figure 4.2, it has been presumed that the equilibrium is Marshallian stable.

Now as m increases, at constant P_m, the supply curve drawn in Figure 4.2 shifts rightwards with higher new equilibrium values for both m and P_m. Higher P_m in new equilibrium necessarily implies higher R and lower W, leading to contraction of relatively labour-intensive sector 1 in the HOSS.

The expanded sector m now hosts more capital and labour (released by sector 3, although some labour may still migrate to the urban sector since competitive rural wage falls). But since land productivity is constant in sector m, some of the additional labour and capital in sector m become surplus and they move to sectors 1 and 3 respectively.[43] This induces expansions of sectors 1 and 3.

So the effects on outputs in sectors 1 and 3 are ambiguous. However, under the sufficient conditions mentioned above sector 1 expands but sector 3 contracts. The condition $S_{KL}^{m}\theta_{T1}\lambda_{Tm} \leq 1 \leq \lambda_{T1}(S_{LT}^{1} + S_{TL}^{1})$ intuitively implies if willingness of the producers in sector m to substitute capital by labour is sufficiently low (and not greater than the requirement of labour in the agricultural sector to be used with land in per-unit production); then even though labour is available at cheaper cost, sector m producers will still release some labour to the agricultural sector that will be adequate for the expansion of agricultural sector. ■

4.4.1.5 Effect on Urban Unemployment

$$L_U = a_{L3}X_3\{(W^*/W) - 1\} \tag{4.33}$$

In a similar fashion like Chaudhuri and Yabuuchi (2010), totally differentiating Equation (4.33) we get

$$\left(\widehat{L_U}/\hat{\mu}\right) = \left(\widehat{X_3}/\hat{\mu}\right) - \{(\lambda_{LU} + \lambda_{L3})/\lambda_{LU}\}\left(\widehat{W}/\hat{\mu}\right) \tag{4.34}$$

Since sector 3 contracts under the sufficient condition mentioned above, the expected urban wage for every prospective rural migrant falls. This will induce

[43] Note that sector m does not contract as a result of this. However, if land productivity were not constant in sector m, there would be a Rybczynski effect in the HOSS and sector m would also contract as a result of this effect. In that case, the net expansion of sector m would become a bit ambiguous.

a reverse migration back to the rural sector (centripetal force). But competitive wages also fall, which may persuade some rural workers to migrate and join the urban unemployment pool (centrifugal force). However, the centripetal force may be strong enough to more than offset the centrifugal force so that the rural workers may prefer to accept new jobs created in the rural area at lower wages, rather than remaining unemployed for an indefinite period and so urban employment may fall.

4.4.1.6 FDI and Volume of Export by SEZ

The domestic demand for the SEZ-good is given by

$$X_2^D = F(P_2, P_3, I) \tag{4.35}$$

Where I is the national income at domestic prices and it is given by (owing to balanced trade), in terms of factor income,

$$I = W\bar{L} + R\bar{T} + rK_D \tag{4.36}$$

Export by SEZ is

$$E = X_2 - X_2^D = X_2 - F(P_2, P_3, I) \tag{4.37}$$

Totally differentiating Equation (4.36), one can obtain

$$dI = \bar{L}dW + \bar{T}dR = W\bar{L}\widehat{W} + R\bar{T}\hat{R} \tag{4.38}$$

Substituting for $\widehat{W}$ from Equation (4.29) back into Equation (4.20) one can solve for $\hat{R}$ as

$$\left(\hat{R}/\hat{\mu}\right) = (B/\Omega)\theta_{L1}\lambda_{T1}\widetilde{\lambda_{L3}}(\alpha - 1) \tag{4.39}$$

It is easy to show from Equation (4.39) that $\hat{R} > 0$ when $\hat{\mu} < 0$. Now from Equation (4.38) one can obtain (by substituting values of $\left(\hat{R}/\hat{\mu}\right)$ and $\left(\widehat{W}/\hat{\mu}\right)$ from Equations (4.29) and (4.39) into Equation (4.38))

$$\left(\hat{I}/\hat{\mu}\right) = \left\{(B/\Omega)\lambda_{T1}\widetilde{\lambda_{L3}}(\alpha - 1)\right\}(\theta_T\theta_{L1} - \theta_L\theta_{T1}) \tag{4.40}$$

Where $\theta_T = (R\bar{T}/I)$ and $\theta_L = (W\bar{L}/I)$ are respectively distributive shares of income from land-capital and of wage-income in the entire economy. Since $(B/\Omega) < 0$ and $(\alpha - 1) > 0$, Equation (4.40) implies that national income of the economy (at domestic prices) will go up under FDI promotional measures if $(\theta_L/\theta_T) < (\theta_{L1}/\theta_{T1})$.

Differentiating Equation (4.37) with respect to μ, we have

$$\left(\frac{dE}{d\mu}\right) = \left(\frac{dX_2}{d\mu}\right) - \left(\frac{\partial X_2^D}{\partial I}\right)\left(\frac{dI}{d\mu}\right) \qquad (4.41)$$

Or, substituting and simplifying from Equations (4.27) – (4.29) and Equation (4.40) into Equation (4.41), we obtain

$$\left(\frac{dE}{d\mu}\right) = (BX_2/\mu\Omega)\lambda_{T1}\widetilde{\lambda_{L3}}[\alpha|\theta|_{LT} - \varepsilon(\alpha - 1)(\theta_T\theta_{L1} - \theta_L\theta_{T1})] \qquad (4.42)$$

Where $\varepsilon = \left(\frac{\partial X_2^D}{\partial I}\right)\left(\frac{I}{X_2}\right)$ is the income elasticity of the SEZ-good.

Our main conclusions from Equations (4.40) and (4.42) can be summarised in the following proposition:

Proposition 4.3. *Inflow of foreign capital following easing of FDI restrictions improves national income of the economy and increases export by the SEZ-sector if (i)* $(\theta_L/\theta_T) < (\theta_{L1}/\theta_{T1})$ *and (ii)* $\varepsilon \cong 0$ *hold respectively.*

Remarks. Inflow of foreign capital following easing the entry criteria for FDI reduces W but increases return to land-capital (R), as evident from the zero-profit condition for sector 1. The net effect will be an increase in I, if $(\theta_L/\theta_T) < (\theta_{L1}/\theta_{T1})$ holds.

Now returning to the effect on exports (E) by SEZ, note that production of X_2 increases as established before in terms of Equations (4.27) – (4.28). However since income also increases under the sufficient condition $(\theta_L/\theta_T) < (\theta_{L1}/\theta_{T1})$, this triggers a demand-side effect as well on E, by raising the domestic demand for the SEZ-good. If the income-elasticity of demand for the SEZ-good is sufficiently low ($\varepsilon \cong 0$), then the supply-side effect (i.e. rise in

X_2) dominates the demand-side effect and exports (E) by the SEZ-sector increases.

The model proposes that agricultural sector would expand and sector 3 would contract for a sufficiently higher degree of scale economies in the IRS sector (SEZ). However, the impact on the net agricultural export (of good 1) and net manufacturing import (of good 3) depend on the domestic demands for these two commodities. It can easily be shown (avoided for the sake of brevity) that in the long-run equilibrium model under consideration, trade is always balanced under both steady-state situations (so that total net export becomes always equal to the total net import of sector 3) and therefore, the increase in SEZ exports always gets adjusted.

4.5 Concluding Remarks

The idea behind formation of SEZs is to promote export-led growth and industrial development in small, open developing economies such as India. However, in a dual and agro-based developing Asian country like India, this process also involves acquisition of agricultural land which subsequently results in displacement of people attached to the land. Therefore, to evaluate the general equilibrium implications of this policy, this essay models SEZ as generating positive spillover within a three-sector HT-type general equilibrium structure. This essay finds that, by incentivising multinationals to relocate investment to the SEZ sector, through easing the entry criteria of FDI, for a sufficiently higher degree of scale economies in the IRS sector (SEZ), both SEZ and agricultural sectors may expand simultaneously. However, competitive wage rate falls in real terms while there are possibilities of reduction in urban unemployment. National income of the economy may go up and export by the SEZ sector may improve as well, if the income-elasticity of demand for the SEZ-commodity is negligible. This essay uses static general equilibrium structure to demonstrate these results, by utilising the positive externalities generated in the IRS sector, however without considering the presence of any additional subsidy policy directed to the agricultural and/or SEZ sector. Thus, this model re-establishes the main claim put forward

empirically by several authors in the context of India and other alike densely populated Asian economies that is, starting from the same initial conditions, a small, open economy with SEZs is more likely to attain 'efficient equilibrium' in terms of substantial growth effect (Murayama and Yokota 2009; Aggarwal 2011) compared to an economy without SEZs, albeit the rural workers (non-migrants) will suffer from the reduction in real wage-income (Aggarwal 2004; Murayama and Yokota 2009; Jayanthakumaran 2003). Therefore, this policy essentially indicates a mixed outcome and calls for government support for displaced people and rural workers. An extension (currently in progress) of the illustrated general equilibrium structure is to consider wage-subsidies given to the rural workers by the local government, where the cost of providing subsidies is financed by the tax-revenue of the government earned from the tax on foreign capital income.

Appendix 4.1

Tables Summarising the Model:

Table A4.1: The Model Characteristics

No. of Sectors	Rural Sectors		Urban Sector	Factors of Production		Assumptions
	Agricultural Sector	**SEZ Sector**		**Labour Market**	**Other Inputs**	
4	Sector 1 → produces X_1 with inputs (L, T) using CRS	Sector 2 → produces X_2 by costless assembling of an array of locally produced imperfectly substitute intermediate inputs x_i – increasing returns to the no. of varieties → IRS external to the firm, internal to the industry	Sector 3 → produces a manufacturing commodity, X_3 with (L, K) using CRS	Unorganised 'informal' rural labour market in sectors 1 & 2; with competitive wage (W) – both sectors are in close vicinity – so perfect labour mobility b/n the 2 sectors	Land (T) used in sectors 1 & 2	**Model-specific Assumptions:** (a) Domestic and foreign varieties of capital are perfect substitutes (b) Sector m (that is within the SEZ), is more land-intensive than sector 1.
		Each variety of x_is gets produced by monopolistically competitive producers using a composite factor bundle, m; which, in turn, gets produced using factors (L, T, K) with CRS		Unionised (imperfect) labour market in sector 3; with workers receiving contractual wage (W^*), determined by prior negotiations b/n representative firm and representative trade union	Capital (K) is used in sectors 2 & 3	**Simplifying Assumption:** Land-output ratio in sector m (a_{Tm}) is constant.

Table A4.2: Key Equations Describing the Model

VARIABLES			KEY EQUATIONS DESCRIBING THE MODEL		
ENDOGENOUS	EXOGENOUS	POLICY-PARAMETERS	PRICE SUBSYSTEM (PRICE = UNIT COST)	EQUATIONS FOR IRS	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)
$W, R, r, P_m,$ $X_1, X_2, X_3, L_U, K_D, K_F$	$\overline{K}, L, \overline{T},$ P_2, P_3, α	$t > 0, W^* > 0, \mu > 0$	Equations (4.10) – (4.12), Equation (4.14)	Equations (4.5), (4.9)	Equations (4.15), (4.18), (4.19).

Stability Condition:

We propose a quantity adjustment rule in the domestic market for m.

$$\dot{m} = \gamma \left[{P_m^d(m)}/{P_m^s(m)} - 1 \right] \tag{A4.1}$$

Where '·' represents time derivative, $\gamma > 0$ is the speed of adjustment and $P_m^d(m), P_m^s(m)$ are respectively the demand and supply prices of m.

Linearizing Equation (A4.1) around the equilibrium, we get

$$\dot{m} = \left({\gamma}/{m^e}\right) \left[{\widehat{P_m^d}}/{\hat{m}} - {\widehat{P_m^s}}/{\hat{m}} \right] (m - m^e) \tag{A4.2}$$

Where m^e is the equilibrium value of m. For stability we need, $\left(\widehat{P_m^d}/\hat{m} - \widehat{P_m^s}/\hat{m}\right) < 0$.

From Equation (4.23) in the main text,

$$\left(\widehat{P_m^d}/\hat{m}\right) = (\alpha - 1) \tag{A4.3}$$

Solving simultaneously Equations (4.20) – (4.21) in the main text we obtain:

$$\hat{W} = -\frac{\widehat{P_m^s}\theta_{T1}}{|\theta|_{LT}};\ \hat{R} = \frac{\widehat{P_m^s}\theta_{L1}}{|\theta|_{LT}} \tag{A4.4}$$

$|\theta|_{LT}$ is defined in the main text. Now totally differentiating Equations (4.15), (4.18)-(4.19), ceteris paribus, substituting values for $\hat{W}$ and $\hat{R}$ and solving simultaneously by Cramer's rule, we obtain:

$$\left(\widehat{P_m^s}/\hat{m}\right) = |\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3})/\Theta \tag{A4.5}$$

Where $|\lambda|_{LK}$ and Θ are also defined in the main text. Subtracting Equation (A4.5) from (A4.3) we obtain:

$$\left(\widehat{P_m^d}/\hat{m}\right) - \left(\widehat{P_m^s}/\hat{m}\right) = [(\alpha - 1)\Theta - |\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3})]/\Theta \tag{A4.6}$$

Since $\Theta > 0$, , $\left(\widehat{P_m^d}/\hat{m} - \widehat{P_m^s}/\hat{m}\right) < 0$ implies

$$[(\alpha - 1)\Theta - |\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3})] < 0 \qquad \text{(A4.7)}$$

Since $|\theta|_{LT} > 0$ and $|\lambda|_{LK} > 0$ by our assumed factor-intensity ranking conditions, the stability condition holds and this implies, $\Omega > 0$. ■

Also this means we have,

$$\alpha < 1 + \left\{\underbrace{|\theta|_{LT}(\lambda_{T1}|\lambda|_{LK} + \lambda_{L1}\lambda_{Tm}\lambda_{K3})/\Theta}_{>0}\right\} \qquad \text{(A4.8)}$$

So stability condition ensures that α is bounded above. ■

Chapter 5 – Technological Progress with Segmented Factor Markets and Welfare Implications for the Urban Poor

5.1 Introduction

It is well-known that in a developing economy the 'informal sector' hosts a substantial proportion of the workforce in unregistered activities, as the less regulated part of the economy where minimum wage laws and labour regulations are either totally absent or weakly implemented. Such sectors are mainly engaged in producing non-traded items in the economy. These sectors primarily comprise own-account enterprises, and also many subcontract firms (producing various parts and semi-processed components for the formal sector firms). As suggested by many authors (Agenor, 1996; Schneider and Enste, 2000 and the references therein) more than 70% of the workforce is engaged in the informal sector of a developing country (hereafter DC). In South Asian countries such as India, a significant proportion (about 85% in non-agricultural activities of India) of the working population are engaged in the informal sector. On 2010-11, the informal sector accounted for almost 94 per cent of India's workforce (National Sample Survey (NSS) Report No. 549, 2010-11). Such sectors comprise mainly "wage hunters and gatherers" (Breman 1994), who are usually but not always uneducated, with little or no chance of a living wage and can hardly afford to remain unemployed.

One important implication of the 1991 economic reform in India has primarily been the productivity improvement, primarily *capital-using* (i.e. *labour-saving*) in nature, in the organised (formal) manufacturing and service sectors of the urban area; as evidenced in Pattnayak and Thangavelu (2005), Hulten and Srinivasan (1999) and so on. In light of the evidences provided in Hasan (2002), Golder and Kumari (2003), Topalova and Khandelwal (2011) and so on; such productivity surge in the Indian skill-intensive manufacturing or services industries during the liberalised regime has particularly been driven by greater access to the newer varieties of imported inputs from abroad, owing to

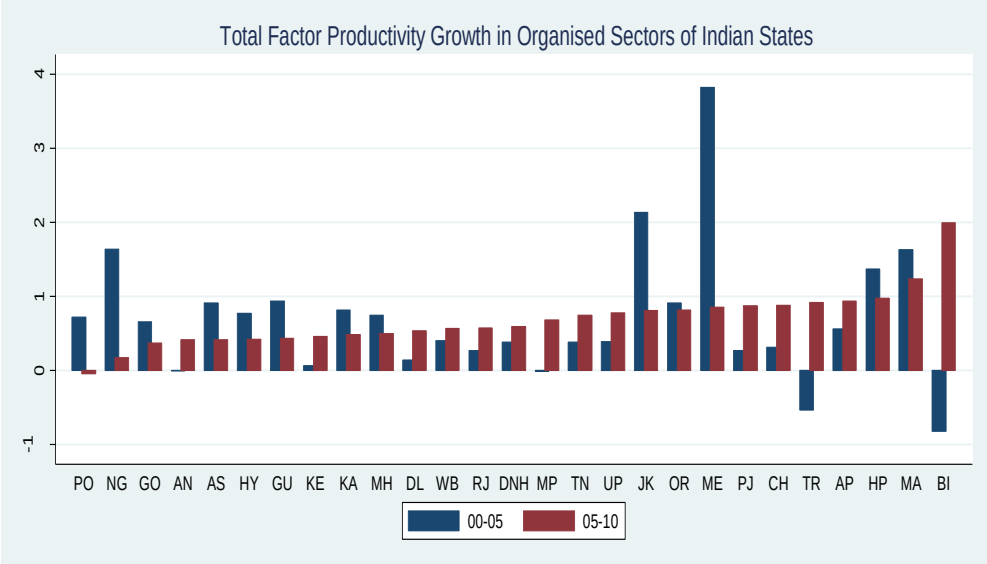
the lowering of input tariffs. However, following such a technological change in the urban formal sectors, organisation of production between the organised and unorganised (informal) segments of the urban economy should be affected; which would, in turn, impart informal activities, wages and employment. Therefore, benefits of productivity improvement in the formal sectors should have percolated to the bottom of the income group working in the urban informal sectors. While it is difficult to assess such an impact at the micro level and in terms of various indicators of poverty and human development, by exploring the general equilibrium impact of productivity take-offs in the formal manufacturing sectors on the informal wage and employment, this essay, according to the definition of income poverty (people are poor if they earn abysmally low wages, which is common among the informal sector workers in developing countries like India), serves to draw an inference on the well-being of the 'poor' urban workers working in the informal sectors. This works in the present context because these workers do not have to be necessarily unemployed in order to be considered poor; prevalence of very low market determined wages describes the impoverishment of those people, who are engaged in informal activities. Vertical production linkages within the domestic urban economy as well as international outsourcing (fragmentation) of production in the formal (skill-intensive) sector have been incorporated within an encompassing general equilibrium model (of production and trade) for the urban economy of a developing country like India; while regarding the factor markets, the model not only allows for having formal-informal segmentation in domestic labour markets, but also for having imperfection in the informal sector capital (credit) market to execute this crucial issue.

5.1.1 Some Stylised Facts

India experienced productivity take-off in the organised urban manufacturing (formal) sectors (primarily service sectors, covered under the Annual Survey of

Industries (ASI) act) over the ten-year period from 2000 to 2010 in almost all the provinces.[44]

Figure 5.1



NOTES:

(1) Abbreviations of the name of the provinces:

AN – Andaman & Nikober; AP – Andhra Pradesh; AS – Assam; BI – Bihar; CH – Chandigarh; DL – Delhi; DNH – Dadra-Nagar-Haveli; GO – Goa; GU – Gujrat; HP – Himachal Pradesh; HY – Haryana; JK – Jammu & Kashmir; KA – Karnataka; KE – Kerala; MA – Manipur; ME – Meghalaya; MH – Maharashtra; MP – Madhya Pradesh; NG – Nagaland; OR – Orissa; PJ – Punjab; PO – Pondicherry; RJ – Rajasthan; TN – Tamil Nadu; TR – Tripura; UP – Uttar Pradesh; WB – West Bengal.

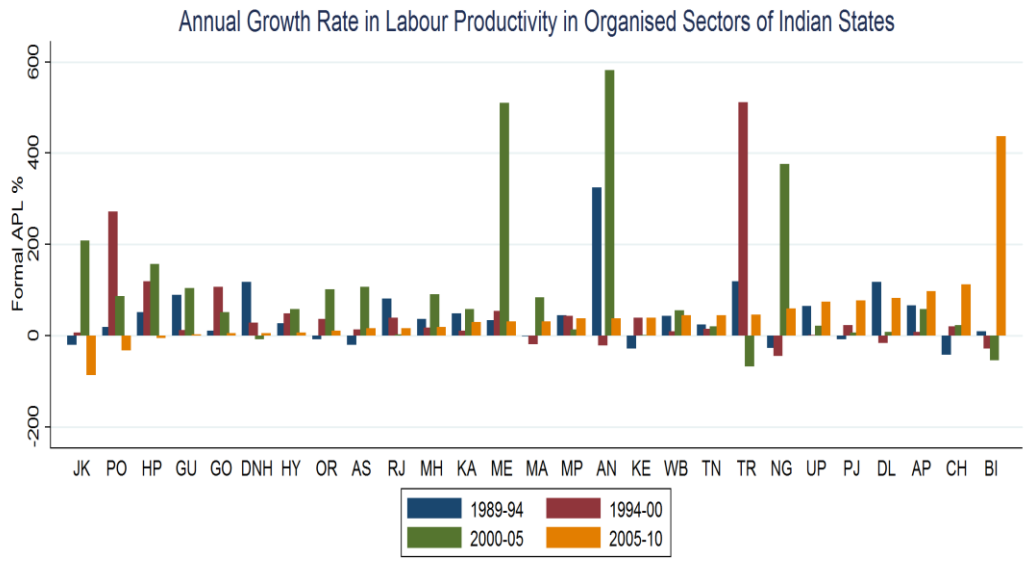
(2) The growth is the *annual average rate* of growth.

Source: Author's calculation using Annual Survey of Industries (ASI) survey data, various rounds.

Furthermore, labour productivity in the organised formal sectors has increased fairly evenly across the provinces of India between 1989 and 2010 as revealed in Figure 5.2 below:

[44] The survey data on the registered manufacturing industries across 27 major Indian states available from the Annual Survey of Industries (ASI) have been used to compute total factor productivity growth (TFPG) using the growth accounting method for the survey years 2000-01, 2005-06 and 2010-11. See Appendix 5.3 for details on the construction of TFPG.

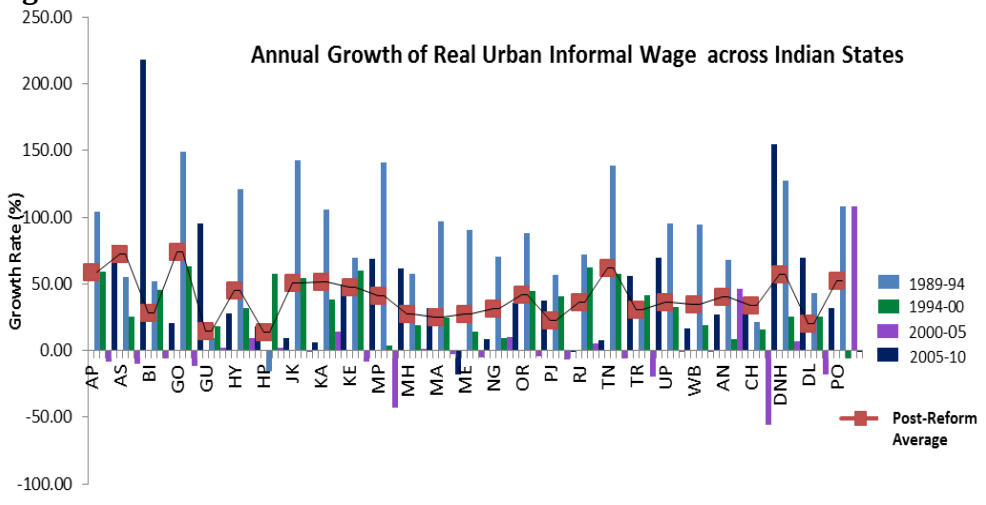
Figure 5.2



Source: Author's calculation using ASI surveys, various rounds.

However, we observe a sharp increase in real informal wages in the urban areas during this period as observed in the following figure. To construct the variables for urban unorganised informal sector in the context of the sample under consideration, data from various rounds of surveys conducted by 'National Sample Survey Organisation' (NSSO) of the Government of India for Non-Directory Manufacturing Establishments (NDMEs) (not covered under the ASI act and having strong inter-linkages with the organised sectors) in the urban areas have been utilised in this essay. Furthermore, this essay employs NSS surveys for 1989-90, 1994-95, 2000-01, 2005-06 and 2010-11 across twenty-seven Indian provinces for this purpose. Detailed construction of variables (including that of the real informal wage) from survey data are available in Appendices 5.2 and 5.3.

Figure 5.3



Source: Author's calculations from NSS surveys, various rounds.

This seems a puzzle since we observe improvement in labour productivity in the formal sectors and increase in informal wages concurrently during the liberalised regime in Indian provinces.

However, Sundaram et al. (2012) found strong positive correlation between formal and unorganised (informal) sector activities (employment, output and value added) at the industry-province level, which supports significantly the inter-linkage between formal and informal sectors. Also the reliance of formal sectors on informal sectors is much higher where labour laws are more stringent and organised sectors are relatively human capital (or skill) -intensive (Sundaram et al. 2012). This is because the formal sector firms with rigid labour markets and higher skill-requirement often find it profitable to farm out a part or whole of their production to the informal sector firms (that enjoy advantages of cheap labour supply) to avoid various regulations and associated costs. On the other hand, the informal firms are also dependent on formal firms for marketing their products and, in particular, for the supply of credit from the formal sector firms since the formal firms usually have an advantage over the informal firms in the credit market.

In this context, this essay constructs a broad measure of input purchases by the formal sectors from local informal firms. This variable, capturing the notion of

vertical production linkages between urban formal and informal sectors, is the sum of

(a) Value of products sold by the registered factories in the same condition as purchased from the other local firms; and

(b) Cost of contract and commission work done by others on materials supplied by the factory.

(c) Total delivered value of all other materials (other than fuel), which have not been produced by the registered factories.

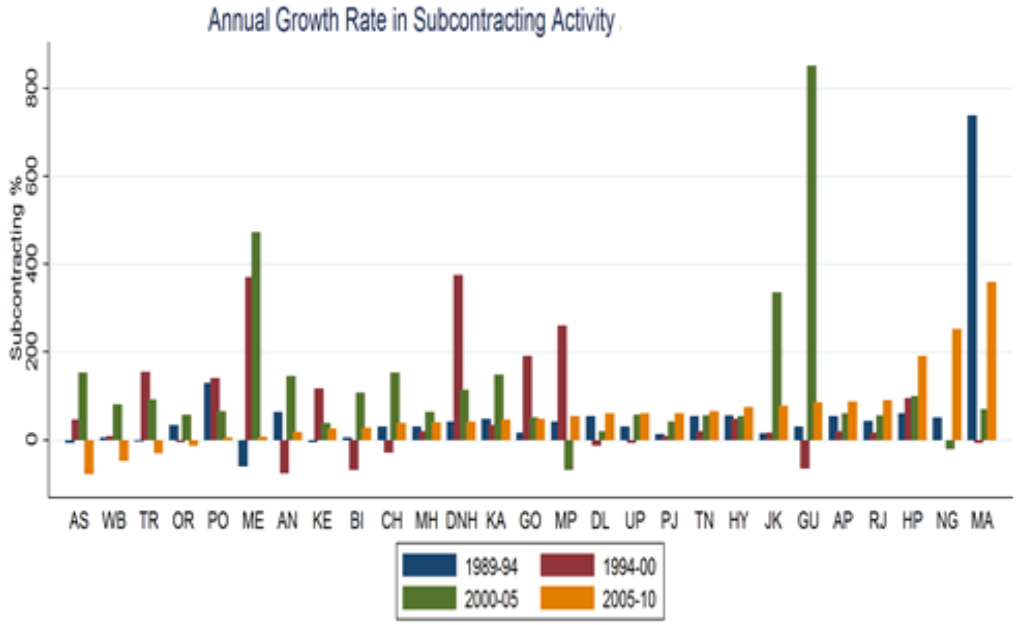
The first two items together constitute a measure of subcontracting.[45]

However, value added has been rising over time in both the informal and formal manufacturing sectors. On the other hand, employment in the formal sector has remained static or has even been slightly declining, while in the informal sector it has been rising steadily. Therefore, in case of value added, a percent-to-percent match in the growth of formal and informal manufacturing has been obtained, which is indicative of some degree of complementarity between the two sectors, while the growth in population or labour force has mainly been absorbed by the informal manufacturing sector. The positive growth rate in subcontracting activity during the liberalised regime in most of the Indian provinces can be observed in Figure 5.4.[46]

[45] Ramaswami (1999) measured subcontracting intensity in formal sectors in a similar fashion. He used the ratio of the value of goods sold in the same condition as purchased to value-added as a measure, but this excludes other forms of subcontracting recorded as contract work performed on materials supplied.

[46] Although for some of the provinces, for some particular year-interval(s), we observe negative annual growth rate in subcontracting activity, such as for Assam during 2005-10. This means that the growth rate of the variable comprising total value of products sold by the registered factories in the same condition as purchased from the other local firms, together with the costs of contract and commission work done by others on materials supplied by the factory, declined from 2005 to 2010 for Assam. This, in turn, implies over this time period, registered factories of Assam have lesser reliance on local resources for their production.

Figure 5.4

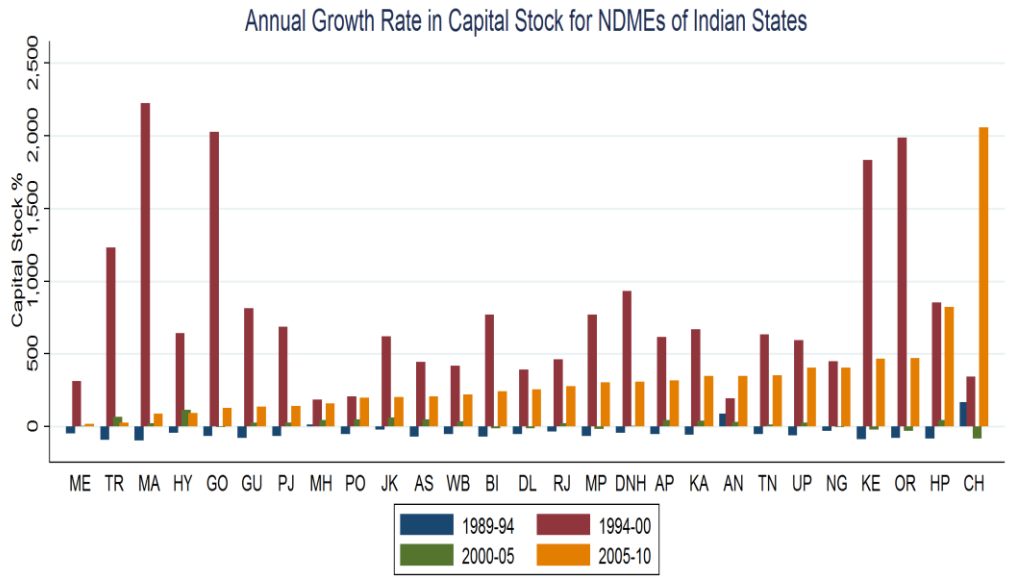


Source: Author's calculations using ASI and NSS surveys, various rounds.

A high rate of growth is also observed in accumulation of real fixed assets of urban NDMEs (relative to that in the registered factories), an approximation to capital accumulation in the urban informal sectors relative to that in formal sectors,[47] across almost all the 27 provinces (Figure 5.5) during the liberalised regime.

[47] Other more appropriate variable, such as 'Working Capital' in the urban NDMEs to provide a proper notion of 'Capital' could not be utilised, due to data-unavailability. However, the overwhelming fixed assets formation in the informal sectors definitely indicates that a large portion of the investments (previously in the formal sector) has flown into the informal segment. Kar and Marjit (2009) have also used this empirical approximation. For some provinces, however, we observe negative annual growth rate of relative capital accumulation for some particular time-interval. That means, over this particular time-interval, lesser capital has been reallocated to the informal sectors from the formal sectors in these provinces.

Figure 5.5



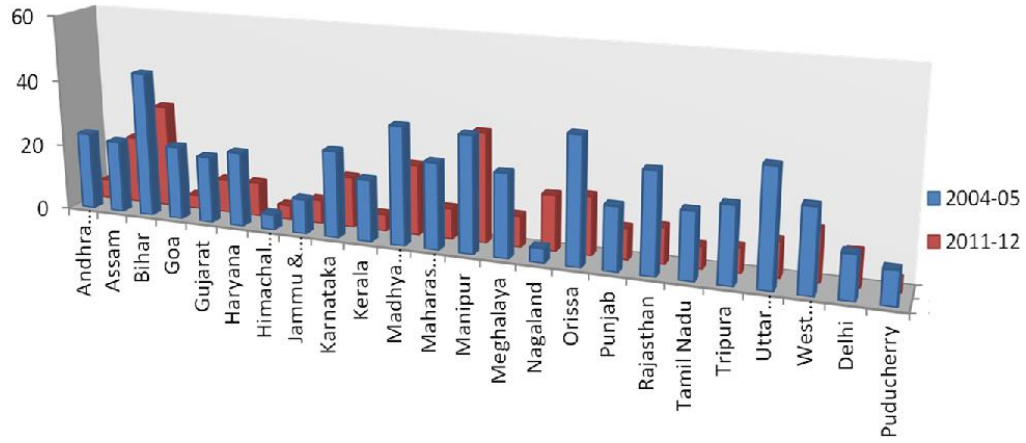
Source: Author's calculations using NSS surveys, various rounds.

Therefore, we observe four concurrent events across Indian provinces during the liberalised regime: productivity improvement in the organised sectors, formal-informal production linkages in the urban area, movement of both capital and labour to the informal sectors, and sharp increase in informal wages. Hence, it becomes a challenge to the trade-theorist to explore channel(s) through which technological progress in the organised sectors can plausibly lead to increase in urban informal wage and subsequently impart employment in the urban informal sectors for a small, open developing economy like India – that typically suffers from rigid organised sector labour market and imperfection in credit market of the informal sector.

Against this backdrop, this essay explores the association between the urban informal wage and urban poverty at the provincial level to motivate the main research agenda, calculating the poverty head count ratios in the urban areas of Indian provinces for the years 2004-05 and 2011-12. As demonstrated in Figure 5.6 (below), the head count ratio has dropped across all the provinces except Nagaland. The increase in the urban informal wage between 2005 and 2010 (as shown in Figure 5.3) in these Indian states can plausibly be one significant reason for the decrease in urban poverty headcount ratio, given the

fact that the majority of the urban poor in India are engaged in the non-agricultural urban informal sector. This observation substantiates the choice of informal wage as a reasonable benchmark to conclude on the welfare implications of 'urban poor'.

Figure 5.6: Change in the Incidence of Poverty across Indian Provinces between 2004-05 and 2011-12



Source: Planning Commissions and NSSO data, various rounds and author's calculations.

Given the concentration of informal workers in the urban economy and presence of urban poverty, the theoretical exercise enables to obtain an overall view of the well-being of the 'urban poor' as a consequence of productivity take-offs in the organised sectors.

5.1.2 Research Gap and Contribution of This Essay

Goldberg and Pavcnik (2003) and Marjit, Ghosh and Biswas (2006) have explored the asymmetric impact of reform policies on the size of the informal sector. However, DCs like India are also plagued by capital market segmentation among the organised formal and non-organised informal sectors. It has been shown theoretically (Marjit 2003; Marjit and Kar 2004; Marjit et al. 2007a, b ; Marjit and Kar 2008 a, b; Marjit et al. 2008) that informal wage can change depending on various degrees of capital mobility between formal and informal sectors. These studies use simple general equilibrium structure to

answer a critical question – how do exogenous policy changes in the formal sector affect the wage and employment conditions in the informal sector? Marjit and Kar (2009) assessed the implication of a tariff-cut in the organised formal sector on informal wages, explaining the notion of different degrees of capital mobility between informal and formal segments of the economy and how they affect the outcome on informal wage. However, while the paper by Marjit and Kar (2009) attempted to check trade policy induced relative price effects on real informal wage, this essay highlights the productivity issue explicitly.

It should be mentioned that Marjit and Kar (2008a) explored the link between labour productivity growth and informal wage, emphasising the role of capital mobility between formal and informal segments of the economy. Moreover, it has been illustrated in different studies that informal sector firms are integrated to the formal sector firms on a contractual basis. Thus, it would be unrealistic to assume that the informal sector produces internationally traded final goods, capital is sector-specific and that the informal and formal credit markets are completely disintegrated (Marjit and Kar 2008a, 2009). This is because the informal sector money-lender borrows capital from the formal credit market for re-lending. Hence a part of the formal credit enters the informal credit market. Therefore the 'zero mobility' case in Marjit and Kar (2008a, 2009) paper is unlikely to happen in reality.

There has been a pertinent debate on the desirability of various types of technological progress among labour economists and trade-theorists (Jones 1996, 2003, 2006; Krugman 2000; Ethier 2005). Trade-theorists, emphasising the importance of relative factor intensities in different sectors (Jones 1965; Oladi and Beladi 2007; Beladi et al. 2008) argue that a labour-augmenting type technological change in the labour-intensive sector will push the wages up. This result is in contradiction to the usual predictions of labour economists. Findlay and Jones (2000) argued that trade and labour theory outcomes will be merged for a major modification of production structure consequent upon such a technological progress. The most recent attempt has been made by Beladi et al. (2012) in terms of a simple two-sector general equilibrium model with segmented labour markets to show that technological progress leads to

opposite wage movements independent of relative factor-intensity ranking between organised (formal) and non-organised (informal) labour sectors. But the simple two-sector set-up in Beladi et al. (2012) was not quite generic to portray the conditions of urban informal sector in a developing economy. It would be more realistic to classify the urban informal sector as comprising of an industrial segment that uses labour and capital to provide an intermediate input such as leather and rubber products, electrical equipment etc. to the formal sector firm, with the urban informal firm being tied to the formal firm by the system of subcontracting. Another aspect of the informal service sector comprises producing non-traded services such as street-vendors with almost no use of capital. These possibilities have been considered in Kar and Marjit (2009). However, Kar and Marjit (2009) did not consider any dualism in the domestic capital market. The dominant feature of dualism in the capital market is the fragmented interest rate structure, featuring lower allocation of loanable capital to the informal sector at a higher relative rental rate. The informal producers do not have access to credit from formal institutions. Therefore, they have to depend on the informal sources of credit, such as informal moneylenders, who charge exorbitantly high interest rates. Under this policy, the informal sector lenders act as financial intermediaries between the formal credit agency and the final borrowers of credit.[48] This is the precise idea that has been put forward in the theoretical literature invoking the informal capital (credit) market as imperfect (for example, Basu 1984; 1988; Basu and Bell 1991; Chaudhuri 2003). This essay specifically incorporates such dualism in capital (credit) market, thus capital mobility between the formal and informal sectors is triggered by the interest rate differential between the two capital (credit) markets,[49] departing from the existing relevant theoretical contributions in this context.

[48] The dependency of the informal moneylenders on the formal channels stems from the idea of credit-product interlinkage between the vertically integrated formal and informal establishments. The formal firms are dependent on the informal establishments for the utilisation of cheap labour in production, while the informal firms are dependent upon the formal firms for supply of credit and marketing of the product. These two motives form the rationale for the subcontracting of the formal sector production activities to the informal establishments, as evidenced in Papola (1981), Romatet (1983), Sethuraman (1984), Sethuraman and Maldonado (1992) in this context.

[49] This is the best possible treatment of incorporating credit market dualism in the present set-up (given that the purpose of this essay is not to determine the interest rate prevailing in the

Section 5.2 discusses theoretical model and the comparative static responses. Finally, Section 5.3 concludes.

5.2 The Model

Consider a static general equilibrium model for a small, open developing economy with four sectors: two urban formal sectors and two urban informal sectors. Among the two informal sectors, one is an informal service sector (sector 1) providing non-traded services by the unskilled (surplus) labour of the economy. Another sector (sector 2) is within the industrial set-up, producing a non-traded intermediate input using unskilled labour and capital for the formal export sector. Within the formal segment, the export sector (sector 3) uses skilled labour,[50] capital, the domestically produced intermediate input and an imported 'middle product' (M, price P_M^*) a' la Sanyal and Jones (1982) in its production process. M could be viewed as an array of foreign technology-embedded inputs (e.g. computer data storage units, automatic data processing machines and so on, which cannot be supplied by the local firms) for the skilled labour – intensive service sector, Sector 3.[51] Hence, Sector 3 producers are using both local and imported intermediate inputs. Skilled wages

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informal credit market), both from the perspectives of tractability and reliability of the results. In order to avoid paradoxical circumstances, without any loss of generality, this essay models the informal intermediate input producing sector as having Leontief production technology (and thus fixed capital requirement in production). Also see the proof of Proposition 2 in this context.

[50] Here 'skill' does not imply only human capital. In fact, the labourers in the formal sectors are distinguished from the informal sector workers in terms of productivity. Thus 'skilled labour' refers to the combination of wage-earners, mangers, supervisors and clerical job-performers in the organised sector. 'Skilled wage' here means the total wages and salaries paid to 'skilled labour', which includes the payments to the managers and supervisors.

[51] It is well-known that there is a range of productive activities wherein productive resources and raw materials are transformed into final commodities ready for consumption, so that the role of international trade is to convert products available in early stages of production into a different set of products more useful as inputs to produce the final goods required by the consumers. That is, international trade takes place in the 'middle' of the production process. As illustrated in Sanyal and Jones (1982), the 'Input Tier' combines local resources to produce a set of 'middle products', which then get traded for other middle products, which, in turn, will be used as inputs in the 'Output Tier' of the economy, producing the final consumer goods. Let us assume here for simplicity that there is only one production activity in the Input Tier to produce a middle product E that gets exchanged in the world market for the middle product M, which is combined with skilled-labour and capital in the Output Tier (i.e. in import-competing formal industry sector 4) to produce the import-competing product commodity 4.

are fixed at a higher level by prior negotiations with labour unions. I do not explicitly model wage-fixation given the focus of this essay, treating skilled wages as institutionally given.[52] Sector 4 is the import-competing sector of the economy using just skilled labour and capital in production. Countries such as India export primarily skilled labour – intensive products, while they are the net importers of relatively more capital-intensive but less skilled labour – intensive manufacturing products. Therefore, this essay assumes that Sector 4 is the relatively capital-intensive sector in the economy. Production functions in Sectors 3 and 4 follow constant returns to scale (CRS) technology, whereas those in Sectors 1 and 2 are of fixed-coefficient type.

The following symbolisations are used:

W= competitive informal wage rate for unskilled labour ($\bar{L}$);

W_S^*= Institutionally given skilled wage rate in formal segment of the economy;

R =rate of interest in the informal credit market;

r =rate of interest in the formal credit market;

a_{ji}= amount of the j^{th} factor used to produce 1 unit of the i^{th} good ($j = L, S, K; i = 1,2,3,4$);

a_{23} = per-unit requirement of the non-traded intermediate input in Sector 3;

a_{M3} = per-unit requirement of the imported input in Sector 3;

A = state of technology in the production of good 3;

$\overline{K}$ = given total stock of capital in the economy;

$\bar{S}$= given stock of skilled labour in the economy;

K_1 = available capital in informal sector (endogenous, depends on formal-informal interest rate differential);

P_i = domestic prices of non-traded goods ($i = 1,2$);

[52] For a similar treatment of unionised wage in the organised sector, see Mukherjee (2012, 2014). Chaudhuri (2003) has provided an explanation regarding how the unionised wages can be determined through the collective bargaining process.

P_i^* = internationally given prices of traded goods ($i = 3, M, 4$);

θ_{ji} = cost-share of factor j in the production of good i;

λ_{ji} = share of sector i in the total employment of factor j;

t = *ad valorem* rate of tariff imposed on the import of M;

T = *ad valorem* rate of tariff imposed on the import of X_4;

$\wedge$ = proportional change.

Price-unit cost equality in competitive product markets entail the following four equations

$$Wa_{L1} = P_1 \tag{5.1}$$

$$Wa_{L2} + Ra_{K2} = P_2 \tag{5.2}$$

$$W_S^* a_{S3} + ra_{K3} + P_2 a_{23} + a_{M3} P_M^* (1 + t) = P_3{}^* \tag{5.3}$$

Where $P_M^*(1 + t) = P_M$ is the domestic price of M. Also we have,

$$a_{S3} = a_{S3}\left(\frac{W_S{}^*}{r}, A(t)\right), \text{ with } \frac{\partial a_{S3}}{\partial\left(\frac{W_S{}^*}{r}\right)} < 0, \frac{\partial a_{S3}}{\partial A} < 0, \frac{\partial A}{\partial t} < 0. \tag{5.3.1}$$

$$W_S{}^* a_{S4} + ra_{K4} = P_4{}^*(1 + T) \tag{5.4}$$

Equation (5.3.1) states that the labour-output ratio is a decreasing function of both the wage-rental ratio in sector 1 as well as the state of technology while the latter is another negative function of the *ad valorem* rate of tariff imposed on the imports of M. Tariff reduction on the imports of capital goods implies greater access towards increased varieties of foreign-technology embedded imported input (M), thereby lowers skilled labour – output ratio in Sector 3 (a_{S3}). However, it does not disturb the capital-output ratio in Sector 3 (a_{K3}).

The following functional relationship between R and r is assumed

$$R = \rho r;\ \rho > 1 \tag{5.5}$$

Here ρ denotes the degree of imperfection of the informal credit market; $\rho > 1$ implies that $R > r$. This is because the informal moneylenders generally borrow funds from the formal sector at the market rate of return r, re-lend it to the informal borrowers and in this way maximise the net interest income.[53] Therefore, it is realistic to assume that informal interest rate is positively related to and steeply higher than the formal interest rate. The lower the number of alternative sources of credit to the borrowers in the informal sector, the higher is the degree of imperfection in the informal credit market. And thereby, the higher is the power of the informal sector lenders to mark up interest rate in the informal credit market over the one in the formal capital market (i.e. the greater the value of ρ).

Using (5.5), Equation (5.2) can be written as

$$Wa_{L2} + \rho r a_{K2} = P_2 \qquad (5.2.1)$$

Equations (5.1), (5.2.1), (5.3), (5.4) are the price-unit cost equality conditions for the informal service sector, intermediate input producing sector, the export (formal) sector and the import-competing manufacturing sector, which is relatively capital intensive compared to the vertically integrated export sector.

It is also assumed that the amount of credit allocated to the informal sector is a positive function of the return differential between the two capital markets. Therefore as long as $\rho > 1$, informal capital market exists and thus the dichotomy between the two credit markets exists.

$$K_1 = K_1(R - r) = K_1\{r(\rho - 1)\}. \text{So when } (R - r) \geq 0, K_1'(.) \geq 0. \qquad (5.6)$$

Thus, full utilisation of informal credit implies

$$a_{K2}X_2 = K_1\{r(\rho - 1)\} \qquad (5.7)$$

Note that *Equation (5.7) is not an independent equation since it only states that part of the available credit is allocated to the informal credit market.*[54]

[53] Thus r could also be interpreted as the opportunity cost of lending credit to the moneylender.
[54] For similar treatment see Chaudhuri (2003, 2010).

The two urban formal sectors use the formal credit. The equilibrium in the formal credit market ensures that

$$a_{K3}X_3 + a_{K4}X_4 = \bar{K} - K_1\{r(\rho - 1)\} \quad (5.8)$$

The presence of foreign capital has been assumed away in the economy's capital endowment.

The full employment conditions of unskilled and skilled labour imply respectively

$$a_{L1}X_1 + a_{L2}X_2 = \bar{L} \quad (5.9)$$

$$a_{S3}X_3 + a_{S4}X_4 = \bar{S} \quad (5.10)$$

The demand-supply equality condition for the non-traded input gives

$$a_{23}X_3 = X_2 \quad (5.11)$$

I assume that per-unit requirements of the local intermediate input and imported inputs are constant in Sector 3.[55]

The general equilibrium system sketched in Tables A5.1 and A5.2 comprises nine independent equations, namely Equations (5.1), (5.2.1), (5.3), (5.4), (5.6), (5.8)–(5.11) to solve for nine endogenous variables: $W, r, P_1, P_2, K_1, X_1, X_2, X_3$ and X_4; given the parameters, namely the world prices of commodities 3 and 4, W_S^*, t, ρ, $\bar{K}, \bar{L}$ and $\bar{S}$. The four price variables can be solved in the following way. r is determined from Equation (5.4) given the unionised skilled wage and exogenous price of the importable. Given r, one can determine P_2 from Equation (5.3) and given the policy-parameter ρ, substituting r and P_2 in Equation (5.2.1) one can obtain W. Finally from Equation (5.1) P_1 is found by

[55] This assumption rules out the possibility of substitution between the non-traded intermediary and other factors of production in sector 3. This is the widely used assumption in the static general equilibrium literature (such as Gupta 1994; Chaudhuri 2003 and many more). This can be justified by the fact that one Brown Tube is used for a TV set. In industries like shoe-making and garments, large formal sector firms farm out their production to the small informal sector firms under the system of subcontracting. So the production is done in the informal sector firms while labelling, packaging and marketing are done by the formal sector firms. One pair of shoes produced in the informal sector does not change in quantity when it is marketed by the formal sector as a final commodity. Thus there remains a fixed proportion between the use of the intermediate input and the quantity of the final commodity produced and marketed by the formal sector.

substituting W. Once factor prices are known, factor-coefficients a_{ji}s are also known. Therefore, using the value of r and given ρ, one can find $K_1(.)$ from Equation (5.6). Then simultaneously solving Equations (5.8) and (5.10), X_3 and X_4 are obtained. After that, X_2 is solved from Equation (5.11). Finally, substituting X_2 in Equation (5.9), X_1 gets solved.

5.2.1 Comparative Static Exercises[56]

Let us now explore the implications of factor-specific technological progress in Sector 4, ceteris paribus, on the urban informal workers. This can be summarised in the following proposition.

Proposition 5.1. *Factor-specific technological progress in the relatively capital-intensive formal sector ceteris paribus, unambiguously raises formal and informal interest rates but reduces wages in both informal sectors. However, as a result of either a capital-saving or a capital-using technological progress in the capital-intensive import-competing formal sector, the intermediate input producing informal sector may contract but the finished non-tradable producing informal sector may expand in terms of both output and employment.*

Remarks: If the relatively capital-intensive import-competing formal segment (Sector 4) undergoes *capital-saving technological progress*, it will raise only the formal interest rate (given the fixed skilled wage and fixed price of the imported intermediate product). As a result of this, the transformation schedule of the Heckscher-Ohlin (HO) '*nugget*' shifts outward, with expansion of the output of the capital-intensive Sector 4 and contraction of the output of relatively (skilled) labour-intensive Sector 3, along with the reduced (skilled) wage-rental ratio at the new production point on the new transformation schedule, naturally with different slope than the initial equilibrium point. Noticeably, such technological progress contributes to the cost-saving of the relatively capital-intensive industry in the nugget (Sector 4) by changing the

[56] The detailed algebraic results are provided in Appendix 5.1.

zero-profit condition in Equation (5.4), like subsidising the industry, and to the relative surplus of capital in the HO '*nugget*' given the product-mix.

Therefore, the demand for non-traded intermediate input falls given the supply. This reduces the price of the intermediate input (P_2), whereas rental costs paid by the informal producers rise (since the formal interest rate goes up). As a result, from the zero-profit condition of Sector 2 (the intermediate input producing sector), it is clear that competitive unskilled wage rate should fall. At the same time, since intermediate input is used in a fixed proportion in the export sector production, which cannot be supplemented by other factors of production in Sector 3, this implies that Sector 2 must shrink as well. Hence Sector 2 releases unskilled labour to be absorbed in sector 1, but at a lower competitive wage than before. Let us call it the 'first round' effect.

However as r rises, $(R - r) = r(\rho - 1)$ goes up as well. This depresses the supply of capital to the formal capital market, inducing a Rybczynski effect in the nugget that tends to expand Sector 3 and Sector 2 given and let us term it as the 'second round' effect. However, as long as the proportion of capital reallocated to the informal sector falls short of the proportion of capital used in Sector 4, the 'first round' effect dominates[57] and both Sector 3 and Sector 2 may contract as a consequence. If that happens, then the finished non-tradable producing informal sector (Sector 1) would expand and the retrenched workers from Sector 2 would join Sector 1. However, such outcome would be *welfare reducing* from various points:

a) The downward pressure on wages of informal workers has a clear impact on aggravating poverty in the urban areas. This is because a large share of the urban poor in developing countries (such as above 78% in India) work in the informal sector and any reduction in the wages of the informal workers may significantly increase the incidence of poverty.
b) Sector 2 contracts in terms of both output and employment. Hence workers are forced to leave the unregulated manufacturing firms and

[57] The algebraic proof of this is laid in Appendix 5.1.

take up insecure non-traded service sector jobs with lower earnings and hence greater likelihood of poverty.

In case of a *(skilled) labour –saving* (i.e. *capital-using*) *technological progress* in the capital-intensive Sector 4; there is now a relative surplus of skilled labour in the HO '*nugget*' given the product-mix, which helps the vertically integrated (skilled) labour-intensive Sector 3. However, increase in the capital cost of production in Sector 3 (due to the increase in r) discourages Sector 3 producers to expand thereby lowering the demand for X_2 and hence P_2 and competitive unskilled wage (informal) fall unambiguously. But there will also be another channel of impact, namely the increase in formal-informal interest rate differential (due to the increase in formal interest rate) that should also help the vertically integrated sectors (Sector 2 and Sector 3) to expand. However, as long as the net credit availability in the HO *nugget* remains positive and $\hat{r}$ has a lower bound; Sector 3 may contract in this case as well.

(Q.E.D.)

As discussed in the introductory section, owing to the lowering of input tariffs during the liberalised regime in the skill-intensive Indian service industries, greater access towards increased varieties of foreign-technology embedded imported input (M) *calls for capital-using* (i.e. *skilled labour –saving*) *technological progress* in the skill-intensive Sector 3. Therefore, *it would be sufficient* (given the focus of this essay) to trace out the *implications of a capital-using technological progress (brought about by uniform tariff reduction on imports of M) in Sector 3, ceteris paribus, on informal sector wage and employment conditions*.

Proposition 5.2. *A uniform tariff reduction on the imported input in the export sector, ceteris paribus, induces a capital-using technological progress in that sector, resulting expansion in product prices and competitive real unskilled wage of the informal workers in the two informal sectors. However, the unskilled workers now move to the local intermediate input producing informal*

sector since this sector expands in terms of both output and employment at the cost of the finished non-tradable producing informal sector.

Remarks. Since the return to capital in the formal sector, r, is already determined from the zero-profit condition for Sector 4; a *capital-using technological progress* in Sector 3, brought about by the uniform tariff reduction on the imports of capital goods as inputs, acts like an increase in the price of commodity 3, or more accurately, like a set of industry subsidies. Therefore, there is now a *parallel outward shift* of the transformation schedule of the HO '*nugget*', with higher X_3 and lower X_4, for the same (skilled) wage-rental ratio at the new production point on the new transformation schedule. Hence, the excess demand for the product of Sector 2 (by Sector 3 producers) contributes to an increase in P_2. However, a_{L1} and a_{j2}s do not change ($j = L, K$) (owing to the fixed-coefficient production technology in Sectors 1 and 2). Therefore, Sector 2 expands unequivocally and unskilled labourers are reallocated from Sector 1 to Sector 2. Thus, Sector 2 expands both in terms of output and employment at the cost of Sector 1. From the zero-profit condition of Sector 2, it is imminent that the real informal wage increases. (Q.E.D.)

It is also evident in this framework that if government would intervene aiming to reduce the degree of imperfection in informal credit market and hence the informal rental return (by reducing ρ, ceteris paribus),[58] that would tend to reduce the capital-cost of production for intermediate input producers. However, this would also bring down the formal-informal interest rate differential to some extent and prevent credit reallocation towards informal

[58] Government intervention aiming to integrate the formal and informal credit institutions through appropriate linkages is the most feasible way to achieve this. Since credit is not directly accessible from formal sources, the focus should lie on the provision of microfinance and related services to informal sector enterprises, strengthening of the institutional framework in this area, creation of alternative sources of credit and developing alternative delivery mechanisms. Most of these interventions in different countries have focused on alleviating credit constraints for the rural poor, but some have also targeted the urban poor. Among these, the following are widely known: Grameen Bank in Bangladesh; Bank Rakyat Indonesia (BRI); and Prodem (the Fundaci´on para la Promoci´on y Desarrollo de la Microempresa) in Bolivia. (See Jackelen and Rhyne, 1991 for details). Apart from governmental initiatives, self-help groups can also have a considerable role in alleviating the problem of obtaining credit. A self-employed women's association (SEWA) in Ahmedabad and the Working Women's Forum (WWF) in Madras (both in India) have created their own banks along the lines of cooperatives to cater to the credit needs of poor women; they follow mechanisms similar to those described above and reach well over half a million people.

sector. Nonetheless, from the zero-profit condition for the intermediate input producing sector, it is clear that this would contribute positively to the increase in informal wage.[59]

5.4.1.2 Capital-using Technological Progress in the Formal Sectors and Informal Wage Response – A Quantitative Analysis

Let us now examine the implication of a capital-using technological progress at the rate $\alpha > 0$ in Sector 3 and at the rate $\gamma\alpha > 0$ in sector 4 on the informal wage, ceteris paribus.[60] Subsequently, total differentiation of Equations (5.1), (5.2.1), (5.3)-(5.4); application of envelope conditions and use of Cramer's rule yield:

$$\widehat{W} = \frac{\alpha}{\theta_{K4}\theta_{L2}}\left\{\left(\frac{\theta_{S3}\theta_{K4}-\gamma\theta_{K3}\theta_{S4}}{\theta_{23}}\right) - \gamma\theta_{K2}\theta_{S4}\right\} = \frac{\alpha}{\theta_{K4}\theta_{L2}\theta_{23}}[\theta_{S3}\theta_{K4} - \gamma\theta_{S4}(\theta_{K3} + \theta_{K2}\theta_{23})] = \frac{\alpha}{\theta_{K4}\theta_{L2}\theta_{23}}\left[\theta_{S3}\theta_{K4} - \gamma\theta_{S4}\,\widetilde{\theta_{K3}}\right] \quad (5.12)$$

Where $\widetilde{\theta_{K3}} = \theta_{K3} + \theta_{23}\theta_{K2}$ represents the share of capital costs in sector 3 for both its direct and indirect use of capital. $|\theta| = \left(\theta_{K4}\theta_{S3} - \widetilde{\theta_{K3}}\theta_{S4}\right) > 0$ if the vertically integrated sector 3 is relatively less capital-intensive than sector 4 in value-terms.

One can use Equation (5.12) to quantify the relationship between productivity change in the formal sectors and changes in informal wage. However, it is evident that Equation (5.12) leads to a linear relationship between $\widehat{W}$ & α. Let us assign the following parameter values for the initial equilibrium according

[59] Another possible relevant way of incorporating credit market dualism would be to consider the case where the borrowers in the informal sector get an additional loan at higher cost, i.e. the interest rate on informal credit is a positive function of the amount of capital borrowed, $a_{K2}X_2$ (see Chaudhuri, 2010 Chapter 3 in this context). This would yield $[dR(.)/d\,(a_{K2}X_2)] > 0$. It is straightforward to show in the present set-up that $\widehat{W} = -(\theta_{K2}/\theta_{L2})(a_{K2}X_2/R)[dR(.)/d\,(a_{K2}X_2)]\widehat{X_2}$, which is negative (positive) if the intermediate input producing sector, sector 2 expands (contracts). But that means changes in demand for unskilled workers in informal sectors would not have any role in driving the informal wage-movement, which is unrealistic and inconsistent given the empirical evidence on India discussed at the beginning. Therefore, this essay does not consider this formulation of credit market imperfection in the informal sector in the present context.

[60] It should be noted that the capital-using technical progress in Sector 3 is not endogenised in this numerical exercise for clarity. This is perfectly fine for this static (long-run) model, since endogenising the technical progress would only imply a positive change in the intercept (i.e. technology component) and does not change the working of the model and the results qualitatively.

to the assumptions in the model in a close approximation to the actual data for India.

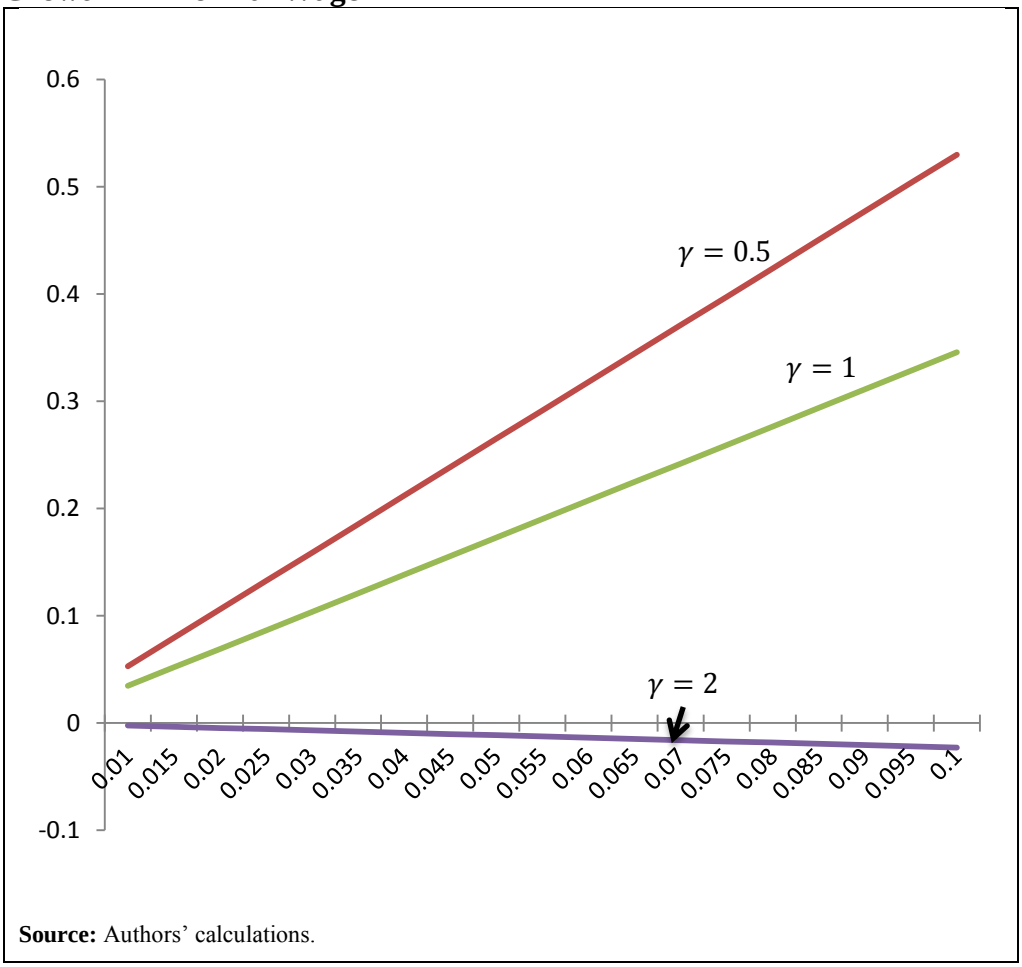
Table 5.1: Parameters for the Initial Equilibrium

Parameters	Description	Values
θ_{L2}	Cost-share of labour in the intermediate-input producing sector	0.7
θ_{K2}	Cost-share of capital in the intermediate-input producing sector	$0.3= (1-\theta_{L2})$
θ_{K3}	Cost-share of capital in the export sector	0.4
θ_{S3}	Cost-share of skilled-labour in the export sector	0.5
θ_{23}	Cost-share of intermediate input in the export sector, defined as the ratio of value-added by the subcontracting activity (defined in Sub-section 1.1) to the value-added in organised sectors	0.1 (constant)
θ_{S4}	Cost-share of skilled labour (managerial and supervisory employees) in capital-intensive import-competing sector	0.3
θ_{K4}	Cost-share of capital in the import-competing sector	0.5
θ_{M4}	Cost-share of middle products in import-competing sector, approximated as average import intensity of the importing firms during 2001-02 in India	0.2 (constant)

Source: Abraham 2010, Berman et al. 2005, Marjit and Kar 2008, Marjit et al. 2011, Seker and Rodriguez-Delgado (2011), ASI and NSSO surveys: various rounds.

Now, we shall consider three alternative values for γ, namely 0.5, 1.0 and 2. In all the cases skilled labour in both the sectors undergo technological progress; but in the first case, productivity of the skilled labour in sector 3 becomes double to the one in sector 4. Similarly, in the second case, productivity of the skilled labour in sector 3 has increased at the same rate to the productivity improvement of the skilled labour in sector 4. In the third case, productivity of the skilled labour in sector 4 becomes double to that in sector 3.

Figure 5.7: Capital-using Technical Progress in Formal Sectors (α) and Growth in Informal Wage



Source: Authors' calculations.

In Equation (5.12), the relationship between technological progress in the formal sectors and change in informal wage is governed by the sign of the term in third bracket, viz., $\left(\theta_{S3}\theta_{K4} - \gamma\theta_{S4}\,\widetilde{\theta_{K3}}\right)$. With $\gamma = 1$, this term becomes nothing else but the net relative factor-intensity rankings of the two formal sectors in the *nugget* in value-terms, which is positive according to our assumption of relative factor-intensity ranking in the *nugget*. Hence, both the formal sectors in the *nugget* use less labour (skilled) in per-unit of production. This means, the relatively (skilled) labour-saving Sector 3 expands at the expense of Sector 4. Subsequently, some of the capital flows to the informal sector and the real informal wage increases.

With $\gamma = 2$, the productivity of skilled labour in Sector 4 becomes double to that in Sector 3, which hurts the relatively skilled labour –intensive vertically

integrated Sector 3. This is because the relative extent of cost reduction in the use of skilled labour is now lesser in Sector 3 within the HO *nugget*. Although some capital will be reallocated towards the informal sector, the 'first-round effect' (mentioned in relation to Proposition 1) dominates and subsequently, decline in real informal wage is observed with the capital-saving technological progress.

However, when $\gamma = 0.5$; the relatively (skilled) labour-intensive vertically integrated Sector 3 expands at the expense of Sector 4, capital reallocates towards the informal sector and we observe sharp increase in real informal wage.

The quantitative analyses presented above would have been qualitatively similar in case of *capital-saving* technological progress in the two formal sectors for $\gamma = 1$, since in either of the two types of factor-biased technological progress, the (skilled) wage – rental ratios are changing in the same direction, given that both X_3 and X_4 are produced in the initial and final equilibrium points. However, with capital-saving progress, Sector 3 would expand now in the *nugget* for $\gamma = 2$ and consequently informal wage increases; while for $\gamma = 0.5$, Sector 3 would contract and real informal wage declines.

5.3 Concluding Remarks

This essay investigates the implications of productivity surge in the formal sectors of the economy on the wellbeing of the workers in urban informal sectors using a four-sector general equilibrium model with labour and capital market distortions. The present research stems from the observation that the 1991 economic reform in India has contributed to the technological improvement in the organised sectors which has been quite substantial over the recent years. Albeit the existence of strong production inter-linkage between

formal and informal sectors; the concurrency of productivity take-offs in the organised sectors and sharp increase in informal wages in recent years still remains a puzzle since both capital and labour flow to the informal sectors. Hence, in order to propose a plausible answer to this puzzle, this essay investigates the general equilibrium implications of trade-induced technological progress in the formal non-agricultural sectors of the economy on the urban informal wages with segmentation in factor markets.

In this simple general equilibrium model, the urban formal sectors wages are pegged at a higher level than competitive wages by prior negotiations with labour unions; while dualism in the capital market is characterised by the fragmented interest rate structure, featuring lower allocation of loanable capital to the informal sector at a higher relative rental rate. Informal sector producers, however, use capital and labour in fixed proportions. The inter-linkage between the formal and informal credit markets (that has been evidenced and demonstrated in different theoretical and empirical literature), has been ignored in earlier related works (Kar and Marjit 2009; Marjit and Kar 2008a; 2009) in course of examining the impact of trade reform measures in the formal sectors on the informal wages in such four-sector general equilibrium model in presence of finished non-tradable and non-traded intermediate inputs.

In sum, the present research highlights the importance of credit-product inter-linkage between the urban formal and informal non-agricultural industries in order to trace out the implications of trade-induced productivity surge in the formal sectors on the wages and employment conditions of the economically marginalised urban workers working under informal arrangements.

The policy implications of the present analysis are straightforward to infer. It has already been discussed in the text that reform, induced by government intervention, in the informal sector credit market tends to prevent capital reallocation towards informal sector in this framework. On the other hand, reform in the formal sector labour market would reduce the net returns to the formal sector workers and thus, owing to the productivity improvement in the formal sectors, increase in the interest rate prevailing in the formal sectors would be more pronounced in that scenario and therefore, formal-informal

interest rate gap would be more widened in this context, leading to a greater reallocation of capital from formal to the informal sectors.

Therefore, this essay has undoubtedly been able to addresses the crucial policy-question, which is often the subject of intensive debate: whether and under what economic conditions could the benefits of productivity improvement in the formal sectors would trickle down to the marginalised workforce in the urban areas working in so-called ‘informal sectors’ (through the impact on their real wages and employment conditions).

Appendices

Appendix 5.1

The Tables Summarising the Model

Table A5.1: The Model Characteristics

No of Sectors	Sector Definitions		Factor Markets		Relative Factor-intensity Ranking
	Non-traded	**Traded**	**Labour Market**	**Capital Market**	
4	**Sector 1 →** • Finished non-tradable producing sector; absorbs surplus labour among the migrants coming to city; represents very low-skilled activities such as domestic help or small vendors with little or no use of capital. • Leontief Production technology.	**Sector 3 →** • Export sector, vertically integrated with sector 2, use (relatively) skilled labour and capital, along with the inputs supplied by Sector 2 and the 'middle product' imported from the ROW. • CRS production function	**'Informal' Labour Market in Sectors 1 & 2 →** Competitive (unskilled) labour market with flexible wages (unskilled).	**Imperfect capital (credit) market in informal sectors (Sectors 1 & 2) →** Interest rate is steeply higher from the one prevails in the formal competitive credit market. Capital (credit) allocated to the informal sector is positively related to the return differential b/n the 2 credit markets.	Only applicable for the traded formal sectors, Sectors 3 & 4 – that is, the sectors using two common factors – Skilled Labour & Capital – therefore, forming the required Heckscher-Ohlin 'Nugget'.
	Sector 2 → • Non-agricultural intermediate input producing sector, using relatively unskilled labour and capital, providing intermediate inputs ranging from leather and rubber products to electronic equipment to the export sector (Sector 3). • Leontief Production technology.	**Sector 4 →** • Import-competing sector; uses skilled labour, capital. • CRS production function.	**'Formal' (Skilled) Labour Market in Sectors 3 & 4 →** Rigid (skilled) Labour Market in formal sectors (Sectors 3 & 4) with institutionally given higher (skilled) wage fixed by prior negotiations (however, the wage-bargaining is not explicitly modelled given the focus of the model).	**Perfect credit market in formal sectors (Sectors 3 & 4) →** Competitive credit market with market-determined interest rate.	• Sector 3 (export sector) is relatively skilled-intensive than Sector 4 (import-competing sector) (with respect to capital). • No factor-intensity reversal.

Table A5.2: The General Equilibrium System

VARIABLES			KEY EQUATIONS DESCRIBING THE MODEL		SIMPLIFYING ASSUMPTIONS
ENDOGENOUS	EXOGENOUS	POLICY-PARAMETERS	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	
$W, r, P_1, P_2, K_1, X_1, X_2, X_3, X_4$ • Note that, $K_1 = K_1\big(r(\rho - 1)\big)$, with $K_1'(.) > 0$	W_S^*, $\bar{K}, \bar{L}$ & $\bar{S}$	$t > 0, \rho > 1$	Equations (5.1), (5.2.1), (5.3), (5.4)	Equations (5.6), (5.8) – (5.11).	a_{23} & a_{M3} are constant

Proof of Proposition 5.1

Let us assume Sector 4 undergoes *capital-saving technological progress* by $\alpha > 0$, ceteris paribus. Totally differentiating Equations (5.1), (5.2.1), (5.3) and (5.4); applying 'envelope conditions'[61] and using Cramer's rule one can obtain

$$\begin{pmatrix} \theta_{L1} & 0 & -1 & 0 \\ \theta_{L2} & \theta_{K2} & 0 & -1 \\ 0 & \theta_{K3} & 0 & \theta_{23} \\ 0 & \theta_{K4} & 0 & 0 \end{pmatrix} \begin{pmatrix} \widehat{W} \\ \hat{r} \\ \widehat{P_1} \\ \widehat{P_2} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ \alpha\theta_{K4} \end{pmatrix} \qquad \text{(A5.1.1)}$$

Similarly, if instead of capital-saving technological progress, Sector 4 undergoes *capital-using* (i.e. skilled labour-saving) technological progress by $\alpha > 0$, ceteris paribus, then we would have

$$\begin{pmatrix} \theta_{L1} & 0 & -1 & 0 \\ \theta_{L2} & \theta_{K2} & 0 & -1 \\ 0 & \theta_{K3} & 0 & \theta_{23} \\ 0 & \theta_{K4} & 0 & 0 \end{pmatrix} \begin{pmatrix} \widehat{W} \\ \hat{r} \\ \widehat{P_1} \\ \widehat{P_2} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ \alpha\theta_{S4} \end{pmatrix} \qquad \text{(A5.1.2)}$$

Therefore, if Sector 4 undergoes *capital-saving technological progress* by $\alpha > 0$, ceteris paribus, we get

$$\hat{r} = \alpha > 0 \qquad \text{(A5.2)}$$

$$\hat{P}_2 = -\alpha\theta_{K3}/\theta_{23} < 0 \qquad \text{(A5.3)}$$

$$\widehat{W} = -[\alpha(\theta_{K3} + \theta_{23}\theta_{K2})/(\theta_{23}\theta_{L2})] = -\left(\alpha\widetilde{\theta_{K3}}/\theta_{23}\theta_{L2}\right) < 0 \qquad \text{(A5.4)}$$

Where $\widetilde{\theta_{K3}} = (\theta_{K3} + \theta_{23}\theta_{K2}) =$ cost-share of direct and indirect capital usage by the vertically-integrated formal sector (Sector 3).

Similarly, if Sector 4 undergoes *capital-using (i.e. skilled labour –saving) technological progress* by $\alpha > 0$, ceteris paribus,

$$\hat{r} = (\alpha\theta_{S4}/\theta_{K4}) > 0 \qquad \text{(A5.5)}$$

[61] This stems from the fact the competitive producers in each sector choose techniques of production in order to minimise unit costs of production. See Caves et al. (2002) for details.

$$\hat{P}_2 = -(\alpha\theta_{K3}\theta_{S4}/\theta_{23}\theta_{K4}) < 0 \quad \text{(A5.6)}$$

$$\widehat{W} = -\left(\alpha\theta_{S4}\widetilde{\theta_{K3}}/\theta_{23}\theta_{L2}\,\theta_{K4}\right) < 0 \quad \text{(A5.7)}$$

Therefore, in either case, the endogenous price variables change in the same direction.

In case of *capital-saving technological progress* in Sector 4, ceteris paribus, by $\alpha > 0$, we have

$$\widehat{a_{K4}} = -\alpha, \text{ with } \alpha > 0, \text{ while } \widehat{a_{K3}} = 0 \quad \text{(A5.8)}$$

Totally differentiating Equations (5.8) and (5.10), one can obtain

$$\lambda_{S3}\widehat{X_3} + \lambda_{S4}\widehat{X_4} = -A\hat{r} \quad \text{(A5.9)}$$

$$\lambda_{K3}\widehat{X_3} + \lambda_{K4}\widehat{X_4} = \alpha\lambda_{K4} + \hat{r}[B - r(\rho - 1)\,K_1'(.)/\overline{K}] \quad \text{(A5.10)}$$

Where $A = (\lambda_{S3}S_{SK}^3 + \lambda_{S4}S_{SK}^4) > 0, B = (-\lambda_{K3}S_{KK}^3 - \lambda_{K4}S_{KK}^4) > 0, S_{j_1j_2}^k$ is the degree of substitution between factors j_1 and j_2 in the k^{th} sector and $S_{j_1j_2}^k > 0$ for $j_1 \neq j_2$ and < 0 for $j_1 = j_2$. For example, $S_{SK}^3 = (r/a_{S3})(\partial a_{S3}/\partial r) > 0,\ S_{KK}^3 = (r/a_{K3})(\partial a_{K3}/\partial r) < 0$ and so on.

Solving Equations (A5.9)-(A5.10) simultaneously by Cramer's rule for $\widehat{X_3}$ and $\widehat{X_4}$ yields

$$\widehat{X_3} = -\hat{r}\,[\lambda_{K4}(A + \lambda_{S4}) + \lambda_{S4}\{B - r(\rho - 1)\,K_1'(.)/\overline{K}\}]/|\lambda| \quad \text{(A5.11)}$$

$$\widehat{X_4} = \hat{r}\,[\lambda_{K3}(A + \lambda_{S4}) + \lambda_{S3}\{B - r(\rho - 1)\,K_1'(.)/\overline{K}\}]/|\lambda| \quad \text{(A5.12)}$$

Since, Sector 4 is relatively capital-intensive vis-à-vis the vertically integrated formal sector in physical and value-sense, $|\lambda| = (\lambda_{S3}\lambda_{K4} - \lambda_{K3}\lambda_{S4}) > 0$. Therefore, in case of a *capital-saving technological progress*, if and only if $B \geq \{r(\rho - 1)\,K_1'(.)/\overline{K}\}$, then the 'first-round effect' dominates the 'second-round effect' and we should have $\widehat{X_3} < 0$ and $\widehat{X_4} > 0$. ■

Similarly, owing to the *capital-using technological progress* in Sector 4 by $\alpha > 0$, ceteris paribus, we have

$$\widehat{a_{S4}} = -\alpha, \text{ with } \alpha > 0, \text{ while } \widehat{a_{S3}} = 0 \qquad \text{(A5.13)}$$

And total differentiation of Equations (5.8) and (5.10) yields

$$\lambda_{S3}\widehat{X_3} + \lambda_{S4}\widehat{X_4} = \alpha\lambda_{S4} - A\hat{r} \qquad \text{(A5.14)}$$

$$\lambda_{K3}\widehat{X_3} + \lambda_{K4}\widehat{X_4} = \hat{r}[B - r(\rho - 1)\, K_1'(.)/\overline{K}] \qquad \text{(A5.15)}$$

Solving Equations (A5.6)-(A5.7) simultaneously by Cramer's rule for $\widehat{X_3}$ and $\widehat{X_4}$ yields

$$\widehat{X_3} = -[\lambda_{K4}(A\hat{r} - \alpha\lambda_{S4}) + \hat{r}\lambda_{S4}\{B - r(\rho - 1)\, K_1'(.)/\overline{K}\}]/|\lambda| \qquad \text{(A5.16)}$$

$$\widehat{X_4} = [\lambda_{K3}(A\hat{r} - \alpha\lambda_{S4}) + \hat{r}\lambda_{S3}\{B - r(\rho - 1)\, K_1'(.)/\overline{K}\}]/|\lambda| \qquad \text{(A5.17)}$$

Hence, $\hat{X}_3 < 0$ and $\widehat{X_4} > 0$ if and only if $\hat{r} \geq (\alpha\lambda_{S4}/A)$ and $B \geq \{r(\rho - 1)\, K_1'(.)/\overline{K}\}$ hold; with at least one having a strict inequality. ■

It is also straightforward from Equation (11) that $\widehat{X_3} = \widehat{X_2}$ since $\lambda_{23} = \frac{a_{23}X_3}{X_2} = 1$. Therefore, sector 2 also contracts. Now totally differentiating Equation (5.9) and substituting $\widehat{X_2} = \widehat{X_3}$ from Equation (A5.16); it is straightforward show that $\hat{X}_1 > 0$ when $\widehat{X_2} < 0$. Hence, we have our Proposition 5.1. ■

Proof of Proposition 5.2

In Sector 3, the technological improvement takes place through the uniform reduction of the *ad valorem* rate of tariff (t) imposed on the imports of the array of intermediate inputs, M, from abroad, ceteris paribus. Therefore, the comparative static exercise we consider is $dt < 0$, ceteris paribus, from the initial equilibrium.

$$\begin{pmatrix} \theta_{L1} & 0 & -1 & 0 \\ \theta_{L2} & \theta_{K2} & 0 & -1 \\ 0 & \theta_{K3} & 0 & \theta_{23} \\ 0 & \theta_{K4} & 0 & 0 \end{pmatrix} \begin{pmatrix} \widehat{W} \\ \hat{r} \\ \widehat{P_1} \\ \widehat{P_2} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ \Omega \\ 0 \end{pmatrix} \quad \text{(A5.18)}$$

Where $\Omega = -\hat{t}\left[\left(\frac{t}{1+t}\right)\theta_{M3} + t\left(\frac{W_S^*}{P_3^*}\right)\left(\frac{\partial a_{S3}}{\partial A}\right)A'\right] > 0$, when $dt < 0$.

Solving Equation (A5.18) by Cramer's rule we get

$$\hat{r} = 0 \quad \text{(A5.19)}$$

$$\widehat{P_2} = (\Omega/\theta_{23}) > 0 \quad \text{(A5.20)}$$

$$\widehat{W} = (\Omega/\theta_{23}\theta_{L2}) > 0 \quad \text{(A5.21)}$$

Thus, informal wage will unambiguously increase.

Since r and hence R are not changing given ρ, there is also no change in credit allocation among the two domestic credit markets. Therefore, we have

$\widehat{a_{S3}} = \widehat{a_{K3}} = \widehat{a_{S4}} = \widehat{a_{K4}} = 0$, and owing to fixed-coefficient production technologies in sectors 1 and 2, $\widehat{a_{L1}} = \widehat{a_{L2}} = \widehat{a_{K2}} = 0$. (A5.14)

Therefore, total differentiation of equations (5.8) and (5.10) now yields respectively

$$\lambda_{S3}\widehat{X_3} + \lambda_{S4}\widehat{X_4} = -\left(\frac{tX_3}{\bar{S}}\left(\frac{\partial a_{S3}}{\partial A}\right)A'\right)\hat{t} = \Phi > 0 \quad \text{(A5.15)}$$

$$\lambda_{K3}\widehat{X_3} + \lambda_{K4}\widehat{X_4} = 0 \quad \text{(A5.16)}$$

It is straightforward to obtain by solving Equations (A5.15) and (A5.16) that $\widehat{X_3} = \{\Phi\lambda_{K4}/(\lambda_{S3}\lambda_{K4} - \lambda_{K3}\lambda_{S4})\} > 0$

And,

$\widehat{X_4} = -\{\Phi\lambda_{K3}/(\lambda_{S3}\lambda_{K4} - \lambda_{K3}\lambda_{S4})\} < 0$.

Since, sector 3 is more skilled-labour intensive with respect to capital in the HO-*nugget*.

Therefore, $\widehat{X_2} = \widehat{X_3} > 0$ and $\widehat{X_1} < 0$.

This is precisely what has been argued in Proposition 5.2. ■

Appendix 5.2

Derivation of TFPG in the organised sectors on provincial level:

First we have derived net value added (net VA) = gross value added – value addition by intermediate inputs – depreciation. Then we deflated this variable using WPI for 2001-02 base year. The TFPG = growth rate of net VA – weighted growth rates of capital and labour (when the weights are share of the factors in net value-added). So Divisia-Tornquist (D-T) approximation has been used for the calculation of TFPG. The TFPG under the D-T approximation is given by the following equation:

$$TFPG = (\ln Q_t - \ln Q_{t-1}) - \frac{1}{2}\left[\left(s_{L,t} - s_{L,t-1}\right)(\ln L_t - \ln L_{t-1}) + \left(s_{K,t} - s_{K,t-1}\right)(\ln K_t - \ln K_{t-1})\right] \quad \text{(A5.17)}$$

Where Q = net VA, s_L= share of labour in net VA; s_K= share of capital in net VA. We consider the share of emoluments in net value added as s_L. Assuming CRS, $s_K = 1 - s_L$.

Data Description and Construction of Variables:

The informal sector real wages have been constructed by deflating the nominal wages in the urban NDMEs using 2001-02 Consumer Price Indices (CPI). And the informal real fixed assets (proxy for capital accumulation in the informal sector) have been formed by deflating the nominal figures using 2001-02 Wholesale Price Indices (WPI) for Machinery and Machine Products.

We have constructed the variable (termed as 'Linkage') capturing formal sector subcontracting activities as 'total inputs' minus 'fuel consumed' in the ASI survey data. Subsequently, this variable was deflated using 2001-02 WPI for Manufactured products.

All the price indices (CPI, WPI for Manufactured products and WPI for Machinery and Machine products) were available at the national level, thus price differences between states were adjusted using the ratio of state to national GDP deflator.

Appendix 5.3

Table A5.3: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Informal Wage 1989	27	90.10185	37.58973	47.32	180.01
Fixed Assets 1989	27	775.9122	441.5575	298.34	1937.68
Linkage 1989	27	15927.22	21047	1.93	92680.77
Informal Wage 1994	27	151.2089	35.65809	96.69	211.79
Fixed Assets 1994	27	441.3022	559.9268	46.83	2874.97
Linkage 1994	27	21081.6	28079.55	16.17	120840.9
Informal Wage 2000	27	197.2741	37.49708	117.8	264.97
Fixed Assets 2000	27	2617.223	2267.978	810.1	12748.86
Linkage 2000	27	25532.24	35163.41	14.84	144254.9
Informal Wage 2005	27	194.5222	52.57534	94.78	321.53
Fixed Assets 2005	27	2827.415	1623.554	1079.22	7698.67
Linkage 2005	27	43442.49	60077.58	25.11	236271.8
Informal Wage 2010	27	269.1952	75.94624	153.08	438.77
Fixed Assets 2010	27	12006.97	12035	1593.86	56504.33
Linkage 2010	27	66629.96	97603.66	79.41	372947.4

Source: Authors' calculations from ASI and NSSO survey data (1989 – 2010).

Chapter 6 – Input Trade Liberalisation and Wage-inequality with Non-traded Goods

6.1 Introduction

One popular issue of research in the context of developing countries (DCs hereafter) is to find out implications of trade liberalisation on the skill-unskilled wage inequality, since one cannot rule out the ambiguity on the resultant implication on the unskilled wage given the complex production structure of a developing dual economy like India. As pointed out by Sharma and Morrissey (2006), in order to be competitive in the world market, the exportable producers in developing countries often seek efficient and relatively high skilled labour. The poor, unskilled labour may only experience changes in their real earnings in an indirect way, through backward linkages in production and consequent demand. However, peculiarities such as exporting both skill-intensive manufacturing and unskilled labour intensive agricultural products, coexistence of organised and informal labour markets and the production of internationally non-tradables – have rarely been taken up in general equilibrium classical trade-theory models. This essay has taken up an issue of input trade in the skill-intensive industries of a DC like India where a particular capital-intensive input gets imported from the world market for another exportable input produced in the home country, inducing access to greater varieties of capital goods at a cheaper rate leading to the improvement in industry's overall productivity with the increased real skilled wage. What this essay has done is to channelize implications of such changes in the skill-intensive formal industries on the real unskilled wage received by the relatively marginalised workers working under informal arrangements in terms of a comprehensive classical general equilibrium model of production and trade incorporating the above-mentioned peculiarities for a dual developing country (like India).

The incidence of labour market rigidity, as observed typically in the formal industrial sectors of India has been documented in a number of empirical literature (such as Topalova 2010; Besley and Burgess 2004), hinders free mobility of unskilled and skilled labourers across sectors. Robbins (1996), Sanchez-Paramo and Schady (2003), Attanasio et al. (2004) on DCs like Argentina, Brazil, Mexico, Chile and Colombia, and Topalova (2010) for Indian districts, provide grounds for the proponents of specific-factor model of Ron Jones (1971) by concluding that the skilled labour-intensive sectors do not substitute away skilled labour for the unskilled labour. But the specific factor model too, unless modified, cannot explain the symmetric changes in the wage gap in the trading nations due to the negligence of the role of the informal establishments (producing mainly non-tradables) in the production linkage. Since DCs are generally deficient in effective employment insurance schemes, the displaced workers from the sector experiencing decline in relative price can hardly afford to remain unemployed. Absorption of labour retrenched from the more regulated sectors by this sector is, therefore, likely to be a major reason behind the concurrent increase in inequality and informalisation, as well as the relatively jobless patterns of growth observed in many DCs in the recent years, including India (Razmi 2009). The share of the informal sector in total employment is typically quite high in DCs (Razmi 2009). Agenor (1996) cites an average figure of more than 70% for DCs. The share of the informal sector in total output can also be quite high. For example, Nagaraj (2004) reports a figure of 40% for India. Unfortunately, most of the relevant literature in this context has neglected the special nature of the informal sector in developing countries' labour markets.

Liberalised economic policies generally shift resources away from the non-traded sectors to the traded sectors of the economy. Since the non-traded production by definition must match its domestic demand, trade liberalisation induced expansion of activities in the traded sectors will be possible only through a fall in the demand for and supply of non-tradable. Therefore, as pointed out by Acharyya and Marjit (2000) and Marjit and Acharyya (2003) that whether non-traded production is organised in the informal or in the

formal sector[62] should be crucial to determine the impact on wage inequality. Typically, the formal non-traded sector produces internationally non-tradable including all public services, hotel accommodation, real estate, construction, hair-cut and commodities produced to meet special customs or conditions of the country. Similarly, the non-tradable produced in the unorganised informal sectors include items such as small domestic industries, services provided by petty traders or street-side vendors and so on. If the non-tradable is produced in a formal sector with unionised wage, the non-traded price may be determined solely by the cost of production independent of the demand for non-tradable. In such a case demand variation consequent upon trade liberalization induced real income changes alters only the non-traded production. Subsequently, any change in the wage gap is triggered by the consequent resource reallocation across the non-traded and traded sectors. But if the non-traded sector is an informal sector, variations in the demand for non-tradable are followed by the changes in both production and price of the non-traded good. Accordingly, trade liberalisation will have quite different implications on the wage gap between skilled and unskilled workers.

As defined in Feenstra and Hanson (1996), Jones and Kierzkowski (2001) and others, a sharp decline in transportation and communication costs during liberalisation makes it easier for the DCs to specialise in part of the production chain and outsource other parts of the production process to countries where factor prices and intensities are appropriate for that particular fragment. This gives birth to the input trade where this particular input gets exchanged in the world market for another exportable input produced in the home country. Das (2012) found that in developing countries such as India, China, South-East Asia and Latin America a higher percentage of trade has been attributed to production-sharing in hi-technology products, service(s) and capital goods. As found in Goldberg et al. (2009), trade liberalisation in India also involves reduction in barriers to trade on imported inputs and thereby providing access to more and newer varieties of cheaper inputs from other countries. Goldberg

[62] Typically we shall confine ourselves in this essay characterising the informal sector as the sector with unorganised unskilled labour market in line with other theoretical papers such as Marjit and Acharyya (2003), Acharyya and Marjit (2000), Chaudhuri (2005), Chaudhuri and Banerjee (2010) and so on.

et al. (2010) estimated that input tariffs declined on average by 24 percentage points during 1989-1997. Arora and Chakrabarti (2004) provide empirical evidence of the significant impact of outsourcing of skill-intensive production on widening skilled-unskilled wage gap in Indian context. Therefore, an important agenda of research becomes to examine the implications of input trade liberalisation on wage-inequality, with explicit considerations of the salient features of a developing dual open economy like India, namely informalisation and presence of non-tradable in a sector-level classical general equilibrium model of production and trade.

The importance of non-traded goods in theoretical models determining the direction of skilled-unskilled wage gap has been documented by Marjit and Acharyya (2003), Chaudhuri and Yabuuchi (2008) who have used a four-sector general equilibrium model to study the consequences of import liberalization on skilled-unskilled wage gap, highlighting the significance of dualism in the labour market and role of non-tradable commodities in driving the results. Gupta and Dutta (2011) incorporated involuntary unemployment of both skilled and unskilled labour in a three-sector model with non-traded goods to understand the implications of trade liberalisation-induced changes on skilled-unskilled relative wage and on the unemployment rates. This essay contributes to this research arena by sketching out the implication of input trade liberalisation on wage-inequality with dual labour markets, large informal sectors and non-traded goods. The purpose of such a comparative static exercise is two-fold. Firstly, the accelerated growth in Indian manufacturing and service sectors has largely been attributed to dramatic reduction in tariffs and NTBs on the imports of intermediate inputs as emanates from recent empirical evidence (Goldberg et al. 2009; 2010). Secondly, the recent empirical literature (Panagariya 2004; Kotwal et al. 2011) suggests that skill-intensive manufacturing and service industries such as communication services, financial services and business services in India experienced significant growth in exports during the liberalised regime, where software accounted for the highest share of all service exports, at least up to the recent financial crisis (Kotwal et al. 2011). Dehejia and Panagariya (2012) argued that imports of capital-intensive foreign inputs (embodying foreign technology) by

the skill-intensive service sectors (primarily software services and IT-enabled services) facilitated the growth of these sectors in India in the post-reform period. At the same instance, Hasan (2002) provided evidence from panel data on Indian manufacturing firms in favour of a significant effect of imported technology on productivity. Hence, access to newer varieties of foreign inputs owing to trade reform has fuelled such growth in India's service industries during the liberalised regime. Therefore, there should be an increased demand for skilled labour, due to the increase in demand by the skill-intensive service industries both at the extensive margin and due to the skill-biased technological change at the intensive margin owing to the increased skill content of imported inputs that are then assembled for export. Therefore, the contribution of this essay is to adopt a tractable but encompassing general equilibrium structure to trace out the implications of such productivity surges in the skill-intensive service sector, brought about by tariff reform on the imports of capital-intensive inputs, on the non-traded sector and subsequently on the unskilled labour market and informal unskilled wage.

The general equilibrium framework used in this essay follows the available empirical evidence that low-skilled workers cannot afford to remain unemployed and the retrenched unskilled workers from the organised formal sectors get absorbed in the unorganised informal sectors at market-determined lower wages. Our modelling approach, closely follows Marjit and Acharyya (2003) with organised (formal) and unorganised (informal) non-traded sectors respectively to enlighten the role of non-tradable in determining the implications on unskilled informal wage and consequently on the relative wage-gap. The framework used in this essay can be viewed as a generalisation of Marjit et al. (2007) with additions of skill-intensive sector and non-traded final good producing sector.

6.2 The Model

6.2.1 Non-traded Production in Formal Sector with Contractual Money Wages

Let us consider a small, open dual economy comprising of four sectors: sector A, vertically integrated sector U ($\&$ sub $-$ sector I), sector S and sector N.

Sector A is the rural agricultural sector (with informal or unorganised labour market for the unskilled labourers) producing a tradable agricultural good using unskilled labour (L) and land-capital (T).[63]

Sector U is an unskilled labour-intensive formal manufacturing sector (with organised labour market for unskilled workers) in the urban area, producing with unskilled labour, capital (K) and an internationally non-traded intermediate input[64], which is, in turn, produced in one segment of the formal sector U (sub-sector I) using unionised unskilled workers and capital.

The skill-intensive manufacturing sector (S) uses skilled labour (L_S), capital and a hi-technology-intensive imported intermediate input produced abroad (M)[65]. Consistent with empirical evidence[66] we assume that only the relatively skill-intensive firms use imported intermediate inputs and consequently pay for foreign technology licences or foreign technical assistance. Furthermore, there is an *advalorem* tariff (t) imposed on the import of M. [67]

Sector N produces finished non-tradable (internationally) goods using only unskilled labour (L). Similar to Marjit and Acharyya (2000, 2003), this model also makes a simplifying assumption that a non-traded final good is produced in the urban area using only unskilled labour in a fixed proportion.

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[63] The input 'land-capital' broadly includes land and other durable assets. See Bardhan (1972), Chaudhuri (2007) and Mukherjee (2012) in this context.

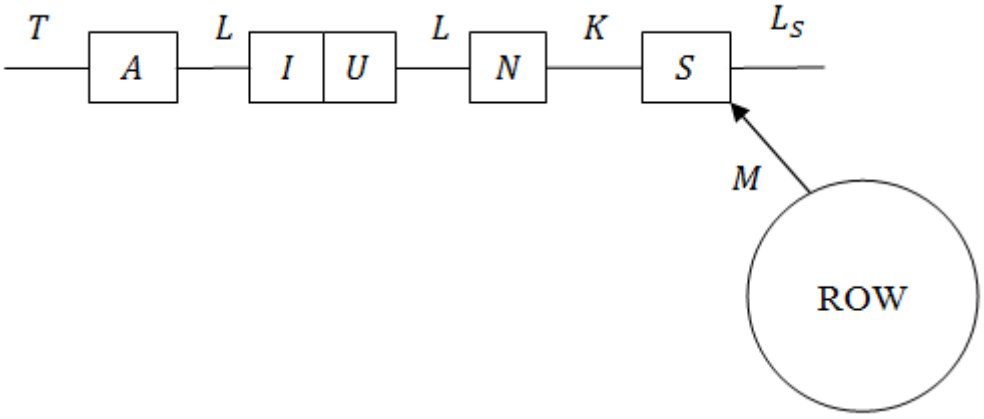
[64] Examples of such non-traded intermediate input include electricity, water supply, local transportation, goods with very high transportation costs such as gravel and so on.

[65] Examples of such imported inputs include computer data storage units, automatic data processing machines and so on.

[66] See for example Alvarez and Lopez (2005), Lopez (2015) and so on.

[67] This should be interpreted here as the *advalorem* equivalence of tariff and non-tariff barriers (NTBs).

Figure 6.1: The Model Structure



Unskilled labourers in the unorganised labour market of the rural agricultural sector get competitive (market-determined) money wages at the rate W, while their counterparts working in the organised labour markets of the formal sectors receive contractual money wages at the rate W^*, determined owing to prior unionised negotiation[68], with $W < W^*$.

The skilled workers receive wages at the rate W_S. The rental to land-capital is denoted as R and the interest rate on capital is denoted as r. The price the non-traded intermediate input I, P_I, is determined domestically by demand-supply mechanism. a_{ji} denotes the amount of the j^{th} input used in per-unit production of the i^{th} good. P_i^* denotes the internationally given price of the i^{th} commodity owing to the small, open economy assumption ($i = A, U, S$).

All markets, except the organised labour markets for the unskilled workers working in the formal sectors, are perfectly competitive. All production is subject to constant returns to scale. Except for the non-traded production and production in the input tier, there are diminishing returns to the variable factors in each sector.

[68] We assume the organised sector wages are institutionally given and we do not explicitly model the wage-bargaining here. For a discussion on how unionised wages are determined through collective bargaining, see Chaudhuri and Mukhopadhyay (2010), Mukherjee (2014) and so on.

CASE I: Non-tradable Production in Organised Sectors with Institutionally Given Wages

Let us first assume that this finished non-tradable is produced in the formal sector where unskilled labour is hired at a contracted nominal wage (institutionally given by prior negotiations), as considered in Marjit and Acharyya (2003) and in Acharyya and Marjit (2000). Examples of such non-tradable include services such as construction, hair-cut, infrastructure (comprising telecommunications, electricity, water and sewerage, natural gas and transportation) and so on – where we observe existence of higher institutionally given nominal wage. Therefore, only the agricultural sector is modelled as the informal sector[69] where the unskilled labour gets a lower market-determined nominal wage. However, the price of non-traded final commodity N, P_N, is determined in this case by the labour cost given W^* and therefore the production of the non-traded good N is determined by the domestic demand for N.

The price-unit cost equality conditions (the so-called 'zero-profit conditions') for the competitive producers are mentioned below.

$$Wa_{LA} + Ra_{TA} = P_A^* \tag{6.1}$$

$$W^* a_{LI} + ra_{KI} = P_I \tag{6.2}$$

$$W^* a_{LU} + ra_{KU} + P_I a_{IU} = P_U^* \tag{6.3}$$

$$W_S a_{SS} + ra_{KS} + P_M{}^*(1+t)a_{MS} = P_S{}^* \tag{6.4}$$

$$W^* a_{LN} = P_N \tag{6.5}$$

We assume that

(i) Per-unit requirement of the non-traded intermediate input in the production of sector U (a_{IU}) is constant

and

[69] See footnote 1 in this context.

(ii) Per-unit requirement of the imported input in sector S (a_{MS}) is also constant.

Although these two assumptions are simplified assumptions, they are not without any basis. If we think of sector U as a Television-making industry that always uses one Brown Tube to make a TV set; and sector S as a software industry that always has a fixed requirement of automatic data processing machine or computer data storage units in the production process, then these two assumptions are perfectly legitimate.

Full-employment in the factor market suggests

$$a_{TA}A = \bar{T} \tag{6.6}$$

$$a_{KI}I + a_{KU}U + a_{KS}S = \bar{K} \tag{6.7}$$

$$a_{SS}S = \overline{L_S} \tag{6.8}$$

Domestic demand-supply equality condition in the market for non-traded intermediate input implies

$$a_{IU}U = I \tag{6.9}$$

Or,

$$\hat{U} = \hat{I} \tag{6.9.1}$$

Where the ^ indicates proportional change. The unskilled labour-endowment equation is

$$a_{LA}A + a_{LU}U + a_{LI}I + a_{LN}N = \bar{L} \tag{6.10}$$

Following Marjit and Acharyya (2003) and Marjit et al. (2011) let us make a simplifying assumption that α-proportion of the total urban income is spent on the non-traded good N. This is also consistent with the assumption that urban consumers have Cobb-Douglas preferences over consumption bundle of tradable goods T (consumption vector of U & S) and non-traded consumption bundle N.

Thus, the domestic market clearing of non-traded good (assuming rural population cannot avail N)

$$\alpha({P_U}^*U + {P_S}^*S) = (1-\alpha)P_N N \tag{6.11}$$

Noting that we have $a_{MS}S = M^*$ =the amount of imported M; in the post-trade steady-state equilibrium situation, the domestic market for N always clears and the endogenous variables are always adjusted to maintain the trade-balance at the overall level.

The above equation system consists of eleven unknowns or endogenous variables of the system (W,W_S,R,r,P_I,P_N,A,U, S, I, N) and eleven equations. The input-coefficients, a_{ji}s, except the per-unit requirements of the imported and non-traded intermediate inputs (a_{IU} and a_{MS}) and the unit labour coefficient in the production of non-traded final good N (a_{LN}), are determined once the factor prices are known.

The model is solved as follows: Equations (6.2) and (6.3) simultaneously solve for r and P_I for exogenously given W^* and P_U^*. Once r is determined, zero-profit condition for the skilled labour-intensive manufacturing sector determines W_S given P_S^*, P_M^* and the ad-valorem rate of tariff imposed on the import of M, t. On the other hand, the price of the non-traded good is given by the labour cost, which is the product of fixed input-coefficient and the contracted unskilled-wage, independent of the demand for non-traded good. Once the nominal skilled wage and the rate of return to capital are determined, total skilled labour force determines the skill-intensive manufacturing production and this together with the total domestic capital stock yields the production of the unskilled labour-intensive manufacturing good and consequently the production of the non-traded intermediate input, I, by dint of the complementarity in production process between these two sectors as given by Equation (6.9). The non-traded output, on the other hand, is demand-determined given the equilibrium values of W_S,r and U (and I), as evident from the market-clearing condition in Equation (6.11). Therefore, the formal sectors form an independent subsystem of the economy under consideration.

The output and prices of the factors used in production of U,I,S and N are all determined independent of the informal agricultural sector in this set-up. But the informal wage rate, the rental to land-capital and production in sector A are determined once the equilibrium values in the formal sectors of the economy are obtained. In this set-up, the production activities in sector A will be constrained by the outputs and hence by the demand for unskilled labour in the formal sectors. This depicts the importance of the non-traded good N. Because of the presence of the non-traded final good N, production of agricultural exports and the consequent demand for unskilled labour are constrained by the demand for N, which otherwise could have been satisfied through imports. Finally, given such an output level of agricultural exports, the informal competitive wage and the return to the specific factor, land-capital, must satisfy the zero-profit condition given by Equation (6.1) and full employment condition for land in Equation (6.6).

6.2.1.1 Comparative Static Exercise – Tariff Reduction on Imported Intermediate Input[70]

The key comparative static exercise in this essay is to consider a reduction in the *ad valorem* rate of tariff (t) on the import of the intermediate input M.

Since interest rate on capital in the formal sector, r, is already determined by solving the zero-profit conditions given in Equations (6.2) and (6.3) simultaneously, r does not change and hence skilled wage goes up as an immediate impact of the reduction in tariff on the imported input, as evident from the zero-profit condition for the skill-intensive sector described in Equation (4). Therefore, denoting the proportional change by '^' (i.e. $\hat{X} = dX/X$), the expression for change in skilled wage is:

$$\widehat{W_S} = -(\theta_{MS} T \hat{t}/\theta_{SS}) > 0, \text{ since } \hat{t} < 0 \qquad (6.12)$$

Where θ_{ji} denotes cost-share of the j^{th} input in the production of the i^{th} good (for example, $\theta_{SS} = (W_S a_{SS}/P_S^*)$) and $T = t/(1+t)$.

[70] Detailed derivations of key algebraic expressions have been put aside in Appendix 6.1.

How does W change? The agricultural sector with an informal labour market employs only those unskilled labourers that are not employed in the formal sectors of the economy (that is not employed in sectors *U* and *N*). Therefore, it is obvious that production activities in the agricultural sector (*A*) will be constrained by the demand for unskilled labour in the formal sectors and hence by the outputs in the formal sectors. So the effect on W depends on whether the organised sectors using unskilled labour contracts or not.

In algebraic terms,

$$\frac{\sigma_A \lambda_{LA}}{\theta_{TA}} \widehat{W} = (1 - \lambda_{LA} - \lambda_{LN})\widehat{U} + \lambda_{LN}\widehat{N} \qquad (6.13)$$

Where λ_{ji} denotes share of the j^{th} input in the production of the i^{th} good (for example, $\lambda_{LA} = (Aa_{LA}/\bar{L})$). LHS measures change in labour demand in sector A due to input substitution effect in sector A, but induced by change in W, which in turn, depends on how demand for unskilled labour by the rest of the economy changes; or in other words, how productions of U (consequent upon change in I) and N change. However, as sector S expands, producers in sector S demand more capital that must come from the vertically integrated sectors U and I, leading to contraction of both sectors.

$$\widehat{U} = \hat{I} = [\sigma_S \lambda_{KS}/\theta_{SS}(1 - \lambda_{KS})]\theta_{MS} T\hat{t} < 0 \qquad (6.14)$$

Hence, $(1 - \lambda_{LA} - \lambda_{LN})\widehat{U} < 0$ implying fall in labour demand due to contraction of U and I. Therefore, the changes in urban income and consequently the demand for the non-tradable can be in either direction. *W* falls unequivocally only if *N* contracts. Here lies the significance of the role of non-tradable. When the non-tradable is produced under contractual wages, the variation in demand for non-tradable only affects the production of non-tradable.

Totally differentiating domestic market-clearing condition for the non-traded good and simplifying

$$\widehat{N} = \mu\widehat{U} - \theta_{MS} T\hat{t} \frac{\sigma_S(1-\mu)\theta_{KS}}{\theta_{SS}} \qquad (6.15)$$

Where $\mu = \{\alpha P_U^* U/(1-\alpha)P_N N\}$ and $(1-\mu) = \{\alpha P_S^* S/(1-\alpha)P_N N\}$. It intuitively follows that higher (lower) value of μ means people in the urban areas earning from sector U (sector S) spend relatively more on the good N. Equation (6.14) suggests direction of change in the demand for non-traded good and consequently on its production is ambiguous. The ambiguity stems from two alternative forces: one is increased demand by the skilled workers due to rise in their real earnings, another is reduced demand by the unskilled workforce in the urban area due to reduction in their real income owing to contraction of sector U.

Quantitative Analysis of the Full-employment Model with Unionised Labour Market in Non-traded Sector

Figure 6.2: Movements in Non-traded Production (N) & Informal Wage (W) following 24% Tariff-cut on Imports of M, for Different σ_S at $\mu = 0.3$ & $\mu = 0.7$, under Contractual Wage in Sector N

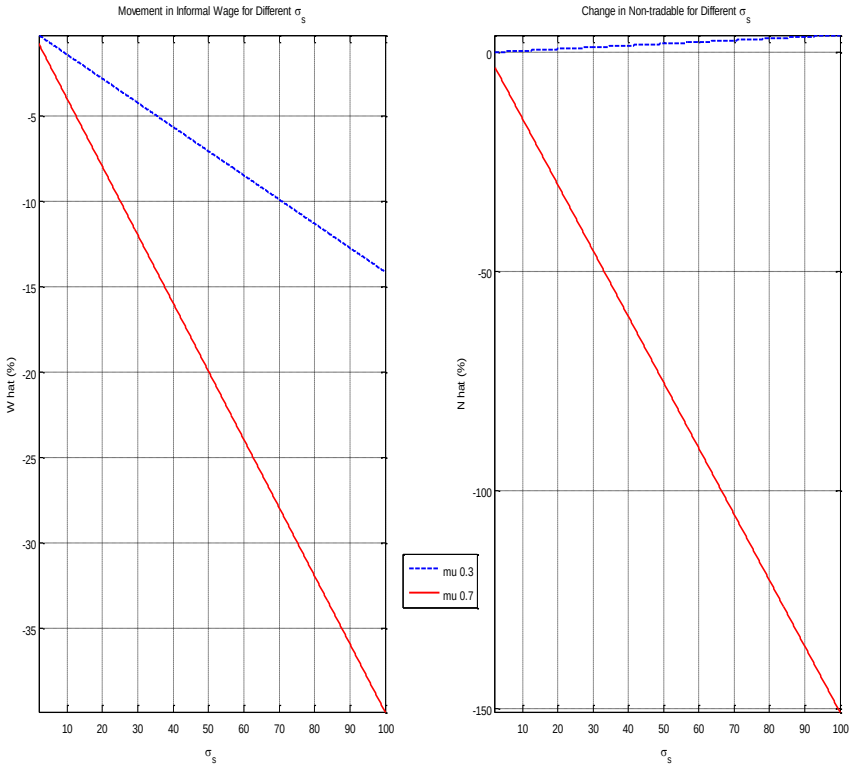


Figure 6.2 quantifies in the two panels respectively the changes in the production of non-tradable N and the consequent movement in informal wage for different values of σ_S (the elasticity of substitution between skilled labour

and capital in the skill-intensive sector S) in two different scenarios: $\mu = 0.3$ and $\mu = 0.7$, owing to a reduction in tariff on the imported input by 24 percentage points (as estimated by Goldberg et al. 2010 during 1989-1997 in India).[71] When the skilled wage increases owing to a tariff cut of 24% on the import of input M, with increase in the elasticity of substitution between skilled labour and capital, producers in sector S would be more tempted to substitute capital for skilled labour and sector S would expand even more and consequent contractionary impact on the vertically integrated sector U would be higher as well since additional units of capital sector S demands must come from sectors I and U, thereby both direct and indirect capital usage by sector U would decline at higher rate. Therefore income from sector S (sector U) increases (decreases) at an increasing rate with increase in σ_S.

When μ =0.3, we have the scenario when urban population earning from sector S would spend relatively larger share of their income on the non-tradable, N, compared to the urban population earning from the vertically integrated sector U. Sector S expands more with the increase in σ_S; when the share of urban income from sector S spent on the non-tradable N is relatively higher, the decrease in the demand for N by the urban people earning from the vertically integrated sector U would be outweighed by the increase in demand for N by the people receiving income from sector S and consequently we observe a modest increase in the production of sector N with increase in σ_S for μ =0.3. Therefore, for μ =0.3, there would be two forces operating on the demand for unskilled workers in the formal sectors and consequently on the informal wage: one is decrease in demand for the unskilled workers at a higher rate by sector U with the increase in σ_S and another is the increased demand by the non-traded sector N, which is however, modest. Therefore, demand for unskilled workers in the formal sectors is not increased as a net effect and informal wage would decline, but the rate of decrease in informal wage is quite modest.

[71] The benchmark parameter values used for the sensitivity analysis are presented in Table A1.1 in Appendix.

However, when μ =0.7, share of urban income from the vertically integrated sector U spent on N is much higher compared to the people earning from sector S. So the contractionary impact on the vertically integrated sector U would now be much more pronounced in determining the demand for N by the urban population with the increase in σ_S. Therefore, demand for non-tradable N would now decline as a net effect with the increase in σ_S. Consequently, demand for unskilled workers in the formal sectors would unambiguously fall and the informal wage would fall at a much higher rate compared to the case with μ =0.3.

Implications on the Employment in the Informal Sector

Totally differentiating the full-employment condition in the unskilled labour market and substituting values we obtain

$$\widehat{L_A} = \hat{a}_{LA} + \hat{A} = -\frac{\sigma_A}{\theta_{TA}}\widehat{W} \qquad (6.16)$$

Since informal unskilled wage falls, total employment of unskilled workers in sector A rises in this scenario with unionised wage in sector N. This is because, the reduction in flexible unskilled wage does not have any impact on determining the production in sector N (due to the unionised unskilled labour market in sector N) and thus, all the retrenched workers from sectors U, I and N now join sector A.

6.2.2 Non-traded Production in Unorganised Informal Sector

However, majority, about 70 per cent of the informal workers are employed in the unorganised smaller enterprises (not covered under the Annual Survey of Industries (ASI) and employ less than six workers) of urban or semi-urban areas, at lower competitive wages to produce and sale domestically (National Sample Survey Report No. 557, 2011-12). Therefore, another alternative feature of the underlying economy should be to consider the scenario where

the finished non-traded good being produced in the informal sector with unorganised labour market where unskilled labour receives market-determined (flexible) nominal wage (W). Typically, the non-tradable produced in the unorganised informal sectors[72] include items such as small domestic industries, services provided by petty traders or street-side vendors and so on. Therefore, variations in the demand for non-tradable are followed by the changes in both production and price of the non-tradable. The implications of input trade liberalisation in sector S on the wage earnings of the informal sector workers will be guided accordingly.

In case of contractual wages in the formal non-traded sector N, non-traded price was held fixed by the unionised unskilled money wage. But in case of non-traded good being produced in the informal sector with unorganised labour market where unskilled labour receives market-determined (flexible) nominal wage, production of N is no longer demand-determined. Consequently, P_N is not just cost-determined. We continue to assume a_{LN} is fixed (simplifying assumption). Therefore, the zero-profit condition for sector N in Equation (6.5) can now be re-written as

$$W a_{LN} = P_N \tag{6.5.1}$$

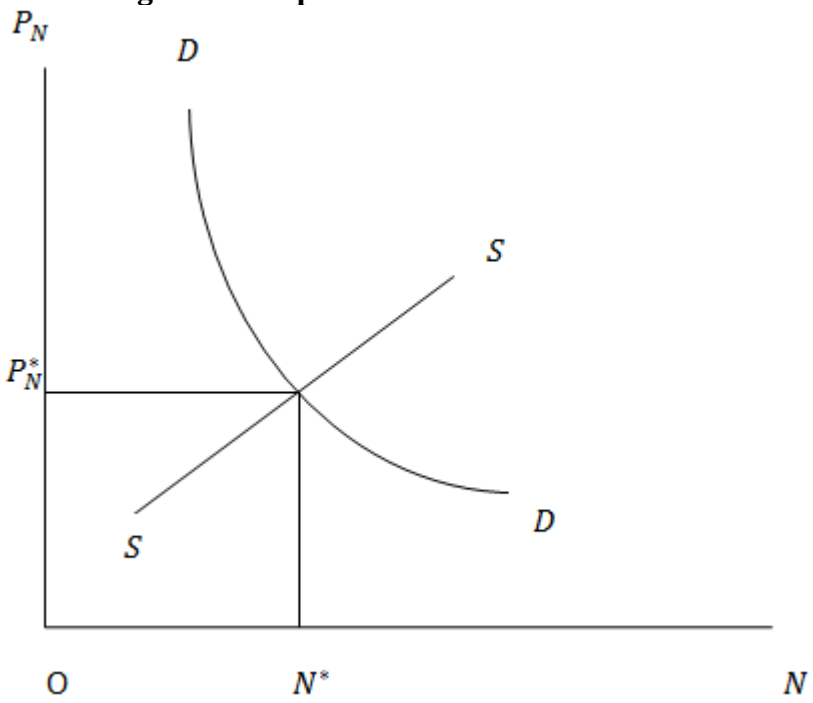
The prices and output levels in the formal sectors (U, I, S) can still be determined independent of the informal sectors (A, N). The remaining variables can be determined as follows. For a given P_N, Equation (6.5.1) determines the unskilled wage, W, which then solves for the return to land-capital, R, from the zero-profit condition in Equation (6.1). Given these values of W, R and the consequent input choices, the output levels of the agricultural exports (A) and non-tradable N, are determined from Equations (6.6) and (6.10) respectively. This yields a supply curve for the non-tradable, N as $N^S = S(P_N)$. An increase in P_N raises W and lowers R. The subsequent increase in intensity of land-capital usage lowers the agricultural output,

[72] Typically I shall confine myself in this essay characterising the informal sector as the sector with unorganised unskilled labour market in line with other theoretical papers such as Marjit and Acharyya (2003), Acharyya and Marjit (2000), Chaudhuri (2005), Chaudhuri and Banerjee (2010) and so on.

which, along with the less intensive use of unskilled labour due to the higher unskilled-wage, releases some unskilled labour; accordingly the non-traded output increases. We, therefore, have a positive association between P_N and N^S. So the supply curve is positively sloped.

On the other hand, the demand relationship for the non-traded good N in Equation (6.11) now becomes a rectangular hyperbola in this case.

Figure 6.3: Equilibrium in the Market for N



6.2.2.1 Comparative Static Exercise – Decline in Tariff on Imports of M under Flexible Wage Production in Non-traded Sector

This interaction of demand for and supply of non-tradable N in determining its price and output levels has important implications on the wage-gap between skilled and unskilled labour. Given (6.5.1), i.e., proportionality between P_N and W, it is immediate that whether the wage-gap widens or declines following tariff cut on imports of M depends crucially on the movement of P_N. In the earlier case of the production of N with contractual unskilled money wage, it was only the demand-determined production of N, which was crucial. But now

with the price of N no longer determined by the contracted unskilled nominal wage, supply of N is of no less importance in determining the movement in unskilled-wage.

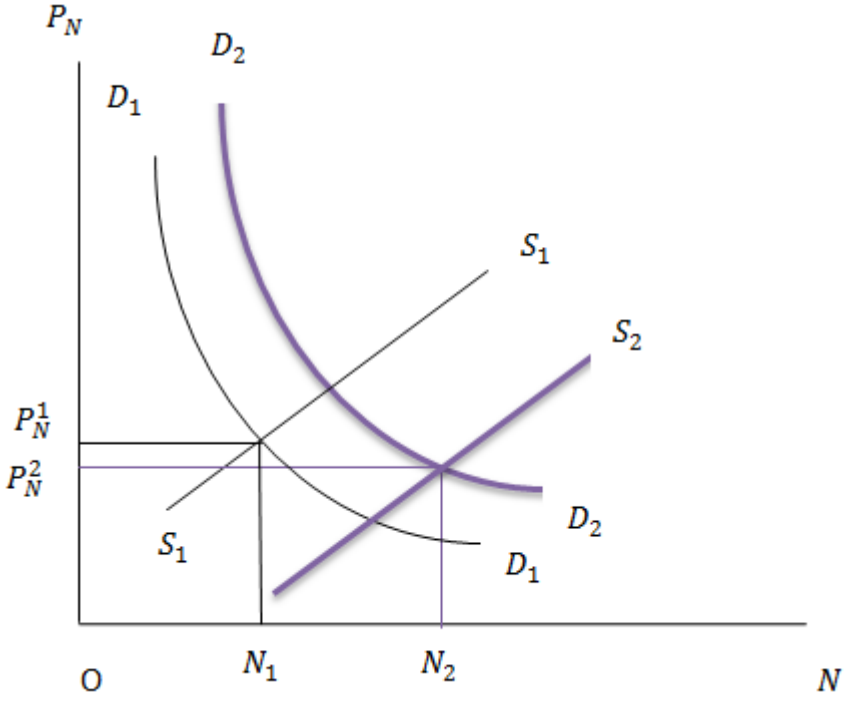
Equation (6.15) now changes to

$$\theta_{LN}\widehat{W} + \widehat{N} = \mu\widehat{U} - \theta_{MS}T\hat{t}\,\frac{\sigma_S(1-\mu)\theta_{KS}}{\theta_{SS}} \qquad (6.15.1)$$

Therefore, when non-tradable is produced in the unorganised informal sector, we can get expression for $\widehat{W}$ under tariff reduction on the imported input M by solving Equations (6.13), (6.14) and (6.15.1) simultaneously.

From Equation (6.15.1) it can be inferred that given supply, the demand for non-tradable N is ambiguous for the same reason mentioned before while discussing Equation (6.15). Therefore, the price of the non-traded good now may move in either direction. On the other hand, the supply effect depresses the non-traded price: At the initial P_N and hence at the initial W and A, unskilled labour released from the contracting sectors U and I relaxes the (net) labour constraint for the non-traded sector and thereby raises its supply. This additional supply effect imposes a downward pressure on unskilled wage and therefore reduces P_N. Figure 6.4 demonstrates the possibility where both demand for and supply of non-traded good increase but since supply increases by more than the increase in demand, price of the non-tradable falls from P_N^1 to P_N^2 while production of non-tradable rises from N_1 to N_2.

Figure 6.4: Comparative Static Response in the Domestic Market for *N* under Flexible Unskilled Wage



Sensitivity Analyses

Figure 6.5: Movements in Non-traded Production (N) & Informal Wage (W) following 24% Tariff-cut on Imports of M, for Different σ_S at μ=0.3 & μ=0.7, under Flexible Wage in Sector N

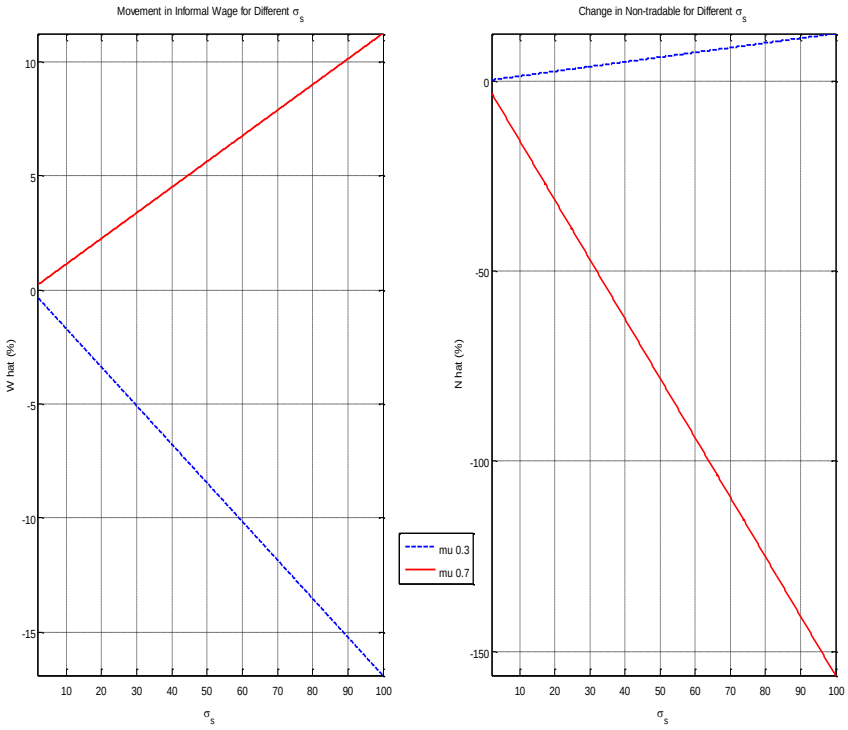
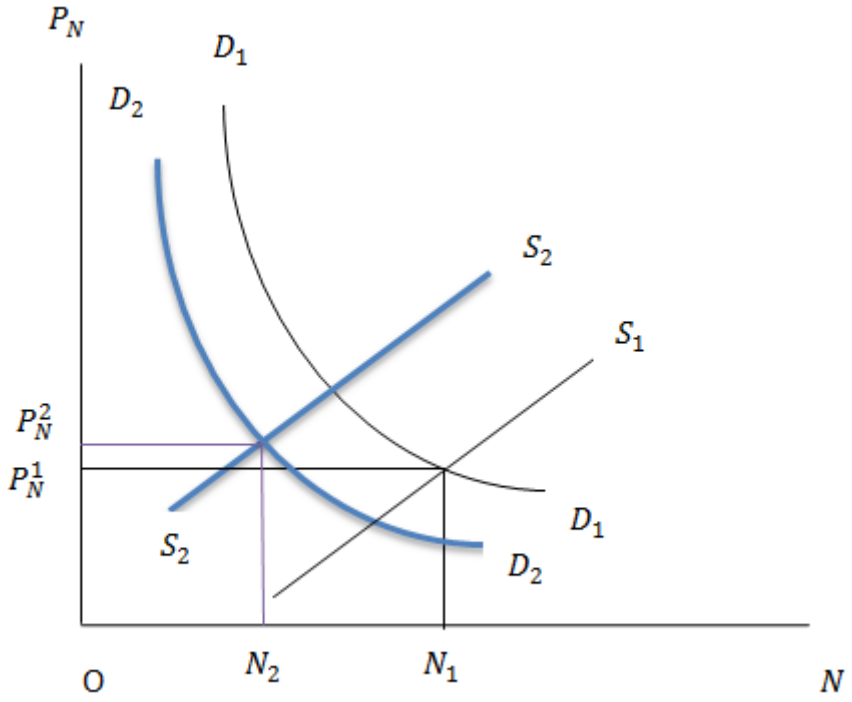


Figure 6.5 represents similar kind of sensitivity analysis as performed in Figure 6.2, however now under the assumption of flexible unskilled wage in the non-tradable sector. When μ =0.3, share of total urban income from sector S spent on non-traded good N is relatively high and hence there is a net increase in the demand for N (since sector S expands at the expense of sector U) at initial P_N. However, the increases in the supply of unskilled labour to sectors A and N depress W and therefore price of non-tradable. This yields the same scenario as the one depicted in Figure 6.4. Hence, as σ_S rises, expansion of sector S and consequent contraction of sectors U and I induce increase in non-traded production by dint of higher supply of unskilled labour, but reduction in W.

However, when μ =0.7, share of urban income from the contracting vertically integrated sector U spent on non-tradable is relatively higher. Therefore, there is a net decline in the demand for and supply of non-tradable at initial P_N. But

this dominant supply effect leads to an increase in P_N (supply curve shifts upwards by more than the downward shift in demand curve, as shown in Figure 6.6 below). Given the proportional relationship between competitive unskilled wage and P_N, as laid in Equation (6.5.1), this latter effect outweighs the former impact on W and we observe a net increase in W but a decline in non-traded production in Figure 6.2 for μ =0.7.

Figure 6.6: Comparative Static Response in the Domestic Market for N under Flexible Unskilled Wage with μ =0.7



Another interesting exercise has been tracing out the movements of production of N and resulting movement of W under flexible wage in the non-traded sector owing to a 24% tariff reduction on the imports of M by changing σ_A, the elasticity of substitution between unskilled labour and land-capital in the agricultural sector, from 0.6 to 3. This analysis has been motivated by an interesting observation in Golder et al. (2014) who have reported that σ_A can either be approaching to or more than unity, with preferred estimated value as 1.2 (obtained by direct estimation of CES production function using non-linear least squares approach) that has been taken as the benchmark value in the earlier analyses for varying σ_S. For the sake of brevity this essay only

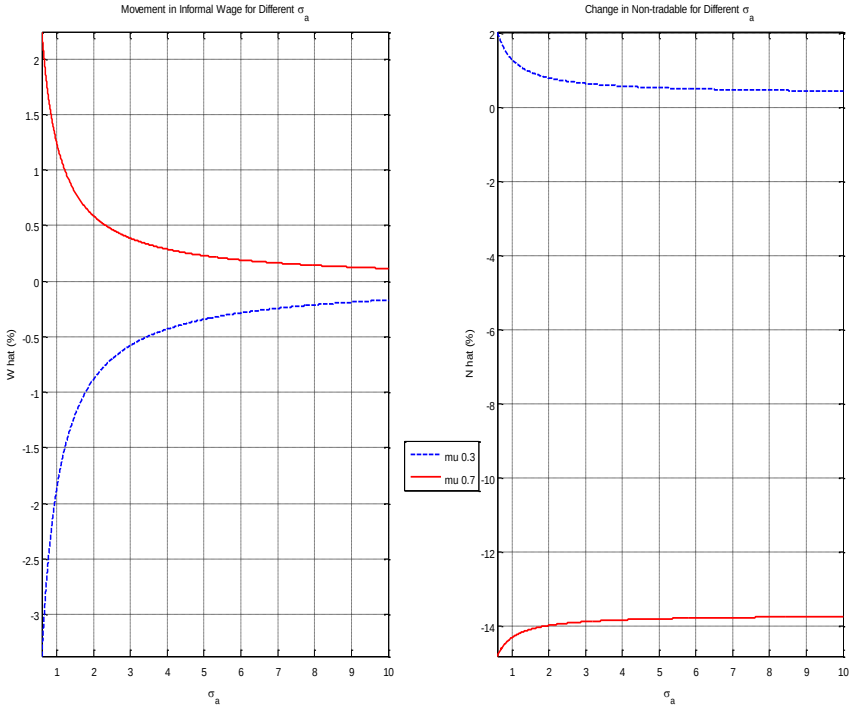
examines this under flexible W assumption in sector N, since that renders seemingly counter-intuitive results.

Although the retrenched unskilled workers from sectors U and I flow to sectors A and N, when μ =0.3, producers in sectors N demand more of the unskilled workers. This will raise the demand for unskilled workers in sector N, imposing an upward pressure on informal wage ($\widehat{W}$ starts becoming less negative in Figure 6.7). Given Equation (6.5.1), this leads to an increase in non-traded price and subsequent reduction in the supply of N. This additional supply effect induces sector N to release some unskilled labour to sector A. For low values of σ_A, even with the increase in W producers in sector A would be relatively less willing to substitute unskilled labour by land-capital and continue to demand unskilled labour for the expansion of sector A. Thus, W continues to go up for low values of σ_A, but after a certain level, for relatively higher values of σ_A, producers in sector A substitute land-capital for relatively costlier unskilled labour that imposes a downward pull on W and consequently on P_N. These retrenched unskilled workers from sector A will now migrate to sector N and that exerts an upward push on non-traded production.

Therefore, the resultant trajectory of $\widehat{N}$ takes a convex (to the origin) pattern while that of $\widehat{W}$ **takes a concave (from the origin) pattern from lower to higher values of σ_A** for μ =0.3.

For μ =0.7, demand for N falls by the urban consumers as a net effect whereas retrenchment of unskilled workers from sectors U and I leads to an excess supply of unskilled labour in the competitive unskilled labour market of sector N and thereby reducing W. However, with the increase in σ_A, producers in sector A are going to substitute land-capital by labour in production that imposes a consequent upward pressure on W, which, in turn, would increase P_N, implying a subsequent reduction in supply of N. Therefore, we observe **exactly mirror images to those for μ =0.3 in the trajectories of $\widehat{N}$ and $\widehat{W}$** (i.e. concave from the origin for $\widehat{N}$ and convex to the origin for $\widehat{W}$) from lower to higher values of σ_A for μ =0.7.

Figure 6.7: Movements in Non-traded Production (N) & Informal Wage (W) following 24% Tariff-cut on Imports of M, for Different σ_A at μ=0.3 & μ=0.7, under Flexible Wage in Sector N



Employment of Unskilled Workers in the Informal Sector

Note that, now we have two sectors with 'informal' labour market: one is sector A and another is sector N. The total employment of unskilled workers in the informal sectors is therefore, given by

$$\widehat{L_A} + \widehat{L_N} = \left(\theta_{LN} - \frac{\sigma_A}{\theta_{TA}}\right)\widehat{W} \qquad (6.16.1)$$

Therefore, if unskilled labour and land-capital are less than perfect substitutes in sector A (i.e. $\sigma_A < 1$), informal employment changes in the same direction of change in W if $\theta_{LN}\theta_{TA} > \sigma_A$. However, if $\sigma_A > 1$, direction of change in informal employment would be opposite to that in W. This is because, when W falls P_N falls and that reduces demand for the non-tradable, which, in turn, affects non-traded production; while if $\sigma_A > 1$, producers in sector A would be quite willing to minimise production cost by substituting retrenched unskilled labour for capital and that can boost employment of unskilled workers in the informal labour market of sector A. However, for low values of σ_A sector A

producers would also be unwilling to employ additional units of retrenched worker for capital. Therefore, total employment in the informal sector also falls in that case.

6.2.3 Expression for Relative Wage-inequality

Since the unskilled labourers are entitled to receive either the flexible wage in the informal unorganised sector or the fixed wage in the organised sector, we can define an average unskilled wage of the economy and can consequently define the ratio of skilled wage over the average unskilled wage of the economy as the expression for relative wage-gap in the economy under consideration.

6.2.3.1 Non-tradable Production under Contractual Wage

With flexible wage in sector A but unionised wage in sectors U, I and N the expression for the average unskilled wage in the economy becomes the weighted average of total money wage paid in respective sectors, when the weights are employment shares of respective sectors.

$$W_A = W\lambda_{LA} + W^*(\lambda_{LI} + \lambda_{LU} + \lambda_{LN})$$

$$\text{Or, } W_A = W^* - (W^* - W)\lambda_{LA}$$

Since $\sum_i \lambda_{Li} = 1$, where $i = A, I, U, N$.

Therefore,

$$dW_A = dW\lambda_{LA} - Wd\lambda_{LA}$$

Or,

$$\widehat{W_A} = (W\lambda_{LA}/W_A)\widehat{W} - (W\lambda_{LA}/W_A)\left(\hat{a}_{LA} + \hat{A}\right)$$

Since $\lambda_{LA} = (a_{LA}A/\bar{L})$. Therefore,

$$\widehat{W_A} = (W\lambda_{LA}/W_A)\left(1 + \frac{\sigma_A}{\theta_{TA}}\right)\widehat{W} \quad (6.17)$$

Therefore, $\widehat{W_A} < 0$ if W falls owing to tariff-cut on the imports of M.

6.2.3.2 Non-tradable Production in the Informal Sector with Flexible Wages

Just like before, it can be shown that

$$\widehat{W_A} = (W/W_A)\widehat{W}(\lambda_{LA} + \lambda_{LN}) + \{(W^* - W)/W_A\}(1 - \lambda_{LA} - \lambda_{LN})\widehat{U} \quad (6.18)$$

Since $\widehat{U} < 0$, $\widehat{W_A} < 0$ if W falls as a consequence of tariff reduction on the imports of M.

— Therefore, the expression for wage-inequality in both (6.2.3.1) and (6.2.3.2) would be

$$\Omega = W_S/W_A$$

Or,

$$\widehat{\Omega} = \widehat{W_S} - \widehat{W_A} \quad (6.19)$$

Wherein an increase (decrease) in Ω means a deterioration (improvement) in wage-inequality. As evident from the above discussions, the degree of substitutability between skilled labour and capital is of utmost importance to determine the fate of sector N and the consequent implication for the unskilled informal wage. Therefore, let us summarise the implications of liberalisation of input trade and the consequent demand-driven rise in skill-premium on the relative wage-inequality for different σ_S in the following table, on the basis of the observations from Figure 6.2 and Figure 6.4:

Table 6.1: Tariff-cut on Imports of M and Directions of Relative Wage-inequality for Rising σ_S

	Case I (Unionised Unskilled Wage in Sector N)	Case II (Flexible Unskilled Wage in Sector N)
μ =0.3	$\widehat{\Omega} > 0$	$\widehat{\Omega} > 0$ and getting magnified
μ =0.7	$\widehat{\Omega} > 0$ and getting magnified	$\widehat{\Omega} > 0$ or < 0, $\widehat{\Omega}$ gets smaller even if >0

6.3 An Extension – Tariff Reduction on Imports of M with Unemployment of Skilled Labour[73]

The reason for inclusion of this section is to demonstrate the readers a more realistic scenario with full employment of unskilled labour but unemployment of skilled labour within the classical general equilibrium model of production and trade with informalisation and non-traded goods. We have incorporated unemployment of skilled labour using efficiency wage hypothesis, in a similar fashion of Gupta and Dutta (2011) where efficiency of a skilled labourer varies positively with its wage rate and the unemployment rate in the skilled labour market.[74] A higher wage rate motivates the skilled worker to work hard; and a higher unemployment rate accentuates the disutility in the presence of a threat of firing and subsequently makes the skilled worker more disciplined.

[73] See Appendix 6.2 for detailed derivations of the key algebraic expressions.
[74] In this context, one may also consult works of Agell and Lundborg (1992, 1995), Gupta (2000), Chaudhuri and Banerjee (2010) and so on.

Table 6.2: Structure of the Extended Model

<table>
<tr><th rowspan="2">No. of Primary Sectors</th><th colspan="4">Sector-definitions</th><th rowspan="2">Skilled Labour Market</th><th rowspan="2">Unskilled Labour Market</th><th rowspan="2">Particulars regarding other Inputs</th><th rowspan="2">Simplifying Assumptions</th></tr>
<tr><th>Name of the Sectors</th><th>Tradability of the Sectors</th><th>(In)Formality of the Sectors</th><th>Factor Usage</th></tr>
<tr><td rowspan="4">4</td><td>A</td><td rowspan="3">Internationally traded</td><td>Informal</td><td>L, T</td><td rowspan="4">There exists unemployment of skilled labour at the rate $v > 0$. Efficiency of a skilled worker, $h = h(W_S, v)$, with $h_1 > 0, h_2 > 0, h_{11} < 0, h_{22} < 0$. Skilled wage per efficiency unit = $\left(\frac{W_S}{h}\right)$.</td><td rowspan="3">Formal Sectors: Unionised labour market, with institutionally given wages set by prior negotiations.</td><td>Capital (K) perfectly mobile between U (with sub-sector I) & S</td><td rowspan="4">Constancy of a_{LN}, a_{MS} & a_{IU} are retained.</td></tr>
<tr><td>U (with sub-sector I)</td><td rowspan="2">Formal</td><td>L, K</td><td>Land (T) is specific to sector A.</td></tr>
<tr><td>S</td><td>L_S, K, M</td><td>Informal Sector(s): Non-unionised labour market with flexible competitive wages.</td><td>There is an advalorem rate of tariff (t)on imports of M.</td></tr>
<tr><td>N</td><td>Internationally non-traded</td><td>Formal/Informal</td><td>L</td></tr>
</table>

Zero-profit condition for sector *S* changes in the following way

$$(W_S/h)a_{SS} + ra_{KS} + P_M{}^*(1+t)a_{MS} = P_S{}^* \qquad (6.4.1)$$

Where (W_S/h) is the effective unit cost employing skilled labour, or nominal skilled wage paid *per efficiency unit*, with $h = h(W_S, v)$ being the efficiency of the skilled worker with $h_1 > 0, h_2 > 0, h_{11} < 0, h_{22} < 0$ (i.e. positive and concave in terms of every argument).

Interestingly, the presence of non-traded final good implies in this framework that the skilled wage *per efficiency unit*, unemployment rate of skilled labour and competitive unskilled wage should simultaneously be affected by any perturbation in non-traded production and equilibrium price of the non-traded final good.

Micro foundations of such an efficiency function are available in several well-known works including Shapiro and Stiglitz (1984), Pisauro (1991), Gupta and Gupta (2001) etc. Minimising (W_S/h) with respect to W_S the following first-order condition of minimisation can be obtained as

$$(\partial h/\partial W_S)(W_S/h) = 1 \qquad (6.20)$$

This is the modified Solow (1979) condition implying that wage elasticity of efficiency is equal to unity in market for skilled labour.

Also we have

$$\widehat{W_S} - \hat{h} = -\varepsilon_v \hat{v} \qquad (6.21)$$

Where $\varepsilon_v = (\partial h/\partial v)(v/h) > 0$ is the elasticity of $h(.)$ with respect to v.

However, totally differentiating the new zero-profit condition for sector *S*, for $\hat{t} < 0$

$$\widehat{W_S} - \hat{h} = -(\theta_{MS}/\theta_{SS})T\hat{t} > 0 \qquad (6.22)$$

Therefore, using Equations (6.21) – (6.22) it is straightforward to obtain

$$\hat{v} = (\theta_{MS}/\varepsilon_v\theta_{SS})T\hat{t} < 0 \qquad (6.23)$$

While differentiating the modified Solow condition and performing a little algebraic manipulation yields (note that $h_{11} < 0$ by the concavity of efficiency function)

$$\widehat{W_S} = [\varepsilon_v h/h_{11}(W_S)^2]\hat{v} > 0 \qquad (6.24)$$

Therefore, skilled wage increases while unemployment rate of skilled labour falls.

The skilled labour endowment equation will now be modified as (with fixed economy-wide physical endowment of skilled labour, $\overline{L_S}$)

$$a_{SS}S = \overline{L_S}(1 - v)h \qquad (6.8.1)$$

Totally differentiating Equation (6.8.1) with Equation (6.7) one can obtain by simple algebraic manipulations and substituting values (note that now $a_{jS} = a_{jS}\left(\frac{W_S}{h}, r\right)$, where $j = S, K$)

$$\widehat{U} = \hat{I} = \{\lambda_{KS}/(1 - \lambda_{KS})\}\left[\left\{\left(\frac{v}{1-v}\right) + (\sigma_S - 1)\varepsilon_v\right\}\hat{v} - \widehat{W_S}\right] \qquad (6.25)$$

And

$$\hat{S} = \widehat{W_S} + \left[-\left(\frac{v}{1-v}\right) - (\sigma_S\theta_{KS} - 1)\varepsilon_v\right]\hat{v} \qquad (6.26)$$

Therefore, if $\sigma_S \geq (1/\theta_{KS})$, $\hat{S} > 0$ and $\widehat{U}\left(= \hat{I}\right) < 0$ as $\widehat{W_S} > 0, \hat{v} < 0$. That is, for a sufficiently higher degree of elasticity of substitution between skilled labour and capital in sector *S*, sector *U* contracts while sector *S* expands.

In this case, it will be appropriate to consider a Gini index of wage-inequality,[75] derived as $\Delta = (W_S/W_A)$, as before:

[75] In the full-employment case considered before, $G = \frac{(\overline{L_S})(\overline{L_U})(\Delta-1)}{(\overline{L_S}+\overline{L_U}-1)(\overline{L_U}+\overline{L_S}\Delta)}$. This can be verified by putting $v = 0$. It can be shown that $(dG/d\Delta) > 0$ in a full-employment model (one can see Gupta and Dutta, 2011), where $\Delta = (W_S/W_A)$, as considered in the earlier scenario. So without any loss of generality, one can take skilled wage relative to the average unskilled wage of the economy as the measure of wage-gap in a full-employment model.

$$G = \frac{\overline{L_S}v\{\overline{L_U}+\overline{L_S}(1-v)\Delta\}+(\overline{L_S})(\overline{L_U})(1-v)(\Delta-1)}{(\overline{L_S}+\overline{L_U}-1)\{\overline{L_U}+\overline{L_S}(1-v)\Delta\}} \quad (6.27)$$

The intuitions are fairly straightforward. A decline in tariff on the imported input M encourage sector S producers to expand by hiring more skilled labour, since skilled labour is specific input used in sector S. This raises wage received by every skilled worker *per efficiency unit*. Consequently, effective rate of unemployment of skilled labour also falls. Thus, there are two effects operating on the efficiency of each skilled worker employed: one is the positive impact of higher money wage received; the other is a negative effect due to decline in the effective rate of unemployment. Therefore, the producers in sector S can now economise production costs by paying higher money wages only to the efficient skilled workers and replacing the relatively less efficient workers by cheaper capital. However, this is possible only if the substitutability between capital and skilled labour is sufficiently high. In that case, sector S will expand but sector U and I contract by releasing additional units of capital to sector S.

Likewise the full-employment scenario, in case of production under unionised wage, the expression in Equation (6.15) changes to

$$\widehat{N} = \left(1 - \left({}^{\mu}/_{1-\lambda_{KS}}\right)\right)\begin{bmatrix} \{h/h_{11}(W_S)^2\} - \\ \left({}^{v}/_{1-v}\right) \\ \left({}^{\lambda_{KS}}/_{1-\lambda_{KS}}\right)\sigma_S(1-\theta_{KS}) \end{bmatrix}\varepsilon_v(\theta_{MS}/\varepsilon_v\theta_{SS})T\hat{t} \quad (6.28)$$

Since $h_{11} < 0$, the bracketed expression is negative. So Equation (6.28) yields $\widehat{N} \lessgtr 0$ when $\hat{t} < 0$ iff $\mu \gtrless (1-\lambda_{KS})$. Therefore, as in the full-employment case, under contractual wage in the finished non-tradable producing sector (N), the resultant impact on the production of N depends on the magnitude of μ (and/or equivalently, on $(1-\mu)$), or in other words, on the relative domestic demand for the non-tradable by urban population working in vertically integrated sector U (and sector I) and/or sector S. As discussed above, tariff cut on imports of M creates more job-opportunities for the skilled workforce, at higher wages per efficiency units, but only to the relatively more productive workers from the unemployment pool. Thus, Equation (6.28) states that if the

relative share of urban income from the vertically integrated sector U spent on N is sufficiently small ($\mu < (1 - \lambda_{KS})$), the resultant demand for the finished non-tradable will be guided by the increase in demand for the urban population working in the skill-intensive sector at higher effective wages.

Substituting $\widehat{N}$ in Equation (6.13), one can solve for $\widehat{W}$ under the scenario when the production in sector N is organised in a unionised unskilled labour market. Assigning λ_{KS} the benchmark value of 0.4 as before,[76] μ =0.3 and μ =0.7 mimic exactly the similar trajectories for the changes in non-traded production and informal wage as in Figure 6.3 (however, non-linearity would be observed due to the presence of quadratic terms in the expressions).

In case of non-traded production with flexible unskilled wage, Equation (6.28) is changed to

$$\theta_{LN}\widehat{W} + \widehat{N} = \left(1 - \left({}^{\mu}/_{1-\lambda_{KS}}\right)\right)\begin{bmatrix} \{h/h_{11}(W_S)^2\} - \left({}^{v}/_{1-v}\right) \\ \left({}^{\lambda_{KS}}/_{1-\lambda_{KS}}\right)\sigma_S(1-\theta_{KS}) \end{bmatrix}\varepsilon_v(\theta_{MS}/\varepsilon_v\theta_{SS})T\hat{t} \tag{6.29}$$

Solving this equation together with Equation (6.13), one can solve for $\widehat{W}$ under the scenario when the production in sector N is organised in informal (non-unionised) unskilled labour market. As in the full-employment scenario, there is an additional supply-effect that depresses informal unskilled wage and thereby P_N and thus adds to the ambiguity in non-traded production as well.

Therefore, as before, the effect on real income of the urban population and the demand for the non-tradable will be ambiguous. Consequently, the direction of change in competitive informal wage (W) and thereby the direction of change in Gini will also be ambiguous in this extended model as well for either of the scenarios – with unionised unskilled labour market in sector N and with flexible unskilled wage in sector N.

[76] See Table A1.1 in Appendix.

Therefore, in qualitative terms, the resultant implications on unskilled informal wage and the relative income-inequality are very similar to the results obtained under the full-employment model considered in Section 6.2, which demonstrates the robustness of the results obtained under the full-employment model.

6.4 Concluding Remarks

Growth acceleration in skill-intensive sectors has been one of the most prominent features of the liberalisation experience in India. On the other hand, liberalisation has facilitated import of capital goods and thus the foreign technology embedded within those imported inputs. To utilise those inputs, or equivalently, to use the foreign technology embedded within those inputs in the most effective way, demand for additional skills has been generated. This leads to increased demand for skilled workforce driving their wages up. This essay explores the general equilibrium impact of such trade-induced growth in the skill-intensive sector on informal sector wages and employment and most importantly, how this impact is mediated through the existence of finished non-tradable and the corresponding domestic demand-supply forces. The numerical analysis performed in this essay also re-establishes the claim put forward by Marjit and Acharyya (2003) that the organisation of production of the non-traded final good, with varying elasticities of factor substitution in skill-intensive and agricultural production respectively, is indeed important in quantification of the impact on unskilled informal wage and subsequently, on the degree of wage-inequality. Therefore, this essay challenges the view that the relative wage-inequality in a DC like India with rigid organised sector labour market has unequivocally been governed only by the increase in the skilled wages. The sector-level general equilibrium approach adopted in this essay has not only been able to enlighten the role of various degrees of factor substitutability in production organised in different sectors, but also to highlight the role of non-traded consumption goods in determining the supply of unskilled labour to the informal (unorganised) sector and consequently the implication on competitive unskilled wage and subsequently, the direction of

the relative wage-gap. Finally, an extended framework with unemployment of skilled labour has also been presented that effectively yields similar conclusions obtained under full-employment model and thus demonstrates the robustness of the full-employment results. Therefore, the relationships and results are indeed important to formulate policies aiming at betterment of the position of the unskilled poor workers. However, one future extension of this exercise could be introducing skill-formation and capital-adjustment costs into the basic full-employment static general equilibrium model under consideration.[77]

Appendix 6.1: The General Equilibrium Structure at a Glance

[77] This is now work in progress.

Table A6.1: Full-employment Model

VARIABLES			KEY EQUATIONS DESCRIBING FULL-EMPLOYMENT MODEL WITH UNIONISED UNSKILLED LABOUR MARKET IN SECTOR N		KEY EQUATIONS DESCRIBING FULL-EMPLOYMENT MODEL WITH FLEXIBLE UNSKILLED WAGE IN SECTOR N		SIMPLIFYING ASSUMPTIONS
ENDOGENOUS	EXOGENOUS	POLICY-PARAMETER(S)	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	CONSTANCY OF a_{IU} & a_{MS}
$W, W_S, R, r, P_I, P_N, A, U, S, I, N$	$P_A^*, W^*, P_U^*, P_M{}^*, P_S{}^*\overline{T}, \overline{K}, \overline{L_S}, \overline{L}$	t	EQUATIONS (6.1) – (6.5)	EQUATIONS (6.6) – (6.11)	EQUATIONS (6.1) – (6.4), (6.5.1)	EQUATIONS (6.6) – (6.11)	

Table A6.2: Model with Unemployment of Skilled Labour

VARIABLES			KEY EQUATIONS DESCRIBING MODEL WITH UNIONISED UNSKILLED LABOUR MARKET IN SECTOR N		KEY EQUATIONS DESCRIBING FULL-EMPLOYMENT MODEL WITH FLEXIBLE UNSKILLED WAGE IN SECTOR N		SIMPLIFYING ASSUMPTIONS
ENDOGENOUS	EXOGENOUS	POLICY-PARAMETER(S)	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL EMPLOYMENT/UTILISATION OF FACTORS)	CONSTANCY OF a_{IU} & a_{MS}
W, W_S $v, R, r, P_I, P_N, A, U, S, I, N$	$P_A^*, W^*, P_U^*, P_M{}^*, P_S{}^*\overline{T}, \overline{K}, \overline{L_S}, \overline{L}$	t	EQUATIONS (6.1) – (6.3), (6.4.1), (6.5), (6.20)	EQUATIONS (6.6) – (6.7), (6.8.1), (6.9) – (6.11)	EQUATIONS (6.1) – (6.3), (6.4.1), (6.5.1), (6.20)	EQUATIONS (6.6) – (6.7), (6.8.1), (6.9) – (6.11)	

Appendix 6.2: Detailed Algebraic Derivations

(a) The Full-employment Model:

Total differentiation of Equation (6.4) allows one to write

$$(W_S a_{SS}/P_S^*)(dW_S/W_S) + (W_S a_{SS}/P_S^*)(da_{SS}/a_{SS}) + (r a_{KS}/P_S^*)(dr/r) + (r a_{KS}/P_S^*)(da_{KS}/a_{KS}) = -[t/(1+t)][{P_M}^*(1+t)a_{MS}/P_S^*](dt/t) \quad (6.A.1)$$

Since, $dP_S^* = 0$.

Using the 'hat' algebra of Ron Jones (1965, 1971), one can write Equation (6.A.1) as

$$\left(\theta_{SS}\widehat{W_S} + \theta_{KS}\hat{r}\right) + (\theta_{SS}\widehat{a_{SS}} + \theta_{KS}\widehat{a_{KS}}) = -\theta_{MS}T\hat{t} \quad (6.A.2)$$

Cost-minimisation by the competitive producers in sector S leads to the condition that the weighted average of changes in unit factor coefficients (with the weights being the cost-share of each factor; e.g., $W_S a_{SS}/P_S^*$ is the cost-share of skilled labour in sector S) along the unit isoquant in each sector must vanish near the cost-minimisation point. This implies an iso-cost line is tangent to the unit isoquant, which is algebraically expressed as

$$\theta_{SS}\widehat{a_{SS}} + \theta_{KS}\widehat{a_{KS}} = 0 \quad (6.A.2.1)$$

This is known as 'envelope condition'.

Substitution of Equation (6.A.2.1) into Equation (6.A.2) yields

$$\theta_{SS}\widehat{W_S} + \theta_{KS}\hat{r} = -\theta_{MS}T\hat{t} \quad (6.A.3)$$

Since r gets already determined from Equations (6.2)-(6.3) in the text, r does not change as a consequence of tariff reduction on the imports of M. Therefore, substituting $\hat{r} = 0$ in Equation (6.A.3) it is straightforward to obtain $\widehat{W_S}$ as in Equation (6.12) of the main text.

By the definition of elasticity of factor substitution in sector S,

$$\sigma_S \widehat{W_S} = \widehat{a_{KS}} - \widehat{a_{SS}} \tag{6.A.4}$$

Solving Equation (6.A.4) and Equation (6.A.2.1) simultaneously we obtain (note that $\theta_{SS} + \theta_{KS} = 1$)

$$\widehat{a_{SS}} = -\sigma_S \theta_{KS} \widehat{W_S} \tag{6.A.5}$$

Totally differentiating Equation (6.8), one can obtain

$$(da_{SS}/a_{SS}) + (dS/S) = d\overline{L_S}/\overline{L_S} = 0 \tag{6.A.6.1}$$

Or,
$$\hat{S} = -\widehat{a_{SS}} \tag{6.A.6.2}$$

Therefore, substituting $\widehat{a_{SS}}$ from Equation (6.A.5) into Equation (6.A.6.2) we obtain

$$\hat{S} = \sigma_S \theta_{KS} \widehat{W_S} \tag{6.A.7}$$

Since $\widehat{W_S} > 0$ when $\hat{t} < 0$, $\hat{S} > 0$. ■

Similarly, totally differentiating Equation (6.6) we obtain

$$\hat{A} = -\widehat{a_{TA}} \tag{6.A.8}$$

Therefore,

$$\widehat{L_A} = \widehat{a_{LA}} + \hat{A} = \widehat{a_{LA}} - \widehat{a_{TA}} \tag{6.A.9}$$

Just like before, using the definition of elasticity of factor substitution in sector A we obtain

$$\widehat{a_{LA}} - \widehat{a_{TA}} = -\sigma_A\left(\widehat{W} - \hat{R}\right) \tag{6.A.10}$$

But totally differentiating the zero-profit condition in Equation (6.1) and applying envelope condition for competitive producers in sector A we obtain

$$\theta_{LA}\widehat{W} + \theta_{TA}\hat{R} = 0 \tag{6.A.11}$$

Since, $\theta_{LA} = (1 - \theta_{TA})$, simple rearrangement of terms in Equation (6.A.11) yields

$$\left(\widehat{W} - \hat{R}\right) = \widehat{W}/\theta_{TA} \tag{6.A.12}$$

Substituting $\left(\widehat{W} - \hat{R}\right)$ from Equation (6.A.12) into Equation (6.A.10), it is easy to obtain

$$(\widehat{a_{LA}} - \widehat{a_{TA}}) = -\left(\sigma_A \widehat{W}/\theta_{TA}\right) \tag{6.A.13}$$

This is the same expression as in Equation (6.16). ■

Now totally differentiating the full-employment condition for unskilled labour in Equation (6.10) we obtain

$$\left(\frac{Aa_{LA}}{\bar{L}}\right)[(dA/A) + (da_{LA}/a_{LA})] + \left(\frac{Ia_{LI}}{\bar{L}}\right)(dI/I) + \left(\frac{Ua_{LU}}{\bar{L}}\right)(dU/U) + \left(\frac{Na_{LN}}{\bar{L}}\right)(dN/N) = 0 \tag{6.A.14}$$

Since (W^*, r) are unchanged and a_{IU} is constant, $\widehat{a_{LI}} = \widehat{a_{KI}} = \widehat{a_{LU}} = \widehat{a_{KU}} = 0$. Also, $\widehat{a_{LN}} = 0$ by the simplifying assumption we have made and total endowment of unskilled labour $\bar{L}$ is parametrically given.

Rewriting Equation (6.A.14) as

$$\lambda_{LA}\left(\hat{A} + \widehat{a_{LA}}\right) + \lambda_{LI}\hat{I} + \lambda_{LU}\hat{U} + \lambda_{LN}\hat{N} = 0 \tag{6.A.15}$$

Using Equations (6.9.1) and (6.16), Equation (6.A.15) yields Equation (6.13) in the text (note that $\lambda_{LI} + \lambda_{LU} = 1 - \lambda_{LA} - \lambda_{LN}$).

Similarly, totally differentiating Equation (6.7) and utilising Equations (6.9.1) and (6.A.4) we obtain

$$(\lambda_{KI} + \lambda_{KU})\hat{U} = -\lambda_{KS}\sigma_S\widehat{W_S} \tag{6.A.16}$$

Substituting for $\widehat{W_S}$ from Equation (6.12) into Equation (6.A.16) it is straightforward to obtain $\hat{U} = \hat{I}$ as in Equation (6.14). ■

Totally differentiating Equation (6.11) in the text, we obtain

$$\mu\hat{U} + (1-\mu)\hat{S} = \widehat{P_N} + \hat{N} \qquad (6.A.17)$$

In case of unionised wage in the non-traded sector N, $\widehat{P_N} = 0$ that yields Equation (6.15) while in case of flexible wage in sector N, $\widehat{P_N} = \theta_{LN}\widehat{W}$ yielding Equation (6.15.1) in the text. ■

(b) Extended Model with Unemployment of Skilled Labour:

Solving Equation (6.20), we have

$$W_S = W_S(v) \text{ with } (dW_S/dv) < 0 \qquad (6.A.18)$$

Optimum efficiency of skilled workers is then given by

$$h^* = h^*[W_S(v), v] \qquad (6.A.19)$$

Thus, totally differentiating the modified Solow (1979) condition in Equation (6.20) we have

$$(\partial W_S/\partial v) = (h_2/W_S h_{11}) < 0 \qquad (6.A.20)$$

Totally differentiating the expression for optimum efficiency of skilled labour in Equation (6.A.19) (assuming that the function is of Cobb-Douglas type) and substituting for $(\partial W_S/\partial v)$ from Equation (6.A.20), we have

$$(dh/dv) = (h_2/W_S h_{11})(h_1 + W_S h_{11}) < 0 \qquad (6.A.21)$$

Now differentiating both sides of Equation (6.20) we have

$$\frac{\partial^2 h}{\partial W_S^2}\frac{dW_S}{W_S}\frac{(W_S)^2}{h} + \frac{\partial h}{\partial W_S}\frac{dW_S}{W_S}\frac{W_S}{h} - \frac{\partial h}{\partial W_S}\frac{W_S}{h^2}\left[\frac{\partial h}{\partial W_S}\frac{dW_S}{W_S}W_S + \frac{\partial h}{\partial v}\frac{dv}{v}v\right] = 0 \qquad (6.A.22)$$

Using Equations (6.20) and (6.A.22) we have

$$h_{11}\frac{(W_S)^2}{h}\widehat{W_S} - \varepsilon_v\hat{v} = 0 \qquad (6.A.23)$$

Solving Equation (6.A.23) it is now straightforward to obtain $\widehat{W_S}$ as in Equation (6.24). ■

Totally differentiating Equation (6.8.1) (note that now $a_{jS} = a_{jS}\left(\frac{W_S}{h}, r\right)$, where $j = S, K$)

$$\widehat{a_{SS}} + \hat{S} = \hat{h} - \hat{v}\left(\frac{v}{1-v}\right) \qquad (6.A.24)$$

Similarly total differentiation of Equation (6.7) and substituting from Equation (6.A.24) yields

$$\lambda_{KS}\left\{(\widehat{a_{KS}} - \widehat{a_{SS}}) + \hat{h} - \hat{v}\left(\frac{v}{1-v}\right)\right\} + (\lambda_{KI} + \lambda_{KU})\hat{U} = 0 \qquad (6.A.25)$$

Since now we have $(\widehat{a_{KS}} - \widehat{a_{SS}}) = \sigma_S(\widehat{W_S} - \hat{h})$, therefore, Equation (6.A.25) gives Equation (6.25) in the text. ■

Similarly, substituting $\widehat{a_{SS}} = \sigma_S\theta_{KS}(\widehat{W_S} - \hat{h})$ in Equation (6.A.24) and a little algebraic manipulation yields Equation (6.26) in the text. ■

Appendix 6.3

Table A6.3: Parameter Values for Sensitivity Analyses

Parameters	Description	Values
θ_{LN}	Cost-share of labour in sector N	0.5
θ_{LA}	Cost-share of labour in sector A	0.6
θ_{TA}	Cost-share of land-capital in sector A	0.4= $(1 - \theta_{LA})$
θ_{SS}	Cost-share of skilled-labour in sector S	0.6
θ_{MS}	Cost-share of imported input in sector S	0.1 (constant)
θ_{KS}	Cost-share of capital in sector S	0.3
λ_{KS}	Share of capital used in sector S	0.4
λ_{LN}	Share of unskilled labour employed in sector N	0.3
λ_{LA}	Share of unskilled labour employed in sector A	0.5

σ_S	Elasticity of substitution between skilled labour and capital in sector S	[1.5,3.7,100]
σ_A	Elasticity of substitution between labour and land-capital in sector A	$[0.6, 1.2, 3]$

Source: Abraham 2010, Berman et al. 2005, Marjit and Kar 2008, Marjit et al. 2011, Seker & Rodriguez-Delgado (2011), Broda et al. (2006) (for the ranges of σ_S) and Golder et al. (2014) (for ranges of σ_A).

Chapter 7 – Concluding Remarks

In this thesis, I have attempted to reconcile seemingly puzzling concurrent outcomes observed in post-liberalization, post-reform India, such as: 'jobless' pattern of growth in urban formal sector, increasing informalisation, volatile income (wage) inequality and poverty in the presence of dualism in domestic factor markets. This thesis illuminates different channels through which liberalised trade policies can affect differently the organisation of production in different sectors and subsequently percolate to the relatively larger share of the workforce, employed in the agricultural or non-agricultural informal sector with wage incomes below or just above the poverty line. The novelty of this thesis is to bring together salient features of a developing dual economy like India, namely the dualism observed in domestic factor markets and co-existence of internationally non-traded goods, within the ambit of general equilibrium framework that captures structural features of trade and production patterns for a developing country (DC hereafter) like India. This thesis has also demonstrated credible scenarios in which increasing wage–wage and rental–wage disparities can co-exist with informalisation and/or retarded formal sector job creation following liberalised trade policies. Our results are consistent both with the within industry as well as between industry shifts in employment compositions (from formal to informal).

Agricultural dualism and retardation in job creation in the urban area are the two common symptoms of an agro-dominated developing dual economy like India. The small and marginal farmers in the rural area produce internationally non-traded agricultural products that can either be consumed domestically, or utilised as intermediate inputs to produce agro-based industrial products (such as use of locally produced fibre in Indian textile industries). Existing theoretical literature in this context (discussed in Chapter 2), namely Hazari and Sgro (1991) and Chaudhuri (2007), considered only one side of the coin, that is the scenario where the backward agricultural sector is engaged in producing finished non-tradable. Chapter 3 incorporates the existence of non-

traded intermediate input, rather than the finished non-tradable, to examine the consequences of not only the removal of protectionist policy but also of structural reform policy, namely deregulating the organised sector labour market, on the competitive rural wage and the pool of retrenched workers from the urban agro-based manufacturing industries with unionised labour market. Interestingly, the analysis in this essay demonstrates that labour market reforms, contrary to the conventional wisdom, may raise the competitive wage. Such findings illuminate the insight that owing to the increased competition during the liberalised regime, the labour laws have been enfeebled with greater substitution from labour to capital that generates the opportunity of the organised sectors' employers to pay their workers at a rate closer to the market-determined one, which, in turn, would make easier for these employers to fire the relatively less productive workers without much protest, since the wage-differences to the outside options has been reduced.

Chapter 4 takes up the challenge to provide an analytical framework for an agro-dominated DC like India with Agriculture and industries aided by Special Economic Zones (SEZs). The purpose of such theoretical framework serves two crucial purposes. The first is to evaluate the efficacy of SEZs to promote industrial development, without hurting agriculture, in the face of a liberalised investment policy. On the other hand, such modelling exercise can also help to understand implications on rural workers of this policy in terms of real competitive wage and employment conditions. The essay, therefore, uses the three-sector Harris-Todaro type general equilibrium model with the SEZ sector characterised by increasing returns to scale (IRS) sector and an imperfectly competitive market; in order to enlighten the role of external economies generated by the SEZ sector in driving the results. The results obtained show that by incentivising multinationals to relocate investment to the SEZ sector, through easing the entry criteria of FDI, for a sufficiently higher degree of scale economies in the IRS sector (SEZ), both SEZ and agricultural sectors may expand simultaneously. The magnitude of urban unemployment may fall, albeit the workers in general will be worse-off due to reduction in the wage income, in the absence of any supportive government intervention. National

income of the economy may increase and export by the SEZ sector may rise simultaneously, given a negligible income-elasticity of demand for the SEZ-good. Therefore, this policy essentially indicates a mixed outcome where the economy gains from the perspective of 'growth effect' but in the absence of any government intervention, the policy fails to help the rural workers and the 'land-losers'; thereby calls for government support for displaced people and rural workers (such as wage-subsidy policy).

The most salient feature of a DC including India has been the coexistence of formal and informal sectors. Liberalisation in India has contributed to a productivity boom in the formal (service) sectors. Given the consistency with the empirical evidence that poor informal workers must be employed for survival, it is certainly appropriate to use a full-employment model (at least for unskilled informal workers) in a general equilibrium setting similar to that considered in Marjit (2003), Marjit and Maiti (2005), Marjit et al. (2007) discussed in Chapter 2. Chapter 5 traces out the implications of technological progresses in the urban formal sectors on the wages and employment conditions of urban informal workers. Therefore, the analysis in Chapter 5 helps assess wellbeing of the poor urban informal workers. The formal sectors typically employ relatively high-skilled workers who enjoy higher contractual wage, whereas producers in the urban informal sectors hire relatively low-skilled workers at market-determined wages. On the top of that, the informal capital (credit) market is imperfect, while the formal credit market is perfectly competitive. The salient feature of such dualism in the capital market is the fragmented interest rate structure, featuring lower allocation of loanable capital (credit) to the informal sector at a higher relative rental rate. This, in turn, implies that a part of the formal credit always enters the informal market and hence the two credit markets are not fully distinguishable or separable. In sum, the research has successfully highlighted the importance of credit-product inter-linkage between the urban formal and informal non-agricultural industries in order to trace out the implications of trade-induced productivity surge in the formal sectors on the wages and employment conditions of the

economically marginalised urban workers working under informal arrangements.

In the final chapter, a multi-sector full-employment general equilibrium model has been presented that serves as an extended version of Marjit et al. (2007) with additions of skill-intensive sector and finished non-tradable producing sector; in order to illustrate the mechanism how growth, induced by tariff reform on the imports of capital-intensive inputs in the skill-intensive sector, is mediated to the informal sector wages and employment through the existence of finished non-tradable and the corresponding domestic demand-supply forces. The sector-level general equilibrium approach adopted in this essay has not only been able to enlighten the role of various degrees of factor substitutability in production organised in different sectors, but also to highlight the role of non-traded consumption goods in determining the implication on competitive unskilled informal wage and subsequently, the direction of the relative wage-gap. Therefore, this essay challenges the view that the relative wage-inequality in a DC like India with rigid organised sector labour market has unequivocally been governed only by the increase in the skilled wages. The conclusions obtained under full-employment model remain similar to those obtained under the extended framework with unemployment of skilled labour, which, therefore, demonstrates the robustness of the full-employment results.

There is, however, further scope to extend the models presented in this thesis in different directions. For example, in the informal credit market there are segments where the moneylenders compete with each other. Therefore, it would be more realistic to model informal credit market considered in Chapter 5 as monopolistically competitive or fragmented oligopolistic.[78] Moreover, skill-formation and capital-adjustment costs should be introduced into the model presented in Chapter 6 with skilled-unskilled divisions. In the full-employment models presented in Chapters 5 and 6, one may model wage-bargaining explicitly and evaluate the consequence of reforming the organised

[78] One may consult Basu and Bell (1991), Mishra (1994) and Basu (1998) in this context.

labour market in the framework under consideration. However, these issues have been avoided primarily for the sake of analytical tractability and making the models friendlier for the numerical analyses performed, to identify the key channels for general equilibrium impacts.

Moving to the issue of empirical testability of the key relationships identified in the models presented in Chapters 5 and 6, one needs to narrow down attention to longitudinal sector (industry) specific data for formal and informal production activities. However, such empirical analysis is presently beyond the scope of this thesis, primarily due to the unavailability of suitable and adequate data.[79] Moreover, as discussed in footnote 6 of Chapter 5, it is another challenge to construct any direct measure of capital (credit) allocation between formal and informal industries, using the secondary survey data on informal sector available from National Sample Surveys (NSS). It is also extremely difficult to provide proper estimates for elasticities of factor substitution in different industries for formal and informal production activities. Turning back to the SEZ issue discussed in Chapter 4, I lack access to any longitudinal data on utilised foreign direct investment, exports and industrial output by foreign-invested enterprises within the location-specific SEZs of India; except some scattered reports available in the Fact Sheets on SEZs (Ministry of Commerce and Industries, Government of India). Therefore, I could not perform any suitable empirical analysis that corroborates the theoretical analysis. It has also been beyond the scope of this research to collect any time-series or longitudinal data on backward agricultural or rural non-farm sectors. However, all these issues have been recognised and identified as future research agenda.

However, this thesis delivers tractable theoretical models and plausible predictions at hand that should rejuvenate empirical testability of liberalisation-structural change-welfare (in terms of wage-employment conditions) nexus. What have been identified here are the avenues through which trade can impact on real informal wage with dual labour market. One crucial channel is, of course, existence of internationally non-traded goods.

[79] The available limited sample has been, however, utilised to provide a set of stylised facts to motivate the key research question in Chapter 5.

Although we have assumed competition (perfect competition and monopolistic competition, where the latter has been assumed in Chapter 4 within the SEZ-sector) in product markets, rather than more realistic assumptions of oligopoly and strategic behaviour, the general equilibrium models of trade and production presented in this thesis have been able to incorporate the salient features of a developing dual economy like India including large agricultural and non-agricultural informal sector(s), dualistic factor markets and non-traded activities in tractable manner.

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