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Opening the Pandora's Box – Liberalised Input Trade and Wage Inequality with Non-traded Goods and Segmented Unskilled Labour Markets

By

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Abstract

This paper, using a full-employment general equilibrium model for a developing Asian country like India 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 model 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. Therefore, the relative wage inequality in a developing Asian country like India with dual labour markets has not been governed only by the increase in the skilled wages.

Keywords: Input trade reform; non-traded goods; informal wage; informal employment; wage inequality; general equilibrium; India.

JEL Classification: F11; F13; J31; J46.

I. INTRODUCTION

India's service sector, growth and contribution of this sector to GDP and its cumulative share in trade and investment have drawn universal attention. India's liberalisation leads to a shift from agriculture to the services sector, as opposed to other countries, where economic growth has contributed to a shift from agriculture to industries. However, the share of service sector products in GDP has also increased with rise in per capita income. Within the service sector, business services (including software and information-technology (IT) related services), banking, and communications exhibited a growth, on average, at more than 10 percent per year during the 1990s; while this is also the sector showing retardation in unskilled employment (Kotwal et al. 2011). However, the most obvious feature of service sector growth has been the outstanding expansion of its exports that have been amplified nearly six times faster than world exports of services (Chanda 2007). Eichengreen and Gupta (2010) conclude that growing share of services in the total exports is one of the primary drivers of growth in the services sector.

India's share in world trade in services has improved from less than one percent to over 3% between 1980 and 2010, while its share in goods trade stayed constant at one per cent during the same period. India is among the top ten exporters and importers of services among WTO member countries. In 2011, India has been the eighth largest exporter and seventh largest importer of services (International Trade Statistics 2012). 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 (Panagariya 2004; Kotwal et al. 2011).

Against such backdrop, this paper identifies the avenues through which trade-induced productivity surges in the skill-intensive service sector can impact on the poor unskilled workers, in terms of wage-employment conditions, during the liberalised regime under the WTO in India. The relationships suggested by the theoretical model have subsequently been quantified using numerical analyses.

India is a proponent of liberalising services trade in the recent WTO's Doha Round of negotiations and in its free trade agreements (FTAs). In fact, India prefers to sign comprehensive FTAs, which include liberalisation of services, investment, trade

simplification and cooperation along with liberalisation of trade in goods. India is also willing to accept liberal commitments in the purchase of imported computers. 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 under the WTO during India's 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. Subsequently, an important aspect of service sector liberalisation under the WTO on India is increased outsourcing of skill-intensive production in the service sector facilitated by reduction in barriers to trade on the imported capital goods.

However, the welfare implication of such trade liberalisation in the skill-intensive service sector on the poor unskilled workers is ambiguous. This is because, 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 households capable of supplying most unskilled labour cannot get direct benefit from trade liberalisation or global integration of a particular sector. The benefit, if any, tends to be indirect, through backward linkages in production and consequent demand. Therefore, in order to properly understand the underlying mechanism, one needs to explore an appropriate general equilibrium model that matches with the empirical regularity and considers explicitly all associated aspects in organisation of production and factor distribution issues for the specific type of small, open economy like India.

One problem is labour-market rigidity as observed typically in the formal industrial sectors of India (Topalova 2010; Besley and Burgess 2004) that hinders free mobility of unskilled and skilled labourers across sectors. Along with this, one should never neglect the role of the informal sector, which is the unregulated part of the economy where minimum wage laws and labour regulations are either totally absent or weakly implemented. Since developing country (DC hereafter) like India is 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 and informalisation, should be the major reason behind the relatively jobless patterns of growth observed in India during the recent years (Razmi 2009).

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 non-tradable. Consequently, the general equilibrium implications on the informal wage and employment would be dependent on the production and cost structure of the finished non-tradable sector.

The general equilibrium framework used in this paper 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 paper can be viewed as a generalisation of Marjit et al. (2007) with additions of skill-intensive sector and non-traded final good producing sector.

II. THE MODEL

Let us consider a small, open dual economy comprising of four sectors: sector A, vertically integrated sector U $(\&\ \text{sub} - \text{sector}\ I)$, 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).[1]

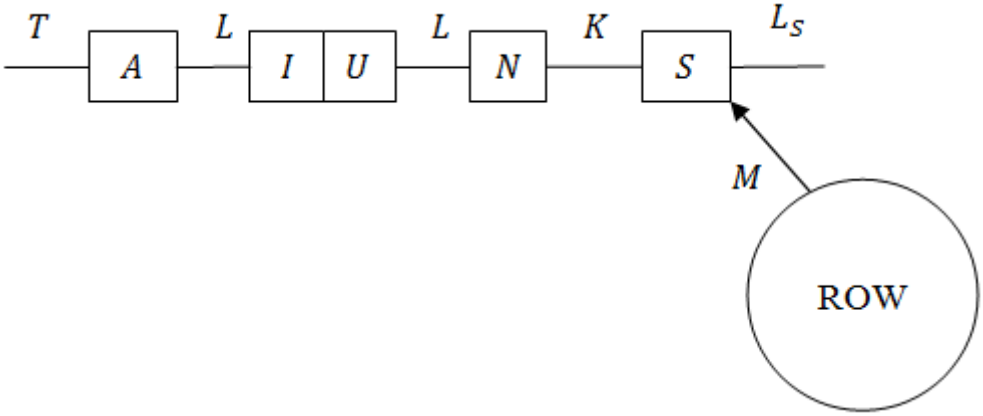
[1] The input 'land-capital' broadly includes land and other durable assets. See Bardhan (1972) and Mukherjee (2012, 2014) in this context.

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[2], 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)[3]. Consistent with empirical evidence[4] I 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. [5]

Sector N produces finished non-tradable (internationally) goods using only unskilled labour (L). Similar to Acharyya and Marjit (2000), Marjit and Acharyya (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.

Figure 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

[2] 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. See Mukherjee (2016) in this context.
[3] Examples of such imported inputs include computer data storage units, automatic data processing machines and so on.
[4] See for example Alvarez and Lopez (2005), Lopez (2015) and so on.
[5] This should be interpreted here as the *advalorem* equivalence of tariff and non-tariff barriers (NTBs).

working in the organised labour markets of the formal sectors receive contractual money wages at the rate W^*, determined owing to prior unionised negotiation[6], 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.

1. 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 one observes existence of higher institutionally given nominal wage. Therefore, only the agricultural sector is modelled as the informal sector[7] 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.

[6] 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.

[7] See footnote 1 in this context.

$$Wa_{LA} + Ra_{TA} = P_A^* \quad (1)$$

$$W^* a_{LI} + r a_{KI} = P_I \quad (2)$$

$$W^* a_{LU} + r a_{KU} + P_I a_{IU} = P_U^* \quad (3)$$

$$W_S a_{SS} + r a_{KS} + P_M{}^* (1 + t) a_{MS} = P_S{}^* \quad (4)$$

$$W^* a_{LN} = P_N \quad (5)$$

I assume that

(i) Per-unit requirement of the non-traded intermediate input in the production of sector U (a_{IU}) is constant

and

(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

$$a_{TA} A = \bar{T} \quad (6)$$

$$a_{KI} I + a_{KU} U + a_{KS} S = \bar{K} \quad (7)$$

$$a_{SS} S = \overline{L_S} \quad (8)$$

Domestic demand-supply equality condition in the market for non-traded intermediate input implies

$$a_{IU} U = I \quad (9)$$

Or,

$$\hat{U} = \hat{I} \quad (9.1)$$

Where the ^ indicates proportional change. The unskilled labour-endowment equation is

$$a_{LA}A + a_{LU}U + a_{LI}I + a_{LN}N = \bar{L} \quad (10)$$

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)

$$\alpha({P_U}^*U + {P_S}^*S) = (1-\alpha)P_N N \quad (11)$$

Noting that here 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 (2) and (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 (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 (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 (1) and full employment condition for land in Equation (6).

i. Comparative Static Exercise – Tariff Reduction on Imported Intermediate Input[8]

The key comparative static exercise in this paper 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 (2) and (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:

[8] Detailed derivations of key algebraic expressions have been put aside in Appendix 2.

$$\widehat{W_S} = -(\theta_{MS} T \hat{t}/\theta_{SS}) > 0, \text{ since } \hat{t} < 0 \quad (12)$$

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 $T = t/(1+t)$.

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,

$$\frac{\sigma_A \lambda_{LA}}{\theta_{TA}} \widehat{W} = (1 - \lambda_{LA} - \lambda_{LN})\widehat{U} + \lambda_{LN}\widehat{N} \quad (13)$$

Where λ_{ji} denotes share of the j^{th} input in the production of the i^{th} good (for example, $\lambda_{LA} = (A a_{LA}/\bar{L})$) and σ_A denotes elasticity of substitution between unskilled worker and land-capital in the agricultural sector. 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.

$$\widehat{U} = \hat{I} = [\sigma_S \lambda_{KS}/\theta_{SS}(1 - \lambda_{KS})]\theta_{MS} T \hat{t} < 0 \quad (14)$$

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

$$\widehat{N} = \mu\widehat{U} - \theta_{MS}T\hat{t}\,\frac{\sigma_S(1-\mu)\theta_{KS}}{\theta_{SS}} \qquad (15)$$

Where $\mu = \{\alpha P_U^* U/(1-\alpha)P_N N\}$ and $(1-\mu) = \{\alpha P_S^* S/(1-\alpha)P_N N\}$ and σ_S is the elasticity of substitution between skilled labour and capital in the skill-intensive sector S. 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 (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.

ii. Quantitative Analysis

Figure 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

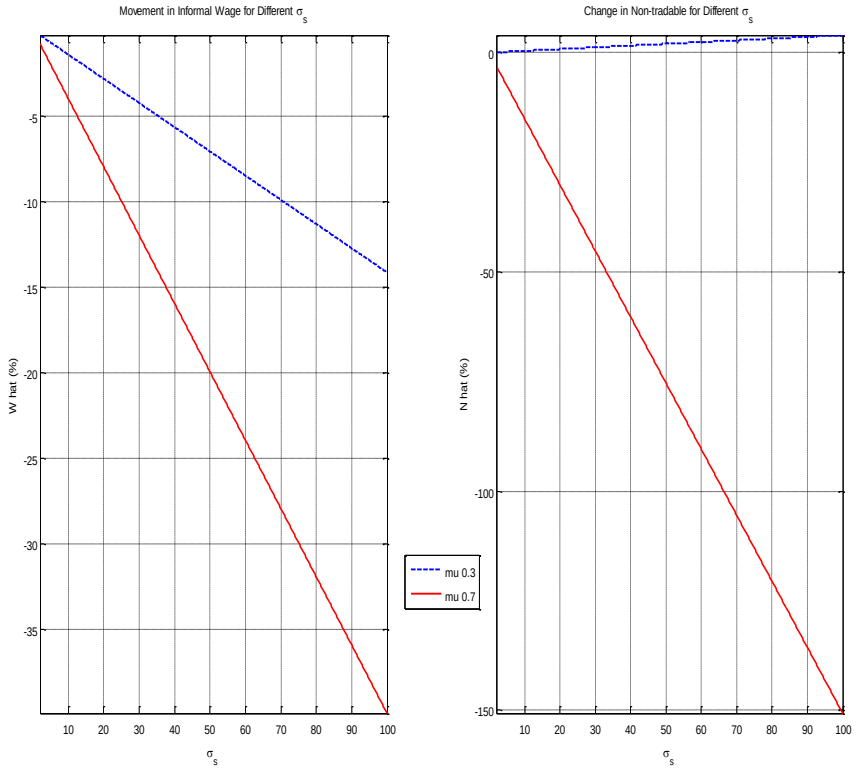


Figure 2 quantifies in the two panels respectively the changes in the production of non-tradable N and the consequent movement in informal wage for different values of σ_S in two different scenarios: $\mu = 0.3$ and $\mu = 0.7$, owing to a reduction in tariff on the imported input by 24 percentage points (as estimated by Goldberg et al. 2010 during 1989-1997 in India).[9] 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.

μ =0.3 yields 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 one should 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.

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.

[9] The benchmark parameter values used for the sensitivity analysis are presented in Table A3 in Appendix.

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.

iii. Implications on the Employment in the Informal Sector

Totally differentiating the full-employment condition in the unskilled labour market and substituting values it is obtained as

$$\widehat{L_A} = \hat{a}_{LA} + \hat{A} = -\frac{\sigma_A}{\theta_{TA}}\widehat{W} \qquad (16)$$

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.

2. CASE II: 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[10] 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

[10] Typically I shall confine myself in this paper 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), Mukherjee (2016) and so on.

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.

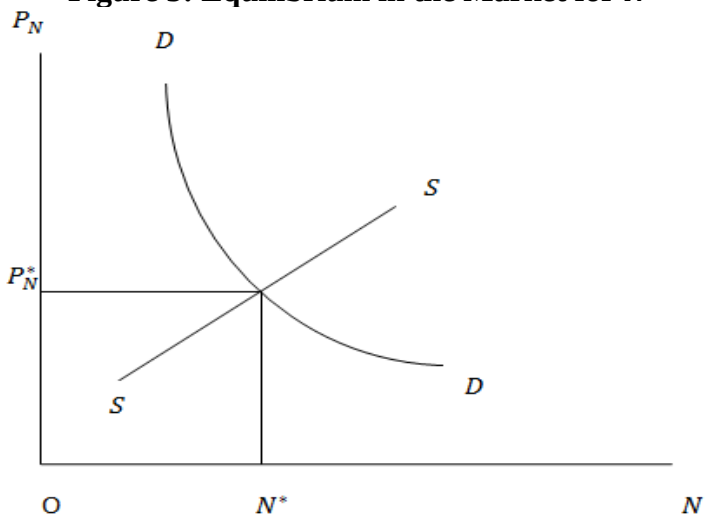
In case of contractual wages in the formal non-traded sector N, non-traded price was held fixed by the unionised unskilled money wage. But in case of non-traded good being produced in the informal sector with unorganised labour market where unskilled labour receives market-determined (flexible) nominal wage, production of N is no longer demand-determined. Consequently, P_N is not just cost-determined. Let me continue to assume a_{LN} is fixed (simplifying assumption). Therefore, the zero-profit condition for sector N in Equation (5) can now be re-written as

$$Wa_{LN} = P_N \qquad (5.1)$$

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 (5.1) determines the unskilled wage, W, which then solves for the return to land-capital, R, from the zero-profit condition in Equation (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) and (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, 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 (11) now becomes a rectangular hyperbola in this case.

Figure 3: Equilibrium in the Market for N



i. 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 (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 (15) now changes to

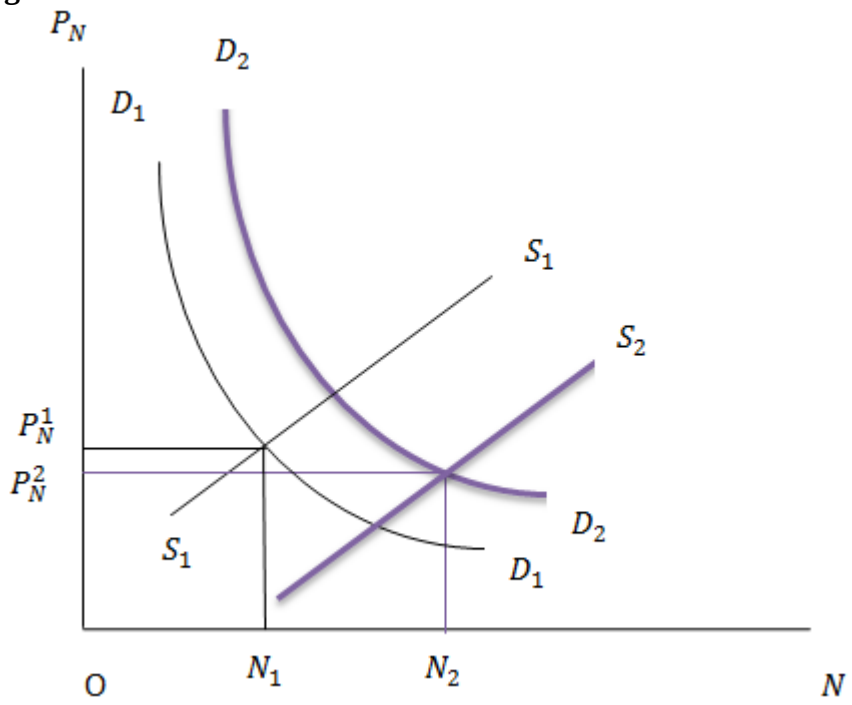
$$\theta_{LN}\widehat{W} + \widehat{N} = \mu\widehat{U} - \theta_{MS}T\hat{t}\,\frac{\sigma_S(1-\mu)\theta_{KS}}{\theta_{SS}} \qquad (15.1)$$

Therefore, when non-tradable is produced in the unorganised informal sector, one can get expression for $\widehat{W}$ under tariff reduction on the imported input M by solving Equations (13), (14) and (15.1) simultaneously.

From Equation (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 (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 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 4: Comparative Static Response in the Domestic Market for N under Flexible Unskilled Wage



ii. Quantitative Analyses

Figure 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

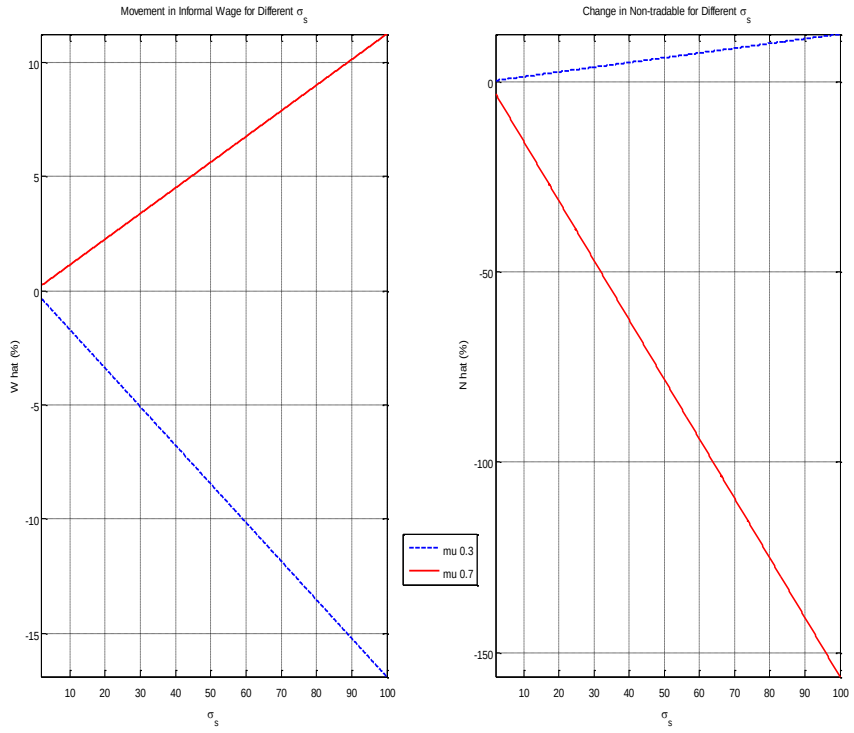
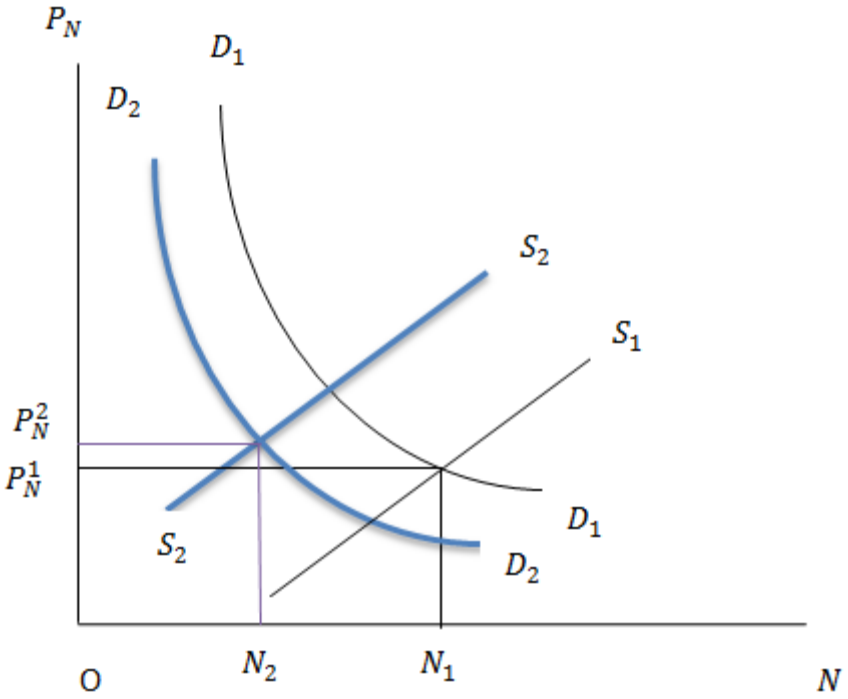


Figure 5 represents similar kind of sensitivity analysis as performed in Figure 2, however now **under the assumption of flexible unskilled wage in the non-tradable sector**. When μ =0.3, share of total urban income from sector S spent on non-traded good N is relatively high and hence there is a net 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 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

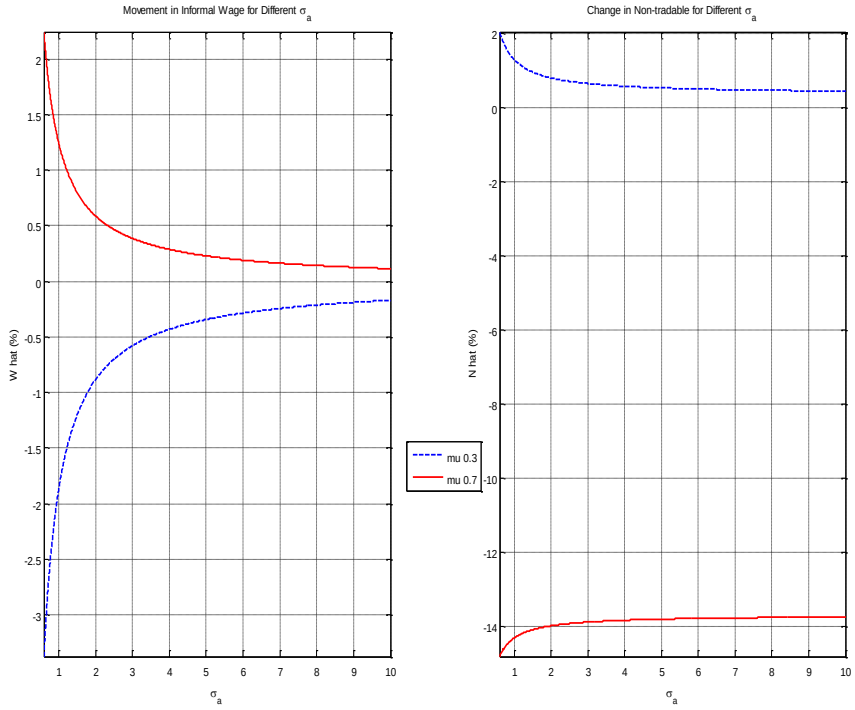
an increase in P_N (supply curve shifts upwards by more than the downward shift in demand curve, as shown in Figure 6 below). Given the proportional relationship between competitive unskilled wage and P_N, as laid in Equation (5.1), this latter effect outweighs the former impact on W and one should observe a net increase in W but a decline in non-traded production in Figure 5 for μ =0.7.

Figure 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 paper only examines this under flexible W assumption in sector N, since that renders seemingly counter-intuitive results.

Figure 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



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 7). Given Equation (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, **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 $\widehat{W}$) are observed from lower to higher values of σ_A for μ =0.7.

iii. 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

$$\widehat{L_A} + \widehat{L_N} = \left(\theta_{LN} - \frac{\sigma_A}{\theta_{TA}}\right)\widehat{W} \qquad (16.1)$$

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.

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, one 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.

i. 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,

$$\widehat{W_A} = (W\lambda_{LA}/W_A)\left(1 + \frac{\sigma_A}{\theta_{TA}}\right)\widehat{W} \qquad (17)$$

Therefore, $\widehat{W_A} < 0$ if W falls owing to tariff-cut on the imports of M.

ii. Non-tradable Production in the Informal Sector with Flexible Wages

Just like before, it can be shown that

$$\widehat{W_A} = (W/W_A)\widehat{W}(\lambda_{LA} + \lambda_{LN}) + \{(W^* - W)/W_A\}(1 - \lambda_{LA} - \lambda_{LN})\widehat{U} \qquad (18)$$

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 CASE I and CASE II would be

$$\Omega = W_S/W_A$$

Or,

$$\widehat{\Omega} = \widehat{W_S} - \widehat{W_A} \tag{19}$$

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 2 and Figure 5:

Table 1: Tariff-cut on Imports of M and Directions of Relative Wage Inequality for Rising σ_S

	CASE I	CASE II
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

III. CONCLUDING REMARKS

Growth acceleration in skill-intensive service sectors under the WTO 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 paper explores the general equilibrium impact of such trade-induced growth in the skill-intensive service 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 paper 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 paper 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 paper 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. These 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.[11]

[11] This is now work in progress.

APPENDICES

Appendix 1: The General Equilibrium Structure at a Glance

Table A1: 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 UTILISATION OF FACTORS)	PRICE SUBSYSTEM (PRICE = UNIT COST)	QUANTITY (OUTPUT) SUBSYSTEM (FULL UTILISATION OF FACTORS)	CONSTANCY OF a_{IU} & a_{MS}
$W, W_S, R, r, P_I, P_N, A, U, S, I, N$	$P_A^*, W^*, P_U^*, P_M{}^*, P_S{}^*\bar{T}, \bar{K}, \bar{L_S}, \bar{L}$	t	EQUATIONS (1) – (5)	EQUATIONS (6) – (11)	EQUATIONS (1) – (4), (5.1)	EQUATIONS (6) – (11)	

Appendix 2: Detailed Algebraic Derivations

(a) <u>The Full-employment Model</u>:

Total differentiation of Equation (6.4) allows one to write

$$(W_S a_{SS}/P_S^*)(dW_S/W_S) + (W_S a_{SS}/P_S^*)(da_{SS}/a_{SS}) + (r a_{KS}/P_S^*)(dr/r) + (r a_{KS}/P_S^*)(da_{KS}/a_{KS}) = -[t/(1+t)][P_M{}^*(1+t)a_{MS}/P_S^*](dt/t) \qquad \text{(A.1)}$$

Since, $dP_S^* = 0$.

Using the 'hat' algebra of Ron Jones (1965, 1971), one can write Equation (A.1) as

$$\left(\theta_{SS}\widehat{W_S} + \theta_{KS}\hat{r}\right) + \left(\theta_{SS}\widehat{a_{SS}} + \theta_{KS}\widehat{a_{KS}}\right) = -\theta_{MS}T\hat{t} \qquad \text{(A.2)}$$

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 isocost line is tangent to the unit isoquant, which is algebraically expressed as

$$\theta_{SS}\widehat{a_{SS}} + \theta_{KS}\widehat{a_{KS}} = 0 \qquad \text{(A.2.1)}$$

This is known as 'envelope condition'.

Substitution of Equation (A.2.1) into Equation (A.2) yields

$$\theta_{SS}\widehat{W_S} + \theta_{KS}\hat{r} = -\theta_{MS}T\hat{t} \qquad \text{(A.3)}$$

Since r gets already determined from Equations (2)-(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 (A.3) it is straightforward to obtain $\widehat{W_S}$ as in Equation (12) of the main text.

By the definition of elasticity of factor substitution in sector S,

$$\sigma_S\widehat{W_S} = \widehat{a_{KS}} - \widehat{a_{SS}} \qquad \text{(A.4)}$$

Solving Equation (A.4) and Equation (A.2.1) simultaneously it is obtained (note that $\theta_{SS} + \theta_{KS} = 1$)

$$\widehat{a_{SS}} = -\sigma_S\theta_{KS}\widehat{W_S} \qquad \text{(A.5)}$$

Totally differentiating Equation (8), one can obtain

$$(da_{SS}/a_{SS}) + (dS/S) = d\overline{L_S}/\overline{L_S} = 0 \qquad \text{(A.6.1)}$$

Or,
$$\hat{S} = -\widehat{a_{SS}} \qquad \text{(A.6.2)}$$

Therefore, substituting $\widehat{a_{SS}}$ from Equation (A.5) into Equation (A.6.2) it is found

$$\hat{S} = \sigma_S\theta_{KS}\widehat{W_S} \qquad \text{(A.7)}$$

Since $\widehat{W_S} > 0$ when $\hat{t} < 0$, $\hat{S} > 0$. ■

Similarly, totally differentiating Equation (6) one should obtain

$$\hat{A} = -\widehat{a_{TA}} \qquad \text{(A.8)}$$

Therefore,

$$\widehat{L_A} = \widehat{a_{LA}} + \hat{A} = \widehat{a_{LA}} - \widehat{a_{TA}} \qquad \text{(A.9)}$$

Just like before, using the definition of elasticity of factor substitution in sector A one obtains

$$\widehat{a_{LA}} - \widehat{a_{TA}} = -\sigma_A\left(\widehat{W} - \hat{R}\right) \quad \text{(A.10)}$$

But totally differentiating the zero-profit condition in Equation (1) and applying envelope condition for competitive producers in sector A

$$\theta_{LA}\widehat{W} + \theta_{TA}\hat{R} = 0 \quad \text{(A.11)}$$

Since, $\theta_{LA} = (1 - \theta_{TA})$, simple rearrangement of terms in Equation (A.11) yields

$$\left(\widehat{W} - \hat{R}\right) = \widehat{W}/\theta_{TA} \quad \text{(A.12)}$$

Substituting $\left(\widehat{W} - \hat{R}\right)$ from Equation (A.12) into Equation (A.10), it is easy to obtain

$$(\widehat{a_{LA}} - \widehat{a_{TA}}) = -\left(\sigma_A\widehat{W}/\theta_{TA}\right) \quad \text{(A.13)}$$

This is the same expression as in Equation (16). ■

Now totally differentiating the full-employment condition for unskilled labour in Equation (10) one can obtain

$$\left(\frac{Aa_{LA}}{\bar{L}}\right)[(dA/A) + (da_{LA}/a_{LA})] + \left(\frac{Ia_{LI}}{\bar{L}}\right)(dI/I) + \left(\frac{Ua_{LU}}{\bar{L}}\right)(dU/U) + \left(\frac{Na_{LN}}{\bar{L}}\right)(dN/N) = 0 \quad \text{(A.14)}$$

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 I have made and total endowment of unskilled labour $\bar{L}$ is parametrically given.

Rewriting Equation (A.14) as

$$\lambda_{LA}\left(\hat{A} + \widehat{a_{LA}}\right) + \lambda_{LI}\hat{I} + \lambda_{LU}\hat{U} + \lambda_{LN}\hat{N} = 0 \quad \text{(A.15)}$$

Using Equations (9.1) and (16), Equation (A.15) yields Equation (13) in the text (note that $\lambda_{LI} + \lambda_{LU} = 1 - \lambda_{LA} - \lambda_{LN}$).

Similarly, totally differentiating Equation (7) and utilising Equations (9.1) and (A.4) it is found

$$(\lambda_{KI} + \lambda_{KU})\widehat{U} = -\lambda_{KS}\sigma_S\widehat{W_S} \quad \text{(A.16)}$$

Substituting for $\widehat{W_S}$ from Equation (12) into Equation (A.16) it is straightforward to obtain $\hat{U} = \hat{I}$ as in Equation (14). ■

Totally differentiating Equation (11) in the text, I find

$$\mu\hat{U} + (1-\mu)\hat{S} = \widehat{P_N} + \hat{N} \qquad \text{(A.17)}$$

In case of unionised wage in the non-traded sector N, $\widehat{P_N} = 0$ that yields Equation (15) while in case of flexible wage in sector N, $\widehat{P_N} = \theta_{LN}\widehat{W}$ yielding Equation (15.1) in the text. ■

Appendix 3

Table A2: 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).

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