CHAPTER 3
GLOBALIZATION, THE REAL WAGE AND WELFARE

Section 3.1: Introduction

Globalization can generate enormous benefit. If properly reaped, it would improve social welfare. However, it also unleashes forces which can adversely affect the lives of families that survive at margins. In the present chapter we explore whether inflow of FDI and agricultural trade liberalization heightens the vulnerability and reduces welfare of people surviving with meager avenues by adversely affecting the real wage measured in unit of food. It is to be noted that a major aspect of vulnerability is food insecurity which can be linked to real income in general and the real wage measured in units of food items in particular.

First, we consider the importance of the real wage in context of vulnerability in general and food security in particular. Household-level food security is determined not only by physical access to food but also by adequate purchasing power. Access to adequate food at the household level is also required for satisfying nutritional levels of all the members belonging to the household. It is to be noted that nutritional security also depends on non-food factors such as health, hygiene and also social practices. Thus, we can state that household food security is one of the primary conditions for achieving the overall nutritional well-being of individuals. FAO studies reveal

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23 The World Food Summit of 1996 conceptualized food security in terms of a situation where all people have access to sufficient, safe, nutritious food on a regular basis. According to UN's Food and Agriculture Organization (FAO), food security exists when all people, on a regular basis, have both physical and economic access to sufficient, safe and nutritious food. Their physical and economic access must be sufficient to fetch their dietary needs and food requirements for leading an active and healthy life. The United States Department of Agriculture (USDA), states that household food security implies regular accessibility of all members of the household to enough food for an active and healthy life. Apart from accessibility, ready availability of nutritionally safe food in adequate quantities is required for food security to exist. Both USDA and FAO agree on the fact that along with easy availability and accessibility, an assured means to acquire nutritious food in socially acceptable manners should also exist.

that household food security would exist only when the capability to acquire food is present. A household access to food is generated through its own production. Access can also be generated through income-generating activities, ownership of assets and transfers of resources from government. What is to be noted is that even though the relative importance of various resources can be different for different households, the command over these resources must be adequate over time to enjoy enough food on a continual basis. According to FAO, household food security is said to exist when adequate effective demand for food exists. FAO studies conclude that an operational measure of short-term effective demand which effectively indicates household economic access to food is the real income. However, wage rate alone is not a complete indicator of household food accessibility. A more comprehensive indicator is the real income of a household. Monitoring price levels is relevant for assessing changes in real income. In this context reference may be made to the work by Lipton (1983), where a proxy indicator using wage rates and prices for measuring changes in the real income and thus accessibility of food at the household level was used. This approach was based on the notion that in poor households food expenditures usually absorb a large proportion of total expenditure. Based on the idea of Lipton (1983), in this chapter, we explore the effect of capital mobility and agricultural trade liberalization on real wage to understand the effect of globalization on food accessibility of labour supplying households.

Four approaches had been utilized for assessing household-level incomes. The four approaches included household income surveys, data on per capita gross domestic product, real wage data and analysis of changes in production sectors. Wage rates are often considered to be a good proxy indicator of the earnings of low-income households. Wage rates have often been used in assessing the impact of structural adjustment programmes on the poor.

There is an extensive literature in the general equilibrium framework focusing on determinants of income inequality in developing countries. Mention may be made to the works of Feenstra and Hanson (1996), Marjit (2003), Marjit, Beladi and Chakrabarti (2004), Marjit and Kar (2005),

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26 Though household surveys can provide good indicators, this is a costly approach for regular global monitoring.
27 see e.g. Cornia, (1987)
Chaudhuri and Yabuuchi (2007), Chaudhuri (2007), Beladi, Chaudhuri and Yabuuchi (2008), Chaudhuri (2008) among others. What is missing in the literature is the determination of the real wage in presence of a non traded traditional agricultural sector. The objective of this chapter is to address the issue of the real wage. In particular we will examine how agricultural trade liberalization and the inflow of capital affects the real wage measured in unit of food. The assumption of non tradedness made is based on available data. World Development Report (2008) had highlighted that traditional agricultural sector has become either import competing or non -traded in nature.

The chapter is organized as follows. In section 3.2, we set up the basic model. In section 3.3 we carry out the comparative static exercises to explore the effect of greater inflow of FDI and agricultural trade liberalization. In section 3.4 we concentrate on welfare consequences. In section 3.5 we extend the first model by introducing full capital mobility. In section 3.6 we carry out the basic comparative static exercises. Section 3.7 is used for exploring the effect on welfare. Section 3.8 concludes the chapter.

Section 3.2: The Model

We consider a developing economy consisting of three sectors. One of the sectors is the industrial import competing sector, \((X)\)\(^{28}\). The other two sectors belong to the broad category of agricultural sector. One is non traded traditional agricultural sector producing wage goods \((Y)\) and the other one is export oriented modern agricultural sector \((Z)\).

Next, we consider the input use in different sectors. \(X\) is produced with labour and capital. \(Y\) is produced with the help of labour and land, while land, labour and capital is used for the production of \(Z\). Labour is mobile between all the sectors while capital is also mobile between the sectors \(X\) and \(Z\). Labour and capital are substitutes in the standard neo classical literature.

\(^{28}\) In the modern day scenario the manufacturing sector of a developing country can also be export oriented in nature.
On the other hand, land is not substitutable and is required in fixed proportions. Domestic capital and foreign capital are assumed to be substitutes.

The following symbols are used for the formal representation of the model:

- $a_x = \text{labour output ratio in the X sector}$
- $a_y = \text{labour output ratio in the Y sector}$
- $a_u = \text{labour output ratio in the Z sector}$
- $a_k = \text{capital output ratio in the X sector}$
- $a_l = \text{capital output ratio in the Z sector}$
- $a_t = \text{land output ratio in the Z sector}$
- $a_p = \text{land output ratio in the Y sector}$
- $w = \text{wage of labour}$
- $R = \text{rate of return on land}$
- $r = \text{rate of return on capital}$
- $L = \text{labour endowment in physical units}$
- $K = \text{capital endowment in physical units}$
- $T = \text{land endowment in physical units}$
- $P, P_Y, P'_Z = \text{prices of X, Y, Z respectively}$
- $\theta_x = \text{distributive share of labour in the X sector}$
- $\theta_y = \text{Distributive share of labour in the Y sector}$
- $\theta_u = \text{distributive share of labour in the Z sector}$
- $\theta_k = \text{Distributive share of capital in the X sector}$
- $\theta_l = \text{Distributive share of capital in the Z sector}$
- $\theta_t = \text{Distributive share of land in the Z sector}$

A similar type of assumption, though in a separate context, has been made by Marjit (2009) in ‘Two elementary propositions on Fragmentation and Outsourcing in Pure theory of International Trade’ Presented at Bengal Economic Association 29th Conference, February 7-8, 2009.
The general equilibrium structure of the model is as follows.

Given the assumption of perfectly competitive markets, the usual price-unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:

\[ a_{r}w + a_{r}r = P_{x} \]  
\[ a_{y}w + a_{y}r = P_{y} \]  
\[ a_{x}w + a_{x}r + a_{n}R = P_{z} \]

Given the full employment condition, the endowment equations are given as follows.

\[ a_{x}X + a_{y}Y + a_{z}Z = L \]  
\[ a_{x}X + a_{z}Z = K \]  
\[ a_{y}Y + a_{z}Z = T \]

Next, we consider the expenditure function. \( \frac{E(P_{x}^{*}, P_{y}^{*}, P_{z}^{*}, U)}{U} \)

From Sheppard's Lemma it follows that:
\[ \frac{\delta E(P^*_x, P^*_y, P^*_z, U)}{\delta P_y} = \text{Demand for } Y \]

and \[ \frac{\delta^2 E(P^*_x, P^*_y, P^*_z, U)}{\delta P_y^2} < 0 \]

Since, Y is a non traded good, the market clearing condition is:

\[ \frac{\delta E(P^*_x, P^*_y, P^*_z, U)}{\delta P_y} = Y \quad (3.2.7) \]

Labour and capital are taken to be substitutable in sector X and sector Z. The elasticity of substitution between labour and capital in sector X and sector Z can be represented by the following equations respectively.

\[ \frac{\hat{\alpha}_x - \hat{\alpha}_k}{\hat{w} - \hat{r}} = \sigma_{x,k} \quad (3.2.8) \]

And \[ \frac{\hat{\alpha}_x - \hat{\alpha}_k}{\hat{w} - \hat{r}} = \sigma_{x,k} \quad (3.2.9) \]

For stability of the equilibrium, we require that excess demand of non traded item should fall with a rise in price of the non traded good. We note that, for stability

\[ \frac{\delta}{\delta P_y} (ED) = \frac{\delta^2 E(P^*_x, P^*_y, P^*_z)}{\delta P_y^2} - \frac{\delta Y}{\delta P_y} < 0 \quad (3.2.10) \]

Where ED= Excess Demand

Since expenditure function is concave in prices we note that. \[ \frac{\delta^2 E(P^*_x, P^*_y, P^*_z)}{\delta P_y^2} < 0 \]. Hence, for stability of the model we require that supply of non traded commodity should rise with a rise in prices of non traded commodity. We will show that the supply curve of the non traded good is positively sloped irrespective of factor intensity ranking. In other words, we have a stable equilibrium irrespective of factor intensity ranking. The explanation is as follows. We compare between Y and Z. First, we assume that the modern agricultural sector uses land intensively compared to the traditional agricultural sector. In such a setup, rise in price of the non traded commodity would lead to rise in wage of labour and fall in interest rate. Thus, usage of labour would fall and that of capital would rise. This can be thought of as a rise in labour endowment. As modern agricultural sector is land intensive compared to the traditional agricultural sector, 30

Since expenditure function is concave in prices, the Hicksian demand curve is negatively sloped
production of the traditional agricultural sector would rise. Hence, the model is stable. On the other hand, if traditional agricultural sector is land intensive compared to modern agricultural sector, then along with an increase in price of non traded commodity, wage would fall and interest rate would rise. Thus, usage of labour would increase and that of capital would decrease. This can be thought of as a fall in labour endowment of the economy. Hence, modern agricultural sector would contract and following the Rybyszynski argument, traditional agricultural sector rises. Again, the model is stable. We thus see that irrespective of factor intensity raking, supply of traditional agricultural sector rises with rise in price.

**Working of the Model**

The model does not have the standard decomposition property. The variables of the model are determined simultaneously from equations (3.2.1)-(3.2.7). Equations (3.2.1)-(3.2.3), (3.2.7) determine the factor prices and price of non traded agricultural sector. Equations (3.2.4)-(3.2.6) determine the levels of output.

**Section 3.3: Comparative Static Exercise**

In this section we would explore the consequences of an increase in capital base of the economy consequent upon an increase in foreign capital. We would then explore the effect of agricultural trade liberalization captured through an increase in price of modern agricultural sector produce. First, we concentrate on the effect of an increase in capital base.

Differentiating the price system, endowment system and commodity market equilibrium with \( K \), we have (See Mathematical Appendix for detailed derivation)

\[
\hat{p}_y = \frac{(\lambda_y A_y + \lambda_x B_x)}{(1 + \theta_y \theta_x) \theta_y \theta_x}
\]

\[
\left(1 + \frac{1}{D_3 \lambda_y \lambda_x K}\right) \ldots \ldots (3.2.11)
\]
\[
\hat{R} = \frac{1}{\theta_\nu} \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) + \frac{P_\gamma \delta^2 E}{Y \delta P^2} \frac{1}{D_3 C_3} \\
\theta_\nu \theta_\kappa \left( \frac{1}{C_3 \theta_\gamma} \right) \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) \cdot (3.2.12)
\]

\[
\hat{\omega} = \frac{\theta_\alpha}{\theta_\kappa} \left( \frac{1}{C_3 \theta_\gamma} \right) \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) \cdot (3.2.13)
\]

\[
\hat{r} = \frac{1}{C_3 \theta_\gamma} \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) \cdot (3.2.14)
\]

\[
\hat{y} = \frac{1}{D_3} \frac{\lambda_\alpha [\lambda_\alpha \hat{K} + (\lambda_\alpha A_3 + \lambda_\alpha B_3)(1 + \theta_\nu)]}{\lambda_\nu} \left( \frac{1}{C_3 \theta_\gamma} \right) \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) \cdot (3.2.15)
\]

\[
\hat{z} = \frac{1}{D_3} \frac{\lambda_\alpha [\lambda_\alpha \hat{K} + (\lambda_\alpha A_3 + \lambda_\alpha B_3)(1 + \theta_\nu)]}{\lambda_\nu} \cdot (3.2.16)
\]

\[
\hat{x} = \frac{B_3}{\lambda_\alpha} \left( \frac{1}{C_3 \theta_\gamma} \right) \left( \frac{\lambda_\alpha A_3 + \lambda_\alpha B_3}{(1 + \theta_\nu) \theta_\nu} \right) \left( -\frac{1}{D_3} \frac{\lambda_\alpha \hat{K}}{\lambda_\nu} \right) \cdot (3.2.16)
\]

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\[ \begin{aligned} &\frac{\partial z}{\partial x} \left\{ \frac{1}{C_3} \theta_y \left( \frac{\lambda_n A_3 + \lambda_n B_3}{1 + \theta_{\alpha x}} \frac{\theta_{\alpha y}}{\theta_{\alpha x}} \left( \frac{1}{D_3} \frac{\lambda_n}{\lambda_{\alpha y}} \lambda_{\alpha y} \right) \right) \right\} \\
&= \frac{P_y \frac{\delta^2 E}{\delta \lambda_y^2}}{Y \frac{\delta^2 E}{\delta \lambda_y^2}} \frac{D_3 C_3}{D_3 C_3} \\
&\left( \frac{\lambda_n - \frac{\lambda_{\alpha y}}{\lambda_{\alpha y}}}{\lambda_{\alpha y}} \right) \frac{1}{D_3} \left[ \left( \frac{\lambda_n A_3 + \lambda_n B_3}{1 + \theta_{\alpha x}} \right) \left( 1 + \frac{\theta_{\alpha x}}{\theta_{\alpha y}} \right) \right] \\
&\left( \frac{1}{C_3} \theta_y \left( \frac{\lambda_n A_3 + \lambda_n B_3}{1 + \theta_{\alpha x}} \frac{\theta_{\alpha y}}{\theta_{\alpha x}} \left( \frac{1}{D_3} \frac{\lambda_n}{\lambda_{\alpha y}} \lambda_{\alpha y} \right) \right) \right] \\
&(3.2.17) \\
\end{aligned} \]

Where,

\[ D_3 = \lambda_{\alpha y} \lambda_n - \frac{\lambda_{\alpha y}}{\lambda_{\alpha y}} < 0 \]

\[ C_3 = \left\{ \frac{\theta_{\alpha x} \theta_{\alpha y} - \theta_{\alpha x} \theta_{\alpha y}}{\theta_{\alpha x} \theta_{\alpha y}} \left[ \theta_{\alpha x} \theta_{\alpha y} \right] \right\} \\
B_3 = \left( \lambda_{\alpha x} \theta_{\alpha x} \sigma_{i,k}^\tau + \lambda_n \frac{\theta_{\alpha x}}{1 - \theta_{\alpha x}} \sigma_{i,k}^\tau \right) \\
A_3 = \lambda_{\alpha x} \theta_{\alpha x} \sigma_{i,k}^\tau + \lambda_n \frac{\theta_{\alpha x}}{1 - \theta_{\alpha x}} \sigma_{i,k}^\tau \]

**Proposition 3.3.1:** The real wage would decrease consequent upon increase in capital base of the economy provided modern agricultural sector is capital intensive compared to the urban manufacturing sector.

**Comment:** If modern agricultural sector uses land intensively compared to the traditional agricultural sector, then following an increase in capital base of the economy, price of the non-traded sector would rise. Following the Stolper Samuelson argument, wage would rise. From equation (3.2.1) we can conclude that interest rate on capital would fall. What happens to rent is of importance. Manufacturing sector and modern agricultural sector forms a Hecksher Ohlin.

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31 Follows from stability condition.
nugget in terms of labour and capital. If modern agricultural sector is capital intensive compared to the manufacturing sector, to maintain equality in equation (3.2.3), land owners’ income would increase. The logic is this. From equation (3.2.3) we find that $\theta w + \theta \hat{r} + \theta \hat{R} = 0$. Since, the modern agricultural sector is capital intensive compared to the traditional manufacturing sector, $\theta w + \theta \hat{r}$ falls. To maintain equilibrium in equation (3.2.3), rent rises.

From the above equations we see that:

$$\hat{w} - \hat{P}_x = \left[\theta w + \theta \hat{r} + \theta \hat{R}\right] \left(\frac{1}{\theta w \theta \hat{R} C_3^3}\right) \left(\frac{\hat{R} A_2 A_3 + \hat{R} B_3}{\theta w \theta \hat{R} C_3}\right) \left(\frac{1}{D_3 \theta \hat{R}}\right) < 0$$

We see that in this case real wage decreases. From the preceding analysis we find that both wages and price of non traded traditional agricultural sector increase. However, the increase in wage rate is less compared to the increase in price of non traded traditional agricultural product. Hence, real wage measured in terms of non traded good decreases.

**Corollary 3.3.A**: Modern agricultural sector and manufacturing sector would expand and traditional agricultural sector would contract provided:

$$1 - \frac{\hat{R}}{A_3} (A_3 \hat{R} + B_3 \hat{R})^2 > 0$$

**Comment**: If there is increase in capital base of the economy, wage interest ratio increases. This can be thought of as an increase in labour endowment and fall in capital base of the economy. However, capital base of the economy tends to increase via an increase in FDI. In this setup, if:

$$1 - \frac{\hat{R}}{A_3} (A_3 \hat{R} + B_3 \hat{R})^2 > 0$$

increase in inflow of FDI helps in expansion of both manufacturing sector and modern agricultural sector. Following the Rybyszynski argument, the traditional agricultural sector contracts.

We now concentrate on the effect of agricultural trade liberalization.

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Differentiating the price system, endowment system and commodity market equilibrium with respect to price of the modern agricultural product, we have (Refer to mathematical appendix for detailed derivation)

\[
\hat{P}_y = \left[ \frac{1}{C_y \theta_x} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) + \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \right] \hat{P}_y + \frac{1}{V C_3} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) \frac{\theta_\alpha}{\theta_y} (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) - \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \]

.....(3.2.18)

\[
\hat{R} = \frac{1}{\theta_y} \left( \frac{M_3}{P_r^*} \frac{\delta^2 E}{\delta P_r^2} + \frac{M_3 \theta_\alpha}{C_y \theta_y} \right) \hat{P}_y + \theta_y \theta_\alpha \left( \frac{1}{C_y} \hat{P}_y - \theta_\alpha \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) + \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \right) \hat{P}_y

.....(3.2.19)

\[
\hat{w} = -\frac{\theta_\alpha}{\lambda_{\alpha}} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) \left( \frac{1}{C_y \theta_y} \frac{\delta^2 E}{\delta P_r^2} + \frac{M_3 \theta_\alpha}{C_y \theta_y} \right) \hat{P}_y + \frac{M_3}{C_y \theta_y} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) - \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \]

.....(3.2.20)

\[
\hat{r} = \frac{1}{C_y} \left( \hat{P}_y - \theta_\alpha \left( \frac{1}{C_y \theta_y} \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) + \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \right) \hat{P}_y

.....(3.2.21)

\[
\hat{y} = -\frac{1}{V C_3} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) \left( \hat{P}_y - \theta_\alpha \left( \frac{1}{C_y \theta_y} \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) + \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \right) \hat{P}_y

.....(3.2.22)

\[
\hat{z} = \frac{1}{V C_3} \left( \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) \left( \hat{P}_y - \theta_\alpha \left( \frac{1}{C_y \theta_y} \frac{\theta_\alpha}{\lambda_{\alpha}} + 1 \right) (\lambda_{\alpha} \frac{1}{\lambda_{\alpha}} B_3 + A_3) + \frac{P_r^*}{Y} \frac{\delta^2 E}{\delta P_r^2} \right) \hat{P}_y

.....(3.2.23)
\[ \dot{X} = \frac{1}{\lambda_x} (1 + \theta_{hx}) B_3 \left[ \frac{1}{C_3} \left\{ \hat{P}_x - \theta_{px} \left( \theta_{tx} \frac{1}{\lambda_x} B_3 + A_3 \right) + \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \right\} \right] \]

\[ \left[ \frac{1}{VC_3} \left( \frac{\theta_{tx} + 1}{\theta_{ty}} (\lambda_{tx} B_3 + A_3) - \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \right) \right] \cdot \left( \lambda_y - \frac{\theta_{ty}}{\lambda_x} \right) \]

\[ \left[ \frac{1}{C_3} \left( \frac{\theta_{tx}}{\theta_{ty}} + 1 \right) (\lambda_{tx} B_3 + A_3) + \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \right] \]

\[ \left( \theta_{ux} + 1 \right) \left( \lambda_{ux} B_3 + A_3 \right) - \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \]

\[ \left( \frac{1}{VC_3} \left( \frac{\theta_{ux}}{\theta_{ty}} + 1 \right) \right) \left( \lambda_{ux} B_3 + A_3 \right) - \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \]

\[ (3.2.24) \]

Where,

\[ C_3 = \frac{\left[ \theta_{ux} (\theta_{ux} - \theta_{ux} \theta_{ty}) + \theta_{ux} \theta_{ux} \theta_{ty} \theta_{ty} \right]}{\theta_{ux} \theta_{ty}} \]

\[ B_3 = (\lambda_{ux} \theta_{ux} \delta_{ux} + \lambda_{ux} \frac{\theta_{ux}}{1 - \theta_{ux}} \delta_{ux} \delta_{ux}) \]

\[ A_3 = \lambda_{ux} \theta_{ux} \delta_{ux} \delta_{ux} + \lambda_{ux} \frac{\theta_{ux}}{1 - \theta_{ux}} \delta_{ux} \delta_{ux} \]

\[ V = \lambda_{ux} \frac{1}{\lambda_x} (\lambda_{ux} - \lambda_{ux} \lambda_{uy}) + \lambda_{ux} \lambda_{uy} \lambda_{ux} \lambda_{ux} \]

From the above equations we arrive at the following proposition.

**Proposition 3.3.2:** If the modern agricultural sector is land intensive to the traditional agricultural sector, the real wage would decrease consequent upon agricultural trade liberalization, provided:

\[ \left\{ 1 - \frac{\theta_{ux}}{\theta_{ty}} \left[ \frac{1}{C_3} \left( \frac{\theta_{ux}}{\theta_{ty}} + 1 \right) (\lambda_{ux} \frac{1}{\lambda_x} B_3 + A_3) + \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \right] \right\} \left[ \frac{1}{VC_3} \left( \frac{\theta_{ux}}{\theta_{ty}} + 1 \right) \right] \left( \frac{1}{\theta_{ux}} \right) \left( \lambda_{ux} B_3 + A_3 \right) - \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} < 0 \]

**Comment:** As soon as price of modern agricultural sector changes, rent increases since Modern agricultural sector is land intensive in nature. However, along with change in price of modern agricultural sector, price of non traded sector also increases. From equation (3.2.2) we come to the conclusion that even though price of non traded sector increases, wage may fall if:

\[ \left\{ 1 - \frac{\theta_{ux}}{\theta_{ty}} \left[ \frac{1}{C_3} \left( \frac{\theta_{ux}}{\theta_{ty}} + 1 \right) (\lambda_{ux} \frac{1}{\lambda_x} B_3 + A_3) + \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} \right] \right\} \left[ \frac{1}{VC_3} \left( \frac{\theta_{ux}}{\theta_{ty}} + 1 \right) \right] \left( \frac{1}{\theta_{ux}} \right) \left( \lambda_{ux} B_3 + A_3 \right) - \frac{P_x}{Y} \frac{\delta^2 E}{SP_x^2} < 0 \]
From equation (3.2.1) we find that interest rate increases. The change in interest rate affects equation (3.2.3). However, taking into account various cross effects we finally come to the conclusion that rent increases.

We see that wage falls but price of non traded good increases. Hence, the real wage measured in terms of non traded item falls.

**Corollary 3.3.B:** The traditional agricultural sector increases, whereas the modern agricultural sector contracts after agricultural trade liberalisation. The manufacturing sector contracts.

**Comment:** As price of the modern agricultural sector rises, demand of the traditional agricultural sector increases. This is because of the fact that the two goods are generally substitutes. Hence, there is a rightward shift of the demand curve. In figure (3.3.1) this can be shown through rightward shift of demand curve of Y from DD to D1D1. At initial equilibrium price P1, there is excess demand. To remove excess demand, supply of Y rises to Y2. However, it is also to be noted that price of traditional agricultural sector increases. This leads to a fall in demand for Y. Thus, there is an upward movement along demand curve D1D1. The new equilibrium finally settles at B. Thus, output in the traditional agricultural sector expands from Y to Y1. Following the Rybyszynscki argument, the modern agricultural sector contracts. Labour released from the modern agricultural sector is less compared to that required by the traditional agricultural sector. Hence, labour has to be released from the manufacturing sector. This leads to a fall in the production of the manufacturing sector.
Section 3.4: Welfare Analysis

In this section we would be analyzing the welfare consequences of globalization policies. For analyzing the welfare of the society, we make use of "Expenditure Function". First, we note that Total Expenditure on X, Y, Z at domestic prices must equal the value of production at domestic prices net of Foreign interest Income repatriated back\(^{32}\)

\[ E(P^*, P_y, P_z^*, U) = P_x^* X + P_y^* Y + P_z^* Z - r(K - K_d), \text{ where } K_d = \text{domestic capital} \]

From the price system and physical system we find that value of production at domestic prices net of foreign interest income repatriated back, equals factor income. Hence, value of expenditure equals factor income.

\[ E(P_x^*, P_y, P_z^*, U) = wL + rTK_d \ldots (3.2.25) \]

Where

\[ E = E(P_x^*, P_y, P_z^*, U) = \text{expenditure function}, \]

\[ U = \text{Utility} \]

\(^{32}\) See Ethier (1988)
We would first concentrate how welfare changes if capital base of the economy increases.

Differentiating equation (3.2.24) with respect to rate of interest we have,

\[
\frac{\delta E}{\delta P} \frac{dP}{dK} + \frac{\delta E}{\delta U} \frac{dU}{dK} = L \frac{\delta w}{\delta K} + K \frac{\delta r}{\delta K} + T \frac{\delta R}{\delta K} \quad (3.2.26)
\]

Manipulating the above equation we have:

\[
\frac{\delta E}{\delta U} \frac{dU}{dK} = L \frac{\delta w}{\delta K} + K \frac{\delta r}{\delta K} + T \frac{\delta R}{\delta K} - \frac{\delta E}{\delta P} \frac{dP}{dK}
\]

The R.H.S of the above expression is equivalent to:

\[
\frac{\left(\lambda_\alpha A^* + \lambda_\beta B^*\right) \left(\frac{1}{\lambda_\alpha} \frac{1}{\theta_y} \frac{\delta E}{\delta P} P - TR \frac{1}{\theta_y} \left(1 - \frac{\theta_y}{\theta_y} \frac{\delta r}{\delta r} C^*_\alpha\right) + \frac{1}{C^*_\alpha} \frac{\theta_y}{\theta_y} (K^*r - L \frac{\theta_y}{\theta_y})\right)}{\left(1 + \frac{\theta_y}{\theta_y}\right) \left(\frac{\lambda_\alpha}{\lambda_\alpha} \right)} \frac{\delta^2 E}{\delta P^2} \frac{P}{\theta_y} \frac{\theta_y}{\theta_y}
\]

As capital base of the economy increases, wage and rent increase. This increases total factor income and thus leads to improvement in welfare. However, interest rate decreases. This reduces the welfare of the economy by decreasing factor income. We also see that an increase in price of traditional agricultural sector produce increases expenditure and hence welfare deteriorates. Thus, various cross effects are seen on welfare. If the positive effects are outweighed by the negative effects immeserisation becomes a reality. Sufficient condition for immeserisation is as follows:

\[
\frac{\left(\lambda_\alpha A^* + \lambda_\beta B^*\right) \left(\frac{1}{\lambda_\alpha} \frac{1}{\theta_y} \frac{\delta E}{\delta P} P - TR \frac{1}{\theta_y} \left(1 - \frac{\theta_y}{\theta_y} \frac{\delta r}{\delta r} C^*_\alpha\right) + \frac{1}{C^*_\alpha} \frac{\theta_y}{\theta_y} (K^*r - L \frac{\theta_y}{\theta_y})\right)}{\left(1 + \frac{\theta_y}{\theta_y}\right) \left(\frac{\lambda_\alpha}{\lambda_\alpha} \right)} \frac{\delta^2 E}{\delta P^2} \frac{P}{\theta_y} \frac{\theta_y}{\theta_y} < 0
\]

We now focus on the effect of change in price of modern agricultural product. Differentiating the expenditure function with respect to price of modern agricultural sector produce we have:

\[
\frac{\delta E}{\delta P} \frac{dP}{dP^*} + \frac{\delta E}{\delta U} \frac{dU}{dP^*} = L \frac{\delta w}{\delta P^*} + K \frac{\delta r}{\delta P^*} + T \frac{\delta R}{\delta P^*}
\]
\[ \frac{\delta E}{\delta U} \frac{\delta U}{\delta P_x} = L \frac{dw}{dp_x} + K \frac{dr}{dp_x} + T \frac{dR}{dp_x} - \frac{\delta E}{\delta P_y} \frac{dp_y}{dp_x} - \frac{\delta E}{\delta P_z} \frac{dp_z}{dp_x}. \]

Manipulating the above equation we find that the R.H.S of the equation is:

\[
\left( -\frac{\delta E}{\delta P_y} + \frac{\theta_y}{\theta_y C_3} - \frac{1}{\theta_y} \right) P_x \left[ \left( \frac{1}{C_3 V} \left( \frac{\theta_y}{\theta_y} + 1 \right) (\lambda_{tx} \frac{1}{\lambda_{ty}} - B_3 + A_t) + \frac{P_y}{Y} \frac{\delta^2 E}{\delta P_y} \right) \right] + (rK_d - \frac{\theta_{tx} - \theta_{ty} \frac{1}{\theta_{ty}}} {rL} \frac{RT \theta_y \theta_{tx}} {P_x C_3}) \frac{P_y}{C_3} \frac{1}{P_x} < 0
\]

As agricultural trade liberalization takes place, wage decreases. This has a negative influence on welfare as total factor income decreases. However, increase in interest and rent increases factor income of the country. This has positive effect on welfare. Increase in price of non-traded traditional agricultural produce and price of traded agricultural produce increase total expenditure and this leads to a decrease in welfare. Thus, there are various forces acting on welfare. If the negative forces outweigh the positive forces welfare falls. Sufficient condition for immeiserisation is as follows:

\[
\left( -\frac{\delta E}{\delta P_y} + \frac{\theta_y}{\theta_y C_3} - \frac{1}{\theta_y} \right) P_x \left[ \left( \frac{1}{C_3 V} \left( \frac{\theta_y}{\theta_y} + 1 \right) (\lambda_{tx} \frac{1}{\lambda_{ty}} - B_3 + A_t) + \frac{P_y}{Y} \frac{\delta^2 E}{\delta P_y} \right) \right] + (rK_d - \frac{\theta_{tx} - \theta_{ty} \frac{1}{\theta_{ty}}} {rL} \frac{RT \theta_y \theta_{tx}} {P_x C_3}) \frac{P_y}{C_3} \frac{1}{P_x} < 0
\]

**Proposition 3.3:** A possibility of immeiserisation exists in case of both inflow of FDI and agricultural trade liberalization.
Section 3.5: An Extended Model With Full Capital Mobility

We consider an economy consisting of three sectors. One of the sectors is the industrial import competing sector, \(X\). The other two sectors belong to the broad category of agricultural sector. One is the non traded traditional agricultural sector producing wage goods \(Y\) and the other one is export oriented modern agricultural sector \(Z\).

Next, we consider the input use in different sectors. \(X\) is produced with labour and capital. \(Y\) is produced with the help of labour and land, while land, labour and capital is used for the production of \(Z\). Labour is mobile between all the sectors while capital is also mobile between the sectors \(X\) and \(Z\). Labour and capital are substitutes in the standard neo classical literature. On the other hand, land is not substitutable and is required in fixed proportions. Domestic capital and foreign capital are assumed to be completely substitutable. Instead of choosing a supply function for inflow of foreign capital to a developing country, we posit the issue of capital market liberalization in terms of interest rate equalization. The idea is this. Initially, the domestic interest rate is endogenous and higher than the world rate. However, capital market liberalization would entail that domestic rate of interest would tend to get equalized with world rate of interest. However, costs of investing in a foreign country is higher than investing in home country. These costs arise due to financial instability, political instability, weak governance, corruption and lack of investment. These costs may be referred to as “country specific risks”. In such a situation world interest rate plus country specific risk premium would tend to be equalized to the domestic rate of interest. The following symbols are used for the formal representation of the model:

\[
\begin{align*}
\alpha_n &= \text{labour output ratio in the } X \text{ sector} \\
\alpha_y &= \text{labour output ratio in the } Y \text{ sector} \\
\alpha_z &= \text{labour output ratio in the } Z \text{ sector} \\
\beta_n &= \text{capital output ratio in the } X \text{ sector} \\
\beta_z &= \text{capital output ratio in the } Z \text{ sector}
\end{align*}
\]

33 In the modern day scenario the manufacturing sector of a developing country can also be export oriented in nature.

34 A similar type of assumption, though in a separate context, has been made by Marjit (2009) in ‘Two elementary propositions on Fragmentation and Outsourcing in Pure theory of International Trade’ Presented at Bengal Economic Association 29th Conference, February 7-8, 2009
$a_u$ = land output ratio in the Z sector

$a_g$ = land output ratio in the Y sector

w = wage on labour

R = rate of return on land

$r^*$ = world rate of interest

L = labour endowment in physical units

T = land endowment in physical units

$P^*_x, P^*_y, P^*_z$ = prices of X, Y, Z respectively

$\theta_{x_l} =$ distributive share of labour in the X sector

$\theta_{y_l} =$ Distributive share of labour in the Y sector

$\theta_{z_l} =$ Distributive share of labour in the Z sector

$\theta_{x_k} =$ Distributive share of capital in the X sector

$\theta_{z_k} =$ Distributive share of capital in the Z sector

$\theta_{z_l} =$ Distributive share of land in the Z sector

$\theta_{y_l} =$ Distributive share of land in the Y sector

$\lambda_{x_l} =$ proportion of labour in the X sector

$\lambda_{y_l} =$ Proportion of labour in the Y sector

$\lambda_{z_l} =$ Proportion of labour in the Z sector

$\lambda_{x_k} =$ Proportion of capital in the X sector

$\lambda_{z_k} =$ Proportion of capital in the Z sector

$\lambda_{z_l} =$ Proportion of land in the Z sector

$\lambda_{y_l} =$ Proportion of land in the Y sector

$\hat{\nu} =$ Proportionate change in variable v

r = domestic interest rate

$\tau =$ Country specific risk premium

U = Utility
Given the assumption of perfectly competitive markets, the usual price-unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:

\[ a_h w + a_h r = P^*_x \quad \ldots \quad (3.5.1) \]

\[ a_y w + a_y R = P^*_y \quad \ldots \quad (3.5.2) \]

\[ a_k w + a_k r + a_n R = P^*_z \quad \ldots \quad (3.5.3) \]

Where,

\[ r = r^* + \tau, \text{ i.e., } r^* \text{ is given in the international capital market and the risk premium } \tau \text{ is exogenous. Thus, } r \text{ is parametrically given.} \]

Given the full employment condition, the endowment equations are given as follows.

\[ a_h X + a_y Y + a_z Z = L \quad \ldots \quad (3.5.4) \]

\[ a_y Y + a_z Z = T \quad \ldots \quad (3.5.5) \]

Next, we consider the expenditure function. \( E(P^*_x, P^*_y, P^*_z, U) \)

From Sheppard’s Lemma it follows that:

\[ \frac{\delta E(P^*_x, P^*_y, P^*_z, U)}{\delta P^*_y} = \text{ Demand for } Y \]

\[ \frac{\delta^2 E(P^*_x, P^*_y, P^*_z, U)}{\delta P^*_y^2} < 0 \quad \ldots \quad (3.5.6) \]

Since, \( Y \) is a non traded good, the market clearing condition is:

\[ \frac{\delta E(P^*_x, P^*_y, P^*_z, U)}{\delta P^*_y} = Y \quad \ldots \quad (3.5.7), \]

Where \( U = \text{ Utility} \)

Labour and capital are taken to be substitutable in sector X and sector Z. The elasticity of substitution between labour and capital in sector X and sector Z can be represented by the following equations respectively. \( \frac{\hat{\alpha}_{k} - \hat{\alpha}_{k}}{\hat{w} - \hat{r}} = \sigma_{1,k} \)

\[ \sigma_{1,k} \] Since the expenditure function is concave in prices, Hicksian demand curve is downward sloping.

\[ 56 \]
The working of the model is as follows. Wage rate of labourers are determined from equation (3.5.1). From equation (3.5.3) the rent on land is determined. Equation (3.5.2) determines the price of traditional agricultural produce. This is represented by a horizontal line in figure (3.5.1). From Sheppard’s Lemma, we get the demand curve which is negatively sloped. Equilibrium is shown at point A. From the equation structure we see that the level of output produced in the traditional agricultural sector is produced is determined from equation (3.5.7)

\[ \frac{\hat{a}_h - \hat{a}_s}{\hat{w} - \hat{r}} = \sigma_{s}^{l_h} \]

Figure 3.5.1

Once, the amount of traditional agricultural product produced is determined, equations (3.5.4) and (3.5.5) determine the amount produced in the manufacturing sector and modern agricultural sector.
Given $Y$, we get $Z$ from equation (3.5.5). Once $Y$ and $Z$ are known, we get $X$ from equation (3.5.4). In figure (3.5.2), CC is derived from equation (3.5.4) and DD determined from equation (3.5.5). Equilibrium is at point E, where $(Z_1, X_1)$ amount of $Z$ and $X$ are produced respectively.

**Section 3.6: Comparative Static Exercises**

We will now examine the effect of a decrease in risk premium of a country. The policymakers of developing countries have been assigning priorities to improvement in quality of institutions, enforcement of prudential norms and the transparency of regulatory mechanisms. The combined effect of this new set of initiatives attracts FDI and also reduce country specific risk premium.

Since, $r = r^* + \tau$, $\hat{r} = \frac{r}{\tau}$

Differentiating equations (3.5.1) to (3.5.7) with respect to $r$ we have: (See Mathematical appendix for detailed derivation)

$$\hat{\omega} = -\frac{\theta_u}{\theta_u} \frac{r}{\tau} \hat{r} \ldots \text{(3.5.8)}$$

$$\hat{R} = -\frac{r}{\tau} \frac{1}{\theta_u} \left[-\theta_u \theta_u + \theta_u \theta_u \right] \frac{1}{\theta_u} \ldots \text{(3.5.9)}$$

$$\hat{X} = \frac{r}{\tau \lambda_n} \left[-A_o(1 + \frac{\theta_u}{\theta_u}) - \frac{P}{\lambda_n} \frac{\delta^2 E}{\delta P^2} (\lambda_n - \frac{\lambda_n \lambda_n}{\theta_n}) \frac{\theta_n}{\theta_n} C_4 \right] \ldots \text{(3.5.10)}$$
Thus, the model leads to the following propositions.

**Proposition 3.5.A:** If the modern agricultural sector is capital intensive compared to the manufacturing sector, following a decrease in interest risk premium, real wage measured in unit of food decreases.

**Comment:**

From equation (3.5.1) we find that as risk premium of the country decreases, money wage increases. It is to be noted that modern agricultural sector and traditional manufacturing sector forms a nugget in terms of labour and capital. Decrease in risk premium would affect equation (3.5.3). If modern agricultural sector is capital intensive compared to the traditional manufacturing sector, a decrease in risk premium would increase the rental on land. The logic is this. From equation (3.5.3) we find that \( \theta_n \dot{w} + \theta_n \dot{r} + \theta_n \dot{\hat{r}} = 0 \). Since, the modern agricultural sector is capital intensive compared to the traditional manufacturing sector, \( \theta_n \dot{w} + \theta_n \dot{r} \) falls. To maintain equilibrium in equation (3.5.3), rent rises. Since, both wage and rent on land rise, price of traditional agricultural sector also increases.

It follows from equations (3.5.7), (3.5.8) and (3.5.13) that

\[
\ddot{w} - \ddot{P_y} = -\frac{\dot{r}}{\theta_n \theta_n \tau} \theta_n (\theta_n - \theta_n) \quad (3.5.14)
\]
If modern agricultural sector is capital intensive to the manufacturing sector, we find that real wage measured in unit of food decreases. This requires a careful interpretation. Despite an increase in money wage, real product wage in unit of traditional agricultural good decreases. This can be attributed to the fact that the rise in price of traditional agricultural commodities decreases the command of workers over basic food items. We can thus conclude that if the modern agricultural sector is capital intensive compared to the traditional manufacturing sector, workers command over food items (measured in terms of real wage in unit of food) decreases.

**Proposition 3.5.B:** Production of the traditional agricultural item falls and the modern agricultural sector expands following fall in risk premium. Manufacturing sector expands.

**Comment:** We have seen from the preceding proposition price of non traded sector rises. We have already shown that supply of output in the traditional agricultural sector is demand determined. An increase in price of non traded sector leads to fall in demand and hence leads to excess supply. To maintain commodity market equilibrium, supply of traditional agricultural item thus falls. Following the Rybyszynscki argument, modern agricultural sector expands. What happens to the manufacturing sector is of importance. The modern agricultural sector requires capital for production. Hence, increase in supply of this sector reduces capital availability to the manufacturing sector. Given, traditional agricultural sector is labour intensive compared to the modern agricultural sector; labour released from this sector is in excess to that required by the modern agricultural sector. The excess labour thus released promotes production in the manufacturing sector. Given, manufacturing sector is labour intensive compared to the modern agricultural sector, manufacturing sector expands. The effect on output composition can also be explained graphically (Refer to figure 3.6.1).
We have already explained why production of the traditional agricultural sector falls and that of the modern agricultural sector rises. This change in the output composition leads to a rightward shift of DD curve. Moreover, a fall in traditional agricultural product leads to release of labour from this sector. This helps production of the manufacturing sector. Hence CC curve also shifts rightwards. Hence, initial level of both modern agricultural product and manufacturing product increases from \((Z_0, X_0)\) to \((Z_1, X_1)\).

We would now explore the consequences of agricultural trade liberalization.

Differentiating equations (3.5.1)-(3.5.6) with respect to \(P^*\) we have: (See mathematical appendix for detailed derivation)

\[
\dot{w} = 0 ...(3.5.15)
\]

\[
\dot{R} = \frac{1}{\theta_a} \dot{P}^* ...(3.5.16)
\]

\[
\dot{X} = \left\{ \frac{\dot{P}^*}{Y} \theta_a \frac{\delta^2 E}{\delta P^*} + \frac{\delta^2 E}{\delta P^*} \dot{P}^* \right\} \left\{ (\lambda_{\beta} - \frac{\lambda_{\beta} \lambda_{\gamma}}{\lambda_{\alpha}}) \right\} ...(3.5.17)
\]
\[
\dot{Y} = \dot{P}_r \frac{P_r \theta_y \delta^2 E}{Y \theta_a \delta P_r^2} + \frac{P^*_r \theta_y \delta^2 E}{Y \delta P_r \delta P^*_r} \dot{P}_r^* \ldots (3.5.18)
\]

\[
\dot{Z} = \frac{\hat{\lambda}_a}{\lambda} \left[ \frac{P_r \dot{P}_r}{Y} \frac{\theta_y \delta^2 E}{\theta_a \delta P_r^2} + \frac{P^*_r \theta_y \delta^2 E}{Y \delta P_r \delta P^*_r} \dot{P}_r^* \right] \ldots (3.5.19)
\]

\[
\hat{P}_r = \frac{1}{\theta_a} \frac{\theta_y}{\theta_a} \dot{P}_r^* \ldots (3.5.20)
\]

**Proposition 3.5.C:** Following agricultural trade liberalization, real wage measured in unit of food falls

**Comment:** From equation (3.5.1) we conclude that wage rate of workers remain unchanged. From equation (3.5.3) we find that as price of nontraditional agricultural sector produce increases, landowners receive a higher return. From equation (3.5.2) we find that price of traditionally agricultural commodity increases. From equations (3.5.15), (3.5.20) we find that:

\[
\dot{w} - \dot{P}_r = -\frac{1}{\theta_a} \frac{\theta_y}{\theta_a} \dot{P}_r^* \ldots (3.5.22)
\]

Though money wage remains unchanged, real product wage in unit of traditional agricultural good falls. This is because of the fact that price of traditional agricultural sector increases and decreases workers command over basic food items.

**Proposition 3.5.D:** Following Agricultural trade liberalization, traditional agricultural sector expands if:

\[
\frac{P_r \theta_y \delta^2 E}{Y \theta_a \delta P_r^2} + \frac{P^*_r \theta_y \delta^2 E}{Y \delta P_r \delta P^*_r} > 0.
\]

**Comment:** We have seen from the preceding proposition that price of non traded sector rises. We have already shown that supply of output of the traditional agricultural sector is demand determined. An increase in price of non traded sector would lead to a fall in demand for traditional item and lead to excess supply. However, increase in price of modern agricultural product has a positive effect on the demand for traditional agricultural product. If the positive effect on demand outweighs the negative effect supply of traditional agricultural product increases.

(Refer to fig 3.6.2).
In figure (3.6.2) we find that initial production of $Y$ is $Y_1$. As price of non traded sector increases with agricultural trade liberalization, there is a movement along the demand curve to point B. However, increase in price of modern agricultural product has a positive effect on demand for traditional agricultural product (the two goods are assumed to be substitutes). Hence demand curve shifts rightwards and the new equilibrium point is C and output expands to $Y^*$. Following the Rybzynscki argument modern agricultural sector contracts. What happens to the manufacturing sector is of importance. Given, traditional agricultural sector is labour intensive compared to the modern agricultural sector; labour required by this sector is more compared to that released by the modern agricultural sector. Hence, additional labour is released from manufacturing sector. Given, manufacturing sector is labour intensive compared to the modern agricultural sector, manufacturing sector contracts.
Section 3.7: Welfare Analysis

In this section we would be analyzing the welfare consequences of globalization policies.

For analyzing the welfare of the society, we make use of "Expenditure Function". First, we note that

Total Expenditure on X, Y, Z at domestic prices is equal to Value of production at domestic prices net of interest income repatriated back. Using this concept we get\(^36\):

\[ E(P_x^*, P_y^*, P_z^*, U) = P_x^* X + P_y^* Y + ZP_z^* - rK_f \cdots (3.5.22) \]

Where \( K_f = \) Foreign capital

\[ E(P_x^*, P_y^*, P_z^*, U) = \text{expenditure function}, \]

\[ U = \text{Utility} \]

\[ \frac{\delta E}{\delta U} > 0, \frac{\delta E}{\delta P_x^*} > 0, \frac{\delta E}{\delta P_y^*} > 0, \frac{\delta E}{\delta P_z^*} > 0 \]

We would first concentrate how welfare changes if there is a decrease in risk premium of the country.

Differentiating equation (3.5.22) with respect to rate of interest we have,

\[ \frac{\delta E}{\delta P_y^*} P_y + \frac{\delta E}{\delta U} dU = P_x^* X + P_y^* Y + ZP_z^* - rK_f dr \cdots (3.5.23) \]

Manipulating equation (26) we have:

\[ dU = \frac{1}{\delta E} \left\{ P_x^* X + P_y^* Y + P_z^* Z - rK_f \right\} \]

\[ + \frac{\delta E}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^* \delta U} \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \]

\[ + \frac{\delta E}{\delta P_y^*} \frac{\delta^3 E}{\delta P_y^* \delta U} \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \]

\[ + \frac{\delta E}{\delta P_y^*} \frac{\delta^4 E}{\delta P_y^* \delta U} \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \left[ - \frac{\theta_y}{\theta_x} \frac{\theta_y}{\theta_u} \right] \]

\[ + K_f dr \]

\[ \text{See Ethier (1988)} \]
Production of the traditional agricultural item falls and the modern agricultural sector expands following fall in risk premium. Manufacturing sector expands. That is, post fall in risk premium of the country, value of production of the traditional agricultural sector measured at domestic prices fall. The fall in value of production suppresses welfare. However, value of production of the manufacturing product and the modern agricultural product at domestic prices increase. This in turn increases welfare. Hence, two opposite effects act on the value of production. On the other hand, interest income repatriated back home reduces. This increases welfare.

It follows from Sheppards Lemma, that \( \frac{SE}{SP_y} \) is demand for traditional agricultural product and \( Y \) represents supply of traditional agricultural product. Since, the good is non traded,

\[
(Y - \frac{SE}{SP_y}) = 0
\]

and hence:

\[
P_y(Y - \frac{SE}{SP_y}) \frac{r}{\tau} \left[ -\frac{\theta_y}{\theta_n} + \frac{\theta_y}{\theta_n} \left[ -\theta_n + \theta_n + \theta_n \right] \right] = 0
\]

Hence, we notice various cross effects acting on welfare of the economy. In the present model if the negative effect on welfare outweighs the positive effect on welfare immeserisation follows. Sufficient condition for immeserisation in this case is:

\[
\lim_{r \to 0} \frac{P_x X + \frac{1}{\lambda_n} \left[ A_n(1 + \frac{\theta_n}{\theta_n}) - \frac{P_x}{SP_y} \frac{\delta^2 E}{\delta P^2_y} \left( \frac{\lambda_n}{\lambda_n} - \frac{\lambda_n}{\lambda_n} \right) \frac{\theta_n}{\theta_n} \right] + \frac{P_x}{SP^2_y} \frac{\delta^2 E}{\delta P^2_y} \left[ \theta_n - \theta_n \theta_n + \theta_n \theta_n \right] \left[ \frac{P_y}{\lambda_n} + P_x Z \left( \frac{\lambda_n}{\lambda_n} \right) \right] - K_f dr < 0 \ldots \ldots (3.5.25)
\]

We now turn to the effect of agricultural trade liberalization.

Differentiating equation (3.5.22) with respect to price of modern agricultural sector produce we have:

\[
\frac{SE}{SP_y} \frac{dP_y}{dP_{\tau}} + \frac{SE}{SP_{\tau}} \frac{dU}{dP_{\tau}} + \frac{SE}{SP_{\tau}} = P_x \frac{\delta X}{\delta P_{\tau}} + Y \frac{\delta P_y}{\delta P_{\tau}} + P_x \frac{\delta Y}{\delta P_{\tau}} + Z + P_x \frac{\delta Z}{\delta P_{\tau}} \ldots \ldots (3.5.26)
\]

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Manipulating equation (3.5.26) we have:

\[
\frac{dU}{dP'} = \frac{1}{\delta U} \left\{ \frac{P_x \theta_y \delta^3 E}{Y \theta_a \delta P_y} + \frac{P_x^* \delta^3 E}{Y \delta P_y \delta P'_x} \right\} \left\{ \frac{P_x X}{P_x^*} \left( \frac{\lambda_y}{\lambda_a} \frac{\lambda_a}{\lambda_y} \right) + P_x Y \frac{1}{P_x^*} - Z \frac{\lambda_y}{\lambda_a} \right\} + \frac{(-\delta E + Y)}{P_x^* \theta_a - \delta E} \right] \]

Following Agricultural trade liberalization traditional agricultural sector expands and modern agricultural sector contracts. The manufacturing sector contracts. Fall in the production level of the modern agricultural sector and the manufacturing sector reduce value of production measured at domestic prices and in the process reduces welfare. However, rise in production of the traditional agricultural product increases value of production and hence increases welfare.

It follows from the fact that from Sheppards Lemma, that \(\frac{\delta E}{\delta P_y}\) is demand for traditional agricultural product and \(Y\) represents supply of traditional agricultural product. Since, the good is non traded, \((Y - \frac{\delta E}{\delta P_y}) = 0\).

Thus, \((-\frac{\delta E}{\delta P_y} + Y) \frac{P_x \theta_y}{P_x^* \theta_a} = 0\)

We should also note that from Sheppard's Lemma: \(\frac{\delta E}{\delta P'_x}\) is demand for modern agricultural product and \(Z\) denotes it's supply. Since the good is export oriented in nature: \([Z - \frac{\delta E}{\delta P'_x}]\) expresses physical volume of exports of \(Z\).

Thus, we notice various effects counteracting on each other. If the negative effect outweighs the positive effect, immeserisation follows. In the present case sufficient condition for immeserisation is as follows:

\[
\left\{ \frac{P_x \theta_y \delta^3 E}{Y \theta_a \delta P_y} + \frac{P_x^* \delta^3 E}{Y \delta P_y \delta P'_x} \right\} \left\{ \frac{P_x X}{P_x^*} \left( \frac{\lambda_y}{\lambda_a} \frac{\lambda_a}{\lambda_y} \right) + P_x Y \frac{1}{P_x^*} - Z \frac{\lambda_y}{\lambda_a} \right\} + \left[ Z - \frac{\delta E}{\delta P'_x} \right]<0
\]

**Proposition 3.3:** A possibility of immeserisation exists in case decrease in country specific risk premium and also in case of agricultural trade liberalization.
Section 3.8: Conclusion
In the present chapter we have constructed two general equilibrium models to focus on effects of FDI and agricultural trade liberalization in a developing country characterized by agricultural dualism. In the first model we have considered capital to be a binding constraint. We have constructed a three sector general equilibrium model incorporating agricultural dualism. We have kept in mind that foreign capital is being utilized by the agricultural sector also. Through the model we come to the conclusion that in case of increase in capital base of the economy and agricultural trade liberalization real wage decreases. However, what is also to be noted is that factor intensity rankings play important role in determining the nature of the results. Possibility of immerserisation is a reality in both the cases.

In the second model of the chapter we have incorporated full capital mobility. Decrease in country specific risk premium and agricultural trade liberalization depress real wage measured in unit of food. Through the second model of this chapter we explore the possibilities under which immerserisation may take place along with adverse effect on real wage measured in unit of food. The results are crucially dependent on multiple cross effects in this three good general equilibrium structure. Decreasing real wage is a disturbing global phenomenon in recent times. The broad policy message of the chapter is that the policy makers in emerging market economies should judiciously work out sequence, speed and modalities of globalization. The chapter can be extended in different directions. We can also introduce different aspects of factor market segmentation such as division between the skilled-unskilled labourers to explore the effect of globalization on real wage of both skilled and unskilled labour.

Mathematical Appendix
Appendix for section 3.2
The general equilibrium structure of the model is as follows.
Given the assumption of perfectly competitive markets, the usual price- unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:
\[ a_u w + a_{x} r = P^* x \quad \ldots \quad (3.2.1) \]
\[ a_y w + a_{y} R = P_y \quad \ldots \quad (3.2.2) \]
Given the full employment condition, the endowment equations are given as follows.

\[ a_w X + a_y Y + a_Z Z = L \quad \text{(3.2.4)} \]

\[ a_w X + a_Z Z = K \quad \text{(3.2.5)} \]

\[ a_y Y + a_Z Z = T \quad \text{(3.2.6)} \]

The following equation shows the market clearing condition.

\[ \frac{\delta E(P_x^*, P_y^*, P_z^*)}{\delta P_y} = Y \quad \text{(3.2.7)} \]

\[ E(P_x^*, P_y^*, P_z^*) = E = \text{Expenditure Function} \]

\[ \text{Where,} \quad \frac{\delta E(P_x^*, P_y^*, P_z^*)}{\delta P_y} = \text{Demand for Y} \]

This follows from Sheppard's Lemma.

**Effect of increase in capital stock:**

From the price system we have:

\[ \dot{w} = -\frac{\theta_w}{\theta_u} \hat{\lambda}_u \quad \text{(3.2.a)} \]

\[ \hat{\lambda} = -\frac{\theta_u}{\theta_y} \left\{ \frac{1}{C_3} \hat{p}_y \right\} \quad \text{(3.2.b)} \]

\[ \hat{R} = \hat{p}_y \left\{ \frac{1}{\theta_y} \right\} + \frac{\theta_y}{\theta_y \theta_u} \hat{\lambda}_u \quad \text{(3.2.c)} \]

From market clearing equation we have:

\[ \frac{P_x}{Y} \frac{\delta^2 E}{\delta P_y^2} \hat{p}_y = \hat{\lambda}_y \quad \text{(3.2.d)} \]

From the factor endowment equations we have:

\[ \lambda_y \hat{Y} + \lambda_x \hat{X} + \lambda_z \hat{Z} = -\lambda_y \hat{a}_y - \lambda_x \hat{a}_x - \lambda_z \hat{a}_z \quad \text{(3.2.b5)} \]

\[ \lambda_y \hat{Y} + \lambda_z \hat{Z} = 0 \quad \text{(3.2.b6)} \]
Using equations (3.2.a)-(3.2.b71) we have:

\[ \hat{p}_x = \frac{(\lambda_n A_3 + \lambda_x B_3)}{(1 + \partial_x \theta_x)} \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \] 

\[ \hat{R} = \frac{1}{\theta_y} \frac{(\lambda_n A_3 + \lambda_x B_3)}{(1 + \partial_x \theta_x)} \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \] 

\[ \hat{\omega} = \frac{1}{\theta_x} \frac{(\lambda_n A_3 + \lambda_x B_3)}{(1 + \partial_x \theta_x)} \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \] 

\[ \hat{r} = \frac{1}{\theta_y} \frac{(\lambda_n A_3 + \lambda_x B_3)}{(1 + \partial_x \theta_x)} \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \] 

\[ \hat{y} = \frac{1}{D_3 \lambda_y} \{ \lambda_n \hat{K} + (\lambda_n A_3 + \lambda_x B_3)(1 + \partial_x \theta_x) \} \left[ \frac{1}{C_y} \theta_x \right] \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \] 

\[ \hat{Z} = \frac{1}{D_3} \{ \lambda_n \hat{K} + (\lambda_n A_3 + \lambda_x B_3)(1 + \partial_x \theta_x) \} \left[ \frac{1}{C_y} \theta_x \right] \left( -\frac{1}{D_3 \lambda_y} \right) \lambda_n \hat{K} \]
\[
\dot{X} = -\frac{B_x}{\lambda_x} \left[ \frac{1}{C_x \theta_y} \left( \frac{\lambda_x A_3 + \lambda_x B_3}{1 + \frac{\lambda_x}{\theta_x} \theta_x} \right) - \frac{P_x \delta^2 E}{Y \delta^2 \phi_y} \left( \frac{1 + \frac{\lambda_x}{\theta_x} \theta_x}{C_x \theta_y} \right) \right]
\]

\[
\theta_x \left[ \frac{1}{C_x \theta_y} \left( \frac{\lambda_x A_3 + \lambda_x B_3}{1 + \frac{\lambda_x}{\theta_x} \theta_x} \right) - \frac{P_x \delta^2 E}{Y \delta^2 \phi_y} \left( \frac{1 + \frac{\lambda_x}{\theta_x} \theta_x}{C_x \theta_y} \right) \right]
\]

\[
(\lambda_x - \frac{\lambda_y \lambda_x}{\lambda_y}) \left[ \frac{1}{D_3} \left( \frac{\lambda_x A_3 + \lambda_x B_3}{1 + \frac{\lambda_x}{\theta_x} \theta_x} \right) - \frac{P_x \delta^2 E}{Y \delta^2 \phi_y} \left( \frac{1 + \frac{\lambda_x}{\theta_x} \theta_x}{C_x \theta_y} \right) \right]
\]

Where,

\[D_3 = \lambda_x \lambda_x - (\lambda_x - \frac{\lambda_y \lambda_x}{\lambda_y}) > 0\]

\[C_3 = \frac{\left[ \theta_x (\theta_x - \theta_y) + \theta_x \theta_y \theta_x \theta_y \right]}{\theta_x \theta_y} > 0\]

\[B_3 = (\lambda_x \theta_x \sigma^x \theta_x + \lambda_x \frac{\theta_x}{1 - \theta_x} \sigma^x \theta_x)\]

\[A_3 = \lambda_x \theta_x \sigma^x \theta_x + \lambda_x \frac{\theta_x}{1 - \theta_x} \sigma^x \theta_x\]

**Effect of Agricultural Trade Liberalization**

\[\dot{w} = -\frac{\theta_y}{\theta_x} \hat{r} \ldots (3.2.a1)\]

\[\dot{R} = \frac{\theta_y}{\theta_y} \frac{\theta_x}{\theta_x} \hat{r} + \frac{1}{\theta_y} \hat{r} \ldots (3.2.b1)\]

\(^{37}\) Follows from stability condition.
\[ \dot{r} = \{ \dot{p}_r^* - \dot{p}_r \} \frac{1}{C_3} \]  

From market clearing equation we have:

\[ \frac{P_y \delta^2 E}{Y} \frac{\partial^2}{\partial p_r^2} \dot{r} + P_y \frac{\delta^2 E}{\delta p_r \delta p_r^*} \dot{r} = \ddot{y} \]  

From the factor endowment equations we have:

\[ \lambda_y \dot{y} + \lambda_x \dot{x} + \lambda_z \dot{z} = -\lambda_x \hat{a}_y - \lambda_y \hat{a}_x - \lambda_z \hat{a}_z \]  

\[ \lambda_y \dot{y} + \lambda_x \dot{x} = 0 \]  

\[ \lambda_x \dot{x} + \lambda_z \dot{z} = -\lambda_x \hat{a}_x - \lambda_z \hat{a}_z \]  

Using the above equations we have:

\[ \dot{r} = \frac{1}{C_3} \left[ \frac{\partial \dot{p}_r^*}{\partial \theta_y} \right] + \left( \frac{1}{C_3} \right) \frac{\partial^2 \dot{r}}{\partial \theta_y \partial \theta_y} + \left( \frac{1}{C_3} \right) \frac{\partial \dot{p}_r^*}{\partial \theta_y} \]  

\[ \dot{K} = \frac{1}{C_3} \frac{M_3}{C_3 \left( \frac{P_y \delta^2 E}{Y} + M_y \theta_x \right)} \dot{r} ] \]  

\[ \dot{w} = \left( \frac{\partial \dot{p}_r^*}{\partial \theta_y} \right) \frac{M_3}{C_3} \left( \frac{\partial \dot{p}_r^*}{\partial \theta_y} \right) + \left( \frac{1}{C_3} \right) \frac{\partial^2 \dot{r}}{\partial \theta_y \partial \theta_y} + \left( \frac{1}{C_3} \right) \frac{\partial \dot{p}_r^*}{\partial \theta_y} \]  

\[ \dot{r} = \frac{1}{C_3} \left[ \dot{p}_r^* + \frac{1}{C_3} \frac{\partial \dot{p}_r^*}{\partial \theta_y} \right] \]  

\[ \dot{r} = \frac{1}{C_3} \left[ \dot{p}_r^* + \frac{1}{C_3} \frac{\partial \dot{p}_r^*}{\partial \theta_y} \right] \]
\[ \dot{y} = \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \frac{P_{x}}{\theta_{y}} \right) \frac{1}{\theta_{y}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} \frac{1}{\lambda_{\theta_{y}}} B_{3} + A_{3} \right) + P_{x} \frac{\delta^{2}E}{\delta P_{x}^{2}} \dot{P}_{x} \]

\[ \left[ \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} B_{3} + A_{3} \right) - \frac{P_{x} \delta^{2}E}{\delta P_{x}^{2}} \right] \].....(3.2.22)

\[ \dot{z} = -\frac{\lambda_{\theta_{y}}}{\theta_{y}} \left[ \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \frac{P_{x}}{\theta_{y}} \right) \frac{1}{\theta_{y}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} \frac{1}{\lambda_{\theta_{y}}} B_{3} + A_{3} \right) + P_{x} \frac{\delta^{2}E}{\delta P_{x}^{2}} \dot{P}_{x} \right] \]

\[ \left[ \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} B_{3} + A_{3} \right) - \frac{P_{x} \delta^{2}E}{\delta P_{x}^{2}} \right] \].....(3.2.23)

\[ \dot{\dot{z}} = -\frac{\lambda_{\theta_{y}}}{\theta_{y}} \left[ \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \frac{P_{x}}{\theta_{y}} \right) \frac{1}{\theta_{y}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} \frac{1}{\lambda_{\theta_{y}}} B_{3} + A_{3} \right) + P_{x} \frac{\delta^{2}E}{\delta P_{x}^{2}} \dot{P}_{x} \right] \]

\[ \left[ \frac{1}{V_{C3}} \left( \frac{\theta_{y}}{\theta_{y}} + 1 \right) \left( \lambda_{\theta_{y}} B_{3} + A_{3} \right) - \frac{P_{x} \delta^{2}E}{\delta P_{x}^{2}} \right] \].....(3.2.24)

Where,

\[ C_{3} = \frac{[\theta_{y} \left( \theta_{y} + \theta_{y} \theta_{y} \right) + \theta_{y} \theta_{y} \theta_{y} \theta_{y}]}{\theta_{y} \theta_{y}} \]

\[ B_{3} = \left( \lambda_{\theta_{y}} \theta_{y} \sigma_{t,b} \theta_{y} + \lambda_{\theta_{y}} \frac{\theta_{y}}{1 - \theta_{y}} \sigma_{t,b} \right) \]

\[ A_{3} = \lambda_{\theta_{y}} \theta_{y} \sigma_{t,b} \theta_{y} + \lambda_{\theta_{y}} \frac{\theta_{y}}{1 - \theta_{y}} \sigma_{t,b} \]

\[ V = \lambda_{\theta_{y}} \frac{1}{\theta_{y}} \left( \lambda_{\theta_{y}} \theta_{y} \sigma_{t,b} \theta_{y} + \lambda_{\theta_{y}} \theta_{y} \sigma_{t,b} \right) \]

**Stability Condition of the Model**

We know, \( \frac{\delta(ED)}{\delta P_{y}} < 0 \) (for stability)

\[ \frac{\delta}{\delta P_{y}} (ED) = \frac{\delta^{2}E(P_{x}, P_{y}, P_{x}^{*})}{\delta P_{y}^{2}} - \frac{\delta Y}{\delta P_{y}} < 0, \]

Where ED= Excess Demand
\[ \frac{\delta^2 E(P^*_x, P^*_y, P^*_z)}{\delta P^*_y} < 0 \] (Since expenditure function is concave in prices.)

Hence, for stability we require:

\[ \frac{\delta Y}{\delta P^*_y} > 0 \]

\[ \hat{Y} = \left( \frac{1}{D_3 C_3} \frac{\theta_\alpha}{\theta_\nu} \right) (\lambda_\nu A_3 + \lambda_\nu B_3) \]

\[ D_3 = \lambda_\nu \lambda_\nu - \left( \frac{\lambda_\alpha \lambda_\alpha}{\lambda_\eta} \right) \]

\[ C_3 = \left[ \frac{\theta_\alpha \left( \theta_\alpha \theta_\nu - \theta_\alpha \theta_\eta \right) + \theta_\alpha \theta_\alpha \theta_\eta}{\theta_\alpha \theta_\eta} \right] \]

\[ B_3 = \lambda_\alpha \theta_\alpha \sigma^*_n \lambda_\eta \left( \frac{\theta_\alpha}{1 - \theta_\eta} \right) \]

\[ A_3 = \lambda_\alpha \theta_\alpha \sigma^*_n \lambda_\eta \left( \frac{\theta_\alpha}{1 - \theta_\eta} \right) \]

Manipulating the above equation we find that irrespective of the fact that Z is land intensive to Y or Z labour intensive to Y, the model is stable.

**Appendix for model in section 3.5**

\[ a_x \cdot w + a_y \cdot r = P^*_x \ldots (3.5.1) \]

\[ a_y \cdot w + a_y \cdot R = P^*_y \ldots (3.5.2) \]

\[ a_x \cdot w + a_x \cdot r + a_y \cdot R = P^*_x \ldots (3.5.3) \]

Where,

\[ r = r^* + \varepsilon \]

Given the full employment condition, the endowment equations are given as follows.

\[ a_x \cdot X + a_y \cdot Y + a_z \cdot Z = L \ldots (3.5.4) \]

\[ a_y \cdot Y + a_z \cdot Z = T \ldots (3.5.5) \]

The following equation shows the market clearing condition.
\[ \frac{\delta E(P_x^*, P_y^*, P_z^*, U)}{\delta P_y} = Y \ldots (3.5.7), \]

Where, \( \frac{\delta E(P_x^*, P_y^*, P_z^*, U)}{\delta P_y} \) = Demand for Y

Where U= Utility

This follows from Sheppard’s Lemma.

Labour and capital are taken to be substitutable in sector X and sector Z. The elasticity of substitution between labour and capital in sector X and sector Z can be represented by the following equations respectively.

\[ \frac{\hat{\alpha}_{lx} - \hat{\alpha}_{xz}}{\hat{w} - \hat{r}} = \sigma_{i,k}^x \]

\[ \frac{\hat{\alpha}_{lx} - \hat{\alpha}_{xz}}{\hat{w} - \hat{r}} = \sigma_{i,k}^z \]

**Effect of a decrease in country specific risk premium**

From equation (3.5.1)

\[ \hat{w} = \frac{\theta_{yx} \hat{r}}{\theta_{lx}} \ldots (3.5.8) \]

From (3.5.2) we have:

\[ \hat{R} = \hat{P} \frac{1}{\theta_y} \frac{\theta_y}{\theta_y} \hat{w} \ldots (3.5.a) \]

From (3.5.3) we have:

\[ \hat{w} = \frac{1}{A} (\theta_{yx}) \hat{P} \ldots (3.5.b) \]

From the food market equilibrium condition we have:

\[ P_y \frac{1}{Y} \frac{\delta^2 E}{\delta P_y^2} \hat{P}_y = \hat{Y} \ldots (3.5.I) \]

From the factor endowment equations we have:

\[ \lambda_y \hat{Y} + \lambda_x \hat{X} + \lambda_z \hat{Z} = -\lambda_y \hat{b}_y - \lambda_x \hat{a}_x - \lambda_z \hat{a}_z \ldots (3.5.G) \]
\[
\lambda_p \hat{y} + \lambda_n \hat{z} = 0 \ldots (3.5.H)
\]

With the help of (3.5.b), (3.5.i), (3.5.G), (3.5.H) and the fact \( \hat{r} = \frac{\hat{r}}{r} \)
we have the effect on factor prices and output given below

\[
\hat{w} = -\frac{\theta_{n_{2}}}{\theta_{n}} \hat{r} \ldots (3.5.8)
\]
\[
\hat{R} = -\frac{P_{r}}{\tau \theta_{n}} \frac{1}{\theta_{n}} \left[-\theta_{n_{2}} \theta_{n_{2}} + \theta_{n_{2}} \theta_{n_{2}} \right] \ldots (3.5.9)
\]
\[
\hat{X} = \frac{\lambda_{n}}{\theta_{n}} \left[-A_{0} \left(1 + \frac{\theta_{n_{2}}}{\theta_{n}} \right) + \frac{P_{r}}{Y} \frac{\sigma_{2}E}{Y} \left(\lambda_{p}^{2} - \lambda_{n}^{2} \right) \frac{\theta_{n_{2}}}{\theta_{n}} C_{4} \right] \ldots (3.5.10)
\]
\[
\hat{Y} = \frac{\lambda_{n}}{\theta_{n}} \left\{ \frac{P_{r}}{Y} \frac{\sigma_{2}E}{Y} \frac{\theta_{n_{2}}}{\theta_{n}} \theta_{n_{2}} \theta_{n_{2}} \left[-\theta_{n} \theta_{n_{2}} + \theta_{n} \theta_{n_{2}} \right] \right\} \ldots (3.5.11)
\]
\[
\hat{Z} = -\frac{\lambda_{n}}{\theta_{n}} \left\{ \frac{P_{r}}{Y} \frac{\sigma_{2}E}{Y} \frac{\theta_{n_{2}}}{\theta_{n}} \left[-\theta_{n} \theta_{n_{2}} + \theta_{n} \theta_{n_{2}} \right] \right\} \ldots (3.5.12)
\]
\[
\hat{P}_{r} = \frac{r}{\tau} \left[-\theta_{n} \theta_{n_{2}} + \theta_{n} \theta_{n_{2}} \right] \ldots (3.5.13)
\]
\[
\hat{r} = \frac{\hat{r}}{r}
\]
\[
A_{4} = \left[ \lambda_{n} \sigma_{r_{1}}^{2} \left(1 - \theta_{n} \right) + \lambda_{n} \theta_{n_{2}} \frac{1}{\theta_{n}} - \theta_{n_{2}} \right]
\]
\[
C_{4} = \frac{\theta_{n_{2}} \theta_{n_{2}}}{\theta_{n}} \frac{\theta_{n_{2}} \theta_{n_{2}}}{\theta_{n}} - \theta_{n_{2}}
\]

Thus, the model leads to the following propositions.

**Agricultural Trade Liberalization**

Differentiating equations (3.5.1)- (3.5.6) with respect to \( P_{r} \) we have:

\[
\hat{w} = 0 \ldots (3.5.15)
\]
\[
\hat{R} = \frac{1}{\theta_{n}} \hat{P}_{r} \ldots (3.5.16)
\]
\[
\hat{P}_{r} = \frac{\theta_{n}}{\theta_{n}} \hat{P}_{r} \ldots (3.5.20)
\]
From the factor endowment equations we have:

\[
\lambda_y \dot{Y} + \lambda_x \dot{X} + \lambda_z \dot{Z} = -\lambda_y \dot{\alpha}_y - \lambda_x \dot{\alpha}_x - \lambda_z \dot{\alpha}_z \ldots (3.5.G)
\]

\[
\lambda_y \dot{Y} + \lambda_x \dot{X} + \lambda_z \dot{Z} = 0 \ldots (3.5.H)
\]

From the food market equilibrium condition we have:

\[
P_y \frac{\delta^2 E}{\delta P_y^2} \dot{P}_y + P_y^* \frac{\delta^2 E}{\delta P_y^* \delta P_y^*} \dot{P}_y^* = \dot{Y} \ldots (3.5.1)
\]

From equations (3.5.G), (3.5.H), (3.5.I) we have:

\[
\dot{X} = \dot{P}_y^* \frac{P_y}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} + \frac{P_y^*}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} \dot{P}_y^* \{ (\lambda_y - \frac{\lambda_y^*}{\lambda_y^*} ) \} \ldots (3.5.17)
\]

\[
\dot{Y} = \dot{P}_y^* \frac{P_y}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} + \frac{P_y^*}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} \dot{P}_y^* \ldots (3.5.18)
\]

\[
\dot{Z} = -\frac{\lambda_z}{\lambda_z^*} \{ \dot{P}_y^* \frac{P_y}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} + \frac{P_y^*}{Y} \frac{\theta_y}{\delta P_y^*} \frac{\delta^2 E}{\delta P_y^*} \dot{P}_y^* \} \ldots (3.5.19)
\]