Trade and Labor Market Imperfection: A Model with Status Conscious Preference

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Abstract

The present model develops a hypothetical economy with status conscious individuals and two types of labor markets. One exhibits search friction, while the other is perfectly competitive. It is shown that in equilibrium, this economy with a status-conscious preference may yield unemployment. If such a single factor economy, with one non-traded final good and two traded intermediate goods, opens up to trade then the difference in the degree of the labor market imperfection becomes a source of comparative advantage between two otherwise identical countries. Complete specialization is impossible in such a uninhibited set up. Moreover, trade does not equalize wages within the country, neither does it guarantee the reduction of unemployment.

Keywords: Trade; Search and matching; Unemployment; Social Status; Inheritance

JEL Classification: F10, F11, F16, E24, J64

1. Introduction.

Public discourses and debates have always related the opening up of the domestic economy to the creation or destruction of domestic jobs, popularly increase or decrease in unemployment. However attempts to build formal trade models that incorporate unemployment endogenously are not a very old practice. The seminal contributions of Diamond-Mortensen-Pissarides model of search and matching unemployment has opened up the rich possibilities for building general equilibrium models of trade with unemployment. It was the beginning of the 1990's, when a sizable literature started to address the issue of international trade and equilibrium unemployment simultaneously in a general equilibrium set up. The present paper is closely related to this genre of literature, but it sheds light on the issue of unemployment from the perspective of social status. The present model contributes by filling in a gap in the existing literature which has remained silent on this issue. Moreover this paper focuses on the possibility and the effects of opening up of trade in such an economy.

> "…employment can be a factor in self-esteem and indeed in esteem by others… If a person is forced by unemployment to take a job that he thinks is not appropriate for him, or not commensurate with his training, he may continue to feel unfulfilled…"
>
> ---Amartya Sen (1975)

One of the most important determinant of the social status of a person in the society is her employment type. Broadly, if the nature of employment is classified into two categories, namely organized and unorganized sector jobs, then it has seen that working in the unorganized sector is undesirable from the societal status[1]. Greater the social status of the individual, higher is social stigma associated with the unorganized sector jobs. Compared to unorganized sector, organized sector jobs are more remunerative, but it is more difficult to get employment in this sector. Labor market of the organized sector faces a higher search friction which excludes a positive number of job searchers from the organized sector. Unorganized sector brings an alternative to those unsuccessful job seekers. But, people could still remain unemployed. This model, argues that the status consciousness associated with employment type can give one explanation to this persistence

[1] Unorganized sector workers in many countries face social exclusion too, along with economic and political exploitation (see, Car and Chen (2004)). Sociologists recognize occupational type as one of the important factor to compute social status. Among different employment type they assign least score for the informal jobs in the process of estimating the social status (Hollingshead (2011)).

of unemployment in equilibrium. Interestingly in this frame work, the difference in the degree of labor market imperfection manifests itself as a source of comparative advantage between two otherwise identical nations and after opening up for trade, denies the possibility of complete specialization and explores situation where both the countries may lose in aggregate employment term.

The concept of status in economics is not new. Indeed the idea of 'conspicuous consumption' is as old as Veblen (1899). More recently, Grossman and Shapiro (1988), and Basu (1989) have recognized the presence of a 'status good'[2] in the preference function and captured the features of the market for such status goods. The early 1990's usage of status conscious preference has been used to explain many real life economic phenomenon. Cole, Mailath and Postlewaite (1992) introduced status good in the preference function for the purpose of explaining cross country heterogeneity of growth rates. Empirical justification of the conspicuous consumption has been given by Charles, Hurst and Roussanov (2009). They show the presence of conspicuous consumption among "Blacks and Hispanics" to demonstrate their economic status in comparison with "Whites". Moav and Neeman (2010) explains choices made by the poor that do not appear to help them escape poverty, by assuming preference to be status conscious. On similar line, Banerjee and Mullainathan (2010) argues that the consumption puzzle of the poor can be explained using 'temptation good' in the utility function. In Marjit (2012) poverty and inequality are explained in terms of the societal status. Effect of status has been captured by the relative income of the individual. This method of introducing status consciousness is more close to our approach. In our model the inheritance level represents the social status of an individual.

A large number of works are related to the study of trade and unemployment. However here we constrain the discussion only to those studies which are closely related to the present work. In continuous time-frame there are few papers which includes two types of sector: one with lesser and another with higher labor market friction. The assumption of continuous search and matching process allows to include these two sectors in the model. One example of such kind of model is Davidson et al. (2006). They build a model in a continuous time framework with skill hierarchy among different individuals. By assumption the return from the frictionless sector is fixed (i.e. not dependent on the productivity level). Return in the sector with search friction, on the other hand,

[2]"…those goods for which the mere use or display of a particular branded product confers prestige on their owners, apart from any utility deriving from their function", Grossman and Shapiro (1988) defined status-good in this way.

depends on the productivity level of the agent. In this set up it can be shown that high skilled individuals choose to work in that sector where they get the return according to their productivity in spite of facing an entry deterrent search friction. Although the main focus of that paper is to illustrate the possibility that in the short run a small open economy can produce outside its long run frontier. Davidson *et. al.* (1987), consider a discrete time set up and by the assumption of exit restriction they constrained an individual searcher, who fails to get job in the sector with search friction in a period, to join the frictionless labor market in that same period. Present paper closely builds on Davidson *et. al.* (1987) but departs from it by incorporating the possibility of trade.

The way the possibility of trade is invoked in the present model is close to Davidson, Martin and Matusz (1999) and Helpman and Itskhoki (2009). In both these models trade opening up due to a difference in the labor market parameters among otherwise identical nations. Davidson *et. al.* (1999) (if large country-small country argument is not considered) or the single factor version of Dutta *et. al.* (2009) have supported the classic Ricardian result of complete specialization. Helpman *et. al.* (2009) constructs a model of firm heterogeneity (as in Melitz (2003)) with differentiated products in monopolistic competition and has shown that country benefits from lowering frictions in its labor market, but this harms the country's trade partner.

Single factor trade models with unemployment in general claims that trade leads to a fall in unemployment for both the countries. H-O-S framework with unemployment (Dutta *et al.* (2009)) shows a rise in unemployment in one country and fall at the other. In a model of firm heterogeneity with differentiated skill levels, Davidson *et. al.*(2008) have come up with a different result and demonstrate that in the short-run unemployment increases due to trade, whereas in the longrun there is a confounding factor, namely the entry of new firms arising out of an increase in profitability. However Mirta and Ranjan (2010) show that offshoring leads to unambiguous reduction of unemployment. Interestingly some contributions raises the issue of an increase in unemployment after trade opens up in a single factor model. Helpman *et. al.* (2009) have pointed out that the opening to trade raises a country's rate of unemployment if its relative labor market frictions in the differentiated sector are low, and it reduces the rate of unemployment if its relative labor market frictions in the differentiated sector are high. Davidson *et. al.* (1999) has argued that capital abundant large country will face a higher unemployment rate, but trade will bring unemployment rate down for small country.

Another set of literature is also relevant in this discussion. Effect of trade on informality is presently a wide issue of discourse. Empirical evidences do not favor a single sided conclusion. Koujianou, Goldberg and Pavcnik (2003) find an increase in informality after trade liberalization episodes in the 1980s and 1990s in Colombia. Again in case of Brazil they do not find any such clear evidence. Heid, Larch and Riaño (2013) use a calibrated heterogeneous firm model to study informality in Mexico during the 1990s and find that informality has slightly increased due to an increase in US off shoring. However not much theoretical development has been done in this area. In our model the preference structure of an individual is postulated as having a status dependent disutility of working in the unorganized sector. Here the inheritance level is considered as an indicator of status. Inheritance is an indicator of accumulated wealth of a whole dynasty. There are two basic sectors, one designated as the organized sector and the other unorganized. The former is characterized by search friction while the other (for simplicity) it is assumed, is completely frictionless. These two sectors supply intermediate goods for production in a final good's sector. The final good is non-traded, while there can be trade in intermediaries. In this structure, stated preference pattern creates the possibility of positive rate of unemployment and gives an alternative micro-explanation of the existence of the aggregate unemployment. Given this setup, we allow this economy to open up to international trade and determine the possibility of trade even with a very similar country.

This model belongs to the tradition of Ricardian type trade models where a single factor of production is employed in two tradable goods sector. Here trade can take place between two countries with same technology of production and with same endowment level. The two trading countries differ in their frictional labor market structures. Labor market of the organized sector is considered as imperfect. Neither firms get worker for their vacant post, nor do the workers get employment in the organized sector readily. Both have to face a search process (or friction). To announce their vacancies firms of this sector bear a positive fixed cost. In the aggregate the number of firms that can commence production by employing labor is determined by the matching function. This model claims that the differences in the fixed cost of posting vacancy between the two countries lead to a situation that permits international trade. Unlike the standard Ricardian model, incomplete specialization is the unique outcome of trade for both the countries.

In this model, after trade, relative wages are equalized between the two countries. Across sectors within a country, wages remain unequal. In fact, wage inequality increases for the organized sector good exporting country while it reduces for the unorganized sector good exporting country in the free trade equilibrium. The total number of organized sector job created in the organized-sector-good exporting country increases under free trade compared to autarky. The reverse happens for the organized-sector-good importing country. Before trade the relative employment levels in the organized and the unorganized sectors are different. The country with a higher friction in the organized labor market having a lower level of organized jobs. After trade that gap may actually increase. Therefore, once trade opens up in the organized-sector-good importing country the economy becomes more informal job oriented. Since in this model there is a disutility associated with unorganized sector jobs, opening up of trade may create a loss of welfare of the unorganized sector good exporting country. In the present model, free trade does not guarantee a decrease in unemployment in either of the countries. The aggregate level of unemployment in the free trade situation depends, among other things, on the distribution of inheritance, and there could be situations where in both countries the unemployment level rises after trade compared to autarky. The other cases can also arise, where the aggregate unemployment actually falls after trade in one of the countries, or in both the countries. In all these situations distribution of long-run wealth (inheritance) has an important role to play. Helpman et. al. (2010) also have the similar ambiguity. Our result of wage inequality within a country is similar to the findings of Helpman et al. (2010), though the modeling set up and technology is completely different. The two factor scenario of Dutta et al. (2009) have proved that factor price inequality increased for both the countries, like typical Stolper-Samuelson result, which is evidently not the case for the present work. In Davidson et. al. (1999), the steady-state real return to searching factors varies according to the Stolper–Samuelson Theorem in case of large country.

The plan of the paper is as follows. The next section explains the assumptions and the modeling detail of this paper. The model is solved for the autarky equilibrium in Section 3. Section 4 restructures the model in the two-country framework and explores the possibility of international arbitrage. Free trade equilibrium and the associated results are explained in Section 5. Since our model is heavily dependent on the wealth distribution of the economy, we take the help of a numerical exercise for a better expositional purpose. Section 6 summarizes all the simulation results and the propositions derived from that analysis. The last section, namely section 7, summarizes the whole model and draws some concluding remarks.

2. The Model

This section is set to describe a three-goods and one factor general equilibrium model in a discrete time framework. The following sub-sections elaborate the different minutiae of this model.

2.i. Basic Structure

In our hypothetical economy there are infinitely lived firms and single period lived individuals. At the beginning of a period, a new generation joins the economy and the previous generation ceases to exit. The total mass of each generation is normalized to unity (thus in our economy there is no population growth). An individual, i, receives some inheritance $(X_t(i))$ from her previous generation. $G_t(X)$ proportion of people who has less than or equal to X amount of inheritance. Thus $G_t(X)$ is the endogenously determined distribution of inheritance over the entire population. Every individual derives utility (U) from consumption (c) and bequest (b) kept for her next generation. Both of these economic activities are done by using only one non-perishable final good, F. The final good is produced by two intermediate goods, namely m and n. m is assumed to be an organized sector product, whereas n is assumed to be produced in the unorganized sector. Although this unorganized sector is economically productive, and hence remunerative, working in this sector is against the social status. Social stigma brings a disutility with the choice of working in the unorganized sector.

Firms employ only labor to produce those intermediate goods. Each individual supplies one unit of labor inelastically to the economy. There exists free entry and exit for both the sectors. Unorganized sector of the economy consists of a frictionless labor market, whereas organized sector can start production only after a costly search-matching process.

2.ii. Time sequence

We first explicate the sequence of events within a period. As mentioned earlier, workers (as well as consumers) live for a single period. A representative individual, born at the very beginning of a period is endowed with the inheritance which had been kept as bequest by her predecessor. Given her inheritance level she takes her occupational decision by maximizing expected utility (in the next subsection the particulars of this decision making process have been discussed in more detail). From this optimization exercise of a representative individual, number of organized sector job-searcher in the equilibrium is determined. Vacancies are posted by the organized sector firms to get worker. Since the individuals live for a single period, at the start of a period each organized sector firm is vacant. A firm of this sector pays the cost of posting a vacancy before the initiation of search. Thus, a matching takes place between the vacant firms and the job seekers.

Matched firm-worker pairs start production immediately. Unmatched searchers either gets employed in the unorganized sector to produce or remain unemployed. Unmatched firms of the organized sector, on the other hand, are compelled to wait for that period without receiving any positive return. Unsuccessful firms of a period may join the search activity in the next period by again paying the cost of posting vacancy.

Before the end of the period matched firms and workers of the organized sector share the surplus through bargaining for operational profits and wages respectively, and unorganized sector workers get their competitive wage. At the end of the individuals' life span they consume and keep bequest for their successor, and receive utility. A particular period ends with the death of the representative individual.

2.iii. Utility

An individual, i, born at time period t, is assumed to have a simple Cobb-Douglas type preference structure with a disutility term:

$$U(i) = \frac{1}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} c^{\,1-\alpha} b^{\alpha} - DkX_t(i) \text{ with } \alpha \in (0,1) \text{ and } k > 0. \quad (1)$$

Notations are as specified before. In this model individuals do not have the option of monetary savings. Hence they exhaust all the monetary income, which they earn by supplying labor, to purchase the final good and to make bequests. D acts as a decision dummy. It takes the value unity if the individual works in the unorganized sector, otherwise it assumes the value zero. Clearly the individual gets a disutility from working in the unorganized sector. The disutility level increases in a proportion, k with the level of X. Here inheritance (which is actually a good indicator of the wealth of a particular dynasty) appears in the utility function as a symbol of social status background. Individual optimally chooses c, b and D to maximize her utility given her wealth. She does the optimization sequentially. At the first stage she maximizes her utility by choosing optimal c and b given any D. After that optimal D is decided. Hence, the determination of D leads to the occupational decision choice. This optimization exercise is done by the individual at the beginning of the period, by maximizing her expected utility. Section 3 explains the equilibrium decisions in length.

2.iv. *Organized sector*

It is presumed that perfect competition is present in the product market of m good but not in the factor market. The latter consists of a search friction. Each firm of this sector can post only a single vacancy for a period. The existence of uncoordinated search process (or, search friction) prevents firm and labor (remember, at the beginning of a period individuals are also looking for jobs) to be matched instantaneously and with certainty. Job search is a time consuming, uncertain and costly process. So it may well be the case that, on the one hand, some of the vacant posts fail to get filled up by a worker, while on the other hand some worker remains jobless after an active search. To capture this real feature *Pisserides* type matching modeling device has been introduced in this model.

More specifically we assume that

$$M_t \equiv M(u_t, v_t).$$

where, M_t is the proportion of the population who are matched at time t, u_t is the proportion of searching population in the total population at time *t* and v_t is the ratio of total number of vacancy and total population at time t. It is assumed that M is homogenous of degree one, increasing in each argument and concave.

Hence, $\frac{M_t}{u_t} = M(1, \theta_t)$ and $\frac{M_t}{v_t} = M(\theta_t^{-1}, 1)$.

Where, $\theta \equiv \frac{v}{u}$. That means that in a particular period an organized sector's firm may not get a worker with a positive probability $(1 - M(\theta_t^{-1}, 1))$. At period t, a job seeker in this sector remains jobless with probability $(1 - M(1, \theta_t))$.

Once a firm and a worker are matched then the production of good m takes place. Firms of this sector utilize a production technology where one unit of labor produces a_m units of the m good. In this sector, market imperfection prevails in the distribution of surplus also. Costly search friction generates a positive rent. Both firms and workers have a bargaining power and the revenue is shared through Nash Bargaining. The next two subsections describe the cost and benefit of the firms and the workers respectively.

2.iv.a. *Firms*

To post a single vacancy in this sector, a firm has to incur a positive cost (d) in terms of the final good. However that does not guarantee a worker to the vacant firm. After posting the vacancy that firm ensures the position in matching process as a vacant firm. As a result of search, if a particular firm gets a worker then that firm can commence production, otherwise the firm receives nothing. Although a firm can produce for a single period at a time (since a worker is a single period lived individual), but stays infinitely in the economy. Let V_t be the life time expected return from a vacant post to an organized sector firm and J_t be the gain from a filled post to a firm at time t.

$$V_t = -p_{Ft}d + M(\theta_t^{-1}, 1)J_t + \left(1 - M(\theta_t^{-1}, 1)\right) * 0 + V_{t+1}$$

$$J_t = (p_{mt}a_m - w_{mt})$$

Where, p_m and p_F are the price of m and F respectively, and w_{mt} is per period wage of this sector at time t.

Free entry condition guarantees that new firms enter the market as long as V_t remains positive and leaves if V_t becomes negative. Hence in equilibrium, we fix V_t at zero. That implies the following:

$$J_t = p_{mt}a_m - w_{mt} \tag{2}$$

$$M(\theta_t^{-1}, 1) = \frac{p_{Ft}d}{J_t} \tag{3}$$

Notice, an increase in cost of posting vacancy, $p_{Ft}d$, leads to an exit of firms to avoid the negative return from a vacant firm. That decreases the number of vacancies in the matching process. Interestingly, that action makes the situation easier for the existing firms. Probability of getting a worker to a particular vacant firm rises (since, matching function is concave) after the departure of some firms and that brings return from vacancy back to zero. Exit of a firm in this frictional labor market creates a positive externality for the rest of the firms. This is the 'congestion externality'[3] of the matching framework which the agents do not endogenize while decisions are taken. This holds equally for the job seekers as well.

2.iv.b. workers

Similar to a firm, an individual who wants to supply her labor in m sector, faces a random matching process before getting employed. Once a worker successfully matches with a firm, she can deliver her single unit of labor and receive the wage in return. On the other hand if she is unsuccessful and

[3] Hosios (1990)

fail to get a vacant firm she will receive nothing from the organized sector. Unlike firms, for simplicity, there is no search cost for a worker.

As stated earlier, both the agents of this sector have some positive bargaining power. Total revenue from production is distributed among firm and worker by Nash Bargaining. Hence,

$$w_{mt} = \arg\max_{w_{mt}} \ (w_{mt})^{\beta}(J_t - V_t)^{1-\beta}$$

i.e. $w_{mt} = \arg\max_{w_{mt}} \ (w_{mt})^{\beta}(p_{mt}a_m - w_{mt})^{1-\beta}$. (This step follows from the free entry condition).

That is,

$$w_{mt} = \beta p_{mt} a_m. \tag{4}$$

Hence from equation (2)

$$J_t = (1-\beta) p_{mt} a_m. \tag{5}$$

So initially (ex-ante) expected gain to a worker from this sector is $M(1, \theta_t) w_{mt}$.

2.v. Unorganized sector

Good n, the other intermediate good, is produced and marketed in a perfectly competitive setup. Frictionless factor market of this sector guarantees full employment. An individual, who chooses to work in the n-sector can be matched instantaneously with a job. The same also holds for a firm looking for a worker and they can immediately start producing. To commence production, a firm needs only labor. Production technology is assumed to follow constant return to scale (CRS): a single unit of labor can produce a_n units of the n good.

In this sector, unrestricted entry of firms with no bargaining power equates factor payment with the value of its marginal product. Therefore per period wage of unorganized sector (w_{nt}) is $p_{nt}a_n$, where price of n is p_{nt} at period *t*, and firms are making zero profit.

Therefore,

$$w_{nt} = p_{nt} a_n. \tag{6}$$

2.vi. Final good's sector

Final good (F) sector uses the two intermediate goods as factors (*m* and *n*) from a frictionless market. The production function of *F* good is given by,

$$F_t = m_t^{\gamma} n_t^{1-\gamma} \tag{7}$$

This non-perishable good is sold in a perfectly competitive market. So, F sector firms make zero profit in each period. The intermediate goods prices are determined by equating demand and supply.

3. Equilibrium in Autarky

The subsequent subsections optimize the individual decisions and determine the prices of m, n and F under autarky, endogenously.

3.i. Optimal decisions of the individual

Since ex-ante (at the beginning of her life span) the level of income is uncertain to an individual, she takes her decision according to the optimization of her expected indirect utility function.

There exists an uncertainty in the organized sector's labor market. So, the expected wage rate ($M(1, \theta_t)\beta p_{mt}a_m$, derived as is equation 4) of this sector should be greater than or equal to the unorganized sector wage rate ($p_{nt}a_n$, from equation 6).Otherwise in equilibrium, no one choose to supply labor in m-good sector and the *m*-good cannot be produced. Due to the Cobb-Douglas type production function of the final good, each intermediate good is essential and therefore, demand pulls the price of good *m* and the wage rate prevailing in that sector rises, such that individuals optimally select to supply their labor in the organized sector. That implies, organized sector job is more lucrative than the unorganized sector job to all individuals. Since search is not costly for the workers and does not preclude the opportunity to work in the unorganized sector, in equilibrium each worker participates in the search process of the organized sector.

Thus we have the following proposition:

Proposition 1: In equilibrium wage of the organized sector is higher than the unorganized sector and each individual searches for the organized sector job.

i.e., $u_t = 1$. (8)

In the second stage, those who remain unmatched after the search process, decides whether to join unorganized sector or to continue as an unemployed person. An individual, in this model, with a very high level of inheritance has a proportionally higher level of disutility for working in the unorganized sector. On the contrary, the disutility, compared to the gain in utility from the wage of the unorganized sector, is lesser for the individual who has lesser inheritance. Appendix 1 proves that there exists a critical level of inheritance (X^c) which is $\frac{w_{nt}}{kp_{Ft}}$, that makes the marginally unmatched worker indifferent between taking up an unorganized sector job and remaining unemployed. If the agent has $X \leq \frac{w_{nt}}{kp_{Ft}}$ then she opts for the unorganized job after being 'unlucky'. On the other hand, if her inheritance, X, is greater than $\frac{w_{nt}}{kp_{Ft}}$ then she chooses to remain as unemployed. Intuition behind this is, higher status in the society gives more disutility for working in the unorganized sector.

Proposition 2: Individual with higher inheritance remains unemployed. $\frac{w_{nt}}{kp_{Ft}}$ *is the cut-off level of inheritance, below which being unemployed is suboptimal.*

At the end of an individual's life span there is no uncertainty related to her wage income. So, she can determine her consumption and bequest level given her total wealth. Her wealth includes the wage she earned and the inheritance she received. Since utility can be derived only in terms of the final good, individuals transform their wages into F-good.

Maximizing (1) with respect to the budget constraint, $c_t + b_t = \frac{wage_t}{p_{Ft}} + X_t$, optimal consumption and bequest level can be written as follows.

$c_t = (1-\alpha)(\frac{wage_t}{p_{Ft}} + X_t)$

and, $b_t = \alpha(\frac{wage_t}{p_{Ft}} + X_t)$.

3.ii. Intermediate goods market

Both the intermediate goods are produced using CRS technology, and hence, the aggregate production of each good equals the total number of laborers working in that particular sector multiplied by the marginal productivity (in this single factor case which is also the average productivity) of labor.

Total supply of good -m, at period t, denoted by S_{mt}, is therefore $M_t a_m$, where M_t is the total number of individuals who are matched with an organized sector job at period t. From the rest of the population (i.e. $1 - M_t$) workers with inheritance level belowX_t^c, i.e. $G_t(X_t^c)$,works in the n good sector at period t. Since at any particular period matching and remaining below $X^c$are two independent events, total labor supply for the unorganized sector is, therefore, equal to $(1-M_t)G_t(X_t^c)$. Hence, $(1-M_t)G_t(X_t^c)a_n$ is the total supply of good n for the t[th] period. This is denoted by S_{nt}. So, the relative supply of *m* and *n* is,

$$\frac{S_{mt}}{S_{nt}} = \frac{M_t a_m}{(1-M_t)G_t(X_t^c)a_n} \tag{9}$$

Proposition 3: Relative supply of the intermediate goods depends on the distribution of inheritance.

Demand for the intermediate goods is generated from the final good sector. Producers of the F good minimize their cost of production by choosing m and n optimally in accordance with the prices of these two intermediate goods. The producers minimize $p_{mt}m + p_{nt}n$, which is the total cost subject to the technology constraint given in equation (7). That yields the following relative equation:

$$\frac{D_{mt}}{D_{nt}} = \frac{\gamma}{1-\gamma}\left(\frac{p_{nt}}{p_{mt}}\right) \tag{10}$$

Where, D_i is denoted as demand of the i[th] good, (i = {*m, n*}).

3.iii. *Market Equilibrium*

The equilibrium of the product market is characterized by equalizing relative demand relative supply. Using the equations (9) and (10) the following can be obtained:

$$\frac{p_{nt}}{p_{mt}} = \frac{1-\gamma}{\gamma}\frac{M_t}{(1-M_t)G_t(X_t^c)}\frac{a_m}{a_n}. \tag{11}$$

From equation (3) and equation (5), a relation between relative price and matching function can be derived:

$$M(\theta_t^{-1}, 1) = \frac{1}{1-\beta}\frac{d}{a_m}\frac{p_{Ft}}{p_{mt}}. \tag{12}$$

On the other hand zero profit condition in the product market of F good implies the equality between the total costs of production and the total revenue from production.

That is, $p_{Ft}F_t = p_{mt}m_t + p_{nt}n_t$. Equations (10) and (7) can be used to show (Appendix 2):

$$\frac{p_{Ft}}{p_{mt}} = A\left(\frac{p_{nt}}{p_{mt}}\right)^{1-\gamma} \tag{13}$$

Where $A \equiv \left(\left(\frac{\gamma}{1-\gamma}\right)^{1-\gamma} + \left(\frac{\gamma}{1-\gamma}\right)^{-\gamma}\right)$ is a constant parameter.

Again, critical inheritance level X_t^c can be written as following:

$X_t^c = \frac{a_n}{k}\frac{p_{nt}}{p_{mt}}\frac{p_{mt}}{p_{Ft}}$.

And hence using (13),

$$X_t^c = \frac{a_n}{Ak}\left(\frac{p_{nt}}{p_{mt}}\right)^{\gamma}. \qquad (14)$$

Equation (12) can also be transformed into a function of the ($\frac{p_n}{p_m}$) and that takes the following form:

$$M(\theta_t^{-1}, 1) = \frac{A}{1-\beta}\frac{d}{a_m}\left(\frac{p_{nt}}{p_{mt}}\right)^{1-\gamma}. \qquad (15)$$

The technique for solving the short run equilibrium of the model is not much different with the longrun solution except for the dynamics of the wealth distribution function, G. The next subsection deals with the wealth dynamics. As a function of $\frac{p_{nt}}{p_{mt}}$, the direction of the change in the distribution function remains the same corresponding to the change in $\frac{p_{nt}}{p_{mt}}$ both in the short run and in the longrun. Simulation result (displayed in section 6) guarantees that at least for some parametric specifications wealth distribution converges in the longrun.

The model is then solved for the longrun steady state. We describe the economy in the longrun steady state using equations (11), (14) and (15) by dropping the time subscript. Thus,

$$\frac{p_n}{p_m} = \frac{1-\gamma}{\gamma}\frac{M}{(1-M)}\frac{a_m}{a_n}\frac{1}{G\left(\frac{a_n}{Ak}*\left(\frac{p_n}{p_m}\right)^{\gamma}\right)} \qquad (16)$$

and, $M(\theta^{-1}, 1) = \frac{A}{1-\beta}\frac{d}{a_m}\left(\frac{p_n}{p_m}\right)^{1-\gamma}$ (17)

Clearly, right hand side (RHS) of the equation (16) is a continuous and monotonically decreasing function of $\frac{p_n}{p_m}$, this is because from equation (17) it is evident that increase in $\frac{p_n}{p_m}$ actually brings the equilibrium vacancy posting down and therefore Mfalls and $G(.)$ increases with an increase in $\frac{p_n}{p_m}$. At the steady state, equation (16), therefore, solves for an equilibrium value of the relative price of the intermediate goods (appendix 3 contains some more details). Now the model has been solved in autarky.

Proposition 4: Unique equilibrium exists in autarky.

It is to be noted that, both in the short run and the steady state equilibrium price ratio, $\frac{p_n}{p_m}$, depends not only on the production parameters but also on the distribution of wealth and labor market parameters. If an economy consists of more rich people then correspondingly higher status effect drives the economy to produce less unorganized sector good by supplying fewer labor towards this sector. That leads to a higher price level of the unorganized sector good. Again, if a labor market demands higher cost for posting a vacancy in organized sector then lesser firms can afford to post vacancy (since return from a vacant firm falls) and therefore, production of organized sector falls. Therefore in the long run, price level may also vary due to such labor market differences.

3.iv. Aggregate equilibrium unemployment in autarky

The aggregate steady state level of equilibrium unemployment in autarky in our model is

$$TU = (1 - M)(1 - G(X^c)). \tag{18}$$

or, $TU = \left(1 - M\left(\left(\frac{p_n}{p_m}\right)^{1-\gamma}\right)\right)\left(1 - G\left(\frac{a_n}{Ak} * \left(\frac{p_n}{p_m}\right)^{\gamma}\right)\right)$

The first term shows the number of unmatched individual and the second term is the proportion of the population lies above X^c. Therefore the aggregate equilibrium unemployment in this model depends on the distribution of inheritance. Although G is a positive function of $\frac{p_n}{p_m}$, but M has a negative relation with $\frac{p_n}{p_m}$. So, the change in TU with respect to the change in $\frac{p_n}{p_m}$ is ambiguous and depends on the price elasticity of the distribution function of wealth and of the matching function.

Proposition 5: Aggregate unemployment depends on the distribution of inheritance and labor market inefficiency.

3.v Dynamics of inheritance distribution function (G)

This sub-section explain the dynamic path of different dynasties with respect to their wealth levels. In other words, given the inheritance level in period *t* we study the behavior of the inheritance of the dynasty in period $t + 1$. For this purpose, the following system of dynamic equations is useful.

If $X_t \leq X^c$,

$$X_{t+1} = \alpha\left(X_t + \frac{w_{mt}}{p_{Ft}}\right), \text{ with probability } M(1, \theta_t) \tag{I}$$

$X_{t+1} = \alpha\left(X_t + \frac{w_{nt}}{p_{Ft}}\right)$, with probability $(1 - M(1, \theta_t))$ (II)

If $X_t > X^c$,

$X_{t+1} = \alpha\left(X_t + \frac{w_{mt}}{p_{Ft}}\right)$, with probability $M(1, \theta_t)$ (I)

$X_{t+1} = \alpha(X_t)$, with probability $(1 - M(1, \theta_t))$ (III)

These equations are generated from an inherent assumption: $X_{t+1} = f(b_t)$. Here for simplicity it is assumed that $X_{t+1} = b_t$. From subsection *3.i.* we have seen the bequest level is equal to the α proportion of the total wealth of the individual. The difference equation (I) shows that if the agent receives the opportunity of working in the organized sector, her wealth is $\left(X_t + \frac{w_{mt}}{p_{Ft}}\right)$ for all X_t at the end of her life. Cases (II) and (III) depicts situations when the inheritance level plays a key role. First let us consider $X \leq X^c$. Individual works in unorganized sector if she remains unmatched after the search. So, total wealth is $(X_t + \frac{w_{nt}}{p_{Ft}})$ with probability $(1 - M_t)$. Again, if $X_t > X^c$, optimal decision dictates the agent to stay as unemployed (jobless) when she does not get employment in the organized sector after an active search. Hence her wealth remains X_t and this is shown by (III).

Note that, the distribution of inheritance is altered by the price ratios from the three aspects. The wage income of the individuals, probability of matching with the vacant organized sector firms and the cut off level of inheritance, all these three are the function of the price ratios.

Let us depict the equations in the following figure:

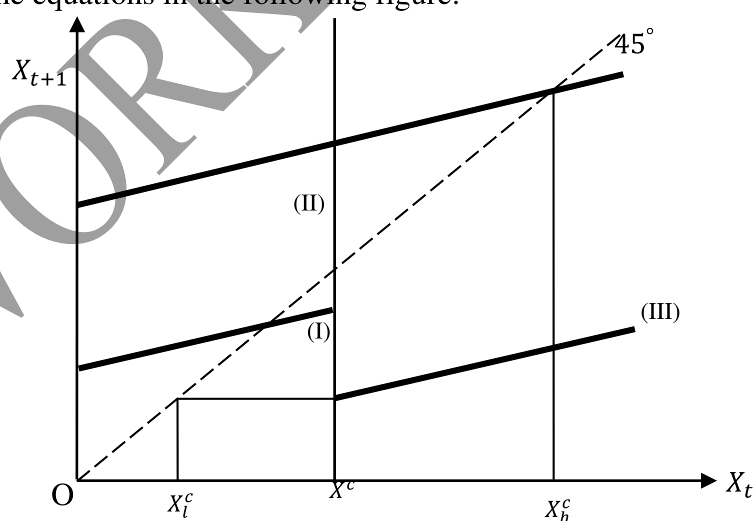


Figure: 1

The bold lines I, II, III represent the difference equations I, II and III respectively. The above figure (Figure 1) is drawn by imposing suitable parametric restrictions such that we can concentrate on the case where in long run unemployment prevails in the economy.

Let us call them '*poor*' whose inheritance level is in between $(0, X^c)$ and '*rich*' whose inheritance level is above X^c. From figure 1 one can obtain the following observation. An individual who herself initially starts as poor may bring her next generation to the richer section with positive probability if she gets an organized sector job. If she does not get the unorganized sector job (according to this parametric restriction), her next generation will not find herself in the richer class. In the reverse case, a rich agent may put her next generation into the poorer section, if she fails to match with an organized sector firm. This tells us that people always face a positive probability (until the probability value of getting matched or unmatched in the organized sector hits zero or one) of changing her social status. Hence in this model, the economic mobility from rich (higher status) to poor (lower status) depends mostly on the degree of labor market inefficiency of the organized sector.

$$P(X_{t+1} > X^c | X_t > X^c) \quad = \begin{cases} M(1, \theta_t), & if\, X^c < X_t < \left(\dfrac{w_{nt}}{p_{Ft}\alpha k}\right) \\ 1 & if, \;\; X_t > \dfrac{w_{nt}}{p_{Ft}\alpha k} \end{cases}$$

$$P(X_{t+1} > X^c | X_t < X^c) \quad = \begin{cases} M(1, \theta_t), & if \quad \left(\frac{w_{nt}}{p_{Ft}\alpha k}\right) - \frac{w_{mt}}{p_{Ft}} < X_t < X^c \\ 0, & if, \;\; X_t > \frac{w_{nt}}{p_{Ft}\alpha k} \end{cases}$$

Proposition 6: Longrun distribution of inheritance cannot be polarized to a single point, although it remains bounded.

These above stated equations are the determinants of the dynamics of wealth distribution. Due to such stochastic nature wealth distribution can never be polarized in a single point. However in this model income distribution cannot go out of bound in longrun. It is not difficult to prove that after a finite time, inheritance of all individual come within the interval $[X_l^c, X_h^c]$ (shown in figure 1), provided probability value of getting organized sector job remains strictly positive and non-unitary and the whole longrun wealth distribution does not come within the bound $[0, X^c]$. That is, X_c^h should remain above X^c, in longrun.

4. Two Country Framework

In this section the scope of opening up to trade is explored. Let us assume that there are only two countries in the world, home (*h*) and foreign (*f*). Both the countries have the same technology of production, factor endowment level and preference structure. The lone difference among the two countries is in the degree of labor market imperfection in the organized sector. Even between these two otherwise identical countries relative price ratios of tradable goods may differ. Firms located in h are paying less, in real terms, to post a vacancy than in the firms of f(so, $d^f > d^h$). This means, commencing production of good *m* is more difficult (costly) in foreign than in home. Therefore, number of vacancies posted in f, v_t^f, for each $\frac{p_{nt}^f}{p_{mt}^f}$ is less than that of *h* (from equation (17)). Since the preference structure of the individuals in h and *f* are same, the number of job seekers in the organized sector labor market also remains same: $u^h = u^f = 1$. Consequently for each $\frac{p_{nt}^f}{p_{mt}^f}$, lesser number of successful matches are realized in '*f*' in equilibrium due to the increasing nature of the matching function. Right hand side of the equation (16) in the case of foreign country, remains smaller for all $\frac{p_{nt}^f}{p_{mt}^f}$ compared to *h*.

For the foreign country (16) and (17) are the following

$$\frac{p_n^f}{p_m^f} = \frac{1-\gamma}{\gamma}\frac{M^f}{(1-M^f)}\frac{a_m}{a_n}\frac{1}{G^f\left(\frac{a_n}{Ak}\left(\frac{p_n^f}{p_m^f}\right)^{\gamma}\right)}, \tag{19}$$

where $M^f \equiv M(1, v^f)$, since $u^f = 1$ as in the case of home, in equilibrium. Above discussion proves $M > M^f$.

$$M\left({\theta^f}^{-1}, 1\right) = \frac{A}{1-\beta}\frac{d^f}{a_m}\left(\frac{p_n^f}{p_m^f}\right)^{1-\gamma} \tag{20}$$

Since $d^f > d^h$, for any price ratio of the intermediate goods ($\frac{p_n^f}{p_m^f}$), LHS of equation (20) is higher than LHS of equation (17). That implies $v^f < v^h$ in autarky and hence $M^f < M^h$ for each $\frac{p_n}{p_m}$. Note that the wealth distribution function contains a superscript '*f*'. Simulation exercise shows that the steady state wealth distribution changes for the change in the real cost of posting vacancy (that is d). Typically for most of the values of X, $G^h(.) \leq G^f(.)$ (this is discussed in detail latter in Section 6). Given $M^f < M^h$ and $G^h(.) \leq G^f(.)$, for each value of $(\frac{p_n^f}{p_m^f})$, RHS of equation (19) is lesser than RHS of equation (16).

Thus, the above analysis proves that, in equilibrium, $\frac{p_n^h}{p_m^h} > \frac{p_n^f}{p_m^f}$. Appendix 3 (CHECK IT!!) displays this result in more details. Since the two countries have identical market setup in the final good sector, equation (13) hold, for the foreign country as well. That leads to the similar directional result for the price of final good: $\frac{p_F^h}{p_m^h} > \frac{p_F^f}{p_m^f}$.

Proposition 7: Trade can open up between two otherwise similar countries due to the difference in the degree of labor market imperfection.

5. Trade Equilibrium and results

Previous section has demonstrated the possibility trade may open up among identical nations. If home and foreign agree to trade freely then the intermediate goods can be exchanged among themselves successfully. Let us allow the two economies to participate in trade. Since the relative price of good *n* is higher in home country than foreign, good n is exported from foreign to home and good *m* is exported from home to foreign in this free trade environment. This arbitrage equalizes the price ratios of the intermediate goods of the two the countries.

The equilibrium price is determined where the world demand is equated with the world supply of the intermediate goods. It is pretty straightforward to verify that world relative supply of the intermediate goods is the following:

$$\frac{S_m^W}{S_n^W} = \frac{(M^{T^h} + M^{T^f})a_m}{\left(\left(1-M^{T^h}\right)G^{T^h}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right) + \left(1-M^{T^f}\right)G^{T^f}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)\right)a_n},$$

and the world relative demand is:

$$\frac{D_m^W}{D_n^W} = \frac{\gamma}{1-\gamma}\left(\frac{p_n^T}{p_m^T}\right).$$

Where $M^{T^j} \equiv M\left(1, v^{T^j}\right)$, since $u^{T^j} = 1$ (let $j = \{h, f\}$) and superscript T is used as a notation for trade. As final good sector is a non-traded goods equation (13) still holds for both the country. Producer of good F takes the price ratio of the intermediate goods as externally given. (This analysis assumes steady state).

Using the following three equations equilibrium $\frac{p_n^T}{p_m^T}$ in free trade situation can be solved

$$\left(\frac{p_n^T}{p_m^T}\right) = \frac{1-\gamma}{\gamma} \frac{(M^{T^h} + M^{T^f})a_m}{\left(\left(1-M^{T^h}\right)G^{T^h}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right) + \left(1-M^{T^f}\right)G^{T^f}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)\right)a_n} \tag{21}$$

Correspondingly labor market equations of the organized sectors of the two countries become the following:

$$M\left({\theta^{T^f}}^{-1}, 1\right) = \frac{A}{1-\beta} \frac{d^f}{a_m} \left(\frac{p_n^T}{p_m^T}\right)^{1-\gamma} \tag{22}$$

$$M\left({\theta^{T^h}}^{-1}, 1\right) = \frac{A}{1-\beta} \frac{d^h}{a_m} \left(\frac{p_n^T}{p_m^T}\right)^{1-\gamma} \tag{23}$$

Hence, a free trade equilibrium price level can be solved from equations (21), (22) and (23). From equation (13) it can be seen that, price ratio of the final good and the *m*-good ($\frac{p_F^T}{p_m^T}$) of two countries are also equalized in the free trade regime.

Proposition 8: Unique equilibrium exists in free trade situation.

Given a unique price level exists in the free trade situation, from equations (22) and (23) it can be written that:

$$\frac{M\left({\theta^{T^f}}^{-1}, 1\right)}{d^f} - \frac{M\left({\theta^{T^h}}^{-1}, 1\right)}{d^h} = 0.$$

⇨ $M\left({\theta^{T^f}}^{-1}, 1\right) > M\left({\theta^{T^h}}^{-1}, 1\right)$, (since $d^f > d^h$).

Since $u^j = 1$, to hold the above equation following condition must be satisfied,

$$v^{T^h} > v^{T^f}. \tag{24}$$

Therefore, after trade vacancy posting by the organized sector firms, and hence the production of the *m*-good (since M is an increasing function of it arguments), remain higher in the home country in comparison with the foreign.

Equation (21) can be re-written as follows

$$\left(\frac{p_n^T}{p_m^T}\right) = \frac{1-\gamma}{\gamma} * \frac{a_m}{a_n} * \left(\frac{M^{T^h}}{\left(1-M^{T^h}\right)} * \frac{1}{G^{T^h}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)} * (1-\Theta) + \frac{\left(M^{T^f}\right)}{\left(1-M^{T^f}\right)} * \frac{1}{G^{T^f}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)} * \Theta \right) \tag{25}$$

Where, $\Theta \equiv \frac{\left(1-M^{T^f}\right) G^{T^f}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)}{\left(\left(1-M^{T^h}\right) G^{T^h}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right) + \left(1-M^{T^f}\right) G^{T^f}\left(\frac{a_n}{Ak} * \left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)\right)} < 1.$

If the two countries stop trading, the possible trade price ratio will belong within the two instantaneous autarky price ratios. Equation (25) explains that. $\frac{p_n^T}{p_m^T}$ is determined by taking the weighted average of the two instantaneous (assuming, wealth distribution does not change instantaneously) autarky price ratios (after they stop trading). That means, opening up always leads to a successful arbitrage. Note that, there is a superscript *T* on the wealth distribution function, *G*, as well. The wealth distribution function itself can change in free trade situation, since probabilities of getting a job in organized sector is varying with the change in price ratios. Given that a general wealth distribution function is considered and the model is a stochastic difference equation model, it is not possible to comment analytically about the steady state distribution function. Still the simulation exercise shows, at least for some parametric specifications, equation (25) can produce an equilibrium $\frac{p_n^T}{p_m^T}$ such that $\frac{p_n^f}{p_m^f} < \frac{p_n^T}{p_m^T} < \frac{p_n^h}{p_m^h}$ holds in the steady state also.

Proposition 9: If $\frac{p_n^f}{p_m^f} < \frac{p_n^T}{p_m^T} < \frac{p_n^h}{p_m^h}$ *then* $v^{T^f} < v^f$ *and* $v^h < v^{T^h}$ *in equilibrium after trade.*

If $\frac{p_n^f}{p_m^f} < \frac{p_n^T}{p_m^T} < \frac{p_n^h}{p_m^h}$ holds, then the comparison exercise between equation (17), equation (22), equation (20) and equation (23) can show that $v^{T^f} < v^f$ *and* $v^h < v^{T^h}$(see *appendix 4*). Therefore after trade the number of vacancies of two countries are not equalized and hence, probability of getting a worker (job) by a vacant firm (job searcher) are also not equalized in the two countries. The probability actually falls for the home country after the opening up of trade, and reverse is the case for the individual searchers.

Following subsections briefly describe some more impact of free trade.

5.i. Factor price equalization

After trade, the relative wage of the organized sector and the unorganized sector in the home become equalized with the foreign. This is because, wages depend on prices, productivity parameters and bargaining strength of the labor. Price ratios are identical in free trade regime and other parameters are same for both the countries. Real wages (in terms of final good) of the two countries are also equalized after opening up to trade. Nonetheless the wage differential exists between the two sectors within a country. If the wage of *m*-good sector merges with the *n*-good sector's wage then in the equilibrium production of *m*-good will drop down drastically (since getting job in *m*-good sector is probabilistic, job seekers will opt for frictionless *n*-good sector for supply their labor which indicates shortage of labor supply in *m*-good sector and that will be true for both the countries) and as a result price adjustment pulls back the wage of the *m*-good sector above. This wage difference increases for the home country and decreases for the foreign country after trade. Intuitively the reason behind this finding is the following: after trade *m*-good sector (relative to *n*-good sector) gains in *h* (vis-à-vis *f*) which increases $\frac{{w_m^T}^h}{{w_n^T}^h}$ and $\frac{{w_m^T}^f}{{w_n^T}^f}$ falls compared to autarky, and wage in the *m*-good sector is higher than in the *n*-good sector's wage in both the countries. These two arguments taken together, the difference in wage gap of the two sectors in the two different countries can be explained after the trade opening up. A*ppendix 5* describes the result mathematically. This is clearly a departure from the classical Ricardian type results.

Proposition 10: Relative wages of the two sectors are equalized between home and foreign ($\frac{{w_m^T}^h}{{w_n^T}^h} = \frac{{w_m^T}^f}{{w_n^T}^f} \equiv \frac{w_m^T}{w_n^T}$*). After trade wage inequality increases in the home country and falls in the foreign.*

5.ii. Specialization

Although structurally the present model is very similar to the Ricardian setup, complete specialization cannot be a solution in the free trade equilibrium. If foreign country specializes in good-*n* that means working in the unorganized sector become more lucrative. That is, $\frac{{w_n^T}^f}{{p_F^T}^f} > \frac{{w_m^T}^f}{{p_F^T}^f}$.

The problem is, equalization of two countries factor price-ratio tells that, real wages are same in both the countries and hence, this inequality is true for the home as well (see *appendix 5* for mathematical clarification). Therefore in both the countries all the individuals should opt for joining in n-good sector and they get jobs readily in that sector (as we know that the factor market of the n-good sector is friction less). That leads to a situation where the production of *m*-good cannot take place worldwide and which is impossible to sustain in the equilibrium. On the other hand persistence of labor market friction in *m*-good sector guarantees the production of *n*-good in both the countries. So, in the free trade situation also incomplete specialization prevails for both home and foreign country.

Proposition 11: Complete specialization cannot occur in the equilibrium.

5.iii. Impact on aggregate unemployment

The aggregate unemployment after trade is $TU^{T^j} = \left(1 - M^{T^j}\right) * \left(1 - G^{T^j}\left(X^{T^c}\right)\right)$. Clearly this expression depends on the distribution of wealth. Even if the directional change in $\left(1 - M^{T^j}\right)$ after trade compared to no trade regime is traced, then also, the wealth distribution may change that direction altogether. That is, trade cannot guarantee fall in unemployment. In subsection (*3.iv*) the impact of the change in price on TU is discussed. Change in the distribution function for the change in the price ratio has an important role to determine the effect of trade on aggregate unemployment. Due to its analytical intractability it is left here without commenting much in detail. In the next section simulation results put some light in this regard.

Proposition 12: Impact of trade on aggregate unemployment is ambiguous.

6. Simulation Results

This section has a separate importance specifically for this model. Since the distribution of the wealth plays a crucial role here, an analytical intractability arises in the issues mainly related to convergence (implies, the questions associated to the longrun stability of the endogenous variables). However numerical exercise not only gives support to the theoretical findings of this model, additionally it brings out some very interesting results. Following table displays the hypothetical parametric assumptions.

Table1: Parameter values

Parameters	Description	Value
α	Proportion of income spent for bequest	0.45
m	Matching efficiency	0.4
d	Cost of posting a vacancy for home country	0.05
d^f	Cost of posting a vacancy for foreign country	0.2
β	Bargaining power of an organized sector worker	0.8
γ	Elasticity of production with respect to m-good	0.65
a_m	Marginal productivity of labor in m-good sector	1
a_n	Marginal productivity of labor in n-good sector	0.2
k	Disutility parameter from social stigma	0.65
θ	Matching elasticity	0.75

Here, following Petrongolo and Pissarides (2001), it is assumed that matching function is of Cobb-Douglas type. The functional form is,

$M_t = m v_t^{\theta} u_t^{1-\theta}$.

Number of individuals under observation are 10000. Number of iteration is, '*Time*'=1000.

Result 1: *The distribution of inheritance and the price ratios converge in the long run. That steady state values does not depend on the initial wealth distribution.*

Following figures depict the convergence of autarky price ratios ($\frac{p_n}{p_m}$ and $\frac{p_F}{p_m}$) for the home country.

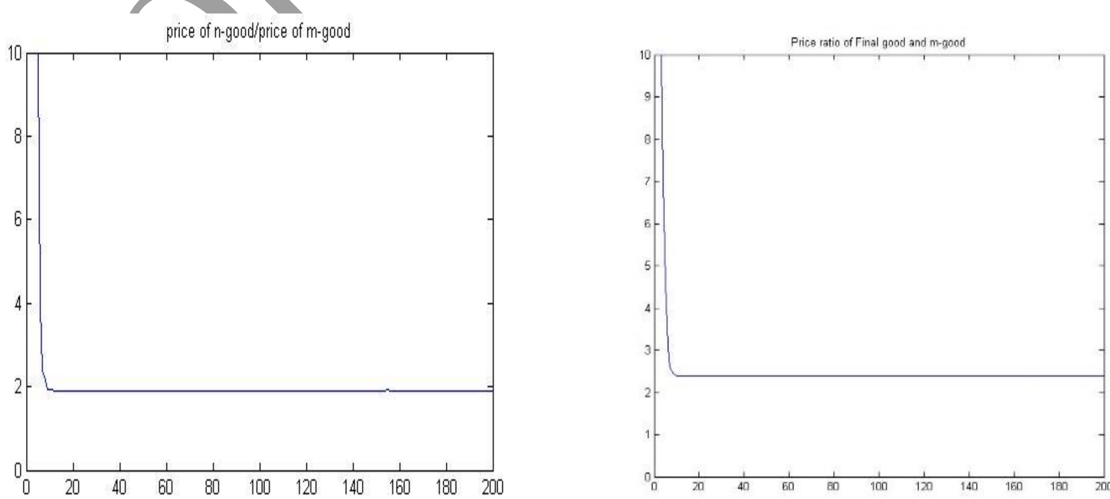


Figure: 2

The long run distribution of inheritance is displayed in the following histogram.

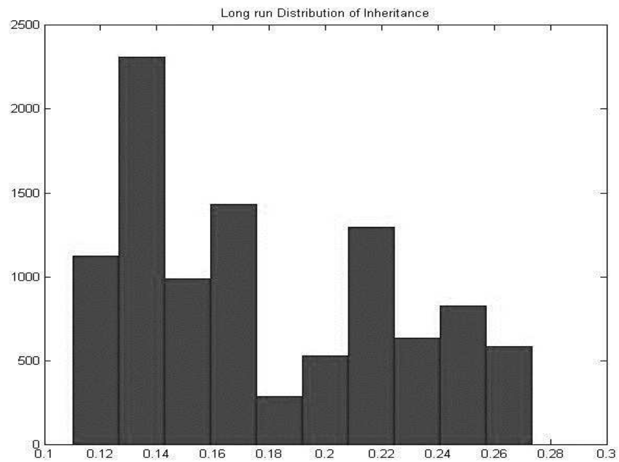


Figure: 3

Following table depicts Kolmogorov-Smirnov test[4] statistic for the convergence test of the longrun inheritance distribution.

Table2: Convergence of inheritance distribution

Initial wealth distribution	'*Time*' vis-à-vis '*(Time-1)*'	'*Time*' vis-à-vis '*(Time-100)*'
Normal	0.0101 (*0.8049*)	0.0150 (*0.3269*)
Uniform	0.0074 (*0.9811*)	0.0138 (*0.4336*)
Single valued (all the values are same but below the cut-off level)	0.0115 (*0.6630*)	0.0119 (*0.6230*)

[4] Kolmogorov-Smirnov test is done between the two randomly taken samples of size 8000 considering the end distributions as the population.

Single valued (all the values are same but above the cut-off level)	0.0110 (*0.7162*)	0.0111 (*0.7030*)

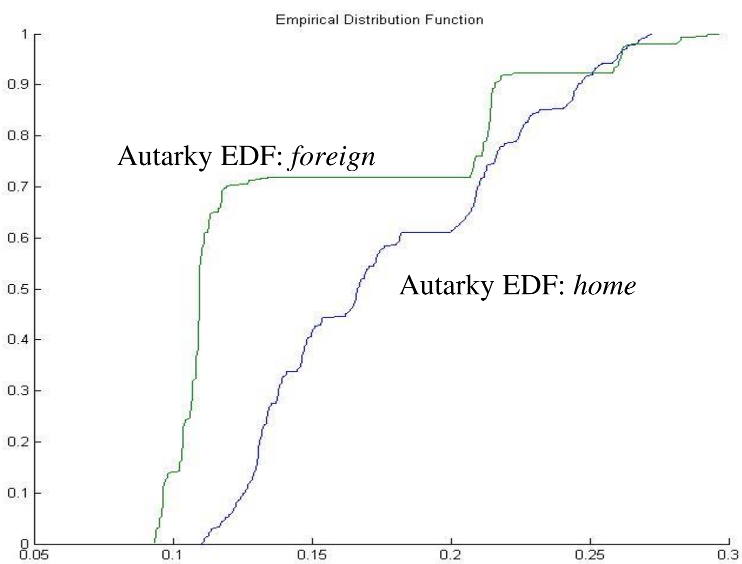
Following table shows the convergence in the long run starting from two different initial wealth distributions given the other parametric values. Results narrates that initial condition has no significant role for the long run distribution of inheritance.

Table3: Convergence test starting from two different initial distribution of inheritance

Two different initial distributions	Kolmogorov-Smirnov test statistic
Normal vis-à-vis Uniform	0.0115 (*0.6630*)
Normal vis-à-vis Single valued (below the cut-off)	0.0132 (*0.8421*)
Normal vis-à-vis Single valued (above cut-off)	0.0104 (*0.7804*)
Uniform vis-à-vis Single valued (below the cut-off)	0.0146 (*0.3569*)
Uniform vis-à-vis Single valued (above the cut-off)	0.0111 (*0.7030*)
Single valued: below cut-off vis-à-vis above the cut-off	0.0068 (*0.9931*)

Result 2: Long run empirical distribution function of inheritance for home country is dominated by foreign country.

Here we would like to mention about the issue of first-order stochastic dominance. Longrun empirical inheritance distribution of the foreign country does not stochastically dominates (first order) the same for home country. Nevertheless for most of the observed values of the longrun empirical distribution function of the foreign is ling above the home empirical distribution function in autarky. Random sample of size 8000 is drawn from each of the longrun wealth distribution (home and foreign). Steady state empirical distribution functions are constructed for the stated two samples and the plots are given in the figure below.



<u>Figure: 4</u>

After trade the two empirical distribution functions indicates the following pattern.

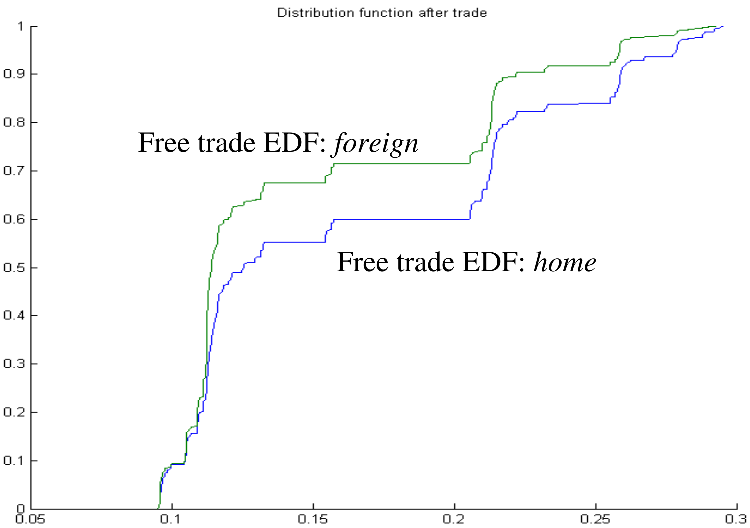


Figure: 5

Result 3: $\frac{p_n^f}{p_m^f}$ *lies below than* $\frac{p_n^h}{p_m^h}$.

Result 4: $\frac{p_n^T}{p_m^T}$ *can lie in between* $\frac{p_n^h}{p_m^h}$ *and* $\frac{p_n^f}{p_m^f}$. *This comparison is done starting from the autarky steady state values*[5].

Following figure supports the above two results.

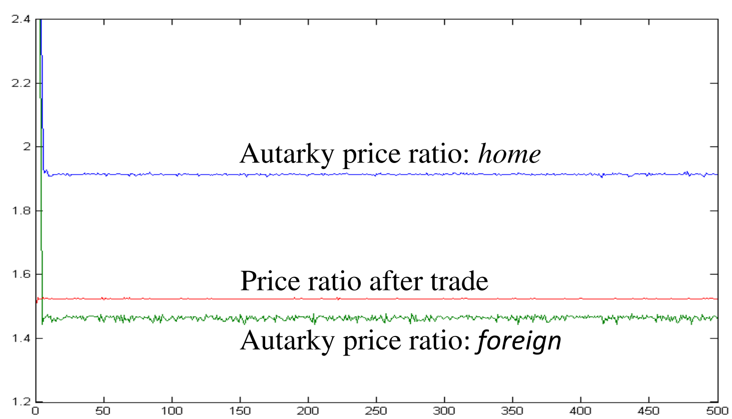


Figure: 6

[5] For some parametric restriction it may be the case that $\frac{p_n^T}{p_m^T}$ goes out of the bound of steady-state autarky price ratios. However that does not mean that trade becomes ungainful. At every instance (taking inheritance distribution as given) of time trade price ratio remain in between the autarky price levels of two countries. Trade open up leads to successful arbitrage. So, no-trade is always inferior than free-trade to the sellers of both the countries.

Result 5: Given this parametric specification, unemployment rate increases in home country but falls in case of foreign[6].

Following figures display the above result.

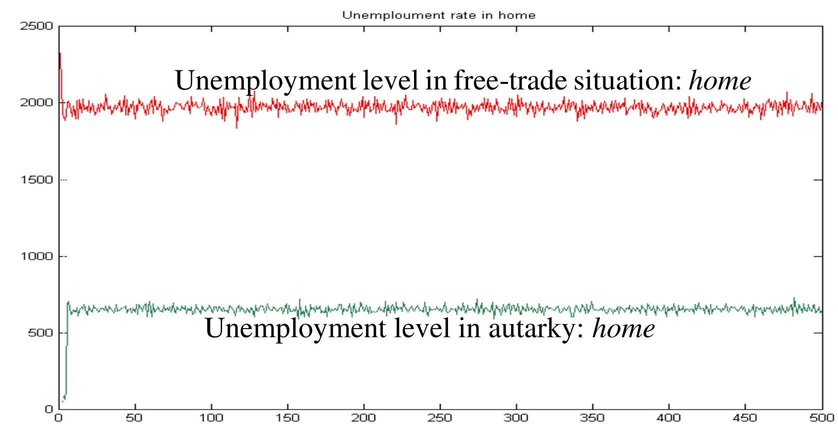


Figure: 7

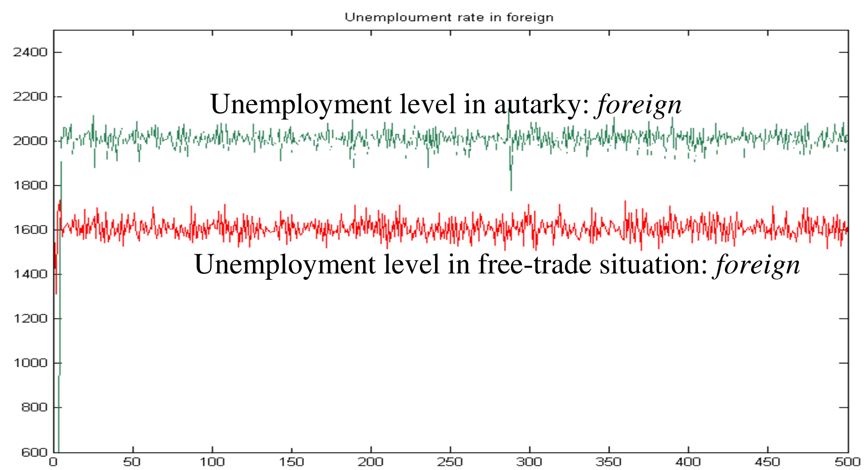


Figure: 8

7. Conclusion.

The three-good general equilibrium model under the discussion assumes a societal status conscious preference, and captures the link between the inheritance level, the labor market friction and unemployment. After solving the model in autarky we allow the economy to enter into the international trade and explore the possible free trade results. Here in the trade situation, the

[6] For some different parametric specification unemployment in both the countries can actually rise in a free-trade steady-state compared to the steady-state level in autarky. This is observed through simulation study that if the steady state price-ratio in a free trade situation comes below the steady-state level of *foreign* autarky price ratio then unemployment can rise in both the countries.

comparative advantage between the two almost similar countries are originating from the difference in the degree of the labor market inefficiency. Although it is a single factor model with two tradable goods, but the findings in the trade situation are quite different from the Ricardian results. Even if the trade takes place between the two very similar countries (with same market size and same production technology), this modeling strategy shows that complete specialization cannot be an equilibrium outcome. As a result, the wage inequality prevails after trade irrespective of the country. In one country it falls and in the other it rises after opening up.

A very frequent question that is asked in the context of unemployment is, whether free trade has pacified the problem or not. Previously it was argued that both of the countries in the Ricardian setup gains in employment terms after trade, and only labor abundant countries gain when trade happens due to endowment differences. Given the present model, free trade is not the sufficient condition for the unambiguous reduction in unemployment in any of the two countries. The wealth distribution of a country, as well as the extent of the status consciousness can play a key role in this regard.

Appendix

Appendix 1

Here the optimal decisions of the agents are solved. Since in the discussed model, cost of searching is equal to zero, each individual likes to search for an organized sector job at each period. An agent can receive a higher wage from organized sector, only if she faces the search process. But she does not lose anything if she goes for search. Therefore she can take a chance in the search process of the organized sector to get a higher wage without cost. Hence, it is optimal for any agent to search in the organized sector. The choice problem between opting for a search or not is actually a comparison between weighted average with strictly positive weights and the minimum value, where all values are not identical. Hence, opting for search becomes a dominant strategy.

The following table shows different pay-offs for different strategies under alternative states of the world. States and strategies are noted in rows and columns respectively. Notations used in the table are likewise: 'L' and 'U' indicate lucky and unlucky situations; 'O', 'N' and 'W' are for organized job, unorganized job and wait, respectively.

Pay-off matrix of each period:

	O	N	W
L	$\frac{w_{mt}}{p_{Ft}}$	$\frac{w_{nt}}{p_{Ft}} - kX_t(i)$	0
U	not applicable	$\frac{w_{nt}}{p_{Ft}} - kX_t(i)$	0

Optimal solutions are illustrated below

for, $X_t(i) \le \frac{w_{nt}}{kp_{Ft}}$		for, $X_t(i) > \frac{w_{nt}}{kp_{Ft}}$	
if L then	O	if L then	O
if U then	N	if U then	W

Therefore $\frac{w_{nt}}{kp_{Ft}}$ becomes the critical level of the inheritance.

Appendix 2

Problem of the firm in the final good sector:

$$\text{Min } p_{mt}m_t + p_{nt}n_t$$
$$\text{s.t } m_t^{\gamma} n_t^{1-\gamma} = F_t$$

This minimization exercise yields

$$\frac{m_t}{n_t} = \frac{\gamma}{1-\gamma}\frac{p_{nt}}{p_{mt}}.$$
$$\text{And, } F_t = m_t^{\gamma} n_t^{1-\gamma}$$

Hence,

$$F_t = \left(\frac{p_{mt}}{p_{nt}}\frac{1-\gamma}{\gamma}\right)^{1-\gamma} m_t$$

$$\text{and, } F_t = \left(\frac{p_{mt}}{p_{nt}}\frac{1-\gamma}{\gamma}\right)^{-\gamma} n_t$$

Since firms are facing perfect competition in product market, zero profit condition for the final good market is also satisfied. So,

$$p_{Ft}F_t = p_{mt}m_t + p_{nt}n_t$$
$$or, \frac{p_{Ft}}{p_{mt}} F_t = \left[\left(\frac{p_{nt}}{p_{mt}}\frac{\gamma}{1-\gamma}\right)^{1-\gamma} + \frac{p_{nt}}{p_{mt}}\left(\frac{p_{nt}}{p_{mt}}\frac{\gamma}{1-\gamma}\right)^{-\gamma}\right] F_t$$
$$or, \frac{p_{Ft}}{p_{mt}} = \left(\frac{p_{nt}}{p_{mt}}\right)^{1-\gamma}\left(\left(\frac{\gamma}{1-\gamma}\right)^{1-\gamma} + \left(\frac{\gamma}{1-\gamma}\right)^{-\gamma}\right)$$
$$or, \frac{p_{Ft}}{p_{mt}} = A\left(\frac{p_{nt}}{p_{mt}}\right)^{1-\gamma}$$
$$\text{Where, } A \equiv \left(\left(\frac{\gamma}{1-\gamma}\right)^{1-\gamma} + \left(\frac{\gamma}{1-\gamma}\right)^{-\gamma}\right)$$

Appendix 3

Equation 16 and Equation 17 respectively are the following two equations.

$$\frac{p_n}{p_m} * G\left(\frac{a_n}{Ak} * \left(\frac{p_n}{p_m}\right)^{\gamma}\right) = \frac{1-\gamma}{\gamma} * \frac{1}{\left(\frac{1}{M} - 1\right)} * \frac{a_m}{a_n}$$

$$M(\theta^{-1}, 1) = \frac{A}{1-\beta} * \frac{d}{a_m} * \left(\frac{p_n}{p_m}\right)^{1-\gamma}$$

The second equation shows that M is a function of $\left(\frac{p_n}{p_m}\right)$. Notice, if for some $\frac{p_n}{p_m}$, M hits 1, then RHS of equation 16 becomes infinity. Let us call that critical price ratio as $\left(\frac{p_n}{p_m}\right)^c$. For all other higher values of $\frac{p_n}{p_m}$, RHS of the equation 16 is monotonically falling.

LHS of equation 16 is a multiplicative function of two monotonically increasing functions of $\left(\frac{p_n}{p_m}\right)$. The first term is a linearly increasing with slope 1. The second term is the distribution function and values within the parenthesis is an increasing function of $\left(\frac{p_n}{p_m}\right)$ with the slope lesser than one. Since these two terms are in multiplicative form, LHS takes the value zero when $\left(\frac{p_n}{p_m}\right) = 0$.

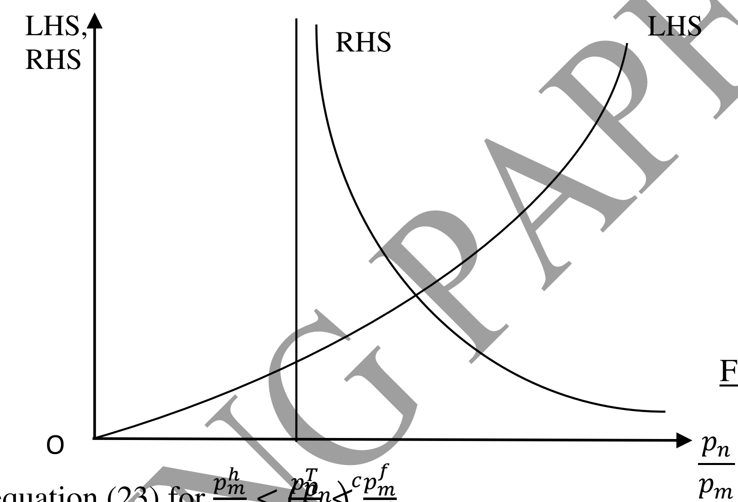


Figure: 7

Appendix 4

Using equation (17) and equation (23) for $\frac{p_m^h}{p_n^h} < \left(\frac{p_n}{p_m}\right)^c < \frac{p_m^f}{p_n^f}$

,

$$\frac{M\left(\theta^{h^{-1}},1\right)}{M\left(\theta^{T^{h^{-1}}},1\right)} = \left(\frac{\frac{p_n^h}{p_m^h}}{\frac{p_n^T}{p_m^T}}\right)^{1-\gamma} > 1$$

$$\Rightarrow \; M\left(\theta^{f^{-1}},1\right) > M\left(\theta^{T^{f^{-1}}},1\right)$$

$$\Rightarrow \; v^h < v^{h^T}$$

Similarly, using equation (20) and equation (22) for $\frac{p_m^h}{p_n^h} < \frac{p_n^T}{p_m^T} < \frac{p_m^f}{p_n^f}$, one can show:

$v^f > v^{h^T}$.

Appendix 5

From equation (4) and equation (6) we get,

$$\frac{w_m^h}{w_n^h} = \frac{\beta a_m}{a_n} * \frac{p_m^h}{p_n^h}$$

$$\frac{w_m^f}{w_n^f} = \frac{\beta a_m}{a_n} * \frac{p_m^f}{p_n^f}.$$

After trade, price ratios of good *m* and good *n* are equalized to $\frac{p_m^T}{p_n^T}$. Therefore,

$\frac{{w_m^T}^h}{{w_n^T}^h} = \frac{{w_m^T}^f}{{w_n^T}^f} \equiv \frac{w_m^T}{w_n^T}$.

Sub-section (*3.i*) has argued that in this modeling set up wage of the organized sector always remain higher than the unorganized sector wage.

Therefore, $\frac{w_m^h}{w_n^h} > 1$.

Now $\frac{p_n^f}{p_m^f} < \frac{p_n^T}{p_m^T} < \frac{p_n^h}{p_m^h}$ can be re-written as $\frac{p_m^h}{p_n^h} < \frac{p_n^T}{p_m^T} < \frac{p_m^f}{p_n^f}$

- ⇨ $\frac{\beta a_m}{a_n} * \frac{p_m^h}{p_n^h} < \frac{\beta a_m}{a_n} * \frac{p_n^T}{p_m^T} < \frac{\beta a_m}{a_n} * \frac{p_m^f}{p_n^f}$
- ⇨ $\frac{w_m^h}{w_n^h} < \frac{w_m^T}{w_n^T} < \frac{w_m^f}{w_n^f}$
- ⇨ $1 < \frac{w_m^h}{w_n^h} < \frac{w_m^T}{w_n^T} < \frac{w_m^f}{w_n^f}$, (since, $\frac{w_m^h}{w_n^h} > 1$).

Hence the organized and unorganized wage reduces in foreign and increases in home after trade.

From equation (13) one can write, after trade, ${p_F^T}^h = {p_F^T}^f \equiv p_F^T = A * p_m^T \left(\frac{p_n^T}{p_m^T}\right)^{1-\gamma}$.

Therefore sector specific real wages (wage of sector *m* (or, *n*)/price of the final good) are also equalized between the two countries.

References

Banerjee, A., & Mullainathan, S. (2010). The Shape Of Temptation: Implications For The Economic Lives Of The Poor. *NBER Working Paper Series*, Working Paper 15973.

Basu, K. (1989). A Theory Of Association: Social. *Oxford Economic Papers*, 653-671.

Charles, K. K., Hurst, E., & Roussanov, N. (2009). Conspicuous Consumption and Race. *Quarterly Journal of Economics*, 425-467.

Cole, H. L., Mailath, G. J., & Postlewaite, A. (1992). Social Norms, Savings Behavior, and Growth. *Journal of Political Economy*, 1092-1125.

Davidson, C., & Matusz, S. (2004). An Overlapping-generations Model of Escape. *Review of International Economics*, 749-768.

Davidson, C., & Matusz, S. (2006). Long-run Lunacy, Short-run Sanity: a Simple Model. *Review of International Economics*, 261-276.

Davidson, C., Martin, L., & Steven, M. (1999). Trade and search generated unemployment. *Journal of International Economics*, 271-299.

Davidson, C., Matusz, S. J., & Shevchenko, A. (2008). Globalization and Firm Level Adjustment with Imperfect Labor Markets. *Journal of International Economics*, 295-309.

Dutt, P., Mitra, D., & Ranjan, P. (2009). International Trade and Unemployment: Theory and cross national evidence. *Journal of International Economics*, 32-44.

Goldberga, P. K., & Pavcnikb, N. (2003). The response of the informal sector to trade liberalization. *Journal of development economics*, 463-496.

GROSSMAN, G. M., & SHAPIRO, C. (1988). FOREIGN COUNTERFEITING OF STATUS GOODS. *The QuarterlyJournal of Economics*, 79-100.

Heid, B., Larch, M., & Riaño, A. (2013). The Rise of the Maquiladoras: A Mixed Blessing. *Review of Development Economics*, 252-267.

HELPMAN, E., & ITSKHOKI, O. (2010). Labour Market Rigidities, Trade and Unemployment. *Review of Economic Studies*, 1100-1137.

HELPMAN, E., ITSKHOKI, O., & REDDING, S. (2010). INEQUALITY AND UNEMPLOYMENT IN A GLOBAL ECONOMY. *Econometrica*, 1239-1283.

HOSIOS, A. J. (1990). On The Efficiency of Matching and Realated Models of Search Unemployment. *Review of Economic Studies*, 279-298.

Mitra, D., & Ranjan, P. (2010). Offshoring and unemployment: The role of search frictions labor mobility. *Journal of International Economics*, 219-229.

Moav, O., & Neeman, Z. (2010). Status And Poverty. *Journal Of The European Economic Association*, 413-420.

Petrongolo, B., & Pissarides, C. A. (2001). Looking into the Black Box: A Survey of the Matching Function. *Journal of Economic Literature*, 390-431.

Pissarides, C. A. (2000). *Equilibrium Unemployment Theory.* The MIT Press.

Vishwanat, T. (1989). Job Search, Stigma Effect, and Escape Rate from Unemployment. *Journal of Labor Economics*, 487-502.