Inheritance, Search Friction and International Trade: A General Equilibrium Model

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Abstract

In a general equilibrium framework, an economy, with one non-traded final good and two traded intermediate goods, is modeled in this paper. It is shown that even if the economy consists of one frictionless labor market and a labor market with the search-friction, a status-conscious preference can yield unemployment in equilibrium. If such an economy opens up to trade then comparative advantage can be generated through the difference in the degree of the labor market imperfection even between two otherwise very similar countries. This setup rejects the possibility of complete specialization. Wage inequality persists within the country, for both home and foreign, in spite of free trade and, free trade does not guarantee the reduction of unemployment.

Keywords: Trade; Search Unemployment; Inheritance Distribution

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

1. Introduction

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In spite of the fact that popular debates have always linked international trade to the creation or destruction of domestic jobs, that is to the potential decrease or increase in unemployment, serious attempts to incorporate unemployment in trade models are not more than two decades old. The primary reason for this was the absence of theories of unemployment with proper micro-foundations which could be readily fitted in to a general equilibrium trade model. Visibly the breakthrough came after the introduction of Diamond-Mortensen-Pissarides model of search and matching unemployment. This theoretical structure opened up rich possibilities for general equilibrium models to include a labor market setup which generates unemployment in equilibrium. Davidson, Martin and Matusz (1987, 1991, 1999), Matusz (1996), Davidson and Matusz (2004, 2006), Davidson, Matusz and Nelson (2006, 2007), Davidson, Matusz and Shevchenko (2008), Dutta, Mitra and Priya Ranjan (2009, 2010) and others have built modeling structure alike to the classical trade models incorporating search friction and test the celebrated results of trade theory. Very recently Helpman and Itskhoki (2010) bring firm heterogeneity, trade and search friction together, and ask the questions related to wage rigidity and inequality.

The present paper is also an attempt in the same vein. It builds up a model of trade with search unemployment. There are two important differences between our approach and the present literature. First, unlike in some of the above mentioned papers, along with a formal labor market with search led friction, we have a frictionless informal labor market where jobs are readily available. Second, we assume that there is a status-related disutility associated with working in the informal sector and this disutility increases with the level of inheritance of an individual. It is shown that in such an economy trade can take place even among two almost similar economies. Since we have a single factor of production in our model, our model economy can be called Ricardian. However, our results are different from those of a standard Ricardian model. We show that, a simple impurely altruistic general equilibrium model with a status conscious individual preference gives rise to the possibility of equilibrium unemployment in spite of the presence of a frictionless labor market. After trade in some case unemployment may actually rise.

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. Cole, Mailath and Postlewaite (1992) introduced status good in the preference function for the purpose of explaining cross country heterogeneity of growth rates. Banerjee and Mullainathan (2010) have argued 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.

Sen (1975a, p. 5) argues "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…" Casual observation depicts that, in most of the economies, working in the unorganized sector is socially undesirable. Greater the social status, higher is the social stigma associated with unorganized sector jobs. However the unorganized job market exists in all most all countries, and this market is more flexible (in terms of entry and exist) but less remunerative than formal sector. In every country it is easier to get unorganized sector jobs. Still there are people who fail to get organized sector job, and remain jobless (namely unemployed) instead of joining the unorganized sector job. So, only a fraction of the population who are not working in the organized sector, is contributing to the labor supply of the unorganized sector. To capture this scenario, in this model the preference structure of an individual is postulated as having a status dependent disutility of working in unorganized sector. (Here the inheritance level is considered as a proxy of status.) That also brings out an alternative micro-explanation of the existence of the aggregate unemployment. Clearly this postulated economy has one organized sector with a frictional entry condition, one unorganized sector with much lesser friction (for simplicity, it is assumed as a frictionless labor market), and we have another non-traded final good sector making other two sectors as the intermediate traded good sector for the modeling ease. Given this setup, we allow this economy to open up and determine the possibility of trade even with a very similar country. The classical results of the trade literature are compared with the results coming out from this setup and the effect of trade on unemployment is also considered.

[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.

While, structurally our model is close to the Ricardian setup under autarky (since this is a single factor model with the two tradable goods sector), here trade can take place between two countries with same technology of production. The two trading countries differ in their frictional labor market structures. In this paper, the different degrees of labor market inefficiency (more specifically, differences in the fixed cost of posting vacancy) lead to a situation, that permits international trade. However, unlike in the standard Ricardian model, we get incomplete specialization as an outcome of trade.

In this model, after trade, relative wages are equalized between the two countries. Across sectors within a country, however, 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 free trade equilibrium. The effect of trade is to equalize the wage inequality across countries. 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 give an overall loss of welfare of the unorganized sector good exporting country. In this 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 wealth, 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 income has an important role to play.

In a continuous time framework, theoretical models with two sectors, one without labor market friction and another with search friction, the existence of unemployment is not rare. This is basically because of the assumption that search and matching process is going on at every instance of time. One example of such kind of model is Davidson *et al.* (2006). They have taken a continuous time framework with skill hierarchy among different individuals. They have assumed that 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, 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. The main focus of that paper was to illustrate the possibility that in the short run a small open economy can produce outside its long run frontier. Davidson *et. al.* (1987), have considered a discrete time set up. By the assumption of exit deterrence[3]they restricted 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. The present model does not need the assumption of exit deterrence to generate unemployment. Moreover Davidson *et. al.* (1987, 1991) have not considered trade in their model whereas our main concern is to find out the effects of trade.

The way the possibility of trade is invoked in our model is close to Davidson, Martin and Matusz (1999) and Helpman and Itskhoki (2009). However, Davidson *et. al.* (1999) (if large country-small country argument is not considered) or single factor version of Dutta *et. al.* (2009) have supported the classic Ricardian result of complete specialization. Helpman *et. al.* (2009) has constructed a model of firm heterogeneity with differentiated products in monopolistic competition. Their model has followed typically the modeling device of Melitz (2003) with frictional labor market. Since our model allows trade among the two almost homogenous countries, hence a large country vis-à-vis a small country argument does not hold in this case.

Our result of wage inequality within a country is closer to the findings of Helpman *et al*. (2010). The latter, however, has adopted a completely different modeling setup with firm heterogeneity along with the rigorous analytical treatment on wage inequality. 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.

Effect of trade on informality is presently a widely discussed issue. Empirical evidences are not one sided. For different countries the effects are different. Koujianou, Goldberg and Pavcnik (2003) find an increase in informality after trade liberalization episodes in the 1980s and 1990s

[3]Once an individual started working in one sector it is impossible to come out of that sector until that agent dies.

in Colombia. Again in case of Brazil they do not find any such 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, all these models, unlike us, have taken the assumption of small open economy.

Ricardian structure with unemployment 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. Davidson *et. al.*(2008) have claimed, in shortrun 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. Mirta and Ranjan (2010) have proved that offshoring leads to unambiguous reduction of unemployment. 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. This paper points out that aggregate level of unemployment of a country depends on the inheritance distribution of that country. Therefore effect of trade on unemployment is not unambiguous. Helpman *et. al.* (2010) also have supported this ambiguity.

The plan of the paper is as follows. In the next section the analytical structure of this general equilibrium model is explained at length. 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 have to take the help of a numerical exercise. Section 6 summarizes all the simulation results and the propositions derive from that analysis. Section 7, the last one, briefly recapitulates and then, concludes the whole model.

1. The Model

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

2.i. Structure

In our hypothetical economy there are two types of economic agents, infinitely lived firms and single period lived individuals. At the beginning of a period, a new batch of population joins the economy with the departure of its previous generation. The total mass of each generation is normalized to unity (thus in our economy there is no population growth). Any i^{th} individual receives some inheritance ($X_t(i)$) from her previous generation and for each generation there is a distribution of inheritance over the entire population. This (endogenously determined) distribution function is denoted by $G_t(X)$ for the t^{th} time period. That is, there are $G_t(X)$ proportion of people who has less than or equal to X amount of inheritance. Every individual derives utility (U) from consumption (c) and bequest (b) kept for her next generation. Both of these two economic activities happen only through 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 the only factor input 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.

Sub-sections under Section 2 elucidate the time line of model, individual preferences and the structure of production of intermediate goods and the final good in more detail.

2.ii. Time sequence

Before going into the analysis of this discrete time-frame model, we first explicate the sequence of events within a period. As mentioned above, in our model, workers (as well as consumers) live for a single period. A representative individual, born (with the whole population) 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 are single period lived, 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. Now the economy is prepared with a number of vacant firms and a number of job seekers to perform the matching process.

Matched firm-worker pairs start production immediately. Unmatched searchers either, join unorganized sector's labor pool and get employed readily to produce n-good, 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:

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

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. A close inspection tells us that the disutility level increases in a proportion, k with the level of X. Here inheritance (which is factually a good proxy 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 has to do the optimization sequentially. First she maximizes her utility by choosing appropriate c and b given any D and then optimal D is decided. The determination of D leads to the occupational decision choice. Hence this optimization exercise has to be done by the individual at the beginning of the period, and due to the uncertain job-match in the labor market she maximizes her expected utility. Section 3 explains the equilibrium decisions in length. To do so, first it is essential to model the possible income sources of the individual. For that purpose, we must discuss the structure of production and distribution in the different sectors.

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 (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

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

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. Following Pisserides, here 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 from the production process. 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 good 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. 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 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. Again if she becomes unsuccessful and fails to get a vacant firm she will receive nothing from the organized sector. Unlike firms, for simplicity, here search cost is absent for a searcher.

As stated earlier, both the agents of this sector have some positive bargaining power. So, 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. $w_{mt} = \arg\max_{w_{mt}} \ (w_{mt})^{\beta}(\ p_{mt}a_m - w_{mt})^{1-\beta}$.

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, willing to work in 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 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 assimilates the two intermediate goods as factors from a frictionless perfect market. For simplicity, here also the technology which is used for the production of F, is assumed to be CRS. Both the inputs are essential for production such that demand for any of the intermediate goods can never hit zero. The model takes Cobb-Douglas of degree one as the exact functional form of the production structure with no technology parameter. That is,

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

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

The subsequent section aims to solve the model as a whole and determines the prices of m, n and F under autarky.

2. Equilibrium in Autarky

In the previous section the structure of the model has been discussed thoroughly. The objective of the present section is to solve this general equilibrium model. First, the problem of individual optimization of the utility function subject to their respective budget constrain, and then, the problem of equilibrium price determination are explained in the following subsections.

3.i Optimal decisions of the individual

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

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 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 Cobb-Douglas type production function each intermediate good is essential for production and therefore, demand pulls the price of good m up such that individuals optimally select to give labor in organized sector. That implies, at the first place, organized sector job is more lucrative than 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.

Hence,

$$u_t = 1. \tag{8}$$

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

In the second stage, individuals, who remain unmatched after the search process, decides whether to join unorganized sector or to continue as an unemployed person. Here, decisions vary from one individual to another depending on the levels of inheritance. 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. So, there exists a critical level of inheritance which makes the marginal unmatched worker indifferent between taking up an unorganized sector job and remaining unemployed. Appendix 1 proves that this critical inheritance level (X^c) is $\frac{w_{nt}}{kp_{Ft}}$. 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 never chooses to work in unorganized sector. 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, $b_t = \alpha(\frac{wage_t}{p_{Ft}} + X_t)$.

Next three subsections derive the market equilibrium.

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 m-good and n-good depends on the distribution of inheritance.

Demand for the intermediate goods is generated from the final good sector. Producers of 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' problem is

Min $p_{mt}m + p_{nt}n$ such that $m^{\gamma}n^{(1-\gamma)} = F$

Above minimization exercise yields the following relative demand equation:

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

3.iii Market Equilibrium

Product market of this economy is perfect. In equilibrium relative demand equates relative supply. Using the equations of the above two subsections 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, $p_{Ft}F_t = p_{mt}m_t + p_{nt}n_t$. Using equation (10) and (7), following can be found (simple derivation is put in Appendix 2)

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

Where A 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),

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

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

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

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 more than one parametric specifications wealth distribution converges in the longrun.

Here the model is solved for the longrun steady state. Equations (11), (14) and (15) can be re-written without using the time subscript like the following way:

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

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 $\frac{p_n}{p_m}$, since 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 $\frac{p_n}{p_m}$. As stated earlier left hand side (LHS) is a positively sloped function of $\frac{p_n}{p_m}$ with the value zero at origin, and increases with $\frac{p_n}{p_m}$ monotonically. Appendix 3 contains some more details.

Therefore at the steady state, the relative price of intermediate goods has a finite solution. So, now the model has been solved in autarky. Henceforth all the analysis is done at the steady state.

Proposition 4: Unique and stable equilibrium exists in autarky.

It is noteworthy that, both the 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. In section 6 it is shown that for the different level of cost of posting vacancy, long run wealth of the population also converges to the different distributions. Therefore in the long run, price level can also differ due to the different level of cost of posting vacancy and for the different wealth distribution.

3.iv Aggregate equilibrium unemployment in autarky

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

$$TU = (1 - M)(1 - G(X^c)). \quad (18)$$

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.

Next section contains some detail discussion about the distribution of inheritance.

3.v Dynamics of inheritance distribution function (G)

Before this subsection although all other variables of the model are explained and discussed, the dynamics of wealth distribution remain unexplored to which we turn now. Here our main concern is to understand the dynamical 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 $X_t \leq X^c$,

$X_{t+1} = \alpha\left(X_t + \frac{w_{mt}}{p_{Ft}}\right)$, with probability $M(1, \theta_t)$ (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 $X_{t+1} = b_t$. Because of the Cobb-Douglas structure of the utility function, optimization exercise yields that the bequest level is equal to the α proportion of the total wealth of the individual.

Other details of the equation are straight forward to see. 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. So it explains (I). In case (II) and (III) 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 clarifies (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:

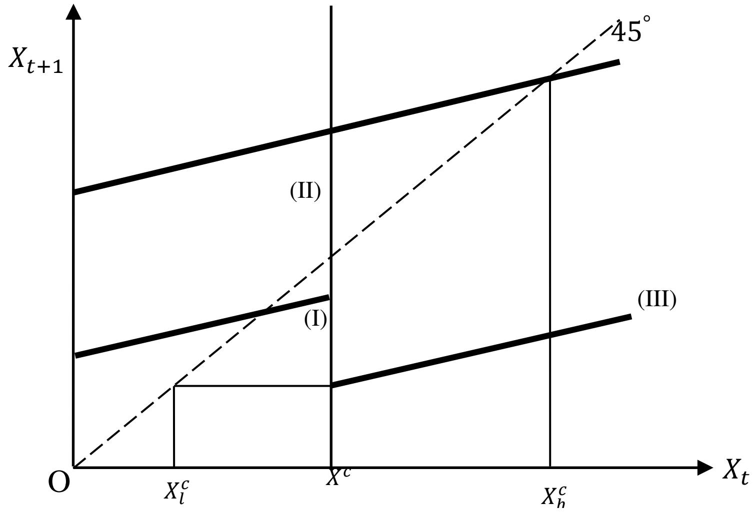


Figure: 1

Numbering of the thick lines is done according to the difference equation number. 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. 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 always people 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.

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

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

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.

3. Two Country Set-up.

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. Even between these two similar countries relative price ratios of tradable goods may differ. The lone difference among the two countries is in the degree of labor market imperfection in the organized sector. It is introduced in the following way. Firms located in h are paying less, in real terms, to post a vacancy than in the firms of f(so, $d^f > d^h$). In some sense difficulty of production of good *m* is higher in the foreign than the home country. That leads to a fall in v_t^f, number of vacancies posted in f,for each $\frac{p_{nt}^f}{p_{mt}^f}$ from equation (17). 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, therefore, remains smaller than that of the home country for all $\frac{p_{nt}^f}{p_{mt}^f}$.

Foreign country version of the equations (16) and (17) are the following

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

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

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

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, $G\left(X^{c^h}\right) \leq G^f(X^{c^f})$ (this is discussed in detail latter in Section 6). Therefore, for any price ratio of intermediate goods, LHS of equation (20) is higher than LHS 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 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.

4. Trade Equilibrium and results.

Previous section has demonstrated that if home and foreign open up their economies to free trade then successful arbitrage is possible in the tradable intermediate goods sector. 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.

Now 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:

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

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 superscript T is used as a notation for trade and $M^{T^j} \equiv M\left(1, v^{T^j}\right)$, since $u^{T^j} = 1$ (let $j = \{h, f\}$). 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.

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

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

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

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

Numerator of the RHS of the equation (21) is a monotonically decreasing function of $\frac{p_F^T}{p_m^T}$. LHS side of this equation is clearly a monotonically increasing function starting from zero. Hence, a free trade price level is determined. From equation (13) it can be seen that price ratio of final good and *m*-good ($\frac{p_F^T}{p_m^T}$) of two countries are also equalized in the free trade regime.

Proposition 8: Unique and stable equilibrium exists in free trade situation.

Equation (21) can be re-written as follows

$$\left(\frac{p_n^T}{p_m^T}\right) = \frac{1-\gamma}{\gamma} * \frac{a_m}{a_n} * \left(\frac{M^{T^h}}{\left(1-M^{T^h}\right)} * \frac{1}{G^{T^h}\left(\frac{a_n}{Ak}*\left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)} * (1-\Theta) + \frac{\left(M^{T^f}\right)}{\left(1-M^{T^f}\right)} * \frac{1}{G^{T^f}\left(\frac{a_n}{Ak}*\left(\frac{p_n^T}{p_m^T}\right)^{\gamma}\right)} * \Theta\right) \tag{24}$$

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

Given a unique price level exists in the free trade situation, from equations (22) and (23) below mentioned equation can be generated.

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

Since $d^f > d^h$ and $u^j = 1$, to hold the above equation following condition must be satisfied,

$${v^T}^h > {v^T}^f. \tag{25}$$

Therefore, after trade vacancy posting by the organized sector firms, and hence the production of the *m*-good (since, ${M^T}^f < {M^T}^h$), remain higher in the home country in comparison with the foreign. Nonetheless this is not the sufficient condition for the free trade price ratio to remain within the steady state autarky price ratios of home and foreign.

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 from the simulation exercise it can be shown that equation (24) 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 and in the steady state equilibrium trade becomes remunerative for both the countries.

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* ${v^T}^f < v^f < v^h < {v^T}^h$.

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 similar kind of comparison exercise between equation (17), equation (22), equation (20) and equation (23) can show that ${v^T}^f < v^f < v^h < {v^T}^h$. 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. In fact the gap between the probability values of two countries increases after trade. The probability of the getting a worker by a particular firm of the organized sector of the home country actually falls after the opening up of trade, although 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 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 or the foreign country after trade. This is clearly a departure from the Ricardian type results and it is also not the same result which comes from the H-O type models.

Proposition 10: After trade wage inequality increases in the home country and falls in the foreign. Sector specific wages and the relative price of F-good and m-good are equalized between the two trading countries.

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 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. Therefore in both the countries all the individuals 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 given the Cobb-Douglas production function of the final good. 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 some simulation results put some light in this regard.

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

5. 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

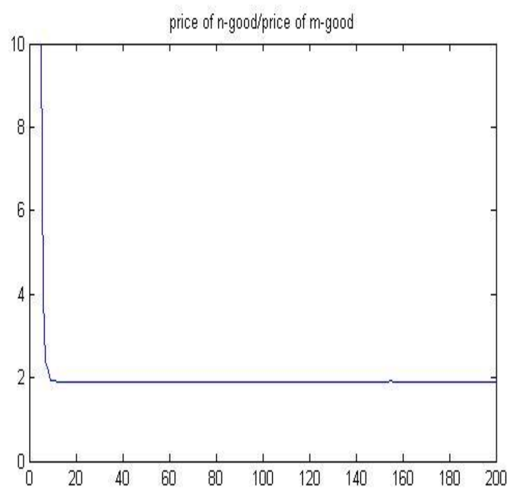
Here, following Petrongolo and Pissarides (2001), it is assumed that matching function is of Cobb-Douglas type. The functional form is,

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

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

Result 1: *The distribution of inheritance and the price ratios converges 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.



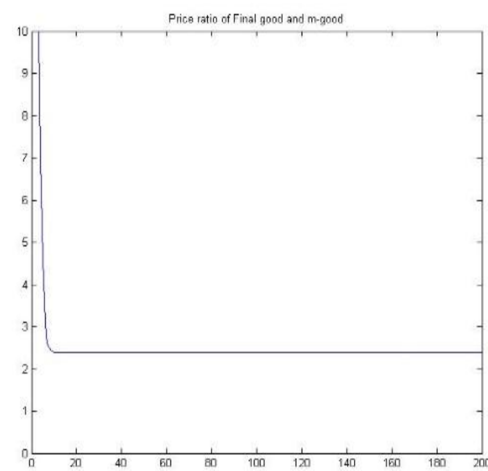


Figure: 2

Convergence of price ratios can also be proved by Kolmogorov-Smirnov test. The long run distribution of inheritance is displayed in the following histogram.

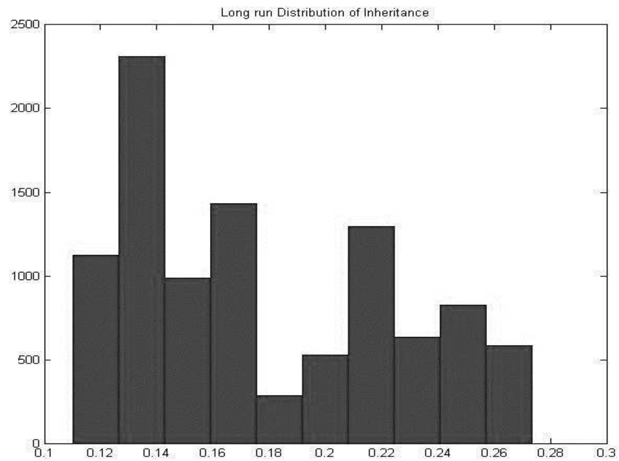


Figure: 3

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

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

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 at the critical level of inheritance (X^{cj}).

Number of individuals with inheritance level lower than the critical value is greater in case of foreign country than the home in autarky. This is empirical true for more than 99% cases for the given specifications of the parameter values.

Additionally 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 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). Empirical distribution functions are constructed for the stated two samples and the plots are given in the figure below.

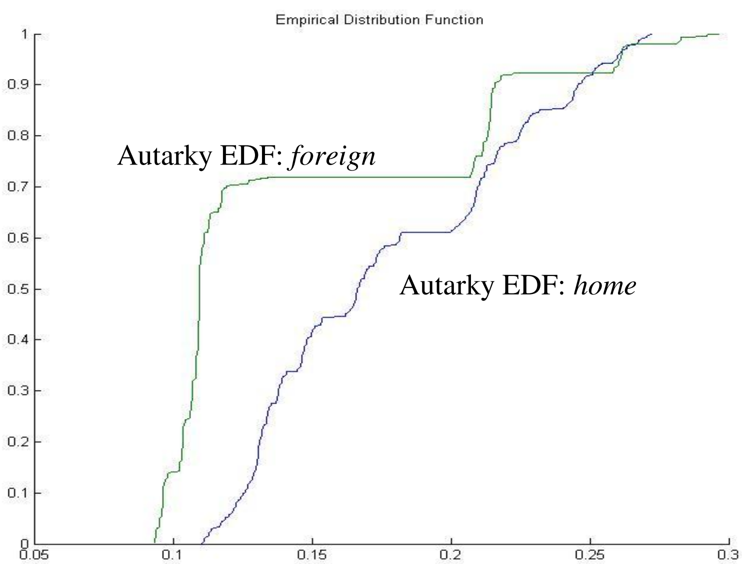


Figure: 4

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

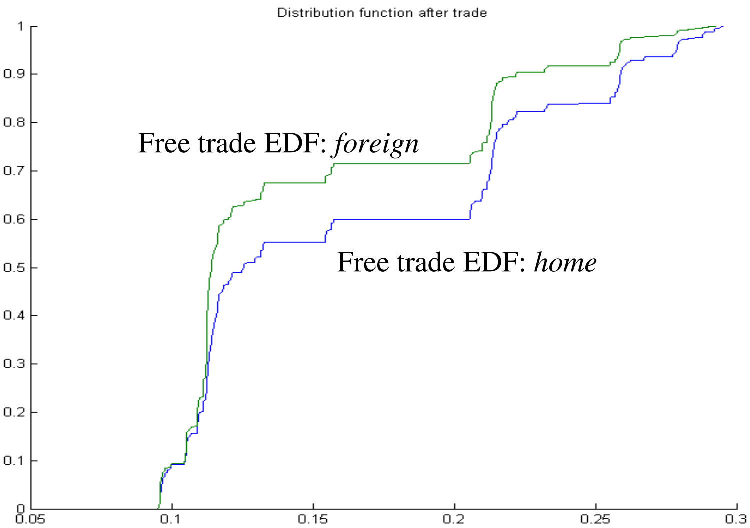


Figure: 5

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.

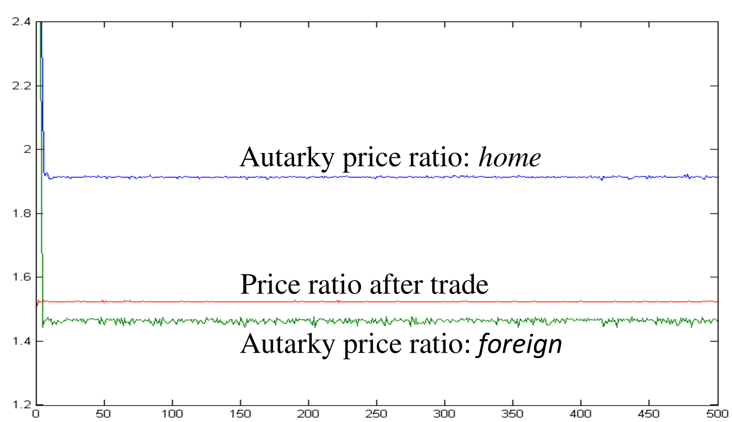


Figure: 6

Result 5: Given this parametric specification, unemployment rate increases in home country but falls in case of foreign[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. So, no-trade is always inferior than free-trade to the sellers of both the countries.

Following figures display the above result.

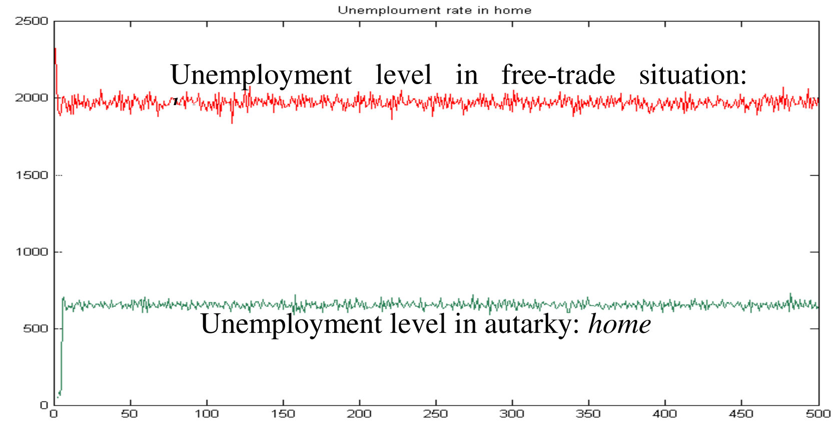


Figure: 7

Figure: 8

6. 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 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

[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.

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 is present also 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 $\left(\frac{p_n}{p_m}\right) = 0$.

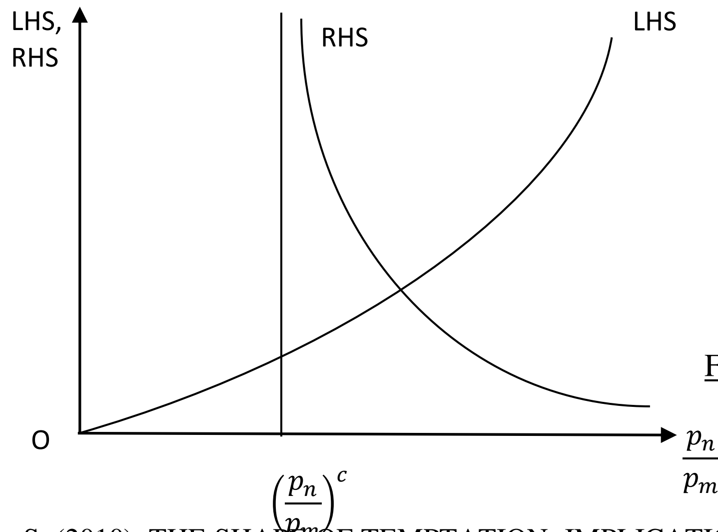


Figure: 7

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