Unemployment and Inheritance Linkage: A Dynamic General Equilibrium Analysis

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Abstract

This general equilibrium model seeks to find an explicit relationship between inheritance (and hence, the long run wealth distribution) and the unemployment, generated due to search-friction in the labor market. The existence of unemployment in the equilibrium is guaranteed together with a perfect and an imperfect labor market. The model displays that inheritance affects unemployment positively in micro-level. Amongst the different countries as a whole, a negative relationship between income and unemployment is established. The model ensures that a dynasty does not get stagnated in a particular income class. By simulating the model, we isolate the initial income distribution from the long run income path and question the efficacy of the celebrated trap theory.

JEL Classification: E24, J64

Keywords: Status conscious preference, Inheritance, Search and matching, Income distribution.

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1. Introduction

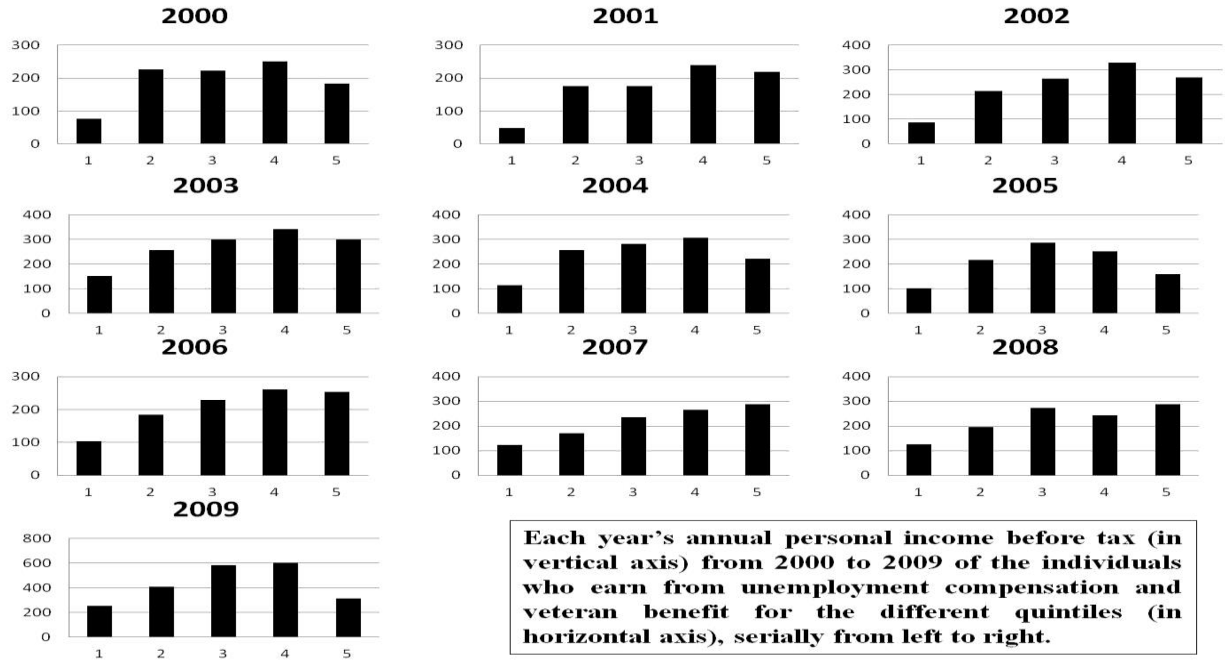
Casual observation on real world shows two contraindicative facts: most of the unemployed persons do not represent the poorest mass of a country and on the contrary, all most all underdeveloped countries register a high rate of unemployment. This acts as the primary motivation behind the current work. At micro level, people with higher wealth become more selective to accept a job. Hence, the possibility of remaining unemployed increases with higher wealth. On the other hand, developed countries do have a more efficient labor market with a lesser unemployment problem. Therefore a clear discordance exist between micro and macro level actuality. Next few paragraphs display some empirical result to establish these two apparently conflicting observations.

A simple empirical exercise is taken in this project using American Time Use Survey (ATUS) data. A significant (at 10% level) positive relation for 4 years within 2003-2009 has been found between family income of the different individuals and the total time spent for job search, waiting and other activities, not associated with earning. Detail result of that exercise is given in the following table.

Year	Spearman's rho	Prob > |t|
2003	**0.0169**	**0.0106**
2004	*0.0059*	*0.4654*
2005	*-0.0135*	*0.1053*
2006	**0.0142**	**0.0846**
2007	**0.0190**	**0.0251**
2008	**0.0271**	**0.0016**
2009	*-0.0012*	*0.8883*

Previous data (from 2000 to 2009) of Consumer Expenditure Survey provided by US Bureau of Labor Statistics reveals that annual personal income (before tax) of the people who earn from (*source of income*) unemployment benefit is least in the lowest income quintiles. For each time period represented in the tables, consumer units are ranked in ascending order, according to the level of total before-tax income reported by the consumer unit. The ranking is then divided into five equal groups as five different quintiles. There is an increasing tendency of unemployment with income quintile at least till third quintile.

The following figure[3] showcases yearly average consumption expenditure of the individuals earning from unemployment compensation.



Each year's annual personal income before tax (in vertical axis) from 2000 to 2009 of the individuals who earn from unemployment compensation and veteran benefit for the different quintiles (in horizontal axis), serially from left to right.

If total personal income from unemployment compensation is taken as a proxy of number of unemployed people in an income quintile, then it is evident that unemployment rises for higher income class for the first four quintiles.

Hence the above analysis suggests the existence of a positive relationship between wealth and unemployment within an economy.

This model accommodates both organized sector and unorganized sector with status conscious individual preference (exact form of the preference function is discussed in the next section). In every economy unemployment and unorganized sector persists simultaneously (along with the organized sector). This co-existence of unemployment and unorganized sector within an economy is theoretically somewhat enigmatic. After an active search for the job if an individual fails to get employed in the organized sector, then staying without earning (which is the definition of unemployment[4]) should be dominated by getting

[3] Source: bureau of Labor Statistics, US. http://www.bls.gov/cex/#tables (Quintiles of income before taxes)

[4]The "unemployed" comprise all persons above a specified age who during the reference period were "without work", "currently available for work" and "seeking work". http://www.ilo.org/public/english/bureau/stat/download/res/ecacpop.pdf

a job in the unorganized sector where obtaining a job (i.e. a strictly positive earning opportunity) is relatively easier. Our model, in line with the real world observation, establishes the existence of unemployment in equilibrium after incorporating the unorganized sector with a perfect labor market. Here the difference in the level of inheritance is very crucial to guarantee the existence of the two classes of people, namely unemployed and unorganized sector worker. Intuitively the argument is the following: people with lesser inheritance level are less capable to afford to remain jobless. On the other hand wealthier individuals like to avoid working in the technologically inferior unorganized sector. Thus we connect the labor market with the wealth distribution, and explain the wealth dynamics of a dynasty with the help of the degree of labor market efficiency. Here lies the main contribution of this work.

We assume that the technological superiority exists for the organized sector, but with the factor market imperfection. In this sector laborers cannot freely enter the market to supply their labor. Firms also do not get the worker freely to fill the vacant post. There exists a costly search and matching friction in the organized sector labor market. That allows the scope of extracting some positive rent out of this market interaction. Both firm and workers of this sector have a bargaining power on wage negotiation. Specifically we utilize Nash bargaining to model the factor market payments. Alongside this imperfection in the factor market of the organized sector, the search and matching modeling mechanism is also incorporated in our set up.

Search and matching models are developed eyeing on the fact that the labor market are not frictionless. Nexus between a job and a worker is established after a complex process of search; and more crucially, the search process may not yield a successful match at a particular point of time for a particular searcher (either firm or worker). Matching function plays a very pivotal role in this literature. 'Inputs' of this function are the stock of unemployment and vacancies, and the matching function declares the rate at which successful job-matches are formed from the total number of searchers (including both laborer and employer). In our analysis Pissarides type (Pissarides (2000)) setup is followed to design the matching function, empirical backings of which are strong (Pissarides (1986), (1990); Layard *et al.* (1991); Blanchard and Diamond (1989), (1990); Coles and Smith (1996)).

In our model economy one individual has a single unit of labor which she can deliver inelastically to the firm. Her single unit of labor can earn a higher wage by supplying it to the organized sector, although receiving a job in that sector depends on a successful match. On the other hand, the disutility obtained by an agent while working in the unorganized sector confronts her with a choice problem at the time of entering into the job market. Individuals optimally decide for both the periods at the beginning of their life regarding the usage of the labor endowment, but consume and save for their following generation at the end. We present our model more formally and examine the optimal decision taken by the agents in the next section.

There are quite large literatures dealing with search generated unemployment following Pissarides type matching. Although incorporating the concept of unorganized sector in this modeling set up is not really ample. Davidson and Matusz in (2006) established equilibrium unemployment in that set up along with the concept of unorganized sector. Skill heterogeneity was the decisive characteristic in their modeling strategy. Existing literature does not include inheritance with unemployment in a general equilibrium frame. A relation between inheritance (termed there as wealth) and choice of occupation was formulated in Banerjee & Newman, (1993). In their model of occupational choice, a window was kept open for the least wealthy individuals to remain idle; but lacks to explain why the wealthier individuals are more probable to remain unemployed. Moreover in their contribution 'remain idle' cannot be a feasible option in the equilibrium either.

Bequest motive (which has enough empirical support as well; e.g. Wilhelm, 1996; Altonji et al., 1997; Carroll, 2000) of the agent generates an inheritance distribution in the discussed setup. Agents are willing to save a part of their wealth for the intergenerational transfer and, the inheritance of the offspring is a function of that transferred part. Hence this recursive process leads us in the direction of income dynamics. Starting from any initial income, the labor market search friction in our model randomizes the next point of the income path. That evident feature not only rescues a dynasty from getting stagnated into a particular income class but also stops the long run income path from being concentrated (or polarized) in some particular point or points (c.f. Galor and Zeira (1993)) or mutually exclusive small intervals (c.f. Grossman (2008)) on the income stream. At this point our model supports Banerjee and Newman (1993). We elucidate this topic further and put forward some discussion about the transition probabilities for the different dynasties in section 3.

Invariably discussions on income dynamics questions about the convergence issue. Galor, (1996) pointed out that, debates related to the convergence of income distribution focuses on the validity of the three competing hypothesis: absolute convergence, conditional convergence and club convergence. Definition of the absolute convergence is the following: per capita incomes of countries converge to one another in the long-run independently of their initial conditions. Whereas conditional convergence means that per capita incomes of the countries that are identical in their structural characteristics converge to one another in the long-run independently of their initial conditions. Club convergence claims per capita incomes of the countries with identical structural characteristics to converge to one another in the long-run provided that their initial conditions are similar as well.

According to the above classification our hypothetical economy can converge conditionally. By simulating our model, we isolate the initial income distribution from the long run income path (as in Loury,(1981)) and this questions the efficacy of the celebrated big push theory. It is here where we differ from Grossman,(2008); Zhang(2008), Galor and Zeira,(1993); Banerjee and Newman (1993) etc. Section 4 studies the long run dynamics of the income of the individuals and the labor market where we ensure the long run matching probabilities as non-unity and non-zero.

In section 5 we demonstrate how our model fits with the previously mentioned empirical findings. In our model, disparity between a high and a low average income country is observed through the heterogeneity of the efficiency of the respective labor markets. Hence the obtained policy recommendation is to moderate the labor market parameters. Primarily this reduces the labor market imperfection; and the economy as a whole starts to move from poor to rich. Thus in section 5, we discuss the comparative statics results and try to find possible avenue of the policy intervention.

2. A Brief Empirical Analysis

In this section some results are explored by analyzing data. A positive impact on the proportion of the unemployed mass vis-à-vis the number of the unorganized sector workers is found through the individuals' wealth level within a country. It is also demonstrated that there is a negative relation between GDP and unemployment among different countries. In the next sub-section within a country analysis is done. Section 2.2 deals with inter country study.

2.1. Within a country analysis

The study is done for the India. We concentrate on the National Sample Survey (NSS) data.

2.1.1. Case study of India: Data description

For the present purpose 59th round of the NSS data is used. NSSO in this round of survey has reported the individual level data of occupational status and the detail of the wealth of each households. Wealth includes household specific information on the value of land, house, livestock holding, durable goods, investment etc. No other rounds after 59th round has covered all these information in detail. Span of survey for the 59th round was 1st January 2003 to 31st December 2003.

2.1.2. Case study of India: Summary statistics

For the present purpose all individuals (under survey) are categorized into three different classes: unorganized sector worker, organized sector worker and unemployed. According to the segregation done in this part of the analysis, unorganized sector workers comprise of: self-employed as own account worker, worked at household enterprises as employer, worked at household enterprises as helper, casual wage laborers at public work and at other types of work, beggars, prostitutes and laborers who are available for casual job but did not work due to sickness. Organized sector workers are those who are regular salaried/wage employees. People who are not working but seeking or available for work are listed as unemployed.

The other major variable of interest is the value of long term durable assets. In this analysis the total asset of a household is defined as the sum total of value of lands and buildings, value of the transport equipment, value of other durable assets (like ornaments, television, refrigerator, furniture etc.), value of shares, bonds and value of other non-share financial assets. At the beginning of the analysis, we drop those sample households under survey who are un-capable and reluctant to provide information. Per unit asset of an individual is generated from the total value of the household's wealth by dividing it with the total number of the members of that particular household excluding servants (here onwards we call it as household size). Therefore,

$$\text{Per unit asset} = \frac{\text{value of the total asset of a household}}{\text{household size}}.$$

The analysis is restricted for the individuals of age 18 to 35. Occupational choices are made mostly within this age group. Following table highlights on the descriptive stats of the per unit asset for overall India, rural India and urban India.

Table 1: Descriptive statistics of per unit asset

Per unit asset	Observations	Mean	Std. Dev.	Min	Max
Overall India	504971	65045.49	168403.4	0	2.09e+07
Rural	325309	54211.58	116991.2	0	9632400
Urban	179662	84662.15	233088.3	0	2.09e+07

Occupational choice depends not only on the per unit asset of the individuals, but on many other factors. So we need to set controls for the other variables which can possible affect the occupational pattern to comprehend the relation between asset and the occupational choice correctly. In this analysis age, sex, education, religion and social group are the control variables. Descriptive statistics for the control variables and some more details for per unit asset are given in the appendix.

2.1.3. Case study of India: a simple OLS model.

This sub-section explores the relation between occupational choice and per unit asset. More precisely, the focus of this paper is exploring the choice between remaining unemployed vis-à-vis to joining in the unorganized sector, and the claim is, this choice has a relation with asset class.

The whole range of per unit asset (taken in logarithm[5]) is divided into suitable number of intervals (or classes). According to that division of the asset class, the proportion of unemployed to unorganized sector worker is computed, and that becomes the dependent variable of this model. The aim is to check whether this proportion is increasing or decreasing with the median value for each asset class significantly after controlling the other factors. Correlation coefficients of these two variables for rural and urban Indian are 0.29 and 0.25 respectively.

Following equation describes the model:

$$\boldsymbol{y = \delta_1 + \delta_2 * x + \sum_{i=1}^{10} \delta_{3_i} * ln(E_i) + \delta_4 * M + \sum_{i=1}^{7} \delta_{5_i} * ln(R_i) + \sum_{i=1}^{3} \delta_{6_i} * ln(G_i) + \epsilon}$$

Where, $y \equiv \ln(\frac{\text{asset class wise freq of unemployed}}{\text{asset class wise freq of informal worker}})$

$x \equiv$ median of each asset classes in log scale

$E_i \equiv$ frequency of individuals at the education level i per asset class

$M \equiv$ frequency of male individuals per asset class

$G_i \equiv$ frequency of individuals at the social group i per asset class

$R_i \equiv$ frequency of individuals of religion i per asset class

$\epsilon \equiv$ random error.

We compile the results for rural and urban India separately. R-square value is 0.5145 for the rural India. Other regression results are tabulated below.

Table 2: Regression result for rural India

y	coef. (δ_{-1})	P-value	st. Error
x	**0.1063 *****	**0.002**	**0.0338**
Education level per asset class: level 1	-0.0084	0.24	0.0072
E_2	-0.0084***	0.001	0.0025
E_3	-0.0079*	0.078	0.0045
E_4	-0.01159*	0.08	0.006
E_5	0.0018	0.811	0.0076
E_6	-0.0232***	0.001	0.0052
E_7	-0.00694	0.139	0.0047
E_8	0.0058***	0.008	0.0101
E_9	omitted		

[5] Logarithmic scale is taken to control the outliers.

E_{10}	0.0049	0.165	0.0035
Male individuals per asset class	0.2037	0.6	0.3887
Individuals of religion 1 per asset class	0.0161	0.131	0.0107
R_2	-0.0028	0.608	0.0055
R_3	-0.0161***	0.001	0.0046
R_4	-0.8054***	0.001	0.0025
R_5	-0.0028	0.415	0.0034
R_6	-0.0079***	0.001	0.0021
R_7	omitted		
Individual of social group 1 per asset class	-0.0027	0.7	0.0069
G_2	-0.0108***	0.018	0.0046
G_3	-0.0131**	0.062	0.007
Constant(δ_1)	**-4.6694*** **	**0.001**	**0.50067**

R-square value is 0.3061 is highly significant for the urban India also. Other regression results are tabulated below.

Table 3: Regression result for urban India

y	Coef.. (δ_{-1})	P-value	st. Error
x	**0.0494** **	**0.020**	**0.0211**
Education level per asset class: level 1	-0.0033	0.387	0.0039
E_2	-0.0019	0.289	0.0018
E_3	-0.0122***	0.001	0.0025
E_4	-0.0495	0.233	0.0041
E_5	-0.0089*	0.086	0.0052
E_6	-0.0079	0.188	0.006
E_7	-0.1036***	0.015	0.0042
E_8	0.0022	0.308	0.0021
E_9	omitted		
E_{10}	-0.0066*	0.054	0.0065
Male individual per asset class	0.0629	0.777	0.2215
Individuals of religion 1 per asset class	0.1411	0.388	0.1634
R_2	-0.0037	0.415	0.0047

R_3	-0.0012	0.654	0.0025
R_4	-0.0009	0.613	0. 0018
R_5	-0.0007	0.706	0.0019
R_6	-0.0009	0.620	0.0019
R_7	0.0019	0.695	0.0049
Individual of social group 1 per asset class	-0.0013	0.616	0.0026
G_2	-0.0063*	0.060	0.0033
G_3	-0.0004	0.959	0.0036
Constant(δ_1)	**-2.4785*** **	**0.001**	**0.3451**

In this model y depends significantly and positively on x with a negative. Hence given this empirical result it can be argued that Indian economy wealth class has a statistically significant positive influence on opting unemployment over informal sector job. This is true for both rural and urban India.

2.1.4. Case study of India: Robustness check.

Until now this empirical study focuses on asset class. The conclusions made from the analysis is based, therefore, on certain level of aggregated data. As we know, aggregation always allows some possibility of bias in the results. So, for further verification of the above mentioned results this sub-section deals with individual level data.

Here a multinomial probit model with instrumental variable is formalized. As a major independent variable we take per unit asset (of a particular individual) itself and not the asset class. The control variables, like age, sex, education level, social group and religion are also taken at the individual level. The dependent variable, occupational choice, is a categorical variable, which can take four values: working at the unorganized sector takes the value 1, working at the organized sector takes the value 2, if the individual remains unemployed then 3 is the assigned value, and 4 if otherwise. (This categorization is not ordered. The rank of the category is not important for the analysis). To deal with this kind of a model, a multinomial probit model is introduced. Here our interest is to find the change in the probability of switching from unorganized sector to unemployment as a function of per unit asset level.

Although the individuals are selected belonging to the age-group 18 to 35, the following endogeneity problem may arise: the occupational choice can also affect the possession of the long run asset of an individual. So to make the result more robust instrumental variables are introduced.

The two identified instruments considered here are the number of young members (age below 35) in the household and the marginal propensity to save of the household (in which that particular individual belongs). If the number of young members increase, then it is expected that the per capita wealth the household will be less, but that increase does not affect the occupational choice of the individual directly. Most of the macro-economic models assume that if the propensity to save is on the higher end then the total savings of the household rises. That may lead to a higher level of per unit asset. Savings propensity of the house hold does not affect the occupational choice directly.

Given this set up of multinomial probit with instrumental variables, the model has been computed for the rural and urban India separately. Per unit asset of an individual significantly and positively affects the probability of remaining unemployed in comparison to the probability of joining to the unorganized sector. This holds good for both rural and urban sector. The detailed result is tabulated in the appendix.

2.2. Relation between GDP and overall unemployment.

Now concentrating on overall country-wise data, following results are obtained. An empirical exercise, which is undertaken in this paper, for 100 countries (for the initial years data for few countries were not available) over 32 years (1980-2011) shows a steady negative relationship between unemployment and GDP[6]. It is a cross section analysis for each year. We fit a line for unemployment against GDP, where countries are considered as the different observations. GMM criterion is used to abate the problem of heteroscedasticity. Coefficients of GDP for all the years are significant at 10% level and it is true for 30 years at 5% level of significance.

Table 4: Relation between GDP and unemployment.

Year	Coefficient value	p-value	Year	Coefficient value	p-value
1980	-0.0005395***	0.004	1996	-0.0001607***	0.006
1981	-0.0005036***	0.002	1997	-0.0001758***	0.002
1982	-0.0004586***	0.008	1998	-0.0002013***	0.001
1983	-0.0004193***	0.007	1999	-0.0001987***	0.001
1984	-0.0003231***	0.022	2000	-0.0002152***	0.001

[6] Source: IMF database, http://www.imf.org/external/ns/cs.aspx?id=28.

1985	-0.0002917***	0.026	2001	-0.0002194***	0.001
1986	-0.0002584***	0.025	2002	-0.0002091***	0.001
1987	-0.0002405***	0.026	2003	-0.00018***	0.001
1988	-0.0002268***	0.022	2004	-0.0001649***	0.001
1989	-0.0001981***	0.019	2005	-0.0001486***	0.001
1990	-0.0002259***	0.003	2006	-0.0001361***	0.001
1991	-0.0001937***	0.006	2007	-0.0001237***	0.001
1992	-0.0001852***	0.013	2008	-0.0001114***	0.001
1993	-0.000131**	*0.063*	2009	-0.0000805***	0.017
1994	-0.0001064**	*0.084*	2010	-0.0000733***	0.04
1995	-0.0001287***	0.023	2011	-0.0000745***	0.033

From the above discussion two apparently conflicting facts come into light. There is a clear negative relationship between income and unemployment amongst the different countries as a whole, as opposed to a positive association between the same two within an economy. From the above discussion two apparently conflicting facts come into light. There is a clear negative relationship between income and unemployment amongst the different countries as a whole, as opposed to a positive association between the same two within an economy. Present theoretical model aims to resolve this anomaly using a general equilibrium frame work with search generated unemployment.

3. The Model

We model an economy, producing a single good using labor as the only factor of production. The modelling mechanism allows for intertemporal dynamics through intergenerational transfer of wealth.

3.1 Preferences and time

Consider a discrete time framework where at the beginning of a period, a new batch of population who lives for two periods, joins the economy. Let the total mass of each generation be normalized to unity (thus in our economy there is no population growth). So, a new and an old (call them as 'young' and 'old' respectively) group of people live simultaneously at each time period and therefore at any instance, total population mass is two. These individuals consume the single manufactured good, produced using labor which each individual is identically endowed with (for simplicity we have assumed away other factors of production, like capital and also set the discount rate as zero).

Let us name the young age of an agent as period 1 and period 2 as her old age. Each individual receives some wealth as inheritance (X) from her previous generation. Individuals cannot save and hence she completely exhausts her income earned plus her inheritance at any period (in her lifetime) to purchase the produced good at that period. All the activities associated with the realization of utility (consumption of the purchased goods and leaving a bequest) occur at the end of her lifespan. Thus an individual born at time period t, is assumed to have a preference structure given by:

$$U = \frac{1}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} c^{1-\alpha} b^{\alpha} - D_t k X_t - D_{t+1} k X_t \quad \text{with } \alpha \in (0,1) \text{ and } k > 0 \tag{5}$$

The above function reveals that an individual gets positive utility (U) from consumption (c) and bequest (b). The indicator D takes the value either equal to 1 or 0, depending on the type of employment that the individual receives at the subscripted time. D equals to 1 if the individual joins unorganized sector, otherwise it takes the value 0.

3.2 *Production*

Though only one good is produced in the economy, there are two sectors that engage in this productive activity. One sector, termed as the organized sector, utilizes a technology where one unit of labor produces p units of the consumable, whereas the other sector: the unorganized sector, produces a units of the good. Each firm of both the sector uses a single worker at a time. The technological superiority of the organized sector is assumed by taking $p > a$. This technological dominance of the organized sector is also reflected in the preference structure of the individual's. The utility function of a representative individual thus, exhibits disutility from working in the unorganized sector. This disutility is a positive function of her inheritance level, which reflects her social status.

The unorganized sector is characterized by perfect competition in both product and factor markets while the organized sector has the same only in its product market.

3.3 *Factor market*

At every point of time, each individual in our economy is endowed with an indivisible unit of labor which she can supply either to the organized or to the unorganized sector. Factor market of organized sector is not perfect and consists of search frictions. So at any point of time, a pool of job seekers searches for jobs in the organized sector and at the same time, are there firms in this sector, looking for workers to commence production. This *"trade in the labor market"*[7] is uncoordinated. So this may well be the case that some of the vacant posts fail to get a worker, on the other hand some worker remain jobless after an active search. Here we use a simple modeling device to capture this scenario. We assume a *Pissarides* type *matching function* that gives the number of jobs formed at any moment in time as a function of the number of workers looking for jobs and the number of firms looking for workers. The matching function is increasing in its each arguments, and is concave and homogenous of degree one. The particular functional form assumed is the following:

$$m_t = [u_t^\theta + v_t^\theta]^{\frac{1}{\theta}}$$

Where, m_t be the proportion of the population who are matched, u_t be the proportion of searching population in the total population at time t and v_t be the ratio of total number of vacancy and total population at time t. This form of matching function was used in Stevens(2007).

For simplicity let us assume $\theta = -1$.

Hence, $\frac{m_t}{u_t} = \frac{v_t}{u_t+v_t} \equiv \rho_t(say)$ and $\frac{m_t}{v_t} = \frac{u_t}{u_t+v_t} \equiv \pi_t\,(say)$.

Therefore, $\rho_t + \pi_t = 1$. (1)

i.e. the probability of getting a job (ρ_t) and the probability of getting a worker for a vacant job (π_t) adds up to 1.

Let ϕ_t be the proportion of the young in the searching population. Then $\phi_t\rho_t$ represents the proportion of young agents getting an organized sector job at time t. On the other hand $(1-\phi_t)\rho_t$ becomes the proportion of old individuals who secure their job in the organized sector at time t. Similarly, $\phi_t\pi_t$ is the matching probability of a young worker with a vacant post, likewise a vacant post finds an old worker with the probability $(1-\phi_t)\pi_t$.

Contrary to the existing search-matching literature where a job and an employee are separated by a random shock, job destruction in our case occurs automatically when an employed worker completes her lifespan. That is, once the organized sector job is formed, it cannot be destroyed by any exogenous force in the life span of the laborer. To an

[7] C. Pissarides, Equilibrium Unemployment theory

organized sector firm $(1-\pi_t)$ is the probability of not having a successful match with a worker.

A job seeker in the organized sector may remain jobless with probability $(1-\rho_t)$. So, $(1-\rho_t)\phi_t$ gives the proportion of young unemployed persons and $(1-\rho_t)(1-\phi_t)$ is the proportion of old in the unemployed mass.

An individual does not receive any wage if she remains unemployed. Alternatively, she may opt for a job in the unorganized sector, in which she instantaneously receives employment and earns a positive wage (note that factor market in the unorganized sector is frictionless). Hence a source of labor force supply to the unorganized sector may come from the unmatched pool of organized sector.

3.4 The organized sector firms

To post a vacancy organized sector firm has to bear a strictly positive fixed cost. From our earlier discussion it is evident that there may arise three cases after a vacancy is posted in the organized sector. Other than the possibility of not getting a worker, two more events may occur. A vacant post can be matched either with a young worker or with an old worker. The difference between the last two situations is the following: young worker can work for two consecutive periods where as an old can supply her labor for only one period.

We use J_{yt} to denote the expected infinite income stream from a filled job having a young worker at time 't' and J_{ot} to denote the analogous value for an old worker. V_t, on the other hand is used to denote the expected infinite income stream from a vacancy. New firms enter the market as long as V_t remains positive.

Let w_{sy} be the wage of the young worker employed in the organized sector. w_{so} is the wage paid to an old worker in the same sector.

Now we can write the following relations:

$$J_{yt} = 2(p - w_{sy}) + V_{t+2}$$

$$J_{ot} = (p - w_{so}) + V_{t+1}$$

$$V_t = -d + \pi_{t+1}\left[\phi_{t+1}J_{yt+1} + (1-\phi_{t+1})J_{ot+1}\right] + (1-\pi_{t+1})V_{t+1}$$

Where, 'd' is the cost of posting a vacancy.

Explanation of these equations is the following. A firm receives a positive return of $(p - w_{sy})$ per period whenever the vacant firm gets a worker. Therefore when a young worker is matched with a firm at time t the firm receives positive return for two consecutive periods with certainty. But after these two periods the post becomes empty and the firm has to post a vacancy to resume the production again. Therefore from period $\overline{t+2}$ onwards V_{t+2} is the return to the firm. Similarly we get the equation for J_{ot}. Notice one thing that here we are not allowing any time discount in our model.

A vacant firm pays strictly positive fixed cost d to post a vacancy at each period. If the firm matches with a worker then firm either gets J_{yt} or J_{ot} according to the worker's remaining life span, and on the other hand if the firm flounders to match with any worker then the firm has to start with a vacant post at period $\overline{t+1}$ again; hence will receive V_{t+1} from the next period onward.

Free entry guarantees that in equilibrium $V_t = 0$, for all t. Hence, both the J's become time independent.

$$J_y = 2(p - w_{sy}) \tag{2}$$

$$J_o = (p - w_{so}) \tag{3}$$

$$\pi_t = \frac{d}{\phi_t J_y + (1-\phi_t) J_o} \tag{4}$$

3.5 *Wages*

Here we discuss about the factor payments. As the factor market of the unorganized sector is perfect a laborer receives her value marginal product as wage, and CRS production technology levels the marginal product and average product of laborer. Therefore the unorganized sector wage (w_n) is equal to 'a' (what she produces). Hence it is time independent.

Both the firms and laborers have some strictly positive degree of bargaining power in the organized sector, and firm owner and laborer share the total value of production through Nash bargaining. If $\beta(< 1)$ denotes the bargaining power of laborers, then the wages are determined by the following equations:

$$w_{sy} = \arg\max_{w_{sy}} \; (2w_{sy})^{\beta} (2\overline{p - w_{sy}})^{1-\beta}$$

$$w_{so} = \arg\max_{w_{so}} \ (w_{so})^{\beta}(\ p - w_{so})^{1-\beta}$$

i.e. $w_{sy} = w_{so} \equiv w_s = \beta p$. Here we strengthen our assumption as $\beta p > a$ to make w_s higher than w_n, since the assumption that an organized sector is more productive than the unorganized one does not suffice to guarantee the stated wage differential.

Therefore wages are not age dependent.

(Calculations done by us indicate that if the outside options are included, then the two wages of organized sector become dependent on time, as also their equality breaks down. Including the outside options do not contribute significantly towards our analysis. More importantly they do not jeopardize the properties of the equilibrium, but make the analysis more cumbersome. For simplicity thus, we ignore the outside options. Interested readers though, can consult with the author).

3.6 Decision problem

Any individual in this economy faces a series of choice problems in her life span. At each point where she has to take a single decision, she gets three different possible options of action. They are the following:

I. Organized sector job.
II. Unorganized sector job.
III. Wait.

Initially at period one when she is about to enter the labor market she chooses one among the three. If second or third is selected then no more decisions are to be taken at that period. The first option, on the contrary, creates another choice problem. If she opts for the organized sector job then she has to pass through the search process which is a random 'lottery' to her. After the 'lottery' she may get an organized job (call it as 'lucky' situation) or may remain unemployed (call it as 'unlucky' situation). Here she has to reveal state contingent decisions. Hence again she faces a choice problem and takes a call between the three for different states. In case of 'unlucky' situation the option of 'organized job' does not remain as a feasible one. We may interpret it as: choice of 'organized job' gives her a pay-off equal to almost negative infinity after she faces an unlucky situation. At the beginning of period two, when she becomes old, she has to follow the same path of decision problem.

All the decisions are taken by the individual at the beginning of her young age. Every agent can expect rationally. Decisions are taken so as to maximize the expected indirect utility. Uncertainty in the indirect utility arises because of the search-matching mechanism in organized sector.

4 Short-run Equilibrium

Following sub-sections discuss about the equilibrium solutions of the model in short-run.

3.1 Optimal decisions

Here we consider the optimal decisions of the different individuals. Heterogeneity among individuals arises because of their different level of inheritance (*X*). In our model, probability values which are generated from the labor market friction of the organized sector, are known (agents are rational) to the individual while they are taking decisions.

Every individual optimally chooses to search for a job in the organized sector with any level of *X*, since the wage of this sector is strictly higher than the return from the unorganized sector or from unemployment. Even if she fails to get a job in period one she goes for search in period two. But if she becomes 'lucky' in the first period, there is no more extra incentive to go for search in second period again. Since there is no cost for searching everyone takes a chance for receiving higher wage: unique solution at the beginning of the first period's decision problem.

Decisions vary from one individual to other for the following two situations. Agents, who face a 'unlucky' situation, opt for the unorganized sector job if she has $X_t \leq \frac{w_n}{k}$. This decision remains the same, if she is 'unlucky' in both the two periods. On the contrary if her inheritance, X_t , is greater than $\frac{w_n}{k}$ then she never chooses to work in unorganized sector: even if she faces unlucky situation in both the periods. As stated earlier, agents have a disutility to work in unorganized sector due to her status, represented by her inheritance. Although the unorganized sector job gives an income gain, social stigma outweighs that gain for the individuals with higher *X* (read it as 'higher status'). To follow the result formally, interested readers are requested to consult the Appendix 1.

Therefore the following two strategies prevail in equilibrium:

i. Search for organized job is chosen, at the beginning and then, if becomes 'lucky', 'work for organized sector' is chosen; if 'unlucky' be the case then wait is chosen.

ii. Search for organized job is chosen, at the beginning and then, if becomes 'lucky', 'work for organized sector' is chosen; if 'unlucky' be the case then unorganized job is chosen.

The actual form of the expected indirect utility functions (EIU) for (i) and (ii) are as follows. (For derivations see the appendix 2).

$$EIU(\text{i}) = X + \rho_t(2w_s) + (1-\rho_t)\rho_{t+1}(w_s) \quad (6)$$

$$EIU(\text{ii}) = X - \big((1-\rho_t) + (1-\rho_t)(1-\rho_{t+1})\big)kX + (2\rho_t + (1-\rho_t)\rho_{t+1})(w_s) + \big((1-\rho_t) + (1-\rho_t)(1-\rho_{t+1})\big)(w_n). \quad (7)$$

In the figure below (figure 1) we plot the optimal expected indirect utility path, with needed parametric restrictions, noted by the thick line.

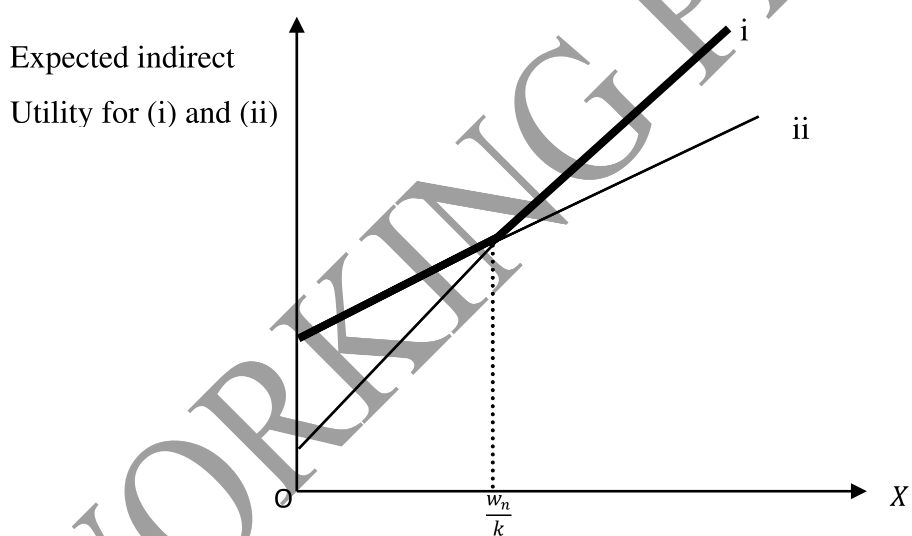


Figure:1

Note that this solution is true for any non-zero and non-unitary probability values generated from the organized sector. In the following section we solve for the equilibrium short-run probability values.

3.2 Factor market solutions

At any point in time, populations from two consecutive generations are economically active. So, in our economy total population adds up to 2 at any instance. The whole young population and the old individuals who became 'unlucky' in their young age participate in each search process. Then, if S_i is the total number of job-seekers at time period i so, $S_i = 1 + (1 - \rho_{i-1}\phi_{i-1}\, S_{i-1})$. As stated earlier ϕ_t is defined as the proportion of the young among the searching population at time t. Since the young population proportion (recollect, they all are searchers too) is equal to one, therefore $\phi_t S_t = 1$. The left hand side of the equation is the young pool of searchers.

Hence, $S_i = 1 + (1 - \rho_{i-1})$.

Thus, $\phi_t = \frac{1}{2-\rho_{t-1}}$. (8)

As all the previous period values of each variables are known to the economy at period t, from equation 8, ϕ_t can be determined for each t. Once ϕ_t is known then using equation 5 and equation 1 one can easily solve π_t and ρ_t for each t, as the wages are already determined.

3.3 Inheritance distribution

This section summarizes our discussion and interprets the results which we get from the previous analysis. Unemployment, as defined by the International Labour Organization, is the situation when people are without jobs and they have actively sought work for a given time period. In our model unemployed mass (according to this definition) lies above a certain level of *X*. We may consider X^c as a critical inheritance level, people below which is termed as ‘poor’; otherwise ‘rich’. Optimal decision of the individual who has lesser *X* than X^c, shows that she chooses to work in the unorganized sector when she does not get the organized sector job. Where, in an ‘unlucky’ state individual with $X > X^c$ does not choose to go for an unorganized job but to wait. Hence the poorer individuals at any point of time are working in this economy. Therefore they are not unemployed. People with the higher level of inheritance remain without any job if they become unlucky after an active search for a job in the organized sector. This is somewhat similar to the empirical facts mentioned in Section 2.

Here we consider the different individuals from the different sections of the population, and find that where their dynasty may move in the next generation given their X and the probability values. For this purpose, here we consider a system of dynamic equations.

Let us call $\frac{w_n}{k}$ as X^c.

If $X_t \leq X^c$,

$X_{t+2} = \alpha(X_t + 2w_s)$, with probability ρ_t (9)

$X_{t+2} = \alpha(X_t + w_n + w_s)$, with probability $(1 - \rho_t)\rho_{t+1}$ (10)

$X_{t+2} = \alpha(X_t + 2w_n)$, with probability $(1 - \rho_t)(1 - \rho_{t+1})$ (11)

If $X_t > X^c$,

$X_{t+2} = \alpha(X_t + 2w_s)$, with probability ρ_t

$X_{t+2} = \alpha(X_t + w_s)$, with probability $(1 - \rho_t)\rho_{t+1}$ (12)

$X_{t+2} = \alpha(X_t)$, with probability $(1 - \rho_t)(1 - \rho_{t+1})$ (13)

These equations are generated from an inherent assumption: $X_{t+1} = f(b_t)$ and from the outcome of the maximization of the utility function (equation 5). Here for simplicity we assume that $X_{t+1} = b_t$. Because of the assumed 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 at the beginning of period 1, her wealth equates with $(X_t + 2w_s)$ for all X_t at the end of period 2. So it explains equation (9). In case of the other equations inheritance level plays a key role. First we consider $X \leq X^c$. Individual works in unorganized sector if the 'unlucky' state is realized. It is true for both young and old age. That is, total wealth can be either $(X_t + w_n + w_s)$ or $(X_t + 2w_n)$ with probability $(1 - \rho_t)\rho_{t+1}$ or $(1 - \rho_t)(1 - \rho_{t+1})$ respectively. Again, if $X_t > X^c$, optimal decision dictates the agent to wait when she does not get employment in organized sector after an active search. Hence if she fails to be 'lucky' in period 1 but receives organized sector job in next period then the total wealth of the individual is$(X_t + w_s)$ and if she faces 'unlucky' state in both the periods, her wealth remains as X_t.

Let us depict the equations in the following figure:

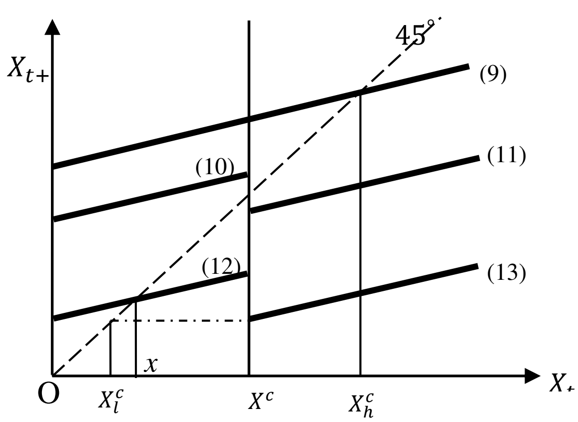


Figure: 2

Numbering of the bold lines is done according to the equation number.

There may arise a situation where all the three lines cut the $45°$ line within $[0, X^c]$. In that case all individuals in the long run have inheritance less than X^c and then no one in the population remains unemployed at any instant of time. That creates an uninteresting situation in the long run for the present purpose. We get the above figure by imposing suitable parametric restrictions (Appendix 3) such that we can concentrate on the case where unemployment prevails in the economy.

From figure 2 we can have the following observation. Individual who herself initially starts as poor may bring her next generation to the richer section. Reverse is also true. This tells us that always a dynasty face a positive probability of changing the economic status between some arbitrary finite number of generations. Hence the economic mobility depends mostly on the labor market efficiency in this model. The corresponding transition probabilities a displayed below:

$$P(X_{t+2} > X^c | X_t > X^c)$$

$$= \begin{cases} \rho_t, & if\ X_t < \left(\frac{w_n}{\alpha k} - w_s\right) \\ \rho_t + (1-\rho_t)\rho_{t+1}, & if\ \left(\frac{w_n}{\alpha k} - w_s\right) < X_t < \frac{w_n}{\alpha k} \\ 1, & otherwise \end{cases}$$

$$P(X_{t+2} > X^c | X_t < X^c)$$

$$= \begin{cases} \rho_t, & if\ X_t < (\frac{w_n}{\alpha k} - w_s - w_n) \\ \rho_t + (1-\rho_t)\rho_{t+1}, & otherwise \end{cases}$$

5 Long run equilibrium

Now in this section, we consider the model with time dynamics. First we discuss the movement of the inheritance distribution with time, given any initial distribution. After that we will consider the dynamics of probability values.

4.1. Population dynamics

For each generation, there is a distribution of inheritance (X) over the entire population. Let the distribution function be $F_t(X_t)$, where $X_t \in (0, \overline{X})$ and $\bar{X}$ is the exogenous finite upper bound of inheritance (the construction of which is shown in fig 2). That is $F_t(X_t)$ proportion of people have less than or equal to X_t amount of inheritance at period t. To analyze the evolution of the inheritance of the dynasty over time from an initial time period, we set up a starting point where the economy is populated by a given pool of old and young individuals with their respective inheritance levels.

Note that, in our model if the probability values remain strictly positive and non-unitary then the inheritance distribution[8] of the population can never become polarized. It cannot be the case that every individual become either 'rich' or 'poor' after a finite time. This remains true for any initial population distribution. This is a very significant departure from Galor and Zeira (1993). Factor market friction in organized sector develops this interesting phenomenon. The probabilistic nature of this factor market halts any unidirectional movement over *X* and opens up the more realistic possibility, that is, X of a particular dynasty can move both way with time.

From Figure 2, let us we concentrate on X_l^c and X_h^c. It is not difficult to prove that after a finite time, inheritance of all individual come within the interval $[X_l^c, X_h^c]$, provided probability values remain strictly positive and non-unitary (the next sub-section shows that in the long-run equilibrium also it actually takes non-unitary value). Note that, in figure 2 all lines cut the $45°$ line from below. Hence, if the model was a deterministic one then x or X_h^c would be a long run stable equilibrium. That is, the process might end up at x or X_h^c after infinite time interval. Because of the stochastic nature of the model under discussion, no X_{t+2} can remain infinitely on the same inheritance path on which X_t lies. There is always a positive probability of switching the path. Therefore, given a X_t either below X_l^c *or* above X_h^c, this dynamic process brings X_{t+n} within the stated interval after some arbitrary n (finite) periods. Once all X_ts come within the interval $[X_l^c, X_h^c]$, it is impossible to get out of that interval; although population will never converge at a point (or on some points). For certain parametric restriction simulation result (shown in section

[8] X is a good proxy of wealth since, X is a function of b and b depends on the wealth.

5) displays that long-run distribution of X converges to a bounded and continuous wealth distribution.

4.2. Factor market dynamics

In this subsection, again we return to the factor market. Here we consider the factor market behavior with time. We have seen earlier that factor market variable of the unorganized sector is time independent, so we concentrate on the factor market of the organized sector. Let us reframe the equation (4) using equation (1).

$$\rho_t = 1 - \frac{d}{\phi_t J_y + (1-\phi_t) J_o} \quad (13)$$

Using (8) and (13) we get a difference equation of ϕ_t.

$$\phi_t = \frac{1}{\left(1 + \frac{d}{\phi_{t-1} J_y + (1-\phi_{t-1}) J_o}\right)} \quad (14)$$

Following results are easy to check:

$\frac{\delta \phi_t}{\delta \phi_{t-1}} > 0,\ \frac{\delta^2 \phi_t}{\delta \phi_{t-1}^2} < 0.$

$0 < \phi_t|(\phi_{t-1} = 0) < 1,\ 0 < \phi_t|(\phi_{t-1} = 1) < 1$ and $\phi_t|(\phi_{t-1} = 0) < \phi_t|(\phi_{t-1} = 1)$ (see Appendix 4). Now we put the above results in figure.

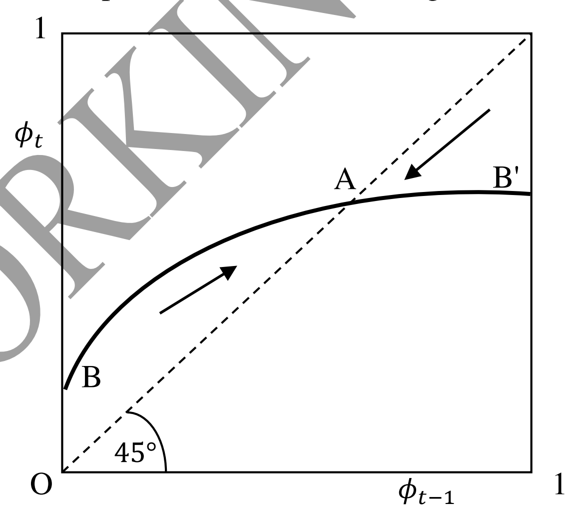


Figure 3

So, it is clear that in the long run ϕ_t converges to an interior stable equilibrium, A. Therefore the long run probability values remain strictly positive and non-unitary. Hence in the long run, ϕ_t becomes time independent. As we solve for ϕ all other endogenous variables of imperfect factor market, ρ, π and hence S, can be determined. This proves the existence of unemployment in the long-run equilibrium.

5. Comparative Static Results

In this section we find on how the economy changes with the change of two different parameters: one is production parameter and other is from factor market. Actually we focus on the parametric change of the organized sector because this is the sector which makes our model interesting and plays a very crucial role for this hypothetical economy.

5.1. Effect of change in production technology

Suppose productivity of the organized sector (i.e. p) jumps up due to some exogenous technological upgradation. So, a filled job pays more and hence increases the incentive of posting vacancies. That is, V_t becomes positive. Therefore more new firms enter and post vacancies till V_t remains positive. That increase in the number of the vacancy increases the probability (i.e. ρ_t) of getting a job in the organized sector in short-run. Mathematically it is clear that an increase in p leads to a rise in the denominator of RHS of the equation 4. Hence π_t falls for a rise in the productivity of the organized sector and that implies an increase in ρ_t from equation 1.

Another interesting thing to notice is the following. Since probability of being 'lucky' rises, it actually decreases the proportion of searchers within the searching population who are old. (Remember that the old searchers are those who failed to get organized job in their younger age).

In Figure 3, BB' curve shifts up with a rise in p and accordingly A, the steady state point of ϕ, also moves in upward direction. From equation (13) it is evident that ϕ and ρ changes in the same direction. Therefore if p increases, the long-run steady state value of ϕ and ρ also increases, and π falls.

As ρ_t changes in the positive direction with p, the total unemployment at time t (i.e. short-run[9]) of the economy declines. On the other hand GDP at time t rises through both the

[9] This claim is true for short-run. Since change in p changes the probability of the job match, and hence the transition probabilities (probability of switching the income class: rich to poor and the reverse) also change, that perturbs the whole inheritance distribution. Therefore long-run change in unemployment or GDP can be shown by simulation results.

increase in productivity and the increment in the probability of getting matched in the organized sector. Although the total production of the unorganized sector falls because of shortage in the supply of labor higher productivity of the organized sector outweighs that loss in GDP at time t. Therefore a more advanced technology in the organized sector implies a higher GDP coupled with a lower unemployment and this has accorded with our empirical findings documented earlier.

Mathematical proofs are in the Appendix 5.

5.2. *Effect of change in cost of posting a vacancy*

In this sub-section we show the comparative static result by simulation study too. It is evident that if the cost of posting a vacancy (i.e. d) falls, it also makes posting a vacancy lucrative. Hence it increases the number of vacancy posting. If d falls, as the previous one, BB' moves upwardly and similar effects take place. So, as d falls total unemployment decreases and GDP increases (Appendix 6) at time t (in short-run).

Knowing the fact that this comparative statics theoretically will not add anything new (from the previous sub-section), we put this into a different subsection as we would like to show the economy wide importance of factor market efficiency in the long run income distribution.

We are summarizing (see next section for detailed results in tabular form) what we have obtained from simulation study with appropriate parameter values for a very large iteration here:

i. Initial distribution of inheritance does not affect the long run distribution. Long run wealth distribution does not depend on initial distribution.
ii. Country with higher cost of posting vacancy faces a greater level of long-run unemployment and a lesser level of long-run GDP.
iii. If cost of vacancy is high enough then in the long run economy wise inheritance distribution becomes biased towards lower income and the vice-versa.

If factor market is not efficient enough (i.e. high ‘d’) then the distribution of income resembles Pareto distribution. Results show that even if initially a country starts with a very high average income then also the average income of the country may drop down because of factor market inefficiency. On the other hand an initially poor country can become a high average income country by improving their factor market.

Countries like USA[10] or Norway[11], representative of lesser labor market friction, show that the long run income distribution is skewed towards the higher income quintiles. On the other hand, for countries like Brazil or India income distribution is skewed in favor of Pareto distribution.

6. Simulation Results

This section elaborates the numerical exercise done in this work. Since the long-run wealth distribution in our model is theoretically intractable, though it has a serious influence on the findings, this section has a separate importance. Following table displays the hypothetical parametric assumptions.

Table1: Parameter values

Parameters	Description	Value
α	Proportion of income spent for bequest	0.40
d	Cost of posting a vacancy (Low)	0.25
d^h	Cost of posting a vacancy (High)	0.54
β	Bargaining power of an organized sector worker	0.55
p	Marginal productivity of labor in organized sector (Low)	1
p^h	Marginal productivity of labor in organized sector (High)	1.5
k	Disutility parameter from social stigma	0.5
a	Marginal productivity of labor in unorganized sector	0.22

Number of individuals under observation are 10000. Number of iteration is, T=1000. Following are the results reported for the parametric restrictions given in the table above.

Result 1: The distribution of inheritance converges in the long run. That steady state distribution does not depend on the initial wealth distribution.

[10] *Economic inequality through the prisms of income and consumption*, David S. Johnson, Timothy M. Smeeding, and Barbara Boyle Torrey (http://www.bls.gov/opub/mlr/2005/04/art2full.pdf)

[11] http://www.regjeringen.no/en/dep/hod/documents/regpubl/stmeld/2006-2007/Report-No-20-2006-2007-to-the-Storting/2/2/1.html?id=466524

Following table depicts Kolmogorov-Smirnov test statistic for the convergence test of the long-run inheritance distribution.

Table2: Convergence of inheritance distribution

Initial wealth distribution	'T' vis-à-vis '(T-1)'	'T' vis-à-vis '(T-100)'
Normal	0.0094 (*0.7671*)	0.0158 (*0.1633*)
Uniform	0.0169 (*0.1138*)	0.0126 (*0.4032*)
Single valued (all the values are same but below the cut-off level)	0.0260 (*0.8840*)	0.0270 (*0.8547*)
Single valued (all the values are same but above the cut-off level)	0.0055 (*0.9981*)	0.0154 (*0.1850*)

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	0.0164 (*0.1345*)
Normal vis-à-vis Single valued (below the cut-off)	0.0267 (*0.5306*)

Normal vis-à-vis Single valued (above cut-off)	0.0086 (*0.8519*)
Uniform vis-à-vis Single valued (below the cut-off)	0.0358 (*0.1907*)
Uniform vis-à-vis Single valued (above the cut-off)	0.6020 (*0.0108*)
Single valued: below cut-off vis-à-vis above the cut-off	0.0296 (*0.3981*)

Result 2: The long-run steady state GDP increases and the long-run steady state unemployment decreases for an increase in the productivity of the organized sector.

Following two figures (figure 4 and figure 5) display the above result. We compute the whole model for a higher value of p ($\equiv p^h$) and compare the GDP and the unemployment values for the two different situations. This exercise is done with the uniform initial wealth distribution.

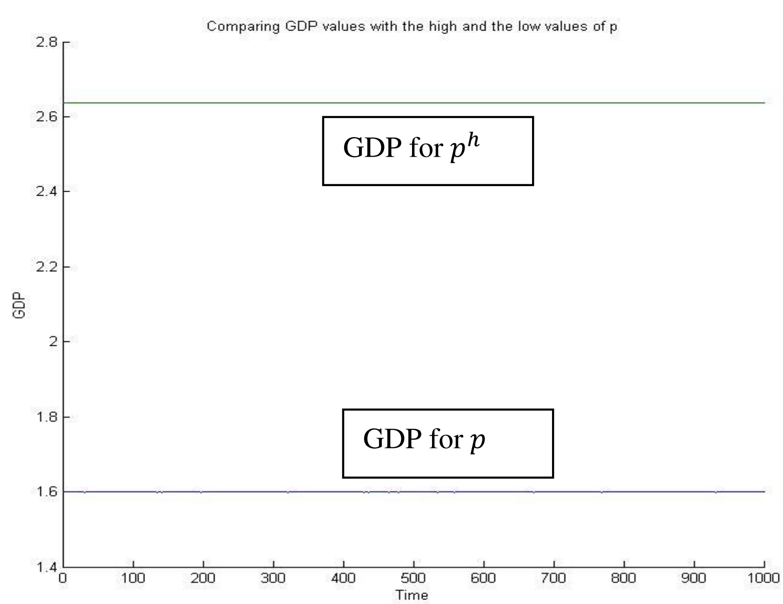


Figure 4

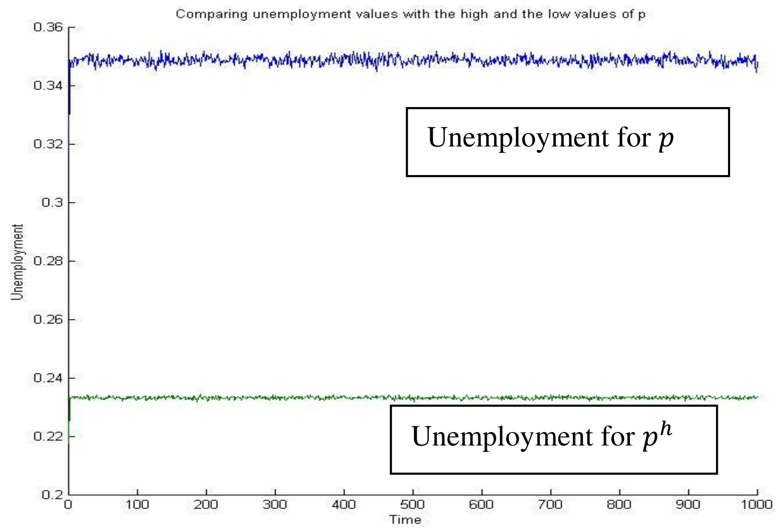


Figure 5

Result 3: The long-run steady state GDP decreases and the long-run steady state unemployment rises for a higher value of cost of posting vacancy at the organized sector.

Following two figures (figure 6 and figure 7) display the above result. We compute the whole model for a higher value of d ($\equiv d^h$) and compare the GDP and the unemployment values for the two different situations. This exercise is done with the uniform initial wealth distribution.

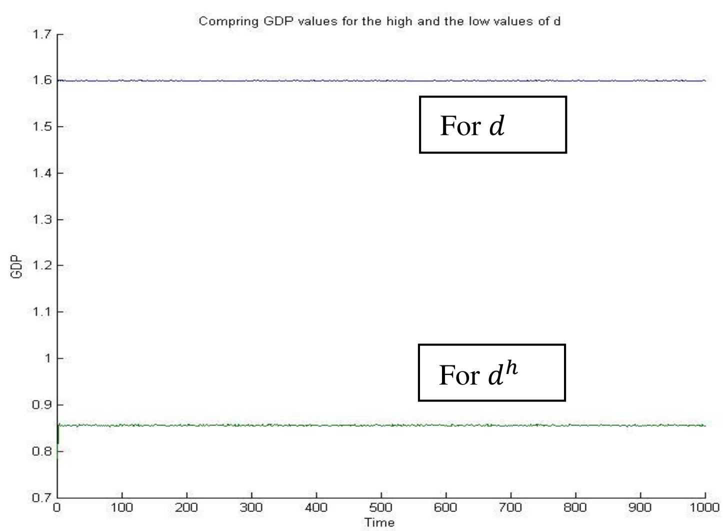


Figure 6

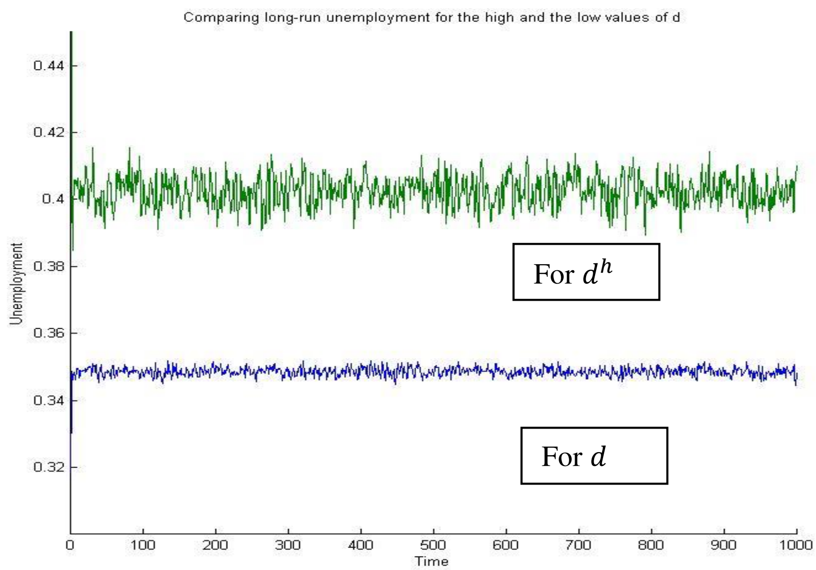


Figure 7

Result 4: If cost of vacancy is high enough then in the long run economy wise inheritance distribution becomes biased towards lower income and the vice-versa.

Next two histograms depict the long-run inheritance distribution of the individuals for the two different level of cost of posting vacancies (for d and d^h respectively).

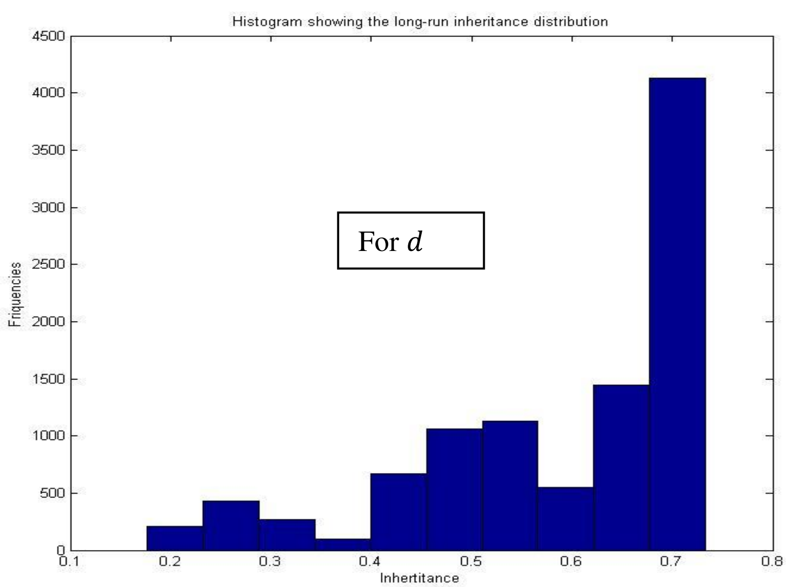


Figure 8

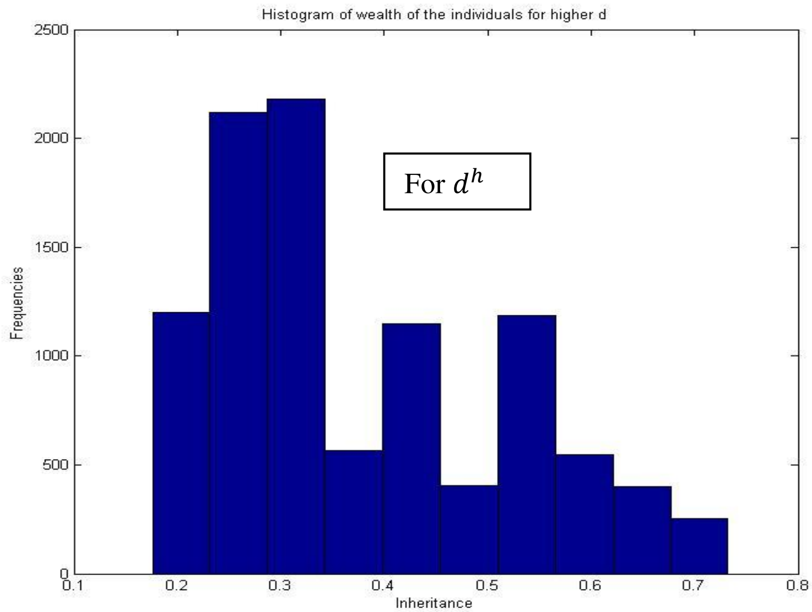


Figure 9

7. Conclusion

Walrasian general equilibrium framework has established the fact that "…factors of production are always fully employed in the full-information, frictionless markets" (Davidson, et al., 1988). To account for the presence of unemployment, economists have sometimes relaxed the assumptions of 'frictionless markets' or have avoided 'full information' situation. Keeping all these contributions in mind we think that an explicit relation between inheritance and unemployment; generated due to labor market friction, needs to be established.

This model churns out a relationship between unemployment and inheritance, and postulates that, individuals who inherit relatively more remain unemployed. It showcases the existence of unemployment together with the persistance of a perfect and an imperfect labor market in the equilibrium both in long and short run without restricting 'on the job search' (c.f. Davidson, Martin, & Matusz, 1988). A cut-off inheritance level is determined under which no one chooses to continue without positive earning.

This model offers a dynamics such that the descendent of any agent can move either below or above the cut-off level of inheritance with positive probability given her present level of inheritance. That is, we refute the importance of the initial and thus, we discord with the concept of equilibrium trap which suggests that if a country begins with a very low (or

high) income can never change their situation in long run. The present paper guarantees an inheritance (and thus, income) distribution spread out both below and above the cut-off in the long run. The long run income distribution is moderated only by the productivity parameters or the factor market parameters and not due to initial inheritance distribution.
A possible alley of extension of this work can accommodate unemployment for targeted income groups (for example the middle class) as well as study the consequences of trade on unemployment in this framework.

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	w_s	$w_n - kX$	0
U	not applicable	$w_n - kX$	0

Optimal solutions are illustrated below

for, $X \le w_n/k$		for, $X > w_n/k$	
if L then	O	if L then	O
if U then	N	if U then	W

Since the agent faces the same pay-off matrix in second period, optimal decisions also remain also unchanged.

Recollect that in our model, after being lucky the job cannot be destroyed, therefore if an agent receives the state L in period one then realization of any state in period two makes no difference to her pay-off. Hence if she is lucky in period one then she continues as organized sector worker in both the periods of her life.

Appendix 2

Expected indirect utility representations (EIU) of the optimal decisions for a representative individual are written below.

If $X \le \frac{w_n}{k}$ then

$$EIU|_{X \le \frac{w_n}{k}}$$

$$= (\rho_t)(2w_s) + (1-\rho_t)(w_n - kX) + (1-\rho_t)(\rho_{t+1})w_s + (1-\rho_t)(1-\rho_{t+1})(w_n - kX) + X$$

$$= [(\rho_t)(2w_s) + (1-\rho_t)w_n + (1-\rho_t)(\rho_{t+1})w_s + (1-\rho_t)(1-\rho_{t+1})w_n] + [1-(1-\rho_t)-(1-\rho_t)(1-\rho_{t+1})]X$$

$$= [\rho_t + (1-\rho_t)(\rho_{t+1})]w_s + [(1-\rho_t) + (1-\rho_t)(1-\rho_{t+1})]w_n + [1-(1-\rho_t)-(1-\rho_t)(1-\rho_{t+1})]X$$

$$EIU|_{X > \frac{w_n}{k}}$$

$$= (\rho_t)(2w_s) + (1-\rho_t)(\rho_{t+1})w_s + X$$

Appendix 3

Parameter restrictions for the figure 2 are listed below:

i) $\frac{w_n}{(w_n+w_s)} < \frac{\alpha k}{1-\alpha} < \frac{w_n}{w_s}$

ii) $\frac{w_n}{2\alpha k} < w_s < \left(\frac{1}{\alpha k} - 1\right) w_n$

iii) $\frac{\alpha}{1-\alpha} < \frac{1}{2k}$

Where $w_n = a$ and $w_s = \beta p$.

Appendix 4

$$\frac{\delta \phi_t}{\delta \phi_{t-1}} = \frac{d(J_y - J_o)}{\left(d + \phi_{t-1} J_y + (1-\phi_{t-1}) J_o\right)^2}$$

$$\frac{\delta^2 \phi_t}{\delta \phi_{t-1}^2} = (-2) \times \frac{d(J_y - J_o)^2}{\left(d + \phi_{t-1} J_y + (1-\phi_{t-1}) J_o\right)^3}$$

$\phi_t | (\phi_{t-1} = 0) = \frac{1}{1+\frac{1}{J_o}} < 1$ and positive.

$\phi_t | (\phi_{t-1} = 1) = \frac{1}{1+\frac{1}{J_y}} < 1$ and positive.

Appendix 5

$\frac{\delta \phi_t}{\delta p} = \frac{d}{\left(d + \phi_t J_y + (1-\phi_t) J_o\right)^2} \times \left(\phi_{t-1} \frac{\delta J_y}{\delta p} + (1 - \phi_{t-1}) \frac{\delta J_o}{\delta p}\right) > 0$, for all $0 < \phi_{t-1} < 1$.

and $\frac{\delta \rho_t}{\delta \phi_t} > 0$

Where, $\frac{\delta J_y(p)}{\delta p} > 0$, $\frac{\delta J_o(p)}{\delta p} > 0$.

Total Unemployment

$\equiv TU_t = (1 - F_{t-1}(X^c))\,(1 - \rho_{t-1})(1 - \rho_t) + \left(1 - F_t(X^c)\right)(1 - \rho_t)$.

$\frac{\delta TU_t}{\delta p} < 0$

$GDP_t = [F_{t-1}(X^c)\,(1 - \rho_{t-1})(1 - \rho_t) + F_t(X^c)(1 - \rho_t)]a + [\rho_{t-1}\phi_{t-1}S_{t-1} + \rho_t S_t]p$.

$$\frac{\delta GDP_t}{\delta p} = \rho_{t-1}(1 - \rho_t) + 2\rho_t + [(p - F_t(X^c)a) + (1 - \rho_{t-1})(p - F_{t-1}(X^c)a)]\frac{\delta \rho_t}{\delta p} > 0.$$

Appendix 6

$$\frac{\delta \phi_t}{\delta d} = -\frac{1}{\left(1+\frac{d}{\phi_{t-1}J_y+(1-\phi_{t-1})J_o}\right)^2} \times \frac{1}{\phi_{t-1}J_y+(1-\phi_{t-1})J_o} < 0.$$

$$\frac{\delta TU_t}{\delta d} > 0.$$

$$\frac{\delta GDP_t}{\delta d} = [(p - F_t(X^c)a) + (1-\rho_{t-1})(p - F_{t-1}(X^c)a)] \frac{\delta \rho_t}{\delta d} < 0.$$

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