Wealth inequality and occupational choice

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This paper attempts to analyze the role of inequality in determining the occupational pattern of an economy. It shows that when the capital market is imperfect and occupational choices involve indivisible investments, inequality tends to tilt the private optimum (PO) occupational mix in favor of the occupation with lesser investment requirement. By welfare maximization it then derives the social optimum (SO) for an economy given its inequality. But market forces may not behave in a way that the PO matches this SO; this paper suggests a counter-intuitive policy of subsidizing entrepreneurs rather than education in highly unequal economies.

Keywords: wealth inequality; overlapping generations; occupational choice

1. Introduction

Occupational pattern plays a major role in determining the mode of industrial activities that fuel the engine of economic growth. Casual empiricism and anecdotal evidence reveal that the world distribution of skill set and entrepreneurship in spite of being widely uneven is not entirely confined to the wealthy North.\textsuperscript{1} The question that naturally arises is: what determines a country’s occupational distribution: is it the ‘scale’ or the ‘spread’ of wealth that matters? The paper underscores the role of wealth spread (distribution) in trying to answer: what is the ideal (optimal) mix (that maximizes welfare); and even if such an optimum exists market forces may not play to match it, then what is the remedial measure to tilt it toward the first best?

Wealth plays a key role in determining occupational choices at the micro level, especially when such choices are associated with indivisible investments and the capital market is imperfect, implying that wealth distribution has a major role in determining the occupational mix at the macro level. Intuitively, with high inequality implied by a larger concentration of people at the lower wealth end, occupational choices get tilted toward the occupation with lesser investment requirements; but then the returns to such occupation is lower and that plays a counteractive role in (a priori) occupational investment decisions. The net effect of occupational mix gets determined by the interaction of the self-fulfilling expectations of agents. Occupational choices and long-run (LR) wealth distribution, polarization of wealth, its LR growth implications and many other related issues have been studied in depth (Banerjee and Newman 1993; Galor and Zeira 1993; Iyigun and Owen 1998; Ghatak and Jiang 2002; Mukherjee and Ray 2004; Chakraborty and Citanna 2005, to cite a few). Laussel and Breton (1995) find the optimal number of entrepreneurs and show that the equilibrium number of entrepreneurs is always larger than the Pareto-optimal one, but their paper has no educational choice. Thus, none of these papers talk about the optimal or ideal mix of occupation that this paper focuses on, taking three broad occupational categories, namely unskilled workers, skilled workers and entrepreneurs. The paper argues that there is no reason to believe that the private optimum (PO) occupational mix exactly matches the social optimum (SO). It highlights on that issue as well from a policy perspective and reaches a counter-intuitive inference that highly unequal countries have a too high (PO) level of skilled labor in proportion to entrepreneurs; hence, an entrepreneurial subsidy rather than an education subsidy is the right policy choice in such countries.

Developing economies often adopt an education subsidy as a means of creating ‘equality of opportunity’ in addition to boosting the process of human capital accumulation and hence growth. Economists provide reasons both in favor of and against the provision of an education subsidy. The underlying justifications for an education subsidy take a variety of forms but mostly the

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arguments concentrate on perceived positive spillover effects of human capital accumulation in production. As these externalities are not taken into account in individual schooling decisions, education subsidies are needed to prevent under-investment in education and to promote economic growth. The other arguments, such as capital market imperfection, which essentially hinders poor individuals to finance educational expenditures, or ‘borrow against human capital’ issues, relate to ‘equality of opportunity’ and distributional concerns. But most of these discussions do not consider an integrated occupational choice decision of individuals, and more specifically, interaction of educational investments with alternative occupational choices such as entrepreneurship. Also, in the literature, so far, limited attention has been paid on policy decisions that prioritize occupational subsidies under tight budget constraint to tilt the private optimum occupational mix towards the social optimum. This paper sheds light on these, pointing out that an education subsidy is not always the desired policy in highly unequal countries.

There are some papers that argue against an education subsidy; the arguments, however, are quite varied. Andersen (2005) shows that in the phase of globalization, countries are concerned with preserving skilled stock, and the policies that balance the government’s budget and keep skill formation and migration incentives unchanged involve a reduction of an education subsidy and an increased income tax on unskilled workers. Hendel et al. (2005) show that when education acts as a signal and borrowing for education is difficult, lack of a college education could mean that one is either of low ability or of high ability but with low financial resources. Unskilled workers are paid according to the expected quality of the uneducated labor force; hence, making education more affordable implies that some high-ability people come out of the unskilled labor force driving down the unskilled wage. Thus, an education subsidy increases wage inequality. Caucutt and Kumar (2003) also conclude that the case for increases in higher education subsidies in the USA might have been overstated. On the other hand, there are papers suggesting subsidies for entrepreneurs: for example, Reiss and Weinert (2005), Li (2002) and De Meza and Webb (1989) argue in favor of an entrepreneurial subsidy. But none of the above provide the link between inequality, occupational choice and the policy dilemma (entrepreneurial or education subsidy) to reach the SO that this paper intends to shed light on.

In Section 2 of this paper, the model with the short-run equilibrium is presented. Section 3 compares the ‘market outcome’ to the socially efficient outcome with some policy implications. In Section 4, the dynamics are depicted and a calibration of the model is done to find the LR convergence of the system using Indian data. Section 5 offers some concluding remarks.

2. The model

The model utilizes a two-period overlapping generations (OLG) framework. There are infinitely many altruistic people with population normalized to unity.

It is a small open economy with international capital mobility. The credit market is imperfect with a gap between the lending and borrowing rates.

There is only one good, which is the numeraire. It can be produced in two sectors: one with only unskilled labor (home production type) and the other in which entrepreneurs employ skilled workers. Full employment prevails in both the labor markets.

Each agent’s choice with respect to occupational investment and employment is as follows. In the first period of his life, each individual receives an inheritance and decides over occupational choice. If he decides neither to take education nor to become an entrepreneur, he invests the wealth in the capital market and works as unskilled labor in the first period. Otherwise, he may choose to invest in education and become skilled labor, or he may choose to invest in the setup cost and become an entrepreneur.

To make any of the above investment decisions, he may borrow from the capital market if he does not have adequate wealth. In case he has adequate wealth, he makes the desired investment and lends the rest of his inheritance in the capital market. In the second period of his life, each individual earns according to the investment made in the first period (unskilled people continue to work as unskilled laborers in the second period), consumes and leaves a bequest.

2.1. Production technology

The home production sector uses unskilled labor and produces under linear technology:

$$Y = wL,$$

where $L$ denotes unskilled labor and $w$ the unskilled wage. The good can also be produced by each entrepreneur, $j$, with skilled labor by the following production function:

$$Y_j = AH_j^a K_j^b, \quad A > 1, \quad 0 < \alpha + \beta < 1,$$

where $A$ is the technology parameter, $H_j$ the skilled labor employed by each entrepreneur, $j$, and $K_j$ the capital used by each entrepreneur $j$.

Diminishing returns to scale implies the presence of some fixed factor, which can be interpreted as fixed entrepreneurial effort. By the full employment assumption, $H_j$ is actually the ratio of the total number of skilled people to the total number of entrepreneurs of the economy.

Suppose $v$ is the skilled wage and $r$ is the internationally given rate of interest. Then, the profit of each
entrepreneur is
\[ \pi_j = (Y_j - H_jv - K_j^p). \]

By profit maximization of entrepreneurs, we obtain
\[ r = A \beta K_j^p H_j^\alpha, \]
\[ v = c_1 \alpha H_j^{(\alpha+\beta-1)/(1-\beta)}, \quad (1) \]

where \( c_1 = (A^{1/(1-\beta)} \beta^{\beta/(1-\beta)})/(1-\beta) \). Assuming that all entrepreneurs are identical in their profit-maximizing behavior, an entrepreneur’s profit is as follows:
\[ \pi_j = c_1 \{1 - (\alpha + \beta)\} H_j^{\alpha/(1-\beta)} = \pi \quad \forall j. \quad (2) \]

Equations (1) and (2), respectively, define
\[ v = v(H_j), \quad \pi = \pi(H_j). \quad (3) \]

Once \( H_j \) is determined (endogenously), Equation (3) yields equilibrium \( v \) and \( \pi \).

2.2. Preferences and occupational choice

The utility function, \( U \), is defined over consumption \( c \) and bequest \( b \). The problem facing each agent is to maximize
\[ U = c^\delta b^{1-\delta}, \quad 0 < \delta < 1 \]
subject to \( b + c \leq Z \),

where \( Z \) is the net wealth, having expressions
\[ Z = \begin{cases} 
(x + w)(1 + r) + w & \text{if one does not invest in education or as an entrepreneur,} \\
(x - h)(1 + i) + v & \text{if one invests in education and is a borrower,} \\
(x - h)(1 + r) + v & \text{if one invests in education and is a lender,} \\
(x - g)(1 + i) + \pi & \text{if one invests in setup cost and is a borrower,} \\
(x - g)(1 + r) + \pi & \text{if one invests in setup cost and is a lender.} 
\end{cases} \]

Here \( x \) is the inheritance, \( h \) the indivisible education cost and \( g \) the indivisible setup cost of entrepreneurs. We assume \( g > h \). From the capital market imperfection assumption, \( i > r \), where \( i \) is the borrowing rate and the lender enjoys \( r \).

As the indirect utility function is increasing in \( Z \), in period 1, the objective is to maximize \( Z \), or net wealth. A person decides to invest in education if his net wealth by investing in education does not fall short of what he would receive if he remains unskilled. Let \( s \) denote the threshold inheritance above which a person decides to invest in education. By comparing (i) and (ii), we obtain \( s \) for \( x < h \) as follows:
\[ s = \frac{w(2 + r) + h(1 + i) - v}{i - r}. \quad (4) \]

In view of the function \( v(H_j) \), \( s \) is a function of \( H_j \), say \( s(H_j) \). We have \( s' > 0 \) as \( v'(H_j) < 0 \).

The skilled–unskilled wage differential must be high enough, so that those who can self-finance education do prefer this choice to remaining unskilled. This amounts to comparing (i) and (iii), which yields
\[ v \geq [w(2 + r) + h(1 + r)] \quad \text{for } x \geq h. \quad (5) \]

Given that the marginal product of skilled labor approaches \( \infty \) as \( H_j \) tends to zero, this condition must hold in equilibrium.

Comparing (iii) and (iv) yields the level of threshold inheritance for the entrepreneurial choice:
\[ e = \frac{v - h(1 + r) + g(1 + i) - \pi}{i - r}. \quad (6) \]

Note that \( e \) is a function of \( H_j \), \( e = e(H_j) \) and \( e' < 0 \).

People with adequate wealth for entrepreneurship \( (x \geq g) \) will invest as an entrepreneur if their net wealth from entrepreneurship is higher than that from investment in education. This is obtained by comparing (iii) and (v), as shown in the following constraint:
\[ \pi \geq [v + (g - h)(1 + r)]. \quad (7) \]

In equilibrium, Equation (7) will be satisfied. This is because, otherwise, there will be no entrepreneur; if it is too costly for people with inheritances \( x \geq g \) to invest as entrepreneurs because of too low profits, people with lower inheritances will always find it costlier to invest in entrepreneurship. With no entrepreneur, \( H_j \rightarrow \infty \), which implies \( \pi \rightarrow \infty \) by Equation (2) and then Equation (7) will automatically be satisfied.

In Figure 1, the indirect utility functions (or the net wealth) are plotted for different inheritance levels taking into consideration the ICCs. The dark line segments show
The highest attainable utility levels for each inheritance level. Clearly, people with inheritance \( x < s \) will get highest utility if they invest as unskilled, people with inheritance \( s \leq x < e \) will get highest utility if they invest as skilled and people with inheritance \( x \geq e \) will derive highest utility if they invest as entrepreneur. Now, let us define unskilled \( (x < s) \) as poor \((P)\), skilled \((s \leq x < e)\) as middle class \((M)\) and entrepreneur \((x \geq e)\) as rich \((R)\).

2.3. Equilibrium skilled–entrepreneur ratio, \( H_j^* \)

Denoting the cumulative distribution of wealth by \( F(\cdot) \), the number of entrepreneurs has the expression \( 1 - F(e(H_j)) \). The number of skilled laborers working in the economy is equal to \([F(e(H_j)) - F(s(H_j))]\). Hence,

\[
H_j = \frac{F(e(H_j)) - F(s(H_j))}{1 - F(e(H_j))}. \tag{8}
\]

Note that the right-hand-side expression is a decreasing function of \( H_j \), while the left-hand-side expression (obviously) is increasing. Furthermore, the right-hand-side expression approaches \( \infty \) as \( H_j \to 0 \). Thus, the existence and uniqueness of solutions of \( H_j \) is guaranteed.

For further characterization, we assume a Pareto distribution of wealth, a very standard form of distribution used in the literature (see Chakravarty and Ghosh 2010) whose density function is given by

\[
f(x) = \frac{\lambda m^{\lambda}}{x^{\lambda+1}}, \quad x \geq m > 0, \quad \lambda > 0,
\]

where \( \lambda \) is the Pareto inequality parameter. The higher the value of \( \lambda \), the greater the number of people concentrated at the lower wealth levels, hence the higher the degree of inequality. The cumulative density function has the expression

\[
F(x) = \int_{m}^{x} \frac{\lambda m^{\lambda}}{X^{\lambda+1}} \, dX = 1 - \left( \frac{m}{x} \right)^{\lambda}. \tag{9}
\]

Now equilibrium \( H_j \) (say \( H_j^* \)) is determined by

\[
H_j = \left[ \frac{e(H_j)}{s(H_j)} \right]^{\lambda} - 1 = \Gamma(H_j; \lambda). \tag{10}
\]

This equation is the same as Equation (8). It is evident from Equation (10) that \( \partial \Gamma / \partial \lambda > 0 \) as \( e > s \). Thus, (a) \( \Gamma \) increases with \( \lambda \); (b) \( H_j^* \) increases as \( \Gamma \) increases. Together, (a) and (b) imply that

\[
\frac{dH_j^*}{d \lambda} > 0.
\]

From this, we obtain the next proposition.

Proposition 1 (a) Higher inequality \( \lambda \) of an economy implies a higher skilled labor–entrepreneur ratio.

(b) There exist \( \lambda_{\text{max}} \) and \( \lambda_{\text{min}} \) such that in highly unequal economies where inequality is higher than \( \lambda_{\text{max}} \), skilled labor and unskilled labor enjoy the same utility and in highly equal economies with inequality level lower than \( \lambda_{\text{min}} \), entrepreneurs and skilled laborers enjoy the same utility.

The higher the inequality (high \( \lambda \)), the higher the number of credit-constrained people for entrepreneurship relative to that for education acquisition as education cost is lower than the setup cost. Thus, for an economy with high inequality (say \( \lambda \geq \lambda_{\text{max}} \)), we have a high value of equilibrium \( H_j^* \). This implies that returns to skill will be low and simultaneously profit will be very high. Similarly, an economy with low inequality (say \( \lambda \leq \lambda_{\text{min}} \)) will have less credit-constrained people for entrepreneurship relative to that for education acquisition and will have lower returns to entrepreneurship equal to that of the skilled in utility terms.

3. Welfare: optimal occupational mix

We define the social welfare \( W \) as

\[
W = \text{total output (TO)} - \text{net payments to the foreigners (NPF)},
\]
where TO is the total output of the economy constituting the output produced by the home production sector and by entrepreneurs in the other sector. People who do not have enough wealth to invest in education or in the setup cost borrow from the capital market and those who have more wealth over and above what they require (if at all) for occupational investment lend in the capital market. Hence, a part of the total domestic borrowings is being financed by domestic lenders in aggregate and the rest is financed by foreigners. We define this rest amount as Net Payments to Foreigners NPF, as that has to be paid back from the total produce of the economy and hence constitutes the total outflow from the economy.

Let \( n \) be the number of entrepreneurs. From the production function, we eliminate capital, \( K \), which is supplied by the foreigners, as it only adds to mathematical complications (but yields the same result):

\[
Y_j = AH_j^\gamma, \quad 0 < \gamma < 1.
\]

Expressing total production, borrowing and lending, we obtain

\[
\text{TO} = w\int_0^\infty f(x)dx + nY_j = w\int_0^\infty f(x)dx + nAH_j^\gamma, \quad \text{NPF}
\]

\[
= \left[ (1 + i)\int_s^h (h - x)f(x)dx + \int_{-\infty}^g (g - x)f(x)dx \right] - (1 + r)\int_0^{\infty} (x - w)f(x)dx - (1 + r)\left\{ \int_s^{\infty} (x - h)f(x)dx + \int_{b}^{\infty} (x - g)f(x)dx \right\}.
\]

The expression of welfare yields

\[
W = w\int_0^\infty f(x)dx + nAH_j^\gamma - \left[ (1 + i)\int_s^h (h - x)f(x)dx + \int_{-\infty}^g (g - x)f(x)dx \right] - (1 + r)\left\{ \int_s^{\infty} (x - h)f(x)dx + \int_{b}^{\infty} (x - g)f(x)dx \right\} + \int_{g}^{\infty} (x - g)f(x)dx \right\}.
\]

Planner’s objective is to obtain the number of entrepreneurs that maximizes welfare. \( H_j \) depends on \( n \) and \( H_j \in [H_j^{\min}, H_j^{\max}] \) has to hold satisfying ICCs for occupational choices where \( H_j^{\min} \) solves Equation (7) and \( H_j^{\max} \) solves Equation (5) with equality. Again, the total population cannot exceed unity. Thus, the problem to the planner is

\[
\max W \{ n \}
\]

subject to \( H_j(n) \in [H_j^{\min}, H_j^{\max}] \) and \( \phi + n + nH_j = 1, \)

where \( \phi = \int_0^\infty f(x)dx \) is the number of unskilled laborers or poor.

Using Leibniz integral rule and setting \( (dW/dn) = 0 \), we obtain the first-order condition

\[
v[\dot{s}'f(s) + nH_j'] + (\pi - v)e'f(e) + \frac{\pi}{1 - \gamma} = 0, \quad (12)
\]

where \( \dot{s}' = (ds/dn), H_j' = (dH_j/dn) \) and \( e' = (de/dn) \).

The welfare-maximizing \( n \), say \( n^* \), depends on \( \lambda \) since \( f(s) \) and \( f(e) \) are Pareto densities with inequality \( \lambda \). Suppose for some \( \lambda \), say \( \lambda^* \), Equation (12) is satisfied at \( n = n^*(\lambda^*) \) and \( W \) is maximized. Note that the first term on the left-hand side of Equation (12) is negative and the other two terms are positive since \( s' < 0, e' > 0 \) by Equations (4) and (6), \( H_j' < 0 \) (obviously) and \( \pi > v \). We know that the higher the value of inequality \( \lambda \), the higher the concentration of people at the lower wealth \( s \) relative to that at \( e \), i.e. the value of \( f(s) \) relative to that of \( f(e) \) is higher. Therefore, at \( n = n^*(\lambda^*) \) (hence at \( H_j = H_j(n^*(\lambda^*)) \)) the left-hand side of Equation (12) is \(< (>)0 \) for all \( \lambda > (\lambda^*) \). This implies that \( n^*(\lambda) < (>) n^*(\lambda^*) \) for all \( \lambda > (\lambda^*) \), since a lower (higher) \( n \) raises welfare. Notice that the relation between \( \lambda \) and \( n^* \) is true for any \( \lambda \) since \( \lambda^* \) is arbitrarily chosen. Thus, we find that \( H_j(n^*(\lambda)) > (\lambda^*)H_j(n^*(\lambda^*)) \) for all \( \lambda > (\lambda^*) \). Now, \( H_j(n^*(\lambda)) > H_j(n^*(\lambda^*)) \) for all \( \lambda > \lambda^* \) implies that SO \( v \) is lower, which indicates that the SO number of unskilled laborers or the poor is higher for all \( \lambda > \lambda^* \). In Proposition 1, we saw that the PO \( H_j \) also increases with inequality. Thus, we obtain the following proposition.

**Proposition 2** As inequality increases, the SO occupational mix tilts in favor of skilled labor; a higher inequality implies a lower number of entrepreneurs and a higher number of unskilled laborers in SO.

Intuitively, we know that the agents who do not have enough wealth to invest as entrepreneurs borrow from the capital market which is a net outflow from the economy. An unequal economy has a lower concentration of people at the high wealth level or the number of lending entrepreneurs is low compared to the credit-constrained entrepreneurs. On the other hand, unskilled people invest their entire inheritances in the capital market. Hence, with a lower number of entrepreneurs and a higher number of unskilled people, the possibility of outflow gets reduced.
3.1. Policy implication

Although both the SO and PO values of \( H_j \) are increasing functions of inequality, there is no reason to believe that the two values will match for all inequality levels. The basic cause of such a difference lies in the fact that in PO, individuals maximize their own net wealth separately whereas the planner maximizes the net wealth of the economy as a whole, which includes the net wealth of both lenders and borrowers. Now, we know that for \( \lambda = \lambda_{\text{max}} \), PO is \( H_{j}^{\text{max}} \) and for \( \lambda = \lambda_{\text{min}} \) it is \( H_{j}^{\text{min}} \), where \( H_{j}^{\text{max}} \) and \( H_{j}^{\text{min}} \) have been defined earlier. Thus, for highly unequal economies defined as \( \lambda \geq \lambda_{\text{max}} \), the following must hold: \( H_j(n^*|\lambda) \leq H_j^* = H_{j}^{\text{max}} \), i.e. the SO cannot exceed the PO even though it is increasing in inequality. Similarly, for highly equal economies, defined as \( H_j(n^*|\lambda) \geq H_j^* = H_{j}^{\text{max}} \), \( H_j(n^*|\lambda) \geq H_j^* = H_{j}^{\text{min}} \) must hold, i.e. the SO cannot be less than the PO.

When the PO is higher (lower) than the SO, which might be the case for highly unequal (equal) economies, the optimum policy is to reduce (increase) the PO. However, possibilities may arise (for some specific levels of inequality) where no policy intervention is required at all, as the PO exactly matches the SO (when \( H_j(n^*|\lambda) = H_{j}^{\text{max}} \) or \( H_j(n^*|\lambda) = H_{j}^{\text{min}} \)). From this, we come to the following proposition.

**Proposition 3** An education subsidy that impacts the PO by increasing it is not an appropriate policy for highly unequal economies where \( \text{SO} \leq \text{PO} \) holds, but it might be an optimal policy for highly equal economies where \( \text{SO} > \text{PO} \) holds.

The alternative policy choice for unequal economies where possibilities of \( \text{SO} < \text{PO} \) arise is to reduce the PO by increasing the number of entrepreneurs via an entrepreneurial subsidy. This paper vouches for that rather than an education subsidy for highly unequal countries.

4. Dynamics

From the preferences, we can write the bequest functions as follows:

\[
\begin{cases}
(1 - \delta)[(x_t + w)(1 + r) + w], & x_t < s_t, \\
(1 - \delta)[(x_t - h)(1 + i) + v_t], & s_t \leq x_t < h, \\
(1 - \delta)[(x_t - h)(1 + r) + v_t], & h \leq x_t < e_t, \\
(1 - \delta)[(x_t - g)(1 + i) + \pi_t], & e_t \leq x_t < g, \\
(1 - \delta)[(x_t - g)(1 + r) + \pi_t], & x_t \geq g.
\end{cases}
\]

Following Galor and Zeira (1993), let us start with the assumption \((1 - \alpha)(1 + r) < 1 < (1 - \alpha)(1 + i)\), which implies a sufficient degree of the capital market imperfection. Now, the skilled laborer–entrepreneur ratio in time \( t \) is

\[
H_j = \frac{H_j}{n_t},
\]

where \( H_j \) is the number of skilled laborers employed by \( n_t \) number of entrepreneurs in time \( t \). From this, we find the change in \( H_j \) with respect to time as

\[
\frac{dH_j}{H_j} = \frac{dH_j}{H_j} - \frac{dn_t}{n_t}.
\]

The sequence of values of \( v \) and \( \pi \) (and hence the entire dynamics of the model) depends upon the values of \( H_j \); the LR convergence of wealth is achieved when \( H_j \) converges. The LR convergence has to be within the band \([H_{j}^{\text{min}}, H_{j}^{\text{max}}]\) to satisfy the ICCs.

In the LR, three possibilities arise: the wealth of middle class (or skilled) people converging to somewhere between that of the rich and poor; the wealth of poor and middle class people equalizing somewhere below the wealth of the rich and the wealth of rich and middle class people equalizing somewhere above the wealth of the poor. Alternatively, the possibilities are (i) \( x^r < x^m < x^p \), (ii) \( x^p = x^m \), and (iii) \( x^p < x^m = x^r \); cases (ii) and (iii) depict polarization of wealth.

We obtain the LR wealth values for the three groups by setting \( x_{t+1} = x_t \):

- **LR wealth of poor:** \( x^p = \frac{(1 - \delta)(w(2 + r))}{1 - (1 - \delta)(1 + r)} \).
- **LR wealth of middle class:** \( x^m = \frac{(1 - \delta)[v^* - h(1 + r)]}{1 - (1 - \delta)(1 + r)} \).
- **LR wealth of rich:** \( x^r = \frac{(1 - \delta)[\pi^* - g(1 + r)]}{1 - (1 - \delta)(1 + r)} \).

where \( v^* \) and \( \pi^* \) are the LR values of equilibrium \( v \) and \( \pi \), respectively. When \( v^* \) is at the minimum, i.e. \( v^* = \lceil w(2 + r) + h(1 + r) \rceil \), we obtain \( x^p = x^m < x^r \), and when \( \pi^* \) is at the minimum, i.e. \( \pi^* = \lceil v^* + (g - h)(1 + r) \rceil \), we obtain \( x^p < x^m = x^r \).

4.1. Calibration: testing LR convergence (polarization?) using Indian data

The purpose of this exercise is to test and analyze the LR convergence pattern of the three groups, namely poor (unskilled labor/self-employed), middle class (skilled labor) and rich (entrepreneurs). The description of the data used with their sources is as follows.

The daily level unskilled wage is taken as Rs. 62.44.10

It is converted to a monthly wage by taking five working days per week and then converted to yearly data. The data of borrowing and lending interest rates (for one-year deposit or borrowing) are taken as 9% and 6%, respectively (Source: Axis Bank Treasury, Central Office). The yearly education cost, Rs. 1439, is taken around the values of
data obtained in a study by the International Comparative Higher Education Finance and Accessibility Project. Setup cost is taken as Rs. 2740 within the range of values of the yearly data of fixed investment cost of some industries in the factory sector data set of Annual Survey of Industries-India. The values of both \( h \) and \( g \) are converted in terms of \( w \) (yearly), which is used as the numeraire in the calibration. The share of skilled laborers (\( \alpha \)) and that of capital (\( \beta \)) in production are taken from the estimation of Kendrick (1976) as 0.4 and 0.35, respectively (Romer 1996, 134). These values are closer to the values estimated by Mankiw, Romer, and Weil (1992; Romer 1996, 140). The value of the parameter for parental altruism has been taken from standard literature as 0.32. The value of the exponent of Pareto distribution is taken as 1.15 for India following the estimation of Sinha (2005).

We assume a generation lives for 20 years as young and then joins respective occupations and works for the remaining period of life. Working age limit and lifetime have been taken as 60. Borrowers compare the entire series of loan repayments for the period of 20 years of education added to the flow of skilled wages they would get on joining the skilled labor force and their opportunity cost (series of unskilled wages forgone). Entrepreneurs invest in setup cost when young (for the first 20 years of their lifetime) and then start production in the next 40 years. The setup cost may be lumpy in the sense that the spread of the total setup cost is not even over all the 20 years when the entrepreneur is young. Comparison of net wealth with opportunity cost gives the wealth threshold for skilled workers and entrepreneurs.

### 4.2. Results

First, the lower and upper bounds of \( H^* \) are calculated from the ICC of entrepreneurs (7) and that of skilled laborers (5), respectively. It is found that \( H^*_j \) declines and then converges. Convergence of \( H^*_j \) implies convergence of all the endogenous variables of the model and hence convergence of LR wealth; Table 1 shows the values of skilled wage (\( v^* \)) and profit (\( \pi^* \)) for several iterations till convergence. Putting LR \( v^* \) and \( \pi^* \) in (a), (b) and (c) adjusted with the rate of interests forgone, we obtain the LR wealth levels for the three groups as \( x^p = 0.00853 \), \( x^M = 0.15268 \) and \( x^R = 0.19807 \). It is interesting to note that the LR wealth levels of the rich and middle class are very close while both are much above the LR wealth of the poor, which indicates the possibility of polarization in the LR.

### 5. Conclusion

This paper relates wealth inequality and occupational choice of economic agents in a two-period OLG framework. Assuming rational expectation behavior of economic agents and taking Pareto distribution for wealth, higher inequality implies a higher number of skilled laborers compared to entrepreneurs in the PO. The optimal mix of occupations in a welfare maximization exercise is also determined. But market forces may not behave in a way that the PO matches the SO. The paper shows that for highly unequal economies, the deviation between the PO and the SO cannot be corrected by an education subsidy, which is in sharp contrast to the usual belief; rather it vouches for an entrepreneurial subsidy to tilt the PO, if required to do so. In the case of an equal economy, however, an education subsidy might be an appropriate policy to reach the SO when the PO deviates from the SO.

A calibration exercise is done to test the LR convergence using Indian data, and, interestingly, the LR wealth levels of the middle class and rich are found to be very close and much above the LR wealth of the poor. This is indicative of a wealth polarization in the LR for this specific data set.

The model can be extended to several directions to cover up some of its limitations. For example, there is real-life evidence that people belonging to the ‘middle class’ run enterprises and people belonging to the ‘rich section’ decide over human capital accumulation. Also, wealth provides a partial explanation of the occupational choice behavior of individuals. Social factors and differences in inherent ability are there as well to explain it. Also, no government budget constraint is imposed in the welfare maximization exercise. Given by the fact that the government earns tax from the rich (say entrepreneurs of any sort: borrower or lender), if an unequal economy chooses lower entrepreneurs out of social welfare maximization it would imply a drag on the total tax collected. Once the budget constraint is introduced, the choice of \( n \) needs to be derived further for unequal economies. Also, if there is a social constraint that the government has to generate a

| \( v^* \)         | \( \pi^* \)         |
|------------------|------------------|
| 10.2228854223    | 10.3279461696    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
| 10.2284939027    | 10.3205019137    |
certain minimum of skilled/literate labor, then that might lead to a different policy direction for the unequal econom-
ies. These are left for further consideration.

Notes

1. Rising skilled emigration from developing nations (see http://perso.uclouvain.be/frederic.docquier/oxlight.htm for database) and emerging group of (rich) entrepreneurs therein (http://cep.lse.ac.uk/pubs/download/cp253.pdf; Forbes report: http://webcache.googleusercontent.com/search?q=cache:wygtPqMRgxUJ:www.forbes.com/sites/pamosmourdoukoutas/2013/10/27/the-rise-of-self-made-billionaire-entrepreneurs-in-china-and-what-it-means-for-the-future-of-chinese-corporations/+/cd=2&hl=en&ct=clnk&gl=in) reinforce such evidence.

2. There are papers that support and empirically justify that entrepreneurs are from the richer section of the wealth distribution. Evans and Jovanovic (1989) were among the first to find the determinants of entrepreneurship focusing, in particular, on the effects of receiving large bequests on the probability of becoming entrepreneurs. Subsequent studies (Hamilton 2000) also find similar effects of large positive income shocks on entrepreneurship.

3. This difference might be due to the cost the lender bears to keep track of the borrower, as assumed by Galor and Zeira (1993).

4. We do not consider the incentive compatibility constraint (ICC) of entrepreneurship for people with x < h. This is because, if it is satisfied, there will be no skilled workers, which can never be equilibrium.

5. As H̅ → 0, we have e → ∞ and s → ∞, respectively, implying P(e(H̅)) → 1 and P(s(H̅)) → 0.

6. See Appendix 1 for λ_{max} and λ_{min}.

7. Note that n can never be zero since the incentive compatibility constraint for skilled laborer (5) gets violated. Thus, we suppose existence of a positive and finite n.

8. Derived in Appendix 2.

9. Suppose H̅ (n | λ) is lower for an economy with higher λ (> λ*) although n* is lower (n*(λ) < n* (λ*)) for the economy. This implies that the number of skilled workers is definitely lower for this economy since H̅ = \frac{s}{n} and n is lower. Now, a lower H̅ implies a higher v, hence a lower s and a lower number of poor. This contradicts the assumption of identical economies with population normalized to unity.

10. Provided by Monthly Economic Review, India. December 2005. http://www.epwrf.res.in/upload/MER/mer10510011.htm. Their data source is Indian Labor Journal, Labor Bureau, on the basis of recommendations made by the National Sample Survey Organisation (NSSO).

11. Website of ICHEFAP: http://www.gse.buffalo.edu/org/inthigheredfinance/region_asia_India.html

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Appendix 1. Proposition 1(b) – values of $\lambda_{\text{max}}$ and $\lambda_{\text{min}}$

We have seen that whatever be the value of $\lambda$ for an economy, the ICC for the skilled (Equation (5)) will automatically get satisfied. Again we saw in Proposition 1(a) that the higher the inequality, the higher the equilibrium $H_j$, which implies a lower equilibrium $H_j^\ast$, which will be maximum) otherwise Equation (5) will be violated.

Therefore, from Equation (13), we obtain

$$v^\min = \alpha A^{1/(1-\beta)} \left( \frac{H_j^\ast}{\lambda} \right)^{\beta/(1-\beta)} H_j^{\max (\alpha + \beta - 1)/(1-\beta)} = [(w + h)(1 + r) + w]$$

or

$$H_j^{\max} = \left( \frac{\alpha c_1}{(w + h)(1 + r) + w} \right)^{(1-\beta)/(1-(\alpha + \beta))},$$

where $c_1 = A^{1/(1-\beta)} (\beta/r)^{\beta/(1-\beta)}$. Putting this on the right-hand side of Equation (10), we obtain

$$\left( \frac{c}{s} \right)^\lambda - 1 = H_j^{\max} = \left( \frac{\alpha c_1}{h(1 + r) + w(2 + r)} \right)^{(1-\beta)/(1-(\alpha + \beta))}$$

or

$$\lambda \ln \left( \frac{c}{s} \right) = \ln \left( \frac{\alpha c_1}{h(1 + r) + w(2 + r)} \right)^{(1-\beta)/(1-(\alpha + \beta))} + 1. \quad (13)$$

Now, when $v = [h(1 + r) + w(2 + r)]$, we find

$$\left( \frac{c}{s} \right) = \left[ \frac{v - h(1 + r) + g(1 + i) - \pi}{w(2 + r) + h(1 + i) + v} \right] = \left[ \frac{w(2 + r) + g(1 + i) - c_1 (1 - (\alpha + \beta)) (\alpha c_1 / h(1 + r) + w(2 + r))^{\beta/(1-(\alpha + \beta))}}{h(i - r)} \right].$$

Therefore, from Equation (13), we obtain

$$\lambda_{\text{max}} = \frac{\ln \left[ 1 + (\alpha c_1 / h(1 + r) + w(2 + r))^{\beta/(1-(\alpha + \beta))} \right]}{\ln \left[ w(2 + r) + g(1 + i) - c_1 (1 - (\alpha + \beta)) (\alpha c_1 / h(1 + r) + w(2 + r))^{\beta/(1-(\alpha + \beta))} / h(i - r) \right]}.$$

Now, for all economies with inequality $\lambda > \lambda_{\text{max}}, H_j^\ast = H_j^{\max}$ by Proposition 1(a), implying $v^\ast = v^\min = [w(2 + r) + h(1 + r)]$ (or profit will be maximum) otherwise Equation (5) will be violated.

Similarly, at the other extreme, when inequality level is very low, by Proposition 1(a) $H_j^\ast$ will be low, implying a low profit. Let us define $\lambda_{\text{min}}$ such that for $\lambda = \lambda_{\text{min}},$ we obtain the minimum value of $\pi^\ast, \pi^\ast = [v^\ast + (g - h)(1 + r)].$ Using Equations (1) and (2), we can easily solve for $H_j^\ast,$ say $H_j^{\min},$ as follows:

$$\pi = v + (g - h)(1 + r)$$

or

$$\{1 - (\alpha + \beta)\} c_1 H_j^{\beta/(1-\beta)} = \alpha c_1 H_j^{\max (\alpha + \beta - 1)/(1-\beta)} + (g - h)(1 + r) \quad \text{or}$$

$$c_1 H_j^{\max (\alpha + \beta - 1)/(1-\beta)} \left\{ 1 - (\alpha + \beta) - \frac{\alpha}{H_j^{\beta/(1-\beta)}} \right\} = (g - h)(1 + r).$$

The above equation gives a unique $H_j^{\min}$ since $\pi^\ast = v^\ast + (g - h)(1 + r)$ implies $H_j = H_j^{\min}.$ Thus, from Equations (6) and (4), we obtain

$$\left( \frac{c}{s} \right) = \left[ \frac{g(i - r)}{w(2 + r) + h(i - r) - \alpha c_1 H_j^{\max (\alpha + \beta - 1)/(1-\beta)}} \right].$$

Now, at $\pi^\ast = v^\ast + (g - h)(1 + r), i.e. H_j = H_j^{\min},$ we obtain from Equation (10), $\left( \frac{c}{s} \right)^\lambda - 1 = H_j^{\min}$ or

$$\lambda_{\text{min}} = \frac{\ln \left[ 1 + H_j^{\min} \right]}{\ln \left[ \frac{g(i - r)}{w(2 + r) + h(i - r) - \alpha c_1 H_j^{\max (\alpha + \beta - 1)/(1-\beta)}} \right]}$$

(putting $\left( \frac{c}{s} \right)$ from above).
Now, for all economies with inequality $\lambda < \lambda_{\min}$, by Proposition 1(a) $\pi^* = [v + (g - h)(1 + r)]$ (or $\nu^*$ will be maximum) since $\pi^*$ cannot fall below $[v + (g - h)(1 + r)]$, otherwise Equation (7) will be violated. Hence the proposition.

Appendix 2. Welfare maximization

$$
W = w \int_0^s f(x)dx + nA H_j \gamma - \left(1 + \frac{i}{1 - \gamma}\right) \left(\int_0^h (h - x)f(x)dx + \int_0^g (g - x)f(x)dx\right) - (1 + r) \left(\int_0^e (x + w)f(x)dx + \int_h^e (x - h)f(x)dx + \int_g^0 (x - g)f(x)dx\right).
$$

Differentiating $\frac{dW}{dn}$ w.r.t. ‘$n$’ using Leibniz integral rule, we obtain

$$
\frac{dW}{dn} = ws'f(s) + AH_j \gamma + nA \gamma H_j \gamma - (1 + \frac{i}{1 - \gamma})(s'h - s)f(s) + (1 + i)e'(g - c)f(e)
$$

$$
= \frac{\pi}{1 - \gamma} + n\gamma H_j' + s'f(s)[w + h(1 + i) - (1 + i)s + s(1 + r) + w(1 + r)]
$$

$$
= \frac{\pi}{1 - \gamma} + n\gamma H_j' + s'f(s)[-(i - r)s + w(2 + r) + h(1 + i) - v + v]
$$

$$
+ e'(e)\left[-e(i - r) + g(1 + i) - h(1 + r) - \pi + v + \pi - v\right]
$$

$$
= \frac{\pi}{1 - \gamma} + n\gamma H_j' + s'f(s)v + e'(e)\pi - v,
$$

where $s' = (ds/dn)$, $H_j' = (dH_j/dn)$ and $e' = (de/dn)$. Therefore,

$$
\frac{dW}{dn} = v[s'f(s) + n\gamma H_j'] + e'(e)(\pi - v) + \frac{\pi}{1 - \gamma}.$$
