Discussion Papers In Economics And Business

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この研究は「大学院経済学研究科・経済学部記念事業」
基金より援助を受けた、記して感謝する。

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May 11, 2006

Abstract

This paper constructs an overlapping generations model of search equilibrium that analyzes intergenerational and coordination traps simultaneously. When parents are uneducated, their children often face difficulty in finishing school, and therefore likely to remain uneducated. In addition, if children expect that other children of the same generation do not receive education, they anticipate that firms will not create enough jobs for educated and thus are discouraged from schooling. These two mechanisms of poverty trap reinforce each other—creating a dual poverty trap. Escaping from the trap requires a combined, not separate, implementation of financial assistance for schooling and policies for changing agents' expectation.

JEL Classification Numbers: O11, J62, J23.

Keywords: overlapping generations model, education, intergenerational externality, job search.

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*This research is partially supported by the Japan Society for the Promotion of Science, Grant-in-Aid for Young Scientists (B), 2004–2006. The authors are grateful to Ryoichi Imai, Noritaka Kudoh, Kazuo Mino, Takashi Shimizu and seminar participants at Osaka University and Kansai University for their valuable comments and suggestions. Any remaining errors are naturally ours.

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1 Introduction

It has been argued that many low income countries cannot escape from poverty because people in youth do not acquire sufficient education and therefore work only in less productive sectors when they are grown up. A survey by World Bank (2005) reports that the gross school enrollment rate for secondary education among low income countries (with a GNI per capita of $755 or less) remains only 46% in 2002. Why don't they then obtain education? A simple answer proposed in the literature says: because they are just poor and therefore cannot afford education—that is, they are poverty-trapped.[1] If the affordability of education is the only problem, foreign aids and assistances that makes education affordable would solve the problem. However, difficulties faced by various aid programs suggest that the existence of some deeper causes.

This paper considers two other mechanisms of poverty traps. In an overlapping generations model of search equilibrium, we analyze intergenerational linkage in each family or lineage, and the coordination issues among the individuals of the same generation. If parents in a family are not educated, children are less likely to obtain education than otherwise. If the majority of other individuals of the same generation within the economy do not receive education, one may expect that the return from schooling would be low and therefore loses incentives to obtain education.

While each of these two mechanisms can separately create a possibility of a poverty trap, this paper shows that, when they simultaneously present, they reinforce each other so that the likelihood that the economy falls into the poverty trap is considerably higher: that is, a coordination failure triggers the intergenerational trap, whereas the limited intergenerational mobility makes the coordination trap more persistent. In addition, it is shown that, in economies trapped in poverty for both reasons—i.e., in

[1]Such an argument often relies on the assumption that the financial market is imperfect and therefore children cannot borrow enough against their future income.

dually trapped economies—the problem can be solved only when both intergenerational and coordination issues are tackled simultaneously.

Regarding the intergenerational linkage, there are empirical views supporting that the education level of parents has a significantly positive effect on children's school attendance, even after controlling for income (e.g., Strauss and Thomas 1995, Grootaert 1999, Ray 1998, Patrinos and Psacharopoulos 1997).[2] In particular, Bratti (2002) shows that children's school level depends more largely on family characteristics (parents' education level and their social class) than on parents' current income, using the British data. Following those observations, our model assumes that the cost of acquiring education is higher when one's parent is unskilled, i.e., when the parent neither is educated nor obtained some skill on the job. As studied in the literature (e.g. Azariadis and Drazen, 1990; De la Croix and Michel 2002, sec. 5.2), such intergenerational positive spillovers of education generates increasing returns in obtaining education, and therefore may create multiple steady states. If the initial generation obtains low education, then the subsequent generation faces a high cost of schooling, and therefore again do not obtain education. Such a link creates an intergenerational poverty trap.

The other key component of our model is coordination failure. We focus on the tendency that, in low income countries, children often have little prospect of finding a good job even when they acquire education. If they hold such a pessimistic expectation, it discourages them from attending school even when it is financially affordable. In fact, the pessimistic expectation is shown to self fulfilling when we explicitly consider the frictional nature of the labor market: if there are few educated workers, firms are not willing to create jobs that requires educated workers since they think it difficult to find appropriate workers successfully.

In the literature, previous studies have shown that multiple equilibria may emerge if acquiring education on the part of workers and creating jobs on the part of firms

[2]Behrman (1997, 2002) focuses on the effect of mother's education level on children's school attainment.

are strategic complements (see Burdett and Smith 2002; Laing, Parivos, and Wang 1995; Acemoglu 1997). Rather, given that acquirement of education takes much longer time than creation of jobs, this paper stresses the importance of expectation among young people. If one thinks that other agents have a pessimistic expectation, one can rationally expect that other agents do not receive education and that, when they are grown up, firms observing it will not create enough jobs. Therefore, this bad outcome cannot be escaped unless all young agents somehow coordinate their expectation: i.e., a coordination trap emerges.

Previous studies have analyzed intergenerational and coordination traps separately. However, for low income countries, both of arguments seem equally plausible; i.e., those countries may be *dually* trapped, where two mechanisms of poverty trap reinforce each other. If a certain mass of people in the previous generation is uneducated, the not only children of those uneducated agents, but also other agents in the economy have to choose not to receive education; i.e., the bad intergenerational linkage causes a coordination failure. On the other direction, once a coordination failure occurs, then the majority of agents in the generation choose not to receive education, which causes the intergenerational poverty trap in the subsequent period. We show that, consequently, any policy prescription that aim to solve one of the problem do not work, and that, in fact, it may fail completely without even partially resolving the directed problem. It would be one of the possible reasons why various forms of development assistance have been largely unsuccessful. International organizations have recently recognized the necessity of combined approach to the dual nature of poverty trap.[3]

This paper is organized as the follows. The next section sets up a simple overlapping generations (OLG) model in which a parent's human capital eases the acquirement of education by her child. We derive the young people's schooling choices given their

[3]For example, the World Bank (South Asia) budgeted for the Female Education Awareness Program as well as for stipend in the Female Secondary Assistance Project of Bangladesh. (see the World Bank's web site:www.worldbank.org)

expectation regarding the prospect of successfully obtaining a job in the modern sector. Firms's decision of creating job is analyzed in Section 3. Section 4 investigates the equilibrium of the economy and shows that, under a particular parameter range, the equilibrium exhibits a dual poverty trap. In Section 5, after explaining why the one-by-one prescription fails, we consider two types of effective policies: public awareness campaigns combined with subsidy for education or provision of free education. Concluding Remarks appear in the last section.

2 Households

In the model, there are overlapping two-period-lived agents with an unit population for each generation. Agents seeks to maximize their utility that are obtained from their consumption flow. For simplicity, we assume either that the economy is a small open country, or that agents are risk neutral. In either case, the discount factor is constant and denoted by $\beta \in (0, 1)$.

2.1 Childhood

Let us consider the life of agents born in period t. In the first period of their life, which we call childhood, agents are endowed with one unit of time and choose whether or not to attend school. Education is assumed to be indivisible; agents can become educated in their adulthood if and only if they finish schooling in their childhood.

If an agent decides not to go to school, she spend all the disposable time in working. Children can work only in the traditional sector, where the productivity is low but neither education nor skill is necessary. Let $z > 0$ denote the marginal productivity of labor per unit time in the traditional sector. Then, her income in the childhood is z.

If an agent wants to become educated in the adulthood, she must spend a certain time in schooling. Although their parents do not leave financial wealth as bequests,

parents' acquired skill has a favorable influence on their ability to learn.[4] If one's parent is skilled (educated or obtained a skill through his job, as discussed later), a time of $\underline{e} \in (0,1)$ is required to finish school. For the remaining time in her childhood, she works in the traditional sector and earns $(1-\underline{e})z$. If one's parent is not skilled, a time of $\overline{e} > \underline{e}$ is required to finish school. Note that this agent needs a longer time to finish school since she cannot rely on her parents' knowledge. For the remaining time, she works and earns $(1-\overline{e})z$.

2.2 Adulthood

In what follows, we consider an agent's behavior in the adulthood. Adult agents can work either in the modern sector or in the traditional sector. Both educated and uneducated adult workers seek to find a job in the modern sector, since the expected income there is higher than elsewhere. However, the labor market in the modern sector is frictional. A worker must meet a vacant job in order to produce output. For simplicity, we do not consider separate labor markets for educated and uneducated workers—they search for a job in the same pooled market and find one with the same probability.[5] Let $q_{t+1} \in [0,1]$ denote the probability for a worker to successfully match with a job. Although the value of q_{t+1} is endogenous, each worker takes it as given.

If a worker fails to match with any vacancy in the modern sector, which occurs with probability $1-q_{t+1}$, she works in the traditional sector where job is easy to find at no friction (e.g., workers can be self-employed). In that case, she earns z, regardless of her education level.

If an adult agent successfully matches with a vacant job in the modern sector, which occurs with probability q_{t+1}. her income depends on whether she is educated or not

[4]This can be interpreted as a particular form of intergenerational transfer of human capital, as is often assumed in the literature; e.g., De la Croix and Michel (2002).

[5]This assumption can be justified if firms cannot distinguish educated and uneducated workers until they match with an worker. In other words, this search process is 'undirected.'

(i.e., whether she has finished schooling in her childhood). When an educated worker matches with a vacancy of a firm, this pair can produce an output of $\widehat{y} > z$. Before the production process starts, the worker and the firm negotiates the division of the output. If the worker and the firm fail to agree on the division of the output, they cannot match with other agents within the period. After the breakdown, the worker can work in the traditional sector, where she can earn z, whereas the firm cannot produce output and its income is zero. Let $y \equiv (\widehat{y} - z)/2 > 0$ denote the half of the surplus from the match. Through negotiations, we assume that the pair reaches the Nash bargaining solution with the equal bargaining powers. Then, the income of the worker is $y + z$, whereas that of the firm is y.

When an uneducated worker matches with a vacancy, she tries to acquire the required skill through self-training, or learning by doing in the modern sector. She successfully obtains the skill with a small probability $p \in (0, 1)$, and for this case the match produces $z + 2y$. The division of the surplus is $y + z$ and y as above. However, with probability $(1 - p)$, she fails and the match produces only z—i.e., the surplus is zero. Then, the worker earns z and the vacancy gets nothing.

2.3 Schooling Decisions

Agents determine whether or not to attend school in order to maximize the present value of their lifetime income. If an agent born in period t decides not to attend school, the present value of expected lifetime income is $z + \beta[pq^e_{t+1}(y+z) + (1-pq^e_{t+1})z]$, where q^e_{t+1} is the expected value of q_{t+1} as of period t. Likewise, if an agent born in period t decides to finish school, her present value of lifetime income is $(1-e)z + \beta[q^e_{t+1}(y+z) + (1 - q^e_{t+1})z]$, where $e = \underline{e}$ if one's parent is skilled whereas $e = \overline{e}$ if not so. Therefore, the net benefit of schooling is

$$-ez + \beta q^e_{t+1}(1 - p)y, \quad \text{where } e = \underline{e} \text{ or } \overline{e}. \tag{1}$$

Note that, since $\underline{e} < \overline{e}$, the net benefit of education is higher for agents with skilled parents (i.e., parents who have finished schooling or obtained skill through working in the modern sector).

A young agent receives education if and only if expression (1) is positive or zero.[6] More specifically, a young agent whose parent is skilled receives education if and only if the expected probability of finding a job is reasonably high:

$$q^e_{t+1} \geq \underline{e}z/(\beta(1-p)y) \equiv q^*. \tag{2}$$

A young agent whose parent is not skilled receives education if and only if the expected probability of finding a job is even higher:

$$q^e_{t+1} \geq \overline{e}z/(\beta(1-p)y) \equiv \overline{q} > q^*. \tag{3}$$

We focus on the case in which the time cost of education for children of unskilled parents, $\overline{e}$, is fairly high so that the threshold level $\overline{q}$ exceed one.[7] This means that children of unskilled parents never receive education—the only way for them of acquiring skill is by learning by doing. In later sections, we show that this limitation in intergenerational mobility constitutes one factor in generating a poverty trap. Before that, however, it must be described how jobs are created.

3 Matching Technology and Job Creation

In the modern sector, a worker must meet a vacant job in order to produce output. Vacant jobs are created by firms through free entry. Let the cost of creating a vacant job be denoted by $k > 0$, and let v_{t+1} represent the number of vacancies created by firms in period $t+1$. Any job, filled or not, deteriorates in one period.

There exists a search-matching friction as mentioned before. Specifically, we assume that the number of match in a period is determined by a standard symmetric Cobb-

[6] It is assumed that agents receive education when they are indifferent to do so.

[7] Specifically, it is assumed that $\overline{e} > \beta(1-p)y/z$.

Douglas matching function, $M(\ell_{t+1}, v_{t+1}) = A\ell_{t+1}^{1/2} v_{t+1}^{1/2}$, where $A > 0$ is a parameter of matching technology and ℓ_{t+1} denotes the number of workers who search for a job. Recall that all adult workers (with population one) search for a job in the modern sector, which means $\ell_{t+1} = 1$. Therefore, the number of match in period $t+1$ is $M(1, v_{t+1}) = A\sqrt{v_{t+1}}$. The probability for a worker to match with a vacant job is

$$q_{t+1} = M(1, v_{t+1})/1 = A\sqrt{v_{t+1}}. \tag{4}$$

In a similar way, the probability for a vacant job to match with a worker can be expressed as $M(1, v_{t+1})/v_{t+1} = A/\sqrt{v_{t+1}}$.

Let us calculate the profitability of creating a job. Let E_{t+1} denote the number of educated among the adult agents in period $t+1$. When a vacant job is created, it meets with a worker with probability $A/\sqrt{v_{t+1}}$. Conditional upon this, the matched worker turns out to be educated with probability $E_{t+1}/\ell_{t+1} = E_{t+1}$, and in that case the firm earns y. With probability $(1 - E_{t+1})$, the matched worker is uneducated. The uneducated worker successfully train himself with probability p, for which case the firm earns y, but if she fails to acquire the skill the firms earns 0. Therefore, the expected profit of creating a vacancy is written by,

$$\left(A/\sqrt{v_{t+1}}\right)\left[E_{t+1} + (1 - E_{t+1})p\right] y - k. \tag{5}$$

In equilibrium, the number of vacant jobs, v_{t+1}, is determined so that expression (5) becomes zero; i.e., $v_{t+1} = A^2 \left[E_{t+1} + (1 - E_{t+1})p\right]^2 / k^2$. Substituting it into (4) shows that the equilibrium probability for a worker of finding a job is[8]

$$q_{t+1} = m_0 + m_1 E_{t+1}, \tag{6}$$

where $m_0 \equiv pA^2y/k$ and $m_1 \equiv (1-p)A^2y/k$ are positive constants. Equation (6) implies that if firms observe that there are greater number of educated worker among

[8] Since q_{t+1} is a probability, it must be between 0 and 1. Therefore, it may be more appropriate to write (6) as $q_{t+1} = \min[m_0 + m_1 E_{t+1}, 1]$, or to write the matching function as $M(\ell_{t+1}, v_{t+1}) = \max[A\ell_{t+1}^{1/2} v_{t+1}^{1/2}, \ell_{t+1}, v_{t+1}]$. If $k > A^2 y$, the right hand side of (6) does not exceed 1 for any $E_{t+1} \in [0, 1]$, and therefore such a consideration is unnecessary. In what follows we assume $k > A^2 y$.

adults, they create more jobs in the modern sector, leading to an increase in q_{t+1}. We also have shown in the previous section that, if young agents expects that q_{t+1} is higher, they are more willing to take education, leading to an increase in E_{t+1}. In the next section, we show that the mutual dependence between q_{t+1} and E_{t+1} give rise to multiple equilibria, which is another factor of a poverty trap.

4 Equilibrium

In the model presented above, the current state of the economy is sufficiently described by the number of educated among the adult agents, E_t. Given E_t, the first subsection investigates the equilibrium of the economy in a particular period. Then, the second subsection considers the evolution of the economy over generations and explains why a poverty trap emerges.

4.1 Stage Equilibria

Let us consider the behavior of generation t agents (those born in period t), given the number of educated among the previous generation's adults, E_t. To this end, we first need to know how many generation t agents have skilled parents. Similarly to (6), firms in period t creates vacant jobs so that the probability for an generation $t-1$ adult of finding job is $q_t = m_0 + m_1 E_t$. Therefore, $q_t(1-E_t)$ uneducated workers find jobs in the modern sector, and $pq_t(1-E_t)$ of them successfully obtain the required skills by themselves. The number of skilled workers among generation $t-1$ is the sum of educated and self-trained workers, which can be written as a function of E_t:

$$S(E_t) \equiv E_t + pq_t(1-E_t) = E_t + p(m_0 + m_1 E_t)(1-E_t). \tag{7}$$

Observe that function $S(E_t)$ is increasing and concave for all $E_t \in [0,1]$.[9]

[9]By straightforward calculations, $S'(E_t) = 1+p(m_1-m_0)-2pm_1E_t$ and $S''(E_t) = -2pm_1 < 0$. In addition, since it it is assumed that $k > A^2y$ (see footnote 8), $S'(1) = 1-p(m_0+m_1) = 1-pA^2y/k > 0$.

Among the young agents in period t, $S(E_t)$ of them are with skilled parents and $1 - S(E_t)$ of them are with unskilled parents. Recall that children of skilled parents receive education if and only if they expect that they will find a job in the modern sector in the next period with probability higher than or equal to q^* (see equation 2). Recall also that children of unskilled parents never receive education. Therefore, the number of young agents who obtain education is

$$E_{t+1} = \begin{cases} 0 & \text{if } q^e_{t+1} < q^*, \\ S(E_t) & \text{if } q^e_{t+1} \geq q^*. \end{cases} \tag{8}$$

Equation (8) determines the number of educated in period $t+1$, E_{t+1}, as a function of the expected matching probability, q^e_{t+1}. Then, as a function of E_{t+1}, the actual matching matching probability q_{t+1} is determined according to (6). As long as agents are rational, the expected matching probability q^e_{t+1} must coincide with the actual probability q_{t+1}.[10] Therefore, rational expectations equilibrium for this period is given by a pair of q^{t+1} and E_{t+1} that simultaneously satisfy (6) and (8).

Figure 1 displays job creation (6) and schooling decisions (8) in (q^{t+1}, E_{t+1}) space. Throughout the analysis, we assume that the probability of obtaining skill without education is low so that $m_0 \equiv pA^2y/k < q^*$ holds. Observe that if $S(E_t) \geq (q^* - m_0)/m_1 \equiv S^*$, there are two rational expectations (stage) equilibria:

$$(q^e_{t+1}, E_{t+1}) = \begin{cases} (m_0, 0) & \cdots \text{thin market eq.} \\ (m_0 + m_1 S(E_t), S(E_t)) & \cdots \text{thick market eq.} \end{cases} \tag{9}$$

If young agents in period t expect that the matching probability in period $t+1$ is low, they do not receive education. Then, in period $t+1$, firms observing few educated worker are not willing to create many jobs in the modern sector. Thus, the low

Therefore $S'(E_t) > 0$ for all $E_t \in [0, 1]$ follows.

[10]Note that, for simplicity, we rule out mixed strategies. If agents are allowed to choose schooling decisions probabilistically, (q^*, S^*) can be another equilibrium. However, equilibria such as (q^*, S^*) are often ruled out in the literature since they seem 'unstable.'

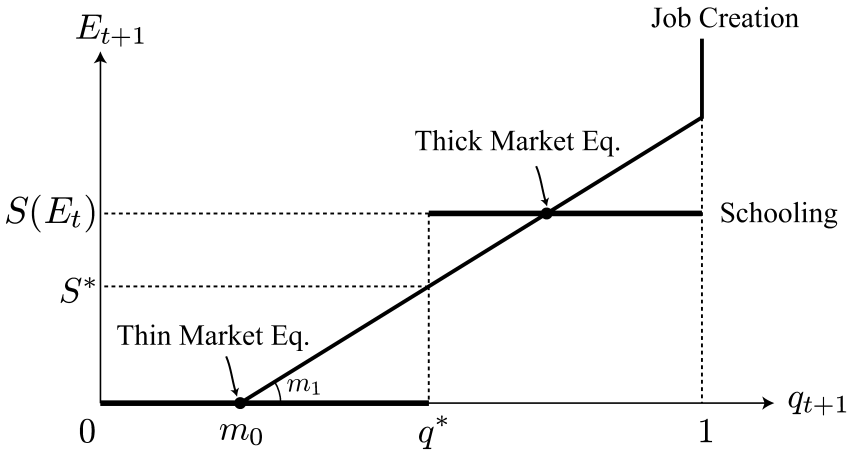

Figure 1: Reaction functions and stage equilibria

matching probability realizes, which we call the *thin market* equilibrium. Conversely, young agents with skilled parents receive education in period t if they expect that the matching probability in period $t+1$ is high. Then, in period $t+1$, firms observing many educated workers create sufficiently many jobs that the matching probability is actually high, which we call the *thick market* equilibrium.

If $S(E_t) < S^*$, only the thin market equilibrium exists:

$$(q^e_{t+1}, E_{t+1}) = (m_0, 0). \tag{10}$$

In this case, the young agents who have skilled parents correctly know that, even when all of them choose to receive education, firms will not create enough jobs such that their devoted time is legitimized.[11]

[11]From (1) and (6), the net benefit of education when all of the fortunate young agents who have skilled parents receive education is $-\underline{e}z + \beta(m_0 + m_1 S(E_t))(1-p)y$. This expression is negative if $S(E_t) < S^*$.

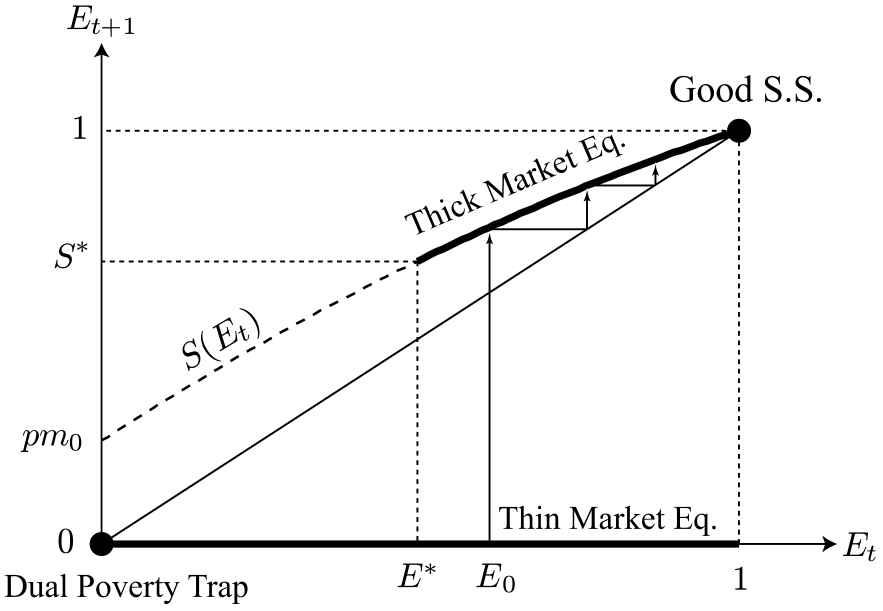

Figure 2: Dynamics and multiple steady states

4.2 Poverty Trap

In what follows, we consider the long-term dynamics of the economy in terms of the number of educated, E_t. From (9) and (10), E_t evolves over generations according to

$$E_{t+1} = \begin{cases} 0 & \text{if } S(E_t) < S^*, \\ \text{either } 0 \text{ or } S(E_t) & \text{if } S(E_t) \geq S^*, \end{cases}$$

as illustrated in Figure 2. We find that there exist two steady state values of E_t: one is a good steady state in which all agents receive education ($E_t = 1$), whereas the other is a poverty trap in which no agent receives education ($E_t = 0$).

Figure 2 also shows an example path converging to the good steady state. Observe that, for the economy to converge to the good steady state, two distinct conditions must be satisfied. First, for every generation, young agents must expect that the probability of finding a job in the modern sector is high so that the thick market equilibrium realizes for all periods. Second, the number of skilled agents in the initial adult generation, $S(E_0)$, must be larger than the threshold level, S^*, since otherwise

the thick market equilibrium does not exist. If either of the above two conditions is violated the economy falls to the poverty trap, as we now describe in detail.

Observe that, regardless of the initial state E_0, the thin market equilibrium is always feasible. Therefore, if the initial young agents happens to have a pessimistic expectation that firms in the modern sector do not create many jobs (which is one of the rational expectations), they do not receive education, and the thin market equilibrium realizes in the next period (i.e., $E_1 = 0$). Obviously, this is a worse outcome than the thick market equilibrium in which many of them obtain jobs in the modern sector. Then, why each of them does not change his or her mind and have a optimistic expectation? The reason is that each agent cannot rationally change one's expectation given that of others: if other agents have a pessimistic expectation, one can rationally expect that other agents do not receive education and that, in the next period, firms observing it do not create enough jobs. Therefore, this bad outcome cannot be escaped unless all young agents somehow coordinate their expectations: i.e., a *coordination trap* emerges.

The selection of equilibrium depends not only on expectation but also on the previous generation's educational attainments. Suppose that the threshold level S^* is larger than pm_0, or equivalently that the time cost of education, $\underline{e}$, is higher than $\beta(1-p)(1+pm_1)m_0y/z \equiv \widehat{e}$. Then, young agents cannot hold an optimistic expectation about the probability of finding a job in the modern sector, unless sufficiently many ($E^* \equiv S^{-1}(S^*)$) agents in the previous generation have obtained education. If the economy starts from $E^0 < E^*$, then the initial young agents necessarily hold a pessimistic expectation since the thin market equilibrium is the only possible equilibrium in the next period, and therefore they choose not to receive education. This means $E_1 = 0 < E^*$, which induces the young agents in period 1 to choose again not to receive education. Such a bad linkage continues over generations, which we call an *intergenerational* trap.

The coordination trap and the intergenerational trap emerge for distinct reasons, but they fortify each other. Suppose that, in some period t, the young agents fails

to coordinate on the optimistic expectation and therefore E_{t+1} realizes. Then, from period $t+1$ on, the only possible equilibrium is the thin market equilibrium. That is, a coordination trap in a certain period triggers the intergenerational trap that persists. Conversely, suppose that the economy has been in the intergenerational trap and then, for some period t, the thick market becomes feasible (e.g., if $\underline{e}$ suddenly falls below $\widehat{e}$). This means that the economy is no longer in the intergenerational trap. However, since young agents in period t know that the probability of finding a job in the modern sector has been low for a number of generations before them, they are likely to think that the thin market equilibrium realizes again in the next period (more precisely, they are likely to think that other young agents will hold a pessimistic expectation). That is, even when the economy can escape from the intergenerational trap, the history that it was in that trap increases the likelihood of the coordination trap in this period, and also in the future.[12]

5 Economic Policies

The previous section has shown that if $E_t = 0 < E^*$, the economy is dually trapped in the sense that both the intergenerational and coordination issues must be resolved before it can archive economic development. This section considers policy prescriptions for escaping from this dual poverty trap.

5.1 Inefficacy of Separate Implementation

When economy is in the intergenerational trap, only a few young agent has skilled parents ($S(E_t) < S^*$). Then the majority of the young agents, with unskilled parents,

[12]Rostow (1990) calls such a phenomenon "long run fatalism," whereas Hoff and Pandey (2004) named it behaviors "historically created social identities." Chamley (2002) shows that a similar equilibrium will be chosen again and again if there is small uncertainty about the structure of the economy.

face a high time cost of education, and therefore do not receive education. This, in turn, lower the number jobs created by firms in the next period, and therefore deters even the fortunate young agents with skilled parents from receiving education. To resolve this trap, one can imagine two types of policy. One is to subsidize education so that the fortunate young agents with skilled parents receive education even when they expect that the probability of finding a job is not very high. Another is to provide free education for some of unfortunate young agents; then firms in the next period will create more jobs, which can induce the fortunate young agents to choose to receive education.

Both types of policy will be effective if the only problem is intergenerational issues. However, in a dually trapped economy, such policies cannot help the economy escape from poverty as long as expectation of the agents, q^e_{t+1}, does not change: i.e., $q^e_{t+1} = pm_0$ and therefore $E_{t+1} = 0$ are always rational expectations equilibrium. Therefore, subsidy or free provision of education should be combined with appropriate policies that convince young agents that their life can be different from their parents' generation (e.g., public awareness campaigns).

Note also that any public awareness campaign never changes the expectation of rational agents unless it is combined with subsidy or free provision of education—the thin market equilibrium is only the feasible equilibrium in the dual poverty trap and the only rational expectation is a pessimistic one.

Therefore, the remedies for the intergenerational issue and the coordination issue must be implemented simultaneously—if they are implemented separately or sequentially, they are most likely to fail. The following discusses the combined policy package in more detail.

5.2 Uniform Subsidy for Schooling

Consider a subsidy program in which any young agent who completes schooling receives $\sigma_t z$, where $\sigma_t > 0$. The expenditure for this program is covered by foreign aids

(the result do not change if it is covered by a non-distortionary tax). Adding $\sigma_t z$ to expression (1) shows that this subsidy in effect lowers the time cost of education, $\underline{e}$ and $\overline{e}$, by σ_t. Unless σ_t is very large, it does not change the behavior of young agents who face the high cost $\overline{e}-\sigma_t$ of schooling.[13] Therefore, the uniform subsidy is virtually directed to privileged agents who have skilled parents.

How much should the size of subsidy σ_t be? By replacing $\underline{e}$ by $\underline{e}-\sigma_t$ in (2), it turns out that subsidy σ_t lowers the threshold number of skilled adults from $S^* \equiv (q^*-m_0)/m_1$ to $S^*-\lambda\sigma_t$, where $\lambda \equiv z/(\beta(1-p)m_1 y)$ is a constant. As shown in Figure 3, the thick market equilibrium becomes possible if

$$S(E_t) \geq S^* - \lambda\sigma_t \;\Leftrightarrow\; \sigma_t \geq (S^* - S(E_t))/\lambda.$$

Suppose that the economy is initially in the dual poverty trap: $E_t = 0 < E^*$. Since the number of skilled adults is $S(E_t) = pm_0$, the subsidy is effective only if $\sigma_t \geq \underline{e} - \widehat{e}$.[14] With subsidy $\sigma_t \geq \underline{e} - \widehat{e}$, an optimistic expectation $q^e_{t+1} = m_0(1+pm_1)$ as well as the pessimistic (or conservative in the sense that it is the same as q_t) expectation $q^e_{t+1} = m_0$ are rational. Therefore, combining a sufficient amount of subsidy *and* a policy instrument that coordinate expectation, the number of agents receiving education can be increased: $E_{t+1} = S(E_t) > E_t$.

How long education should be subsided in this case? Since $S(E_t)$ is increasing in E_t, the required amount of subsidy $(S^* - S(E_t))/\lambda$ falls periods by periods. $S(E_t)$ eventually exceeds S^*, and thereafter subsidy is unnecessary. Even after this take-off periods are finished, young agents must coordinate upon the thick market equilibrium for all periods. This is typically not difficult given that they observe that firms are creating enough jobs for their parents when they form expectations. Over generations, the economy approaches the good steady state, $E_t = 1$.

[13] If σ_t is that large, all agents go to school and economic development is completed in one period. While this is theoretically possible, the magnitude of expenditure required for such a policy would be implausibly huge.

[14] $\sigma_t \geq (S^*-S(E_t))/\lambda = ((q^*-m_0)/m_1-pm_0)\cdot(\beta(1-p)m_1 y)/z = \underline{e}-\beta(1-p)(1+pm_1)m_0 y/z = \underline{e}-\widehat{e}$.

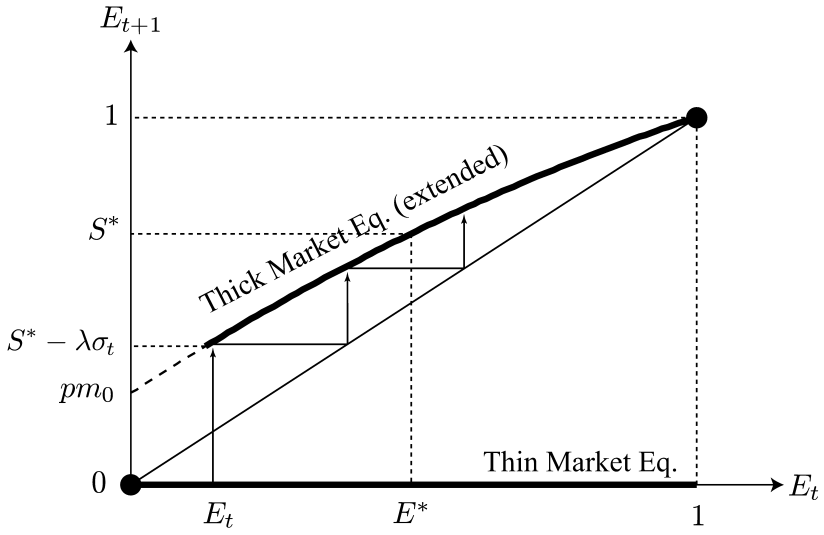

Figure 3: Dynamic effects of subsidy for schooling

It should be noted that even though only agents with skilled parents receive the subsidy, those who are not also benefit from an externality. When the agents receiving subsidy acquire education, firms create more jobs in the modern sector, and agents without education can enjoy more opportunity to self-train themselves when they are hired in the modern sector. In fact, this is the immediate reason why E_t increases over generations.

5.3 Providing free education

The previous subsection has shown that, even though the uniform subsidy for education is virtually directed only for children of skilled parents, if it and appropriate campaigns policy can change the expectation of those fortunate agents, children of unskilled parents also benefit from such a policy package through an externality. However, for various reasons, aid organizations often aims to support directly the most unfortunate people. This subsection examines the effectiveness of such programs.

Consider a policy of providing free education to a certain number young agents. The recipients of 'free education' are compensated not only direct expenses regarding

education (not explicitly considered in the model) but also the opportunity cost of learning (i.e., $\underline{e}z$ or $\overline{e}z$). Suppose that, in each period, the government or an aid organization who implement this program can control the number of recipients, n_t, as well as the number of the children of unskilled parents among the recipients, n_t^u. Then, even in the thin market equilibrium, n_t agents receive education freely. In the thick market equilibrium where agents expect q_{t+1} to be higher than q^*, education is received by all children of skilled parents, $S(E_t)$, and n_t^u young agents not with skilled parents but with provision of free education. Therefore equation (8) changes to

$$E_{t+1} = \begin{cases} n_t & \text{if } q_{t+1}^e < q^*, \\ S(E_t) + n_t^u & \text{if } q_{t+1}^e \geq q^*. \end{cases} \tag{11}$$

Firms' decision of creating job is the same as (6). From (11) and (6), we can derive the dynamics of E_t over generations:[15]

$$E_{t+1} = \begin{cases} n_t & \text{if } S(E_t) + n_t^u < S^*, \\ \text{either } n_t \text{ or } S(E_t) + n_t^u & \text{if } S(E_t) + n_t^u \geq S^* > n_t, \\ S(E_t) + n_t^u & \text{if } n_t \geq S^*. \end{cases} \tag{12}$$

Observe that, as shown by the third line of (12), there is only a thick market equilibrium if free education is provided for more than S^* children (regardless of whether they are children of unskilled parents or not). Obviously, the problems of the dually trapped economy can be solved all at once if the majority of people can receive education freely. However, such a policy typically requires excessively large amount of expenditure in one period, and thus often cannot be implemented within the limited budget (e.g., financial aids).

In the following, we propose a two-step method in which the required budget in each period is smaller. When $n_t < S^*$, the dynamics of E_t, determined by (12), can

[15]Since there are only $S(E_t)$ children of skilled parents, the number of free education recipient among them, $n_t - n_t^u$, cannot exceed $S(E_t)$. Therefore, $S(E_t) + n_t^u \geq (n_t - n_t^u) + n_t^u = n_t$.

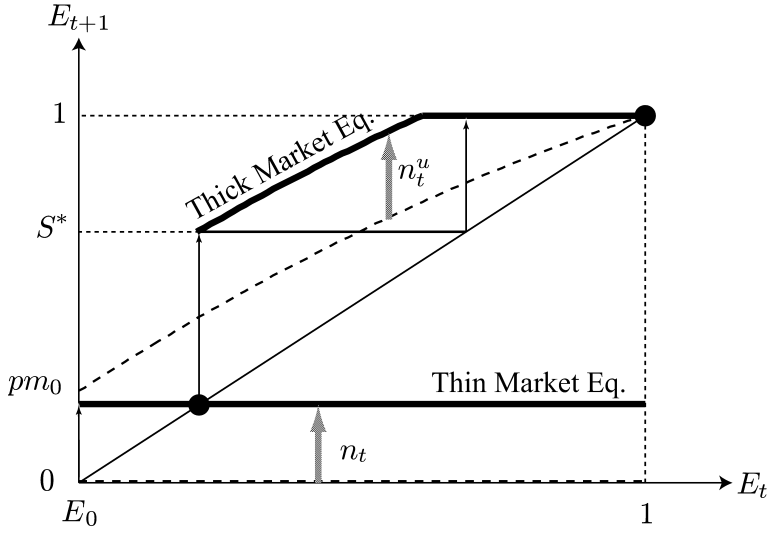

Figure 4: Dynamic effects of free education

be illustrated as in Figure 4. Suppose that the economy is initially in the dual poverty trap and denote the initial period by 0: $E_0 = 0$. If n_1 young agents receive free education in the initial period, they become educated and therefore $E_1 = n_1$. That is, even though n_1 is far smaller than S^* and therefore the economy stays in the thin market equilibrium, the new steady state level of E_t is raised by n_1.

Then, in the following period, let $n_2^u = S^* - S(n_1)$ children with uneducated parent receive free education. $S(E_1) + n_2^u$ reaches the threshold level S^*, and therefore, if combined with appropriate policies that affect the young agents' expectation, such a policy can realize the thick market equilibrium, in which $E_2 = S^*$. Thereafter the economy can trace the development path without further assistance since $E_3 = S(E_2) = S(S^*) > S^*$, and so forth.

Not only this two-step method can diversify the required expenditure over two periods, it can also reduce the total expenditure required before the full development has been done. Let us return to the initial question of who should receive free education. In the first step, the type of recipient does not matter. In that case, as a rule, provision of free education for able students (in the model, those with skilled parents) may

be financially more reasonable.[16] However, it must be noted in the second step the provision of free education must be directed toward the unfortunate children born to unskilled parents. The activities of aid organizations in favor of unfortunate children can be legitimized when such activities are parts of a long-running program.

6 Conclusions

Using an overlapping generations model of search equilibrium, this paper demonstrated that limited intergenerational mobility and a coordination failure mutually reinforce each other, generating a dual poverty trap, Escaping from the dual trap requires a combined implementation of financial assistance for schooling and policies for changing agents' expectation. When financial assistance is given by a uniform subsidy on education, it benefits initially able children who are born to skilled parents but subsequently trickle-down to children in less favorable families. On the other hand, when assistance is given as a form of free education to a limited number of children, it is more effective when it is given to children in less favorable situation. In both cases, there is a threshold level for the size of financial assistance, and the assistance must be continued for certain periods.

We suggest from this research that a combined approach to the intergenerational and coordination traps, not a single approach to either one, is necessary to help low income countries escape from the persistent poverty trap.

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