Educational Cost Differences among Students, Over-education and Educational Policy

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Introduction.

It is known that the pecuniary benefit of education diverges from the cost of education when education yields utility to students (Kodde and Ritzen 1984, Kang 1993) or loan market for education is imperfect (Bell 1984, Kodde and Ritzen 1985, Kang 1993). In a recent study, Perri (2003) suggests another possible reason why there can appear differences between the cost of education and benefit from education. Perri suggests a possibility that, when there exists specialized human capital and students are heterogeneous in a way that non-competing groups exist, the cost of education will not be the sum of direct cost plus net forgone earnings. This study shows that, building a simple three sector model of an economy which is different from Perri’s suggested model, Perri’s results can be extended to the case of non-specific generic human capital. We will show that educational cost diverges from educational pecuniary benefit when students are heterogeneous and human capital is homogeneous [1]. We will examine policy implications when students are heterogeneous and benefit from education is

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greater than the cost for some students.

The three sector model of an economy described in this study can be viewed as a static version of the rural-urban migration model studied by Bencivenga-Smith (1997) or Rauch (1993). In a static version of three sector development models, we will introduce students’ educational decisions and heterogeneity of students. For simplicity of exposition, we will assume urban production requires educated workers while rural production does not demand educated labor (as for empirical evidence for this, see for example, Mazumdar, 1987, Rosenzweig 1988, Williamson 1988). Further, as for urban production, we assume there are two production processes which will be named as urban formal production and informal production. The labor market for educated in urban formal production is assumed to be distorted in a way that wages for the educated in this sector is given above the market clearing level. This wage rigidity has been explained by active labor union (Calvo, 1978) or informational asymmetry (Bencivenga and Smith 1997) or efficient labor market hypothesis (Stiglitz 2002) or public employment of the educated (Upadhyay 1994) or by other reasons (Drazen 1982). As we assume labor market for urban informal sector employment is perfectly competitive, there will not appear educated unemployed despite of wage rigidity of

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[1] Perri suggests that, if some students belong to a non-competing group, then a usual measure of returns to education will tend to understate the cost of other groups of students. As we will explain below, this study shows a reverse possibility that the same measure can overstate the cost of more advantageous group of students. The difference is that, in our model, what is to be empirically observed may be the educational cost of disadvantageous group while in Perri’ model, the cost of advantageous group will be empirically relevant.
urban formal sector (because those educated who can not find a job in formal sector can find employment in informal sector with lower wages), but employment in urban informal sector can be interpreted as underemployment of the educated or overinvestment to education as we will explain in below.

Heterogeneity of students or workers will be defined here as a difference in educational cost required for attaining a certain necessary amount of human capital. We will assume, after educated, heterogeneity is disappeared and every worker has same productivity in jobs for the educated (in this aspect, our model is different from signaling models of education). Suppose there are two groups of students, group 1 and group 2, and the educational cost of group 1 is lower than the corresponding cost of group 2. This difference in educational cost may be explained by the difference in innate ability (Spence, 1973) or difference in schooling technologies for each group (see, e.g., Alderman et. al, 2003,) or differences in family background (see, e.g., Brunello and Checchi, 2005). Assuming educational cost is linear in the number of students, it will be that group 1 students with lower educational cost is educated first, and if the remaining jobs for the educated guarantee profitability of education, then a part of group 2 will be educated until when benefit from education is equalized to the cost of education of group 2. If a part of group 2 choose to be educated and benefit from education is equal to the cost of group 2, then group 1 will enjoy a quasi-rent from education because benefit from education is same for group 1 and 2, but educational cost is lower for group 1. In such a case, the benefit of group 1 from education becomes larger than their educational cost.

We will show that, when two groups are perfectly segregated or when a part of
group 2 choose to be educated, group 1 enjoy a premium or quasi-rent from education originated from lower educational cost. If the higher educational cost of group 2 can be explained by some factors other than their innate ability (e.g., lower income and disadvantageous parental education, or places they are born), such a premium or quasi-rent enjoyed by group 1 would not be justifiable and there would need educational subsidy for group 2 to attain equity of an economy. In the contrary, economic efficiency (in the sense of maximizing the national income) will require absence of over-education or underemployment of the educated and if economic efficiency is to be more important policy target than economic equity, a cut of educational subsidy would be recommended to restrict the number of the educated. This trade-off between equity and efficiency would be a genuine problem in a situation where over-education or educated underemployed prevail while some students suffer from illegitimately higher educational cost. We will discuss this problem within the proposed model. Though the role of education in the following simple model is extremely restricted, intuition underlying our proposed views seems clear, and thus, generality of the proposed result might be claimed.

Now, we will explain our point of view in following steps. In section 2, we will describe the basic framework of an economy. Section 3 introduces heterogeneity of students in the basic framework and explains how quasi-rent from education for group 1 appears and changes as the number of students increases. Section 4 will discuss the policy implications. Concluding remark is given in the final section.
Basic Framework

We will describe a three sector economy. We will name these three sectors as urban formal, urban-informal and rural sector. I should hesitate to add that, for most of our analysis, naming of these three sectors is simply for conveniences of exposition and we will not discuss here what urban informal sector is. We assume urban formal sector and informal sector hire the educated labor and rural sector uses raw labor who are not educated. We will describe a small open economy and we will assume the prices of three goods are given to this economy. Further, for simplicity, we assume physical capital is used only in urban formal sector production.

Students or workers are assumed to be risk-neutral and we assume human capital is homogeneous so that any educated worker is equally productive in urban productions. We can derive the same results without assuming risk-neutrality or homogeneous human capital. As for education, we assume as follows, (a) education itself does not yield utility to students, (b) loan market for education is perfect, (c) education is an indecomposable good and (d) education takes no time. (a) and (b) are assumptions necessary to guarantee “separation theorem” in educational choices (see Kodde and Ritzen 1985, and also, Bell 1984, Kang 1993). Separation theorem means a property that students’educational decision can be made without referring to their utility maximizing choices. With assumption (c), educational choice will become 0 or 1. (d) is given here for simplicity of analysis (see Johnson 1984, Kang 1991). Without this somewhat uncomfortable assumption (d), we must describe a dynamic structure of model, which will complicate our analysis a lot. As our results derived in the proposed simple static
model seem intuitively plausible, we will proceed with assumption (d).

Now, production processes, wage determinations and educational choices will be described as follows:

**Production Functions**

Denoting urban formal sector product by $Y_a$, urban informal sector product by $Y_b$, and rural sector product by $X$, we will define production processes in each sector as

\[
Y_a = f (L_a, K) \quad (1)
\]
\[
Y_b = g (L_b) \quad (2)
\]
\[
X = \beta L_x \quad (3)
\]

where $K$ is physical capital, $L_i$ is labor employed in corresponding sectors ($i = a, b, x$). It is assumed production functions $f$ and $g$ are well-behaved, twice differentiable with usual neoclassical properties. Linearity of production function defined in (3) is assumed here for simplicity [2]. Production of $Y_a$ and $Y_b$ require educated workers so that,

\[
L_a + L_b = L_e \quad (4)
\]

[2] We can derive the same results without assuming linearity in agricultural production. This assumption is often used in studying dual economy models and supported by empirical observations that, for many developing countries, land is not binding factor in rural production and agricultural production uses relatively little or no capital (Ranis, 1988).
where Le means the number of the educated.

**Wage Determination**

Following Harris-Todaro type model of economic development, we will assume wage is given above the market clearing level in urban formal sector. This wage rigidity in urban formal sector has been explained by several authors as we mentioned above and here we will not discuss the possible sources of wage rigidity in this sector. Marginal valuations of wages are assumed to prevail in remaining two sectors, and then, denoting the given price levels by $p_i$ ($i = a, b, x$, respectively), wages are determined as follows,

\[
W_a = p_a \left( \frac{\partial f}{\partial L_a} \right) \quad (5)
\]

\[
W_b = p_b g' (L_b) \quad (6)
\]

\[
W_x = p_x \beta \quad (7)
\]

where $W_i$ is corresponding wage suitably subscripted. As $W_a$ is assumed to be fixed, $L_a$ can be calculated from (5) as $L_a$.

**Educational Decision**

With given assumptions about education, educational decisions become simply life time income maximizations. Educated labor will be hired in urban formal or informal sector and the expected income of the educated will be calculated as [3] :

( expected income of the educated ) $\equiv \omega - C$

\[
= \pi \bar{W}_a + (1 - \pi ) W_b - C
\]
where $\pi$ is $({\overline{L}}_{a}/L)\,$, the probability of employed in urban formal sector and $C$ is the given educational cost (see, e.g., Rauch, 1993, as a model including urban informal sector in a Harris-Todaro type economy). Perfect competition in the labor market of $Y_b$ guarantees full employment of the educated. As it will be $W_a > W_b$, however, employment in $Y_b$-sector can be interpreted as underemployment of the educated or over-education. We would think in a way that those educated who could not find a job in urban formal sector will seek employment in that sector while working in informal sector and we will define the number of the over-educated by the number of $L_b$ in this study.

Now, this expected income of the educated must be equalized to rural sector income or income of the uneducated. Overall labor market equilibrium will be obtained when the following equation is satisfied,

$$\omega (L_e) - C = W_x \quad (8)$$

With given population $N$, $\overline{L}_a + L_b + L_x = L_e + L_x = N$, we can solve (8) for $L_b$ or $L_x$. Labor allocation over the three sectors is determined by (8) and given population constraint and, as soon as labor allocation is determined, production levels of each sector and incomes of workers are all determined with given prices, capital stock, and technologies.

[3] We describe a single period static model, and thus, we will interpret the expected wages like this. At the beginning of a period, students make educational decisions based on the expected income of the educated as defined above, and at the end of a period, those who are lucky enough to find jobs in urban formal sector are selected by a random process.
Graphical explanation will be very helpful in our further discussions and I will describe the equilibrium condition (8) as in Fig. 1. Note that (5) and (6) are labor demand schedules in each sector, and thus, \( \omega \) can be viewed as a (composite) labor demand schedule for the educated. One can easily confirm that \( \omega \) is strictly decreasing in \( L_e \). In Fig. 1, it is assumed that the given \( W_a \) is sufficiently high and \( L_e \geq \bar{L}_e \). The point \( E \) in Fig. 1 is a market equilibrium and \( L_e^* \) is the equilibrium number of the educated. Capital accumulation in urban formal sector (which will shift demand curve outward) or decreasing in educational cost will apparently increase the number of the educated.

**Heterogeneous students and quasi-rent for the educated**

This section introduces a possible heterogeneity among students in the above basic model. We assume there are two group of students, group 1 and group 2.
These two groups are heterogeneous in the sense that $C_1 < C_2$, i.e., the required educational cost of group 2 is larger than that of group 1. We further assume that, after schooling, heterogeneity among students or workers is disappeared so that group 1 and 2 are equally productive in urban production. Only difference between the two groups lies in the different educational costs, which can be explained by ability difference, or differences in family background such as parental education and income levels. Or, as several studies suggested (see references), we could think in a way that group 1 is in urban area wherein they can acquire necessary human capital more efficiently.

There can arise three possible cases, which will be named as Stage 1, Stage 2 and Stage 3. Stage 1 is the case that only a part of group 1 is educated and the remaining part of group 1 and all of group 2 are not educated. Stage 2 is the case of perfect segregation such that all of group 1 is educated and none of group 2 chooses to be educated. Stage 3 is the case that all of group 1 and a part of group 2 are educated. Given demands for the educated, the extent of difference between $C_1$ and $C_2$, and the productivity of the uneducated will characterize the economy as Stage 1 or 2 or 3 in the following way. Firstly, let us define $N_i$ as the number of group $i$ ($i = 1, 2$), $N_1 + N_2 = N$. Then, $\omega (N_1) = \pi W_a + (1 - \pi) W_b (N_1 - \bar{L}_a)$ will play the key role in following analysis, where $W_b (N_1 - \bar{L}_a)$ means $W_b$ evaluated at $L_b = N_1 - \bar{L}_a$. Readers would note that, in any cases, group 1 is firstly educated, and so, if some of group 1 are not educated then it will not be profitable for any of group 2 to choose education.

Suppose $\omega (N_1) < W_x + C_1$, then some of group 1 will not choose education and economy will be characterized as Stage 1. If $W_x + C_1 \leq \omega (N_1) \leq W_x + C_2$, then all
of group 1 will choose education but none of group 2 will be educated. Perfect segregation between the two groups will arise in this case and economy will be characterized as Stage 2. Lastly, if \( \omega (N_i) > W_x + C_2 \), then all of group 1 and a part of group 2 would find education a profitable choice and economy will be in Stage 3.

Fig. 2 describes the economy under Stage 1. In Fig. 2, the point A represents the magnitude of \( \omega (N_i) \). As given \( W_x + C_1 \) is larger than \( \omega (N_i) \), a part of group 1, \( N_1 - L_e^* \) in the figure, will not be educated. It goes without saying that, in such a case, none of group 2 will choose to be educated. Fig. 3 describes the most interesting case of perfect segregation. In Fig. 3, \( \omega (N_i) \), represented by the point A, is larger than \( W_x + C_1 \), but smaller than \( W_x + C_2 \). In such a case, \( L_e^* \), the equilibrium number of the educated is \( N_1 \) and the economy experiences quantity constrained equilibrium at A. The benefit from the education is larger.
than the opportunity cost of education, \( W_x + C_1 \), and the educated would enjoy quasi-rents from education, the distance \( AB \) in the figure. Capital accumulation in urban sector will expand the demands for the educated as the figure shows, which will increase quasi-rent from education, from \( AB \) to \( CB \), without corresponding increase in the number of the educated. Fig. 4 depicts the economy in Stage 3 which will be characterized by sufficiently large demands for the educated. Now, as \( \omega (N_1) \) is larger than \( W_x + C_2 \), a part of group 2 will become educated, \( Le^* > N_1 \). Group 1 enjoys quasi-rent from education in this stage too, depicted by the distance \( DB \) in the figure. Interested readers could notice that this premium or quasi-rent \( DB \) in Fig. 4 is the maximum obtainable quasi-rent from education, which is exactly the difference \( C_2 - C_1 \). As the demands for the educated workers expand with capital accumulation or economic growth, an economy would evolve from the state of Stage 1 to 2, and then, to Stage 3. Thinking in this way, we could assume that Stage 1 represents the state
of low-income countries, Stage 2 the middle income countries and Stage 3 the high income countries.

An interesting feature of this model is that, in Stage 2, capital accumulation or even decrease in the educational costs of group 1 and 2 (possibly by the active government educational policies) does not result in the increases in the number of the educated unless subsidy to group 2 is sufficiently large (see Fig. 3). If the above model has some empirical relevance, it would be that educational subsidies which lower the educational costs in middle income countries may not effective in expanding the number of students.

**Policy Implications.**

In this section, policy implications will be discussed with an added assumption
that the higher educational cost of group 2 is due to inefficient (parental or formal) schooling technology. Denoting this measure of inefficiency in group 2 schooling by $\theta$, we define that,

$$C_1 = C_2 - \theta$$

Especially in Stage 2 and 3 where the schooling inefficiency of group 2 becomes binding factors to an economy, educational subsidy to group 2 may be necessary to attain equity of society and efficiency of group 2 schooling. In the contrary, efficiency of overall economy in the sense of maximizing national output with given number of $L_a$ would require absence of over-education by restricting the number of educated workers in the production process $Y_b$ [4]. Depending on one’s views about social objective function, opposite educational policies will be recommended. This section will make this point clear and I want to leave this as an open question to readers.

Firstly, let us consider educational policy of reducing the educational cost of group 2. We will confine our discussion to Stage 3, but readers would notice that

[4] Assuming inflexibility of labor market of urban formal production can not be improved by a government policy, national output maximization will require an equality between the given agricultural productivity and marginal productivity (net of educational cost) of the educated labor in urban informal production. As educational decisions are made upon expected wages of the educated which is quite larger than the wage received by labor in urban informal production, marginal productivity net of educational cost in urban informal sector becomes lower than the agricultural productivity. Basically, this is the reason why $L_b$ is called over-educated in this study and economic efficiency will require a restriction in the number of the over-educated.
the same arguments can be applied to Stage 2. In Stage 3, educational subsidy for a group 2 student as much as $\theta$ will be necessary to remove illegitimate disadvantage burdened by group 2 students. Tax-cum-educational subsidy policy is, of course, feasible and required tax rate under balanced budget constraint will increase as the number of the students increases, as we will show in below.

Suppose lump-sum tax is levied to every worker at the same rate. Denoting this lump-sum tax rate as $t$, educational decision equation (8) is changed into (for group 2 student in Stage 3),

$$\omega - (C_i + \theta) - t = W_x - t \tag{9}$$

Government budget constraint is,

$$tN = (L_e - N_i) \theta \tag{10}$$

In (10), $L_e - N_i$ is the number of group 2 students. (9) and (10) are two equations in $L_e$ and $t$ with given $\theta$ and other exogenous variables. We can examine some comparative static results from (9) and (10), which shows a property that $L_e$ and $t$ move in the same directions to changes in exogenous variables. For example, from (9) and (10),

$$\partial L_e / \partial K = (\partial \omega / \partial K) / (\partial \omega / \partial L_e) > 0$$
$$\partial t / \partial K = - \theta N (\partial \omega / \partial L_e) (\partial \omega / \partial K) > 0$$

Economic growth or capital accumulation in urban formal sector increases the
number of the educated among group 2, and thus, requires an increase in tax rate for educational subsidy.

However, overall economic efficiency would require opposite educational policy. Given wage rigidity in high-paying jobs for the educated, economic efficiency is obtained when the marginal productivity of low-paying jobs for the educated (Lb) minus the educational cost is equal to the marginal productivity of non-educated workers (in the sense of maximizing national output). Formally, economic efficiency is obtained with given $W_a$ when the following relation is held in Stage 3,

if $W_b (N_1 - L_a) - C_2 > W_s$, then efficient condition is $W_b (L_b) - C_2 = W_s$
otherwise, $W_b (L_b) - C_1 = W_s$.

If the production of $Y_b$ is sufficiently productive such that $W_b (N_1 - L_a) - C_2 > W_s$, i.e., if education is profitable to group 2 even when the educational benefit is measured by $W_b$, then the economic efficiency condition with given $L_a$ requires equalization of $W_b$ with $W_s + C_2$. As $\omega$ is larger than $W_b$ for every $L_e$, $L_e^{**}$ satisfying $W_b (L_e^{**}) = W_s + C_2$ is less than $L_e^*$ defined by $\omega (L_e^*) = W_s + C_2$. Therefore, to obtain economic efficiency with given $L_a$, taxation to education or reduction in current educational subsidy which will limit the number of the educated from $L_e^*$ to $L_e^{**}$ will be required.

**Concluding Remarks.**

In this study, we described how economic benefit of education can diverge from
the cost of education when students are heterogeneous in their given educational technologies and environment. We examined some policy implications when heterogeneity of students becomes binding factors in labor markets for the educated.

We described an economy in a following situation: there are two jobs for the educated — high-paying job and low-paying job. Labor market for high-paying job is not flexible and students’ decision to be more educated is based on the expected income of the educated. As expected income of the educated is larger than the productivity or wage level of low-paying jobs for the educated, over-education could prevail. Further, we have supposed, on the basis of empirical literature, that some students face higher educational cost than others for the same education owing to environment they are involved. We have shown that these two groups of students with different educational costs can segregated perfectly, and if this is the case, economic growth will not expand the number of the educated. In such a case, educational subsidy policy will not be effective unless the subsidy to disadvantaged students is sufficiently large.

Problems related to trade-offs between equity and efficiency arise in this framework. With given labor market rigidity of high paying jobs for the educated, economic efficiency in the sense of maximizing national output will require the minimization of the number of the over-educated. In the contrary, economic equity will demand removal of illegitimate cost differences among students via subsidy policies to group 2.

The model we have studies in this paper has several limitations. Especially, we
described a static single period model in explaining and thinking the problems which are basically dynamic in their structure and the role of education is extremely restricted in this study. Nevertheless, some implications we can derive from this study seem intuitively plausible and would remain valid in different settings of models.

References.


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