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The Prospect of Migration, Sticky Wages, and "Educated Unemployment"

by

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Abstract

An increase in the probability of work abroad, where the returns to schooling are higher than at home, induces more individuals in a developing country to acquire education, which leads to an increase in the supply of educated workers in the domestic labor market. Where there is a sticky wage-rate, the demand for labor at home will be constant. With a rising supply and constant demand, the rate of unemployment of educated workers in the domestic labor market will increase. Thus, the prospect of employment abroad causes involuntary "educated unemployment" at home. A government that is concerned about "educated unemployment" and might therefore be expected to encourage unemployed educated people to migrate will nevertheless, under certain conditions, elect to restrict the extent of the migration of educated individuals.

1. Introduction

It is disheartening to witness unemployment, and it is particularly worrisome to have educated workers left idle when human capital is scarce who could, if employed, help significantly to pull a developing country out of poverty. A policy-maker who seeks to curb unemployment has to address three issues: the labor market attributes of the unemployed; the reasons for their being unemployed; and the effective policy response. Since the third of these issues depends on resolving the first and second, we have sought in our earlier work to characterize the unemployed, and to identify the root causes of unemployment. In Fan and Stark (2007a) we showed how the prospect of international migration from a developing country can entail "educated unemployment" in that country: when the expected returns to investment in education (skill acquisition) increase, as when workers face a positive probability, $p > 0$, of working in a richer, technologically advanced country where the returns to human capital are higher than in the home country, workers find it optimal to acquire more human capital. If a worker fails, however, to secure highly-paid employment abroad, an event occurring with probability $(1-p) > 0$, he may well elect to hold back on getting a job in his country of origin if this enables him to try again for more highly-paid employment. This suggests to us that "educated unemployment" could be a voluntary adjustment to the introduction of the prospect of working abroad.

In the range of possible measures to combat unemployment, one of the remedies most frequently considered is improving the skills and professional qualifications of

the unemployed; but this is not going to be much help when there is already a pool of unemployed who are educated and skilled. "Educated unemployment" is a notable labor market feature in many developing countries. In their influential textbook on Development Economics, Gillis et al. (1996) allude to the Sri Lankan experience as a striking example, noting that in the 1970s, half of the country's new university graduates were unemployed. Boudarbat (2006) reports that in 2000 the unemployment rate of university graduates in Morocco was about four times that of individuals who had had less than six years of schooling.[1] A 2007 Arab Labor Organization (ALO) report, quoted in the Egyptian newspaper Al-Masri al-Yawm, notes that "the trend of higher unemployment among literates applies to countries throughout the Arab world, with a ratio of 5:1 in Morocco and 3:1 in Algeria," and that in Egypt, "the rate of unemployment is ten times higher in the educated section of the population than among illiterates."[2]

The phenomenon of educated unemployment in developing countries contrasts with the pattern of unemployment in developed countries. In the latter, the unemployment rate and educational attainment are strongly negatively correlated (Ashenfelter and Ham, 1979). The causes of "educated unemployment" in developing countries have attracted relatively little attention in the development economics literature. Early and recent exceptions, respectively, are Bhagwati and Hamada (1974), and Fan and Stark (2007a). Bhagwati and Hamada (1974) construct a model with labor market rigidities in which the wage rate of educated workers is fixed. They argue that

by affecting people's psychology, a high wage rate for educated workers in a foreign country can prompt an increase in the fixed wage rate of the educated in the home country. A higher fixed wage leads to increased unemployment. In the model of Bhagwati and Hamada (1974), unemployment is involuntary. And as already noted, in a job-search framework, Fan and Stark (2007a) established a causal analytical relationship between the probability of international migration from a developing country and "educated unemployment" in that country. In that research, unemployment is voluntary.

As early as the 1980s, the argument that "educated unemployment" and international migration are closely linked attracted the attention of policy-related researchers who were concerned about the causal relationship between the two. Reading some of that research is quite telling. King (1987), who studied the brain drain and educated unemployment in the Philippines, noted (p. 101): "In the case of the Philippines, however, a very high demand for college education has accompanied high rates of unemployment and underemployment and generally low real wages. Data on immigration ... reflect how the demand for education has been heavily influenced and encouraged by expected rates of return from employment in overseas labour markets." Tullao (1982), who studied the problem of unemployed nurses in the Philippines, stated (p. 45): "The demand for nursing education in the Philippines is influenced significantly by international migration. The private profitability of investing in nursing education is greatly increased when the probability of emigration is included in the investment

calculus. Filipinos would not demand nursing education in the light of low wages and limited employment opportunities in the domestic market as reflected in the low rate of return to nursing education without migration." A related interesting observation is that "educated unemployment" appears to have pervaded developing countries in which the official language is English (such as the Philippines, India, and Bangladesh in Asia (Muta, 1990)), or French (the former French colonies in Africa (Zoctizoum, 1980)). Education acquired in these countries is relatively readily transferable to the developed world, making skilled migration viable. Consequently, these countries have simultaneously experienced a discernible brain drain and "educated unemployment."

In the current paper we show how "educated unemployment" is exacerbated by the prospect of international migration. Our study of the link between the prospect of migration and unemployment in a fixed-wage framework complements Fan and Stark (2007a), suggesting that the prospect of migration from a developing country could entail both voluntary and involuntary unemployment in that country. An increase in the probability of working abroad, where the returns to schooling are higher than at home, encourages more individuals in a developing country to acquire education, which leads to an increase in the supply of educated workers in the domestic labor market. Where there is a sticky wage-rate, the demand for labor at home is constant. With a rising supply and constant demand, the rate of unemployment of educated workers in the domestic labor market increases. Thus, the prospect of employment abroad causes involuntary "educated unemployment" at home.

Whereas Fan and Stark (2007a) studied "educated unemployment" in a job search setting without invoking the assumption of an imperfect labor market, the current paper investigates "educated unemployment" drawing on the perception that quite often the market for educated labor does not clear because the going wage for educated workers is higher than that which would equate labor demand with labor supply. The assumption of a fixed or sticky wage is central to Keynesian economics, and is supported by considerable empirical evidence (see, for example, the survey by Romer, 2006). Bhagwati and Hamada (1974) argue that there is an additional important reason for the existence of a fixed or sticky wage in the modern sectors of developing countries: "The presence of international income-inequality implies that, for the educated elite which is better informed about the developed world, and more integrated therewith regarding notions of a 'good life' and related values, the salary level demanded *and* fixed by the elite groups themselves tends to reflect the salary levels of comparable groups in the more developed countries … Thus, we can postulate a socio-economic situation in which the real wage levels of the educated elites are set by fiat, legislation, unionization, etc., at levels which reflect the degree of response to the international-elite-integration effect…" (Bhagwati and Hamada 1974, pp. 20-21). The argument of Bhagwati and Hamada (1974) can be interpreted further upon application of the "fair wage" theory of Akerlof and Yellen (1990): the "international-elite-integration effect" tends to increase the "fair wage" demanded by elite groups in developing countries.

The usefulness of this extension goes beyond merely demonstrating that the causal relationship between the prospect of migration and unemployment reported in our earlier work is not model-specific; whether unemployment is voluntary or involuntary obviously matters for the design of public policy (Romer, 2006): as already noted, the efficacy of policies to alleviate unemployment is not independent of the reasons for that unemployment. We contend that a sticky-wage model portrays accurately a reality in which, as considerable empirical and policy-related research has suggested, a great many university graduates compete for relatively few jobs in the economy's public sector, where the wage rate is fixed. We show that the prospect of migration can exacerbate an already prevailing mismatch between the supply of, and demand for skills. And we spell out a corresponding policy response.

The considerations and behavior of the government are studied closely. If the government is not concerned about the problem of unemployment, we show that it will not implement any measure to restrict the migration of skilled individuals. If the government is concerned about the problem of unemployment, however, we show that under certain conditions, it will actually restrict the migration of skilled individuals.

2. A model of involuntary "uneducated unemployment"

Consider a world that consists of two countries: a home country, H, and a foreign country, F. Country H is developing and is poorer than developed country F. In H, there is a large number of individuals who are identical *ex ante*, and who are risk neutral.[3]

An individual can be either skilled or unskilled. If an individual chooses to become skilled, he has to incur the cost of education, which is constant at the level c.

In the economy of the home country, there is a single good that can be produced by constant-returns-to-scale technologies. One technology is a "modern" production technology. We assume that this technology is human capital (or skilled labor) intensive. The other technology is "traditional" production technology. We assume that this technology is physical (or unskilled) labor intensive. For the sake of simplicity, we further assume that the only production input in the modern sector is skilled labor, while the only production input in the traditional sector is unskilled labor.

Specifically, the production function that is based on the traditional technology is described by

$$Y^u = G(L^u) \equiv \Phi L^u, \tag{1}$$

where Y^u and L^u are the output and the unskilled labor force of the traditional sector, respectively[4], and $\Phi > 0$ is a constant. In a competitive economy, the wage rate of an unskilled worker is equal to his marginal product, namely to Φ.

The production function that is based on the modern technology is described by

$$Y^s = F(L^s),$$
$$F'(L^s) > 0, F''(L^s) < 0, \tag{2}$$

where Y^s and L^s are the output and the skilled labor force of the modern sector, respectively. While the modern sector is also competitive, we assume that due to an institutional rigidity in the labor market for skilled workers, the wage rate of skilled workers is fixed. We denote this wage by Ω. Naturally, we assume that $\Omega > \Phi$. Thus, the number of skilled workers who are employed in the home country, which we denote by Γ, is determined by the standard condition

$$F'(\Gamma) = \Omega. \tag{3}$$

Let the skilled individuals in the home country face a prospect of working in the foreign country. The wage rate in the foreign country for a skilled worker is denoted by w^f. To reflect the facts that the foreign country is developed (technologically advanced) and the home country is poorer, we assume that $w^f > \Omega$. Due to a policy of selective migration by F, it is only educated (skilled) individuals from H who have a chance to work in and hence migrate to F.[5] We denote the probability of being selected into work in F by p, where $0 < p < 1$ is a constant.

Let the total number of skilled individuals remaining in H (an endogenously determined variable) be denoted by N. The unemployment rate of the educated individuals in H is thus

$$u \equiv \frac{N - \Gamma}{N} = 1 - \frac{\Gamma}{N}. \tag{4}$$

Let the (lifetime) earnings of an educated unemployed individual be normalized at zero.[6] Hence, if an individual chooses to be skilled, his expected net earnings are given by[7]

$$pw^f + (1-p)\big[(1-u)\Omega + u0\big] - c$$
$$= pw^f + (1-p)(1-u)\Omega - c. \tag{5}$$

We make two additional assumptions:

$$pw^f + (1-p)\Omega - c > \Phi; \tag{6}$$

$$F'\big[(1-p)L\big] < \Phi, \tag{7}$$

where L denotes the total pre-migration number of individuals in H. The meaning of (6) is that absent unemployment, not all individuals will work in the traditional sector. The meaning of (7) is that absent unemployment, not all individuals work in the modern sector. Clearly, (6) will be satisfied if w^f and Ω (the wage rates of the skilled) are sufficiently larger than Φ (the wage rate of the unskilled), and (7) will be satisfied for a sufficiently large L and when p has an upper limit.

We now show that together, (6) and (7) entail "educated unemployment."

Lemma 1: *If (6) and (7) are satisfied, then*

$$u > 0.$$

Proof. We prove the lemma by contradiction. Suppose the reverse, namely that $u = 0$. Upon inserting $u = 0$ into (5) we see, recalling (6), that all the individuals in H will choose to be skilled. Yet, if all the individuals in H so choose, the number of skilled individuals in H after migration occurs will be $(1-p)L$, that is, if $u = 0$, then $\Gamma = (1-p)L$. However, from (7) it follows that in such a case the marginal product of a skilled worker will be less than Ω, which in turn implies that the wage rate Ω cannot clear the labor market of skilled workers, although recalling (3), it has to. This results in a contradiction. □

Having shown that $u > 0$, we insert (4) into (5) and rewrite the expected net earnings of a skilled individual as

$$pw^f + (1-p)\Omega\frac{\Gamma}{N} - c. \tag{8}$$

Recalling the assumption that the individuals are risk neutral, we know that the number of individuals who choose to acquire education is determined by

$$pw^f + (1-p)\Omega\frac{\Gamma}{N} - c = \Phi. \tag{9}$$

We then have the following proposition.

Proposition 1:

$$\frac{dN}{dp} > 0.$$

Proof. Totally differentiating (9) with respect to p and N, and rearranging, we get that

$$\frac{dN}{dp} = \frac{w^f - \Omega \dfrac{\Gamma}{N}}{(1-p)\Omega\Gamma} N^2 > \frac{w^f - \Omega}{(1-p)\Omega\Gamma} N^2 > 0. \tag{10}$$

□

Proposition 1 shows that an increase in the probability of working abroad leads to an *increase* in the number of skilled individuals remaining in the home country. Interestingly, although a sticky wage in the skilled labor market limits employment opportunities in the skilled sector, the increase in the number of skilled individuals remaining in the home country can nonetheless benefit the country in the long run.[8] For example, considerable empirical evidence indicates that the educational attainment of children is closely related to the educational level of their parents.[9] Thus, this paper points to a possible new source of a "brain gain," complementing the gains identified in Stark et al. (1997, 1998), and Stark and Wang (2002).

We next show that an increase in the probability of working abroad increases the

unemployment rate of skilled workers in the home country.

Proposition 2:

$$\frac{du}{dp} > 0.$$

Proof.

From Proposition 1, it follows that

$$\frac{du}{dp} = \frac{du}{dN}\frac{dN}{dp} = \frac{\Gamma}{N^2}\frac{dN}{dp} > 0. \qquad (11)$$

□

The intuition underlying Proposition 2 is as follows. An increase in the probability of working abroad induces more individuals to acquire education, which leads to an increase in the supply of skilled workers in the domestic labor market. Due to a sticky wage rate, the demand for skilled workers is constant. Thus, an increase in the probability of working abroad increases the unemployment rate of skilled (educated) workers in the domestic labor market.

3. Government intervention

Since in our model unemployment is caused by the sticky wage in the skilled labor market and hence is involuntary, the call for government intervention is quite obvious.

It is noteworthy that in this vein, the current paper differs substantially from the framework in Fan and Stark (2007a) where unemployment is completely voluntary. It is a semi-consensus (macro) economics that a government intervention is warranted if and only if the market does not function efficiently, as when this malfunctioning is due to sticky wages in the labor market.[10]

Let us define the government's objective function as follows:

$$G(N,u),$$ (12)

where

$$\frac{\partial G(N,u)}{\partial N} > 0$$
$$\frac{\partial G(N,u)}{\partial u} \leq 0.$$ (13)

This specification means that the government rejoices when the number of individuals who receive education and remain the home country increases, and that it laments when the rate of unemployment increases. In this section, as in the received literature (Stark and Wang, 2002), the choice variable of the government is "*p*."

Clearly, and for example, because of migration restrictions in the foreign country, it is unrealistic to assume that all the skilled individuals migrate. We denote the maximum level of *p* that the home country faces by $\bar{p} < 1$. Also, the case where the

optimal solution is $p = 0$ is clearly of limited interest. Thus, we might just as well assume that $p = 0$ is never the optimal solution for the government. But then the optimal solution of the government, which we denote by p^*, is obtained by solving the following first-order condition for the maximization of (12) with respect to p:

$$\frac{\partial G(N,u)}{\partial N}\frac{dN}{dp} + \frac{\partial G(N,u)}{\partial u}\frac{du}{dp} \geq 0, \tag{14}$$

with strict equality holding if $p^* < \bar{p}$. Namely, if (14) holds with strict inequality, then the optimal solution of the government problem is the corner solution, $p^* = \bar{p}$. Then, we first have the following proposition.

Proposition 3: If $\dfrac{\partial G(N,u)}{\partial u} = 0$, then $p^* = \bar{p}$.

Proof. If $\dfrac{\partial G(N,u)}{\partial u} = 0$, then (14) reduces to

$$\frac{\partial G(N,u)}{\partial N}\frac{dN}{dp} \geq 0. \tag{15}$$

From Proposition 1, we know that $\dfrac{dN}{dp} > 0$. Recalling the first part of (13), we know that (15) will always hold with strict inequality. Thus, in this case, we have that $p^* = \bar{p}$. $\square$

What Proposition 3 implies is that had the government not been concerned about the problem of unemployment, it would not have implemented any measure to restrict the migration of skilled individuals.

We next consider the more applicable case in which the government does care about the problem of unemployment, namely the case of $\dfrac{\partial G(N,u)}{\partial u} < 0$. Recalling (11), we know that

$$\frac{du}{dp} = \frac{\Gamma}{N^2} \frac{dN}{dp} .$$

(16)

Inserting (16) into (14), we get that

$$\frac{\partial G(N,u)}{\partial N} \frac{dN}{dp} + \frac{\partial G(N,u)}{\partial u} \frac{\Gamma}{N^2} \frac{dN}{dp} \geq 0 .$$

(17)

Since $\dfrac{dN}{dp} > 0$, we have from (17) that

$$\frac{\partial G(N,u)}{\partial N} + \frac{\partial G(N,u)}{\partial u} \frac{\Gamma}{N^2} \geq 0 .$$

(18)

Rearranging (9) yields

$$N = \frac{(1-p)\Omega\Gamma}{\Phi + c - pw^f}. \qquad (19)$$

Then, inserting (19) into (4), we get that

$$
\begin{aligned}
u &= 1 - \frac{\Gamma}{N} \\
&= 1 - \frac{\Phi + c - pw^f}{(1-p)\Omega}.
\end{aligned} \qquad (20)
$$

We insert $p = \bar{p}$ into (19) and (20), and then we insert (19) and (20) into (18). If in this case (18) holds, then $p = \bar{p}$ is the optimal solution; otherwise, $p = \bar{p}$ is not the optimal solution. We sum up the preceding analysis in the form of a proposition.

Proposition 4: $p^* < \bar{p}$ if at $p = \bar{p}$

$$\frac{\partial G(N,u)}{\partial N} + \frac{\partial G(N,u)}{\partial u}\frac{\Gamma}{N^2} < 0. \qquad (21)$$

Proposition 4 implies that if the government is concerned about the problem of unemployment then, given some reasonable conditions, it will restrict the migration of skilled individuals. Clearly, the more the government is concerned about the problem of unemployment, namely the higher the absolute value of $\frac{\partial G(N,u)}{\partial u}$, the more likely condition (21) will hold, and hence the more likely the government will restrict migration. This implication is in contrast with the conventional wisdom that a

government that is confronted by the problem of "educated unemployment" should encourage skilled individuals to migrate. Our analysis suggests that adherence to this conventional wisdom will result in more individuals choosing to acquire advanced education, which will only exacerbate the problem of "educated unemployment."

4. Conclusion

"Educated unemployment" is a pronounced phenomenon in many developing countries. We developed a simple model aimed at shedding further light on the causes of this phenomenon. Our model consists of three essential ingredients: multiple sectors of production, sticky wages in the modern sector, and international migration. Due to the stickiness of the wage rate for skilled workers, the number of skilled workers who are employed in the modern sector may be lower than the number of skilled workers in the economy. Our analysis raises the possibility that when a developing economy opens up to the migration of its skilled workers, the resulting equilibrium number of idle skilled (educated) workers could well be exacerbated by the prospect of international migration. Furthermore, we analyzed the government's policy landscape. We showed that if the government is not concerned about the problem of unemployment, it will not take steps to restrict the migration of skilled individuals. However, if the government cares about unemployment, then under some certain conditions it will end up restricting the migration of skilled individuals.

The causal relationship between the state of the labor market in the country of origin (for example experiencing unemployment) and migration from the country is

well researched. It is usually argued in the received literature that the direction of the causality is from unemployment at origin, to migration from origin. The causal relationship established in this paper between the prospect of migration and the state of the labor market in the country of origin (such as it experiencing unemployment), with causality running from the prospect of migration from origin to unemployment at origin, is relatively little researched, yet warrants close attention, especially empirical scrutiny. In policy-related research, it is often asserted that opening an economy to the migration of its skilled workers when there is skilled unemployment at home could help remedy a wasteful underutilization of human capital. Our paper raises the possibility of a bleaker, opposite outcome. Moreover, the mechanism that we have depicted suggests, for example, that when a government opens its economy to migration, it needs simultaneously to improve the efficiency of the labor market.[11] Without such an improvement, the response of skilled workers to the prospect of migration could well exacerbate unemployment in the educated workforce.

For the sake of simplicity, we employed the simplest model to highlight the essential points of interest. In follow-up research, the perspectives delineated and developed in this paper can be further extended in several directions. For example, our analysis is presented in a static framework. If we were to extend the model to a dynamic framework, then it would be necessary to model the government in a setting in which it faces a "time-consistency" constraint of the Kydland and Prescott (1977) type: when the probability of working abroad is lower, fewer individuals will choose to

acquire education, which will result in a lower rate of "educated unemployment." However, the government may be tempted to allow more educated individuals to migrate to further reduce the problem of educated unemployment. Yet doing so will result in the government losing "reputation" since in future periods, individuals in the country will believe that the government will allow maximal migration of educated individuals, which will invalidate the policy of migration control in reducing educated unemployment. Also, our model considered only the policy instrument of migration control. An alternative policy instrument is to "unstuck" (lower) the sticky wage. This can be quite difficult. To this end, we would need to fully study and understand the political, social, and economic procedures and costs of reducing the level of sticky wages, say those of civil servants. This foray aimed at unraveling another route for achieving the social optimum is an intriguing topic of inquiry.

References

Akerlof, George A. and Janet L. Yellen, "The Fair Wage-Effort Hypothesis and Unemployment," *Quarterly Journal of Economics* 105 (1990): 255-283.

Ashenfelter, Orley and John Ham, "Education, Unemployment, and Earnings," *Journal of Political Economy* 87 (1979): S99-S116.

Bhagwati, Jagdish N. and Koichi Hamada, "The Brain Drain, International Integration of Markets for Professionals and Unemployment: A Theoretical Analysis," *Journal of Development Economics* 1 (1974): 19-42.

Boudarbat, Brahim, "Unemployment, Status in Employment and Wages in Morocco," *Applied Econometrics and International Development* 6 (2006): 165-184.

de la Croix, David and Michel Philippe, *A Theory of Economic Growth: Dynamics and Policy in Overlapping Generations*, New York: Cambridge University Press (2002).

Fan, C. Simon and Oded Stark, "International Migration and 'Educated Unemployment'," *Journal of Development Economics* 83 (2007a): 76-87.

Fan, C. Simon and Oded Stark, "The Brain Drain, "Educated Unemployment," Human Capital, and Economic Betterment," *Economics of Transition* 15 (2007b):

629-660.

Fan, C. Simon and Oded Stark, "Looking at the "Population Problem" through the Prism of Heterogeneity: Welfare and Policy Analyses," *International Economic Review* 49 (2008): 799-835.

Gillis, Malcolm, Dwight H. Perkins, Michael Roemer, and Donald R. Snodgrass, *Economics of Development*, New York: W.W. Norton (1996).

Hanushek, Eric, "Measuring Investment in Education," *Journal of Economic Perspectives* 10 (1996): 9-30.

Jasso, Guillermina and Mark R. Rosenzweig, "Selection Criteria and the Skill Composition of Immigrants: A Comparative Analysis of Australian and U.S. Employment Immigration," in Jagdish Bhagwati and Gordon Hanson (eds), *Skilled Migration Today: Phenomenon, Prospects, Problems and Policies*, Oxford: Oxford University Press (2009): 153-183.

King, A.M., "Philippines," in Yogis Atal and Luca Dall'oglio (eds), *Migration of Talent: Causes and Consequences of Brain Drain,* Bangkok: UNESCO Principal Regional Office (1987): 15-117.

Kydland, Finn E. and Edward C. Prescott, "Rules Rather Than Discretion: The

Inconsistency of Optimal Plans," *Journal of Political Economy* 85 (1977): 473-491.

Mathew, Elangikal Thomas, *Employment and Unemployment in Kerala: Some Neglected Aspects*, Thousand Oaks, CA: Sage (1997).

Muta, Hiromitsu, *Educated Unemployment in Asia*, Tokyo: Asian Productivity Organization (1990).

Romer, David, *Advanced Macroeconomics*, New York: McGraw-Hill (2006).

Stark, Oded, Christian Helmenstein, and Alexia Prskawetz, "A Brain Gain with a Brain Drain," *Economics Letters* 55 (1997): 227-234.

Stark, Oded, Christian Helmenstein, and Alexia Prskawetz, "Human Capital Depletion, Human Capital Formation, and Migration: A Blessing or a "Curse"?" *Economics Letters* 60 (1998): 363-367.

Stark, Oded and Yong Wang, "Inducing Human Capital Formation: Migration as a Substitute for Subsidies," *Journal of Public Economics* 86 (2002): 29-46.

Tullao, Tereso S., Jr., "Brain Drain, Education and Unemployment," *Philippines Budget Management*, (1982): 41-45.

Zoctizoum, Yarrise, "Unemployment Among Educated Young People in the French-Speaking Developing Countries," in Morio, Simone and Zoctizoum, Yarrise, (eds), *Two Studies on Unemployment Among Educated Young People*, Paris: UNESCO (1980): 75-129.

[1] In a fascinating account of the labor market of Kerala, Mathew (1997) reports that in 1983, the unemployment rate of university graduates in urban Kerala was 11.34 percent for males and 25.69 percent for females, which is much higher than the unemployment rate of those who had no education (3.52 percent for males, and 1.52 percent for females), and the unemployment rate of those who had up to primary education (6.73 percent for males, and 8.43 percent for females).

[2] See http://en.rian.ru/world/20070802/70181395.html.

[3] We could, as in Stark and Wang (2002), extend the model to allow for heterogeneity in workers' ability to acquire skills. However, such an extension will not change the essence of our argument.

[4] We could have considered a case wherein production in the modern sector involves not only skilled workers but also fixed inputs such as capital and infrastructure. However, we would assume then that the owner of the fixed inputs is either the government, or is absent.

[5] Such a selective migration policy appears to have been implemented, and increasingly more strictly. For example, in May 2006, the lower house of the French parliament passed a selective migration law that allows entry into France of only skilled workers. See also Jasso and Rosenzweig (2009).

[6] As in any fixed-wage model, unemployment is a short-run phenomenon. In the long run, we assume that every unemployed educated individual will take a job in the traditional sector and receive the unskilled wage rate. For notational convenience, however, we might just as well normalize such an individual's total lifetime income at zero.

[7] Conceptually, we may imagine that an educated individual participates in two

consecutive lotteries after acquiring education: the first lottery is the lottery of working in F. The probability of a successful draw in this lottery is p. The second lottery is the lottery of being employed in the modern sector in H. The probability of a "successful" draw in this lottery is the product of two probabilities, $(1-p)$ and Γ/N. (See also (8) below.)

[8]Fan and Stark (2007b) make a similar point in a different context in which an increase in the average level of human capital of the last generation can facilitate a "take off" of the economy in the current generation.

[9]Hanushek (1996) and de la Croix and Michel (2002) provide comprehensive surveys of the empirical literature. Fan and Stark (2008) present a theoretical analysis of the intergenerational transmission of human capital that is related to parental human capital.

[10] For example, see the survey in Romer (2006).

[11] For example, to the extent that the public sector is part of the modern sector, the government will need to revise the wage set there. Interestingly, if one reason for the wage in the public sector being set high is to induce workers to acquire education, the opening of the economy to international migration by educated workers could act as a substitute for the public sector wage-setting incentive.