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Policy Repercussions of "The New Economics of the Brain Drain"

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Abstract

In this paper I delineate novel policy repercussions suggested by my research on "The New Economics of the Brain Drain." In section 1, I provide a succinct account of the model that inspires the derivation of several new policy implications. In sections 2 through 5, I present the policy implications. I address the following questions: When and how can migration to a country substitute for educational subsidies in that country? Who should be admitted when the receiving country cares about the wellbeing of the unskilled workers who stay behind in the sending country? How and why the incentives to form human capital in the sending country will have a paradoxical effect on the migration policy of the receiving country? How and why will the level of a separating tax imposed by the destination country be reduced by the human capital formation calculus in the sending country? I conclude that the policy implications delineated in the paper illustrate the power and appeal of "The New Economics of the Brain Drain" as a framework for rethinking the formation of sound policy responses to migration.

Keywords: The New Economics of the Brain Drain; Policy formation

In this paper I delineate novel policy repercussions yielded by my research on "The New Economics of the Brain Drain." In section 1 I provide a succinct account of the model that inspires the derivation of new policy implications. In sections 2 through 5 I present the policy implications.

1. The benchmark model of Stark and Wang (2002)

Consider a small open economy without migration. The economy produces a single good, the price of which is normalized at 1. The large number of identical workers is a constant *N*. The worker's twice-differentiable cost function of forming human capital is $c(\theta)=k\theta$, where θ is the worker's human capital (the total sum of his efficiency units of labor), and $k>0$ is a constant. The economy-wide output is $Q=Nf(\theta)$, where $f(\theta)=\alpha\ln(\theta+1)+\eta\ln(\overline{\theta}+1)$ is the concave, per-worker production function, $\alpha>k$ is a constant, $\overline{\theta}$ is the economy-wide average level of human capital, and $\eta>0$ represents the externalities accruing from the average level of human capital. Workers supply their human capital inelastically, having acquired it instantly, though not costlessly, at the beginning of their single-period life. Workers borrow the requisite funds to support the human capital formation at a zero rate of interest.

Since labor is the only production input, the gross earnings per worker are simply equal to output per worker, that is:

$$f(\theta)=\alpha\ln(\theta+1)+\eta\ln(\overline{\theta}+1) \qquad \text{for } \theta>0. \tag{1}$$

The coefficients α and η measure the private returns and the social returns of human capital, respectively. The objective of a worker is to maximize his net earnings, that is, his gross earnings minus the cost of forming human capital:

$$W(\theta)=\alpha\ln(\theta+1)+\eta\ln(\overline{\theta}+1)-k\theta \qquad \text{for } \theta>0. \tag{2}$$

Since $\frac{\partial W(\theta)}{\partial \theta} = \frac{\alpha}{\theta+1} - k$ (and since $\frac{\partial^2 W(\theta)}{\partial \theta^2} = \frac{-\alpha}{(\theta+1)^2} < 0$), the worker's chosen level of human capital is:

$$\theta^* = \frac{\alpha}{k} - 1 > 0 . \tag{3}$$

From the assumption that there are N identical workers in the economy it follows that the average level of human capital in the economy is also θ^*. Therefore, the net earnings per worker are:

$$W(\theta^*) = (\alpha + \eta)\ln\frac{\alpha}{k} - \alpha + k \quad . \tag{4}$$

The following lemma will be helpful in subsequent analysis.

Lemma: For any $x > 1$, $x \ln x > x - 1$.

Proof: Consider the function $z(x) = \ln(x^x e^{1-x})$. We know that $z(1) = 0$. Since $z(x) = x \ln x - (x-1)$ and $z'(x) = \ln x > 0$ for $x > 1$, the Lemma follows.

By substituting $x = \frac{\alpha}{k}$ and applying the Lemma, it can be easily seen that $W(\theta^*) > 0$. However, since the social returns to human capital are not internalized by the individual worker, θ^* is not the socially optimal level of human capital. Only when the externalities that accrue from the economy-wide average level of human capital are taken into account, are the net earnings per worker socially maximized. To do so, we consider the function:

$$W(\theta) = \alpha \ln(\theta+1) + \eta \ln(\theta+1) - k\theta \qquad \text{for } \theta > 0 . \tag{5}$$

The social planner optimizes by choosing the level of θ that brings (5) to a maximum. Since $\frac{\partial W(\theta)}{\partial \theta} = \frac{\alpha+\eta}{\theta+1} - k$ (and since $\frac{\partial^2 W(\theta)}{\partial \theta^2} = \frac{-(\alpha+\eta)}{(\theta+1)^2} < 0$), the socially optimal level of human capital is:

$$\theta^{**} = \frac{\alpha+\eta}{k} - 1 > 0 . \tag{6}$$

Clearly, since $\eta > 0$, $\theta^{**} > \theta^{*}$. If a worker were to choose to form this level of human capital, his net earnings would be:

$$W(\theta^{**}) = (\alpha+\eta)\ln\frac{\alpha+\eta}{k} - (\alpha+\eta) + k . \tag{7}$$

Since $W(\theta^{**}) - W(\theta^{*}) = (\alpha+\eta)\ln\frac{\alpha+\eta}{\alpha} - \eta = \alpha\left(x\ln x - (x-1)\right)$, where $x = \frac{\alpha+\eta}{\alpha} > 1$, it follows, upon applying the Lemma, that $W(\theta^{**}) > W(\theta^{*})$. Net earnings per worker attained under the social planner's choice of θ are higher than those achieved when workers choose how much human capital to form without taking into consideration the human capital externality. By construction, $W(\theta^{**})$ represents the highest net earnings per worker achievable, given the production technology. Unfortunately, in his optimization problem, an individual worker perceives the economy-wide average level of human capital only as a parameter that cannot be affected by his decisions; in a large economy, no individual can dent the average level of human capital. Thus, the prevailing level of human capital will be θ^{*}.

Stark and Wang (2002) next introduce the possibility of a governmental intervention aimed at bringing the private optimal level of human capital to coincide with the social optimal level of human capital. They show that a strictly positive probability of migration to a technologically advanced destination country in which the returns to human capital are higher than in the home country increases the optimal level of human capital that individuals elect to acquire. The underlying idea is that higher expected returns to human capital away from home create an incentive to acquire more human capital at home. In the wake of the human capital adjustment process, an individual either ends up as a higher skilled migrant worker in the technologically advanced country F, or he stays as a higher skilled worker in the home country, H. Country F's production technology is given by $\hat{f}(\theta) = \beta \ln(\theta+1) + C$, where $\beta > \alpha + \eta$ and $C \geq 0$ are constant and exogenous to the model. Workers in H obtain the F-country gross earnings with probability $p > 0$. With probability $1-p$ they work in H with whatever human capital that they elected to form, obtaining gross earnings as per (1). The (risk neutral) worker's expected gross earnings are therefore

$$F(\theta) = p\left[\beta \ln(\theta+1) + C\right] + (1-p)\left[\alpha \ln(\theta+1) + \eta \ln(\bar{\theta}+1)\right] \tag{8}$$

for $\theta > 0$, $\beta > \alpha + \eta$, $p > 0$, and $C \geq 0$. The function of the worker's expected net earnings becomes

$$\tilde{W}(\theta) = p\left[\beta \ln(\theta+1) + C\right] + (1-p)\left[\alpha \ln(\theta+1) + \eta \ln(\bar{\theta}+1)\right] - k\theta \tag{9}$$

and the revised optimal level of human capital is then

$$\tilde{\theta}* = \frac{p(\beta-\alpha)+\alpha}{k} - 1. \tag{10}$$

Stark and Wang (2002) show that by setting $p = p*$ where

$$p* = \frac{\eta}{\beta-\alpha} \tag{11}$$

and $0 < p* < 1$, the government forges a "golden" result: $\tilde{\theta}* = \theta**$; individuals are lead out of their own accord to form the socially optimal level of human capital. Stark and Wang (2002) then show that when $p = p*$, $0 < p* < 1$, the level of wellbeing of *all* the individuals, both the ones who left and the ones who stay behind with more human capital that they would have formed in the absence of the migration prospect, is strictly higher than when $p = 0$.

With this summary account of the basic model in place, I will now turn to a presentation of several examples, based on the average, of the model's policy fallout.

2. When and how can migration to a country substitute for educational subsidies in that country?

2.1 From Stark and Wang (2002) we know that individuals form human capital that falls short of the socially optimal level of human capital. Assuming that all the individuals in a country are identical, this human capital formation must entail an average level of human capital that is lower than the socially optimal average level of human capital. By lowering, via educational subsidies, the cost of acquiring human capital, the human capital formed will be increased, that is, the average level of human capital will be raised. This is obvious. In the presence of migration to a country, what will the average level of human capital be in the country if it accepts migrants? If N and M are the numbers of the natives and migrants, respectively, and if θ_N and θ_M are the levels of human capital of the natives and migrants respectively, then $\bar{\theta}$, the average level of human capital, is

$$\bar{\theta} = \frac{N\theta_N + M\theta_M}{N+M}. \qquad (12)$$

Since

$$\frac{\partial\bar{\theta}}{\partial M} = \frac{N\left(\theta_M - \theta_N\right)}{\left(N+M\right)^2},$$

it follows that migration raises the average level of human capital if the migrants are better educated than the natives, thereby reducing the need to resort to educational subsidies.

2.2 A simple average tale thus illustrates how migration, by boosting the average level of human capital in the receiving country, can reduce its need to resort to educational subsidies. The arrival of skilled migrant workers can crowd out subsidies aimed at inducing skill acquisition by native workers.

3. Who should be admitted when the receiving country cares about the wellbeing of the unskilled workers who stay behind in the sending country?

3.1 Let labor be the only production input in the home country H. Let the output, hence the gross earnings, of any worker in H be an increasing function both of the worker's own skill level and of the economy-wide average skill level. Let there be two types of workers: low-ability unskilled workers, and high-ability skilled workers. Let the fractions of the two types be $\frac{1}{2}$ each. Let the level of skill of the unskilled be $\underline{\theta}$, and let the level of skill of the skilled be θ^*, where $\theta^* > \underline{\theta}$. The low-ability workers cannot acquire a skill level that is higher than $\underline{\theta}$. The high-ability workers can choose how much human capital to acquire. Let $\underline{\theta}$ be normalized at zero. Then, to begin with, the average skill level in H is

$$\frac{1 \cdot 0 + 1 \cdot \theta^*}{2} = \frac{\theta^*}{2} . \tag{13}$$

Let the earnings of a worker whose skill level is $\theta \geq 0$ be higher in the developed country of destination, D, than in H. Let θ neither depreciate nor appreciate upon migration, and let the employers in D discern θ accurately and instantly upon a migrant's arrival. Hence, any H country worker will be better off if he migrates to D.

3.2 If a fraction of the unskilled leave, what will the effect be on those who stay behind? Suppose that $\frac{1}{4}$ of the unskilled leave. Then, the new average skill level at H will be

$$\frac{\frac{3}{4} \cdot 0 + 1 \cdot \theta^*}{\frac{7}{4}} = \frac{4}{7}\theta^* . \tag{14}$$

Since $\frac{4}{7}\theta^* > \frac{1}{2}\theta^*$, all those who stay behind gain by virtue of the new average skill level at H being higher.

3.3 Suppose, alternatively, that $\frac{1}{4}$ of the skilled workers leave. Clearly, the consequent average skill level at H will be

$$\frac{1 \cdot 0 + \frac{3}{4}\theta^*}{\frac{7}{4}} = \frac{3}{7}\theta^*. \tag{15}$$

Since $\frac{3}{7}\theta^* < \frac{1}{2}\theta^*$ (recalling (13)), the new average skill level is lower and every H country worker who stays behind will therefore be worse off.

In a static framework, a D country that cares about the wellbeing of the unskilled workers who stay behind at H, if faced with a choice of either admitting unskilled workers from H or skilled workers from H, will thus want to admit unskilled workers from H.

3.4 But suppose that, in line with the "New Economics of the Brain Drain" (Stark, 2005), we have a dynamic setting: the prospect of migrating to D induces the skilled (high-ability) workers to acquire more human capital, θ^{**}, such that $\theta^{**} = \frac{4}{3}\theta^* + \varepsilon$, where ε is any positive number, however small: instead of studying, say, three years of engineering, the high-ability workers study a little bit more than four. Then, not only will the unskilled who stay behind gain from the migration of the skilled, they will gain *more* than they would have gained if $\frac{1}{4}$ of the unskilled migrated. If $\theta^{**} = \frac{4}{3}\theta^* + \varepsilon$, then the new average level of human capital at H will be

$$\frac{1 \cdot 0 + \frac{3}{4}\left(\frac{4}{3}\theta^* + \varepsilon\right)}{\frac{7}{4}} = \frac{4}{7}\theta^* + \frac{3}{7}\varepsilon > \frac{4}{7}\theta^*. \tag{16}$$

Hence, if $\theta^{**} > \frac{4}{3}\theta^*$, the unskilled who stay behind will indeed gain more.

3.5 The lesson to be drawn from this back-of-the-envelope exercise is that the migration policy of a benevolent D cannot be oblivious to the incentives that the policy triggers, to responses to that policy, and to the impact of those responses on the wellbeing of those who stand to be affected by the policies indirectly.

4. How and why the incentives to form human capital in the sending country will have a paradoxical effect on the migration policy of the receiving country?

4.1 Let there be n workers in H: $\frac{n}{2}$ low-ability workers with skill level $\underline{\theta}=2$, and $\frac{n}{2}$ high-ability workers with skill level $\theta^{*}=6$, such that skill level θ^{*} was formed when the probability of migration to D was $\frac{1}{4}$. The skill level $\underline{\theta}$ was formed independently of the probability of migration and cannot be affected by (changes in) that probability. Country D is not able to decipher the skill levels of individual migrant workers; it can only decide on the numbers that it admits. At the outset, the average skill level at H, $\overline{\theta}$, is 4, as is the average skill level of the migrant workers, assuming that the shares of the workers of the two skill types in a migration flow are the same as their shares in the population of H.

4.2 Let D seek to have the average skill level of the migrants at a level higher than 4, indeed, higher than 5, which is the current average level of human capital at D. If D could select, it would admit only those whose skill level is 6, thereby achieving its objective. But it cannot. So let us consider the effect if D *increases* the probability of migration from $\frac{1}{4}$ to, say, $\frac{1}{2}$ such that, as a consequence, while those whose skill level is $\underline{\theta}$ do not acquire any additional human capital, the high-ability workers now acquire $6+2+\varepsilon$ units of human capital: instead of studying, say, six semesters of engineering, the high-ability workers now study a little bit more than eight. The new average level of human capital of the migrants (like that of those who stay behind at H), will be

$$\frac{2+(6+2+\varepsilon)}{2}=5+\frac{\varepsilon}{2}>5. \qquad (17)$$

Thus, D benefits, the unskilled workers who stay behind benefit (since $5+\frac{\varepsilon}{2}>4$), and the skilled workers who migrate benefit (assuming that they expose their $6+2+\varepsilon$ units of human capital to a better paid environment at D). If the skilled workers who stay behind are also better off, then everyone is better off.

Note that raising the probability of migration from $\frac{1}{4}$ to $\frac{1}{2}$ entails a doubling of the numbers of *both* skilled *and* unskilled migrants.

4.3 A lesson to be drawn from this back-of-the-envelope exercise is that the dynamic consequences of a migration policy could lead to a policy that appears somewhat paradoxical: in order to overcome the adverse repercussions of the presence of unskilled workers in the incoming migration flow, *more* unskilled workers have to be admitted.

5. How and why will the level of a separating tax imposed by the destination country be reduced by the human capital formation calculus in the sending country?

5.1 Consider an asymmetric information setting. Both the low-ability unskilled workers and the high-ability skilled workers find it advantageous to migrate, since the average of their earnings in the destination country D, $\frac{1}{2}(20+100)=60$, is higher than their type-specific earnings in their home country, H, which are 10 and 30, respectively. If D resorts to an entry tax as its instrument of migration control, and if D seeks to have only the skilled come in, it will need to impose a tax of $50+\varepsilon$; the unskilled workers will then stay behind, while the skilled, left with post-tax earnings of $100-(50+\varepsilon)=50-\varepsilon$, will still find it advantageous to migrate. There is, though, no apparent reason not to impose a higher tax on the skilled; indeed, they will still come even if the tax is as high as $70-\varepsilon$. Thus, D will seek happily to levy this higher entry tax, filling its coffers with the maximal tax revenue. However, such a policy ignores the effect of the tax on the very incentive to acquire skills: when faced with relatively low earnings in D, the high-ability workers in H will elect to acquire only a correspondingly low skill level, their productivity will be lower, and they will receive lower pay - say 80. But then, if it is desirable for D to have skilled workers from H coming in, $70-\varepsilon$ will not be feasible (incentive compatible).

5.2 This example illustrates why the choice of an entry tax aimed at separating the skilled from the unskilled cannot be independent of the response of the skilled to the incentive to acquire skills which, in turn, is affected by the level of the tax. Put differently, the choice of the level of a migration entry tax by D cannot be de-linked from the human capital formation calculus at H.

A rigorous analysis that gives rise to this example is provided in Stark, Casarico, and Uebelmesser (2009).

6. Conclusion

The policy implications delineated in this paper constitute examples from the average. Even such a simple set suffices to illustrate the power and appeal of “The New Economics of the Brain Drain.” Hopefully, the implications will stimulate further thinking and discussion leading to sound policy responses to migration.

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