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Human capital acquisition and international migration in a model of educational market ☆

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ABSTRACT

This paper analyzes international high-skilled migration caused by financial frictions in educational market. I develop a model of learning in which acquisition of skill is only possible through personal interaction with a skilled individual; the income of the skilled is sensitive to financial constraints for the unskilled. Cross-country differences in such constraints have a multiplicative effect on the skill premium, causing outmigration of skilled individuals from a less developed country. I study welfare implications of such brain drain for the sending and receiving countries. Although it makes more difficult skill acquisition in the sending country, the unskilled may still be better off: increased cost of skill acquisition is offset by higher income once the skill has been acquired. For the receiving country, I identify a phenomenon of *immiserizing immigration*: a depletion of the stock of skill in the sending country due to brain drain hinders further production of skill, which may hurt the receiving country. Additionally, I find that increased openness of the sending country to migration and the resultant accelerated brain drain increase the incentives of the country government to reduce financial frictions.

1. Introduction

Despite the unprecedented development of long-distance communication technologies, knowledge continues to diffuse from one person to another mainly by means of personal interaction. One can become a scientist only through a continuous interaction with other scientists. In stable political environments, virtually all successful politicians have an experience of interaction with politicians from previous cohorts. In most jobs, young workers learn from experienced workers. Teaching services continue to be local in nature, and university professors in the United States do not expect that their jobs will ever be exported to India. Even the acquisition of skills that are labeled by economists as "low", such as taxi driving, require frequent personal interaction with people who have been in the business for some time. Numerous studies find that the first destination of immigrant workers is usually a location where many immigrants from the same country live,[1] despite the fact that the new immigrants, whose skills are usually similar to that of incumbent immigrants, would face less competition on the job market in other locations.

Given the local nature of transmission of productive knowledge, part of the welfare gain from enhanced skills is likely to be shifted from the learners (young, unskilled workers) to the teachers (experienced, skilled workers) through a bargaining process, pushing current income flow of the learners below their current marginal product of labor, and vice versa, raising the income of the teachers. Further, a compensation for education may have a multiplicative effect on the willingness to acquire skill and on the return to skill. When skilled individuals increase their earnings by receiving a compensation for education, unskilled individuals have an increased willingness to acquire skill. Since the best way to acquire skill is to interact with and learn from existing skilled individuals, the latter get a further increase in earnings, further increasing the willingness of the unskilled to acquire skill. This multiplicative positive effect on demand for education offsets the traditional law of demand and makes the demand for education highly inelastic.

With inelastic demand, even small exogenous cross-country differences in the educational technology, such as differences in student access to educational credit, may lead to large differences in the return to skill and create a basis for brain drain from a country with a poor access to educational credit. The objective of this paper is to examine, theoretically, the effects of international migration of skilled individuals caused by such institutional differences, in a model of learning that captures the above mentioned stylized facts.

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[1] E.g. Winters et al. (2001), Bauer et al. (2007), Munshi (2003); Vergalli (2006) provides a theoretical analysis of the location choice of migrants.

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The proposed theory differs from the existing literature that tends to explain international migration by the differences in how much *current* output migrants can produce in different countries. The theoretical model developed in this paper examines migration between countries with identical fundamental parameters (productivity of skilled and unskilled, the learning technology), with the only exogenous heterogeneity being the heterogeneity of institutions that facilitate the transfer of wealth from the unskilled to the skilled in compensation for education.

I find the welfare effects of international migration to be ambiguous for both sending and receiving countries. For the sending country, the departure of a fraction of skilled workers reduces the number of potential teachers and makes it more difficult to acquire skill (the negative effect of openness). On the other hand, increased country openness increases the return to skill, which makes unskilled individuals, who expect to acquire skill in the future, better off (the positive effect of openness). I show that with very high transaction costs in the home educational market, the negative effect of brain drain dominates, while with medium values of transaction costs, the positive effect may overwhelm once the magnitude of migration becomes sufficiently high.

For the receiving country, the welfare effects of skilled immigration are generally positive. I show however that once the skilled emigration *rate* becomes sufficiently high, the *number* of migrants begins to diminish, which hurts not only the sending but also the receiving country. The explanation is simple: if skilled individuals are an essential input of new skill production in the sending country, an excessive brain drain may reduce the number of skilled individuals in the sending country by so much that it can no longer supply skilled individuals to the receiving country. I label this phenomenon as *immiserizing immigration* by analogy with Bhagwati's immiserizing growth in the international trade literature. The immiserizing immigration effect is also reminiscent of the overfishing effect in the Economics of natural resources.

Additionally, I study the welfare gains of the sending country from a marginal increase in the quality of educational credit institutions. I find that such gain is always higher in a more open country: the welfare of the unskilled is more sensitive to the quality of educational institutions when the skilled have a better opportunity to leave. Thus, the increased openness and the resultant increased brain drain help "discipline" a home country government to improve institutions facilitating education.

Although there exists an extensive literature on the diffusion of knowledge[2] and on positive externalities of human capital,[3] virtually all of this literature assumes that all the welfare gains of skill acquisition accrue only to those who acquire the skill. Park (1997) is, to my knowledge, the only discussion of the fact that part of the welfare gain may be shifted to those skilled from whom new skill has been acquired. The main focus of Park (1997), however, is different from that of this paper, and does not include the examination of migration patterns.

Much of the modern literature that relates education and migration begins with Stark et al. (1997) and Mountford (1997) who point out the potential incentive effect of a brain drain prospect: unskilled individuals who face a prospect of emigration have an incentive to study more if emigration is conditioned on skill acquisition. According to the theories, brain drain may thus increase the total number of skilled in the world, and, assuming that emigration is a probabilistic outcome, may even increase the number of skilled that remain in the sending country. Beine et al. (2001) and Beine et al. (2008) take the theory to cross-country data; Chand and Clemens (2008) test the theory in the context of migration from Fiji to New Zealand. All of these studies assume that the technology of skill acquisition does not include the presence of individuals already possessing the skill, the assumption challenged in this paper.

The relationship between financial constraints and human capital accumulation has received a considerable attention in the economic development literature. At the theoretical level, Galor and Zeira (1993) is a seminal contribution to the area that shows that, in the presence of financial constraints, a higher initial income inequality may lead the economy to a poverty trap. Mejia and St-Pierre (2008) is a more recent theoretical investigation of a related topic. On the empirical side, the issue has been studied, among others, by Flug et al. (1998) who discover a significant and robust negative effect of the financial constraints on the human capital accumulation; Schady (2004) examines the effect of macroeconomic crises on education.

The role of this paper is combine, theoretically, the two strands of the literature – the one that relates educational attainment with migration prospects, and the one that relates educational attainment with financial frictions – to analyze their interaction. In the remainder of the paper, I first analyze a one-country ("closed economy") dynamics and a steady-state, and then proceed to a two-country setting to model migration between the two countries.

2. Closed economy

2.1. Overview

2.1.1. Demographics

This is a general equilibrium dynamic model. Time is discrete; at each moment of time t, there is a continuum of mass L of individuals that are endogenously divided into two types — skilled and unskilled. I denote the fraction of skilled individuals in the economy in period t by m_t. Between any two time periods, a randomly selected fraction $1-\delta$ of all individuals dies. The same mass of new individuals is born; therefore, the total population remains constant. Every newly-born individual is unskilled.

2.1.2. Consumption and savings

There is one consumption good, which is produced using the only input – skill – in a manner specified below. The price of the good is normalized to unity. A representative individual maximizes his discounted stream of consumption by:

$$U_{i,t_0} = \begin{cases} \sum_{t=t_0\ldots\infty} \beta^{t-t_0} c_{i,t} & \text{if } c_{i,t} \geq 0 \forall t \\ -\infty & \text{otherwise} \end{cases} \quad (1)$$

where t_0 is the birth date of the individual, t is the index of time, $c_t \geq 0$ is consumption at time t, and $\beta<1$ is the discount factor. Given that death is a random occurrence, individuals do not know the moment of their death and calculate their utility on an infinite time horizon. I assume that the death probability is already built into the discount factor (thus $\beta<\delta<1$), and therefore the parameter δ does not explicitly enter the decision-making process.

Individuals earn a stream of (stochastic) income which depends on skill and which is detailed below; for now, denote it $y_{i,t}, t \geq t_0$. Individuals borrow and save at rate r_t. To model financial frictions, we make a somewhat simplistic assumption that those who need to borrow one dollar actually have to borrow $K \geq 1$ dollars; the difference of $K-1$ dollars is the sunk cost due to financial frictions. Throughout the paper, we refer to K as the "transaction costs'; it reflects the quality of financial institutions in a country.

Denote by

$$a_{i,t} \equiv y_{i,t} - c_{i,t} \quad (2)$$

[2] Jovanovic and Rob (1989) is an example of theoretical analysis; Keller (2002) is an empirical account of geographic localization; Keller (2004) contains a review of literature on knowledge spillovers.

[3] This literature starts with Lucas (1988); applications of this concept to migration include Stark et al. (1997), Mountford (1997), Stark and Wang (2002), and Stark and Zakharenko (2012).