International Review of Economics and Finance 28 (2013) 19–25

Contents lists available at ScienceDirect

International Review of Economics and Finance

journal homepage: www.elsevier.com/locate/iref

Rethinking the brain drain: Dynamics and transition

Lukasz Byra

Faculty of Economic Sciences, University of Warsaw, Dluga Street 44/50, 00-241 Warsaw, Poland

ARTICLE INFO

Available online 11 May 2013

JEL classification:
D62
F22
I30
J24

Keywords:
Human capital formation
Migration
Brain drain
Externalities
Dynamics
Social welfare

ABSTRACT

This paper injects a time dimension into the static, instantaneous adjustment model of Stark (2004). The paper assumes that in response to the incentive conferred by the prospect of migration, the average level of human capital – the source of a productivity-enhancing externality – changes gradually rather than immediately. This might seem to imply that, contrary to what is claimed in Stark (2004), the welfare of the workers who do not migrate, and who early on in the transition period adjust their level of human capital in response to the prospect of migration, declines because these workers do not face a higher average level of human capital. Rather surprisingly, however, the paper finds that the welfare result of Stark (2004) is robust to the relaxation of his assumption of instantaneous adjustment: even "pioneer" workers, who form more human capital in an environment in which the prevailing average level of human capital is approximately at the pre-migration level, are strictly better off when there is a prospect of migration than when there is not.

1. Introduction

A decade ago, Stark (2004) introduced the concept of a socially beneficial brain drain. The main innovation of his model was to show that the migration of skilled workers from a developing country can result in a welfare gain to *all* the citizens of the developing country, migrants and non-migrants alike: as long as the probability of this migration is small, both the migrants and those who stay behind stand to benefit from the human capital formation response of skilled workers, the departure of some of the latter notwithstanding. Assuming that the probability of migration is controlled by the government of the developing country, the model shows that the choice of a specific probability defined by the parameters of the model results in more human capital being formed by all the individuals in the economy in the case of a homogeneous workforce (or by the skilled workers in the economy in the case of a heterogeneous workforce), *and* in the highest possible level of welfare for those who stay behind, given the production technology.

In the model of Stark (2004) as well as in several extensions of the model (Fan & Stark, 2007a; Stark, Casarico, Devillanova, & Uebelmesser, 2009; Stark, Casarico, & Uebelmesser, 2009), an important underlying assumption is an instantaneous adjustment from the pre-migration human capital steady state to the post-migration human capital steady state: the incentive effect to form more human capital in response to the higher expected returns to human capital, brought about by the probability of higher returns to human capital abroad, impacts at once. Thus, the model is static and compares only the initial state of a closed economy with the final state of an economy open to migration; the adjustment process and the transition period between the states are not analyzed.

It stands to reason that in different stages of their lives, individuals respond differently to educational opportunities. In general, we can say that individuals typically acquire education early in their life, and rarely respond to changes in the returns to education

E-mail address: lbyra@wne.uw.edu.pl

1059-0560/$ – see front matter
http://dx.doi.org/10.1016/j.iref.2013.05.004

by acquiring additional education after their formal schooling has been completed. Consequently, in a successive-generations economy, individuals will respond to the higher rewards to schooling that migration confers gradually, not instantaneously as assumed in Stark (2004): the average level of human capital – the source of a productivity-enhancing externality – will change incrementally. This phased adjustment could impose losses upon those who respond to the incentive conferred by migration but do not migrate, and who are members of (or enter) a labor market before its average human capital reaches the socially optimal level. Especially because the model is used to formulate and advocate revised migration policies, it is crucial to check its robustness to a less stringent and much more realistic assumption regarding the speed at which human capital adjusts to the prospect of migration.

We present a dynamic extension of the model of Stark (2004), allowing for the prevalence of a potentially welfare-harming transition period. Indeed, Fan & Stark (2007b) show that in the short-run, a welfare loss is possible. However, in Fan & Stark (2007b), the transitional dynamics is smoothed out rather than modeled in. Here, we proceed in this vein, and do so fully. In this respect then, our paper complements the received literature. Rather surprisingly, it turns out that following the introduction of a well-designed migration policy, as the economy moves gradually to the new and socially optimal level of human capital, no individual incurs a welfare loss during any phase of the transition period. This result reinforces the welfare conclusions of Stark (2004) that were obtained in a static framework.

In Section 2 we reproduce the key ingredients of the model of Stark (2004) because it serves as our benchmark. In Section 3 we present a dynamic extension of the model, and conduct a welfare analysis of the transition period. Section 4 concludes.

2. The benchmark model of Stark (2004)

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.

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

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

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

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

Because $\frac{\partial W(\theta)}{\partial \theta} = \frac{\alpha}{\theta+1} - k$ (and because $\frac{\partial^2 W(\theta)}{\partial \theta^2} = \frac{-\alpha}{(\theta+1)^2} < 0$), 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:

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

The following lemma will be helpful in subsequent analysis.

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

Proof. We seek to show that for any $x > 1$, $x\ln x > x - 1$. Consider the function $z(x) = \ln(x^x e^{1-x})$. We know that $z(1) = 0$. Because $z(x) = x\ln x - (x-1)$ and $z'(x) = \ln x > 0$ for $x > 1$, the Lemma follows. □

By substituting $x = \alpha/k$ and applying the Lemma, it can be easily seen that $W(\theta^*) > 0$. However, because 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:

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