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Brain drain and development traps ☆

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ABSTRACT

This paper links the two fields of "development traps" and "brain drain". We construct a model which integrates endogenous international migration into a simple growth model. As a result the dynamics of the economy can feature some underdevelopment traps: an economy starting with a low level of human capital can be caught in a vicious circle where low level of human capital leads to low wages, and low wages leads to emigration of valuable human capital. We also show that our model displays a rich array of different dynamic regimes, including the above traps, but other regimes as well, and we link explicitly the nature of the regimes to technology and policy parameters.

1. Introduction

The analysis of migration has become an important branch of the development economics literature. One of its main domains is concerned with the phenomenon of brain drain, which emphasizes that an essential cause of impoverishment for developing countries is the flight of skilled elites towards countries with higher standards of living. However, recent research has emphasized that brain drain can also generate positive dynamic forces for development (see Docquier and Rapoport, 2008, 2012 and Gibson and McKenzie, 2011, for overviews of this literature).[1]

Another important domain in development economics is concerned with development traps, also coined poverty traps. These models show how an economy can be characterized by multiple equilibria, and find itself historically trapped in an inferior equilibrium. This is a very rich area, and recent synthetic accounts of the literature can be found, for example, in Azariadis and Stachurski (2005), Bowles et al. (2006) and Matsuyama (2008).

The purpose of this paper is to link the brain drain phenomenon to development traps. For that we construct a model which integrates endogenous international migration into a simple growth model. We show that the existence of brain drain can lead to multiple dynamic regimes, and that the type of regimes displayed is notably affected by both technology and policy parameters.

The will to link these two literatures is not new. The first elaborated model implementing such integration for brain drain appears in De la Croix and Docquier (2010), which actually inspired this paper. They combine a migration function based on wage differentials with a production function inspired by Lucas (1988), and exhibiting positive externalities. They obtain two different types of trajectories: a "vicious circle" one, with high poverty and high brain drain, and a "virtuous circle" one, with low poverty and low brain drain. The actual dynamics is led by a "sunspot" mechanism through which the economy somehow "alternates" stochastically between the two types of trajectories. That article belongs to the category of "expectations driven poverty traps", where unexpected shocks and coordination failures play a central role.

The model in this paper belongs, instead, to the alternative category of "history dependent poverty traps".[2] In our model we have no sunspots, no coordination failures, and the dynamics are fully

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[1] Further references to the literature are found in Section 2 below.

[2] An interesting comparison between "history dependent dynamics" and "expectations dependent dynamics", their differences and similarities, appears in Krugman's (1991) stimulating article.

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deterministic. Yet, we shall nevertheless exhibit a very rich set of dynamics, and notably vicious circle type dynamics. The dynamics will result from the combination of two main elements: (1) The first is that, as in Romer (1990), there are positive externalities between different lines of production using skilled workers. These positive externalities will result in productivity and real wages being possibly increasing with the skilled population. (2) The second, inspired from De la Croix and Docquier (2010, 2012), is the migration mechanism: If the real wage in the home country is low compared to the real wage abroad, then a part of the highly skilled population will emigrate.

The intuition as to why the economy can be led into a vicious circle is the following: If the skilled population is low to start with, their resulting wage is low[3] and therefore many workers emigrate abroad. This in turns reduces productivity and the real wage further, which will lead to further migration and so on. We clearly have a vicious circle, which can create an underdevelopment trap, because of the loss of skilled workers who had accumulated valuable human capital.

In the contrary, if the economy starts with a high level of skilled population and therefore high productivity, most skilled workers will choose to stay in the home country, which leads itself to high productivity, and we now have some sort of a virtuous circle.

As it turns out, we shall find that our model displays many potential different dynamic regimes, as it includes the above development traps, but other regimes as well. The nature of the regimes and the type of dynamic equilibrium depend on two sets of parameters, technology parameters and policy parameters. Let us now examine these in turn.

There are two important technology parameters: the returns to scale (à la Solow, 1956) for skilled labor and the degree of productive externalities (à la Romer, 1990), these two parameters being linked to the functional form of the production function. This will be developed in Section 3.1 below.

When positive externalities à la Romer (1990) dominate, we get the possibility of unstable equilibria, vicious circles, or virtuous circles, as we outlined above. If, however, the diminishing returns to scale dominate, the economy is much more stable and converges to some sort of "Solowian" equilibrium.

So at this stage of the reasoning we would thus have, depending on the value of the above technology parameters, two types of economies: (a) Some "traditional" economies with a single long run equilibrium, towards which dynamic trajectories converge. (b) Economies where this central equilibrium may be unstable, and development traps may occur.

However, the type of economies and dynamics are not linked only to technology parameters, but also to "policy parameters". In our model, we introduce one such parameter, denoted z, which is meant to summarize all possible influences through which government can influence human capital formation.

A typical "academic" example of z is the size of higher education in the country, and investment of government in education. An increase in that variable should normally increase the number of skilled workers. This paper shows that this policy variable has a substantial effect on the dynamics. The multiple equilibria with vicious and virtuous circles actually occur for median values of z. For low values of z, only the bad equilibrium, the "trap", survives, whereas with a high value of z only the high equilibrium remains.

[3] Although this will be treated formally in Section 4.3, we can already briefly explain intuitively why skilled wages may be high when there are many skilled workers, and low when there are few skilled. Consider the "high number" case. Two conflicting effects are at work. First, as in Solow-type models, diminishing returns to labor (Eq. (1) below) will lead to lower wages, the traditional result. But conversely, as in Romer-type models, there are positive externalities between skilled (Eqs. (2) and (3)), so that a high number of skilled workers increases the productivity of each of them, and thus their wage. As we shall see analytically below, this last effect dominates when, somehow, the Romer effect is stronger than the Solow effect.

So our model displays a rich variety of dynamics, going from fully stable economy to multiple equilibria, development traps, vicious and virtuous circles. In the next sections we will develop a more formal presentation of the model and results.

The paper is divided into nine sections. We outline in Section 2 some related literature. Section 3 describes the model. Section 4 studies the short run equilibrium. Section 5 describes the dynamics and long run equilibria. Section 6 begins, somehow as a benchmark, with the traditional "stable" model. Section 7 studies the converse case, and shows when and how it can lead to development traps. Section 8 emphasizes the role of policy. Section 9 concludes.

2. Related literature

The literature on brain drain has, from the beginning, proposed a balanced view between the negative effects (essentially the loss of human capital) and positive ones (such as remittances or contribution to "international knowledge"). Two important early articles are Grubel and Scott (1966) and Bhagwati and Hamada (1974).

We shall ourselves be emphasizing the negative effects of brain drain, but we must mention that lately a number of authors have shown that the possibility of migration could create some positive effects on the emigration country. This has been called a "brain gain" effect. This line of research has been studied by Beine et al. (2001), Gibson and McKenzie (2012), Mountford (1997), Stark (2004) and Stark et al. (1997, 1998). Beine et al. (2008), and Easterly and Nyarko (2009) derive the theoretical effects of migration on human capital creation, and test these effects empirically.

This debate on the brain drain vs. brain gain has stimulated the development of this field. As emphasized by Gibson and McKenzie (2011), the number of studies on this subject has increased in the last decade. Many contributions are empirical, although Docquier and Rapoport (2012) present in their survey a model permitting to discuss the conditions under which we get brain drain or brain gain.

The empirical literature has touched various angles of the questions, and is focusing mainly on the assessment of the size of the phenomenon, as well as on the elements affecting the flows, which are notably the size of the country, political instability, and low levels of human capital. The importance of migration costs should also be emphasized (see McKenzie and Rapoport, 2010). Still, data limitations continue to be a huge challenge to work in this area, and there is a need for better data which tracks the flows of high-skilled workers back and forth.

One outcome of all this research, that has been emphasized recently, is that brain drain is much more complex than the one way migration as analyzed until now. In particular the "return migration", by which the migrants end up returning to their home country, might change not only the perspective on the data but also on the models of migration (see Docquier and Rapoport, 2012).

A particular case of this "return migration" is students, who go abroad for more education and come back to their home country. Lately these student flows have substantially increased, in line with large increases in tertiary enrolment rates. This is already happening in Europe, notably due to the Bologna Process (see Brezis and Soueri, 2011). These phenomena are likely to modify the interpretation and research on brain drain.

The literature on development traps is extremely vast, and builds on many different mechanisms. We indicated a few useful surveys in the introduction. A well known contribution based on human capital accumulation is Azariadis and Drazen (1990).

There are very few papers linking the two issues of development traps and brain drain. We already described De la Croix and Docquier (2010). Some other papers link migration and multiple equilibria, but in a different context than ours. Kwok and Leland (1982) have a model with multiple equilibria in migration, based on asymmetric information. Brezis and Krugman (1996) also present a