Migration, Human Capital Formation, and Growth: An Empirical Investigation

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Summary. — We study the effect of skilled emigration on human capital formation and growth in a sample of developing countries. We find that the migration rate exerts statistically significant effects on both the level and the composition of human capital. We are able to trace the impact of these changes on the growth rate of sending countries via regression analysis and simulations. Our results show that while there are both winners and losers, almost 70% of the population in our sample suffers lower growth as a consequence of skilled migration. Moreover, the losses are concentrated in countries with low levels of technological sophistication.
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1. INTRODUCTION

Over the last decades, an increasing number of developed countries have put in place different mechanisms to encourage the immigration of only the most talented, skilled individuals from developing countries. [1]

As a consequence of such arrangements, the world has witnessed a dramatic modification in the composition of the pool of migrants moving from developing to developed countries. Over the last two decades, the share of highly skilled migrants in the total number of migrants has increased dramatically. Docquier and Marfouk (2006), for example, estimate that during 1990–2000 the number of foreign-born workers with tertiary schooling living in OECD member countries increased by 63.7%, while for unskilled migrants the increase was only 14.4% over the same period. Such accelerating *brain drain* is arguably one of the most striking features of globalization.

Whether the flow of skilled migrants from developing to developed countries is a curse or a blessing for sending countries has been a contentious issue among economists for several decades. [2] One recent strand of literature, started by the pioneering work of Oded Stark and co-authors (Stark, Helmenstein, & Prskatwetz, 1997, 1998), recognizes that the possibility of migration raises the returns to education and leads to an increase in the level of human capital that may ultimately prove beneficial for sending countries—a *Beneficial Brain Drain* or *Brain Gain* (BG). This influential literature has shaped the direction of much of the recent debate on skilled migration (Beine, Docquier, & Rapoport, 2001; Beine *et al.*, 2008; Dustmann, Fadlon, & Weiss, 2011; Mountford, 1997; Stark & Wang, 2002; Vidal, 1998, to name but a few), and has spawned an empirical literature aimed at testing its theoretical predictions. The earliest contribution in this respect is the paper by Beine *et al.* (2001). The authors, however, use gross migration rates to proxy for the migration rate of skilled workers. As a consequence, their findings in support of the BG hypothesis need to be taken with caution. Beine, Docquier, and Rapoport (2003) use the data on immigration rates toward the US by level of education published by Carrington and Detragiache (1998), and also find empirical support for the existence of a BG in a cross-section of 50 developing countries. Their regressions, however, show that migration has a negative growth effect in most developing countries. In the

revised version of the previous paper, Beine *et al.* (2008) use the recent data set by Docquier and Marfouk (2006) to test for the existence of "incentive effects" in human capital accumulation, that is, the positive effect of migration probabilities on human capital accumulation. The authors conclude that these effects are indeed positive and go on to perform counterfactual simulations to compare the *ex-post* level of human capital in sending countries, when skilled workers do not benefit from a higher migration rate. In this instance their conclusions are not clear-cut, as more than half the countries in their sample suffer from brain drain, rather than benefit from a brain gain. In very recent additions to this literature, Beine, Defoort, and Docquier (2011a) provide further evidence in favor of the beneficial brain drain hypothesis using a new panel data set that allows them to explicitly address issues of endogeneity, while Batista, Lacuesta, and Vicente (2012) test the "brain gain" hypothesis for Cape Verde, using specially collected data. Both papers provide additional evidence in favor of the existence of substantial incentive effects.

The fact that migration possibilities exert a positive incentive effect conforms to economic intuition and represents an important result. The literature mentioned above, however, neglects another, more subtle aspect of the brain gain, in that it abstracts from the possibility that migration might change not only the *level*, but also the *composition* of human capital. Indeed, elsewhere in the literature, a number of authors have emphasized how the possibility of migration encourages would-be migrants to concentrate on disciplines that are associated with higher probabilities of migration, especially in health care and ICT (Clemens, 2007; Commander, Chanda, Kangasniemi, & Winters, 2008; Connell, Zurn, Stilwell, Awases, & Braichet, 2007; Gibson & McKenzie, 2011; Kangasniemi, Winters, & Commander, 2007; Lorenzo,

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Galvez-Tan, & Javier, 2007). [3] To date, few theoretical contributions have suggested a connection between the possibility of migration and the type of skills the agents choose to acquire. Mariani (2007) discusses the allocation of talent in a rent-seeking framework à la Murphy, Shleifer, and Vishny (1991). He concludes that if skills traditionally associated with rent-seeking, such as legal ones, are less conducive to emigration, an increase in the probability to migrate might encourage a shift toward skills connected to entrepreneurship, like engineering, ultimately benefiting growth. While Mariani (2007) discusses an alternative channel leading to a beneficial brain drain, he does not allow for the level effect discussed above. In a contribution more focussed on technological change, Di Maria and Stryszowski (2009) argue that the possibility of migration, while potentially leading to an increase in the level of human capital, produces the wrong type of skill composition and slows down the process of economic development in source countries. Within a framework inspired by the literature on "appropriate institutions" (Gerschenkron, 1962), they observe that certain skills are relatively more valuable, and hence more rewarded, in countries closer to the technological frontier. This is due to the fact that in technologically advanced countries productivity advances are due to innovation, while in less developed ones imitation plays a major role. By allowing for the endogenous accumulation of skills on the part of workers, who base their decision on the relative rewards such skills entail, they show that the possibility of migration distorts the optimal formation of human capital, and hinders economic growth. As this effect is stronger the less developed the sending country, Di Maria and Stryszowski conclude that this provides a potential explanation for the co-existence of winners and losers among sending countries emphasized by Beine et al. (2008). From their theoretical analysis, then, it emerges that neglecting composition effects might generate misleading results.

In this paper we build on the theoretical insights of Di Maria and Stryszowski (2009) and assess empirically the effect of migration on the formation of human capital—both on its level and composition—and on economic growth in a sample of developing countries. Using a data set covering 130 developing countries for 1990 and 2000, we find evidence that the possibility of migration does indeed affect both the level of human capital, and the type of skills accumulated in sending countries. Furthermore, consistent with the prediction of Di Maria and Stryszowski (2009), our results show that both effects depend on the level of technological sophistication of the sending country. [4] We also provide evidence that the pace of technological development (and hence the growth rate of the economy) is affected by the composition rather than the level of human capital. We conclude that migration, by affecting the process of skills accumulation has potentially detrimental impacts on growth. To illustrate the substantive implications of our findings, we conclude our analysis by simulating the effects of changes in the skilled migration rate on the composition of human capital and on productivity growth. Our simulations allow us to conclude that there are indeed winners and losers among developing countries. In our data set roughly one third of countries suffer as a result of increased migration; these losers, however, account for over 70% of the total population in the sample (over 2.7 billion people), and are characterized by a lower level of technological development.

Besides being closely related to the literature on the brain drain, our work is also related to the literature studying how the composition of human capital affects growth. While their main contribution focuses on the allocation of talent between entrepreneurship and rent-seeking, the empirical evidence found in Murphy et al. (1991) provides an early example of linking growth to the skill composition of the work force. Iyigun and Owen (1999) build on these findings and show that different ratios of entrepreneurs to professionals are optimal in different phases of economic development. The present paper is closer in spirit to the work of Vandenbussche, Aghion, and Meghir (2006), who explicitly emphasize the interaction between skill composition and distance from the technological frontier in determining a country's growth performance. Their focus is, however, quite different from ours, given that they discuss secondary vs. tertiary education, do not deal with international migration, and concentrate their empirical efforts on OECD countries.

In the next section we describe the conceptual framework underlying our empirical analysis. The data used in the empirical investigation are described in Section 3, and the results of the analysis are discussed in Section 4. The substantive effects of these results for the developing countries in the sample are the object of Section 5. Finally, Section 6 concludes the paper with a summary of the results, and some implications for migration policy.

2. MIGRATION, HUMAN CAPITAL ACCUMULATION AND GROWTH

Before we proceed to our empirical investigation, we outline the theoretical framework that underpins that analysis. In what follows we sketch a model of endogenous growth, where heterogenous labor inputs are used to produce a final good and to generate technological improvements. The model is an extension of the framework in Di Maria and Stryszowski (2009). Its structure is presented in Figure 1.

The structure of production is the familiar one of nonscale Schumpeterian models, where the final good (Y) is produced using a continuum of mass M of intermediate products (x_i) and the labor input of lower-skilled workers L, according to [5]:

$$Y_t = (L_t/M)^{1-\alpha} \int_0^M A_{it}^{1-\alpha} x_{it}^\alpha di. \tag{1}$$

where A_{it} represents the productivity of intermediate i at time t.

If, following Young (1998), we assume that the number of intermediates per worker converges to a constant, the production structure above can be shown to be consistent with sustained growth without scale effects.

Producers of intermediate goods maximize their profits in each period by choosing optimally the levels of production, and the pace of productivity change. Productivity improves as the result of both bona-fide innovation and imitation activities (Benhabib & Spiegel, 1994; Vandenbussche et al., 2006). The former pushes the world technological frontier outwards, whereas the latter consists in copying technologies from the world technological frontier. Following Di Maria and Stryszowski (2009), we assume that both activities require two types of highly-skilled labor inputs, that we refer to as technically skilled (T) and generalists (G), so that productivity changes according to:

$$A_{it} - A_{it-1} = A_{it-1} T_{nit}^\phi G_{nit}^{1-\phi} + (\overline{A}_{t-1} - A_{it}) T_{mit}^\sigma G_{mit}^{1-\sigma}; \tag{2}$$

where the subscripts n and m identify skilled labor inputs employed in innovation and imitation activities, respectively, and $\overline{A}$ represents the frontier's productivity level. In what follows, we further assume that workers endowed with general skills are relatively more productive when employed in creative